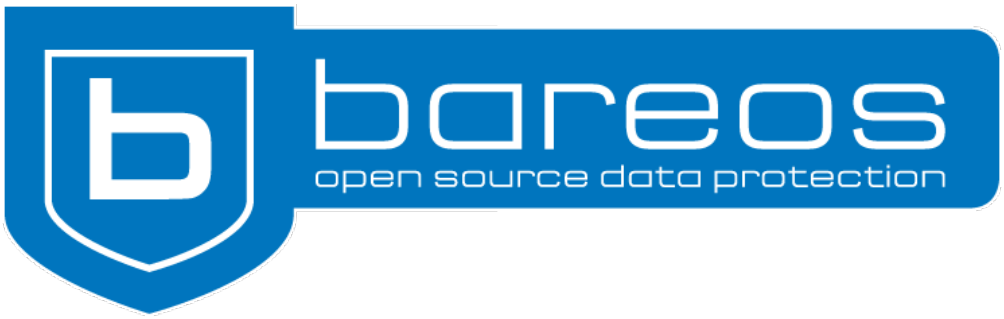


Bareos
Backup Archiving REcovery Open Sourced

Main Reference

Bareos GmbH & Co KG

This manual documents Bareos version master (March 14, 2016)

Contents

Part I

Introduction and Tutorial

Chapter 1

What is Bareos?

Bareos is a set of computer programs that permits the system administrator to manage backup, recovery, and verification of computer data across a network of computers of different kinds. Bareos can also run entirely upon a single computer and can backup to various types of media, including tape and disk.
In technical terms, it is a network Client/Server based backup program. Bareos is relatively easy to use and efficient, while offering many advanced storage management features that make it easy to find and recover lost or damaged files. Due to its modular design, Bareos is scalable from small single computer systems to systems consisting of hundreds of computers located over a large network.

1.1 History

Bareos is a fork of the open source project Bacula version 5.2. In 2010 the Bacula community developer Marco van Wieringen started to collect rejected or neglected community contributions in his own branch. This branch was later on the base of Bareos and since then was enriched by a lot of new features.
This documentation also bases on the original Bacula documentation, it is technically also a fork of the documenation created following the rules of the GNU Free Documentation License.
Original author of Bacula and it's documentation is Kern Sibbald. We thank Kern and all contributors to Bacula and it's documentation. We maintain a list of contributors to Bacula (until the time we've started the fork) and Bareos in our AUTHORS file.

1.2 Who Needs Bareos?

If you are currently using a program such as tar, dump, or bru to backup your computer data, and you would like a network solution, more flexibility, or catalog services, Bareos will most likely provide the additional features you want. However, if you are new to Unix systems or do not have offsetting experience with a sophisticated backup package, the Bareos project does not recommend using Bareos as it is much more difficult to setup and use than tar or dump.
If you want Bareos to behave like the above mentioned simple programs and write over any tape that you put in the drive, then you will find working with Bareos difficult. Bareos is designed to protect your data following the rules you specify, and this means reusing a tape only as the last resort. It is possible to "force" Bareos to write over any tape in the drive, but it is easier and more efficient to use a simpler program for that kind of operation.
If you would like a backup program that can write to multiple volumes (i.e. is not limited by your tape drive capacity), Bareos can most likely fill your needs.
If you are currently using a sophisticated commercial package such as Legato Networker, ARCserveIT, Arkeia, IBM Tivoli Storage Manager or PerfectBackup+, you may be interested in Bareos, which provides many of the same features and is free software available under the GNU AGPLv3 software license.

1.3 Bareos Components or Services

Bareos is made up of the following five major components or services: Director, Console, File, Storage, and Monitor services.

Bareos Director

The Bareos Director service is the program that supervises all the backup, restore, verify and archive operations. The system administrator uses the Bareos Director to schedule backups and to recover files. The Director runs as a daemon (or service) in the background.

Bareos Console

The Bareos Console service is the program that allows the administrator or user to communicate with the Bareos Director. Currently, the Bareos Console is available in two versions: a text-based console and a QT-based GUI interface. The first and simplest is to run the Console program in a shell window (i.e. TTY interface). Most system administrators will find this completely adequate. The second version is a GUI interface that is far from complete, but quite functional as it has most the capabilities of the shell Console. For more details see the Bareos Console.

Bareos File Daemon

The Bareos File service (also known as the Client program) is the software program that is installed on the machine to be backed up. It is specific to the operating system on which it runs and is responsible for providing the file attributes and data when requested by the Director. The File services are also responsible for the file system dependent part of restoring the file attributes and data during a recovery operation. This program runs as a daemon on the machine to be backed up.

Bareos Storage Daemon

The Bareos Storage services consist of the software programs that perform the storage and recovery of the file attributes and data to the physical backup media or volumes. In other words, the Storage daemon is responsible for reading and writing your tapes (or other storage media, e.g. files). The Storage services runs as a daemon on the machine that has the backup device (such as a tape drive).

Catalog

The Catalog services are comprised of the software programs responsible for maintaining the file indexes and volume databases for all files backed up. The Catalog services permit the system administrator or user to quickly locate and restore any desired file. The Catalog services sets Bareos apart from simple backup programs like tar and bru, because the catalog maintains a record of all Volumes used, all Jobs run, and all Files saved, permitting efficient restoration and Volume management. Bareos currently supports three different databases, MySQL, PostgreSQL, and SQLite, one of which must be chosen when building Bareos.

The three SQL databases currently supported (MySQL, PostgreSQL or SQLite) provide quite a number of features, including rapid indexing, arbitrary queries, and security. Although the Bareos project plans to support other major SQL databases, the current Bareos implementation interfaces only to MySQL, PostgreSQL and SQLite.

To perform a successful save or restore, the following four daemons must be configured and running: the Director daemon, the File daemon, the Storage daemon, and the Catalog service (MySQL, PostgreSQL or SQLite).

1.4 Bareos Packages

Following Bareos Linux packages are available (release 14.2):

Package Name	Description
bareos	Backup Archiving REcovery Open Sourced - metapackage
bareos-bat	Bareos Admin Tool (GUI)
bareos-bconsole	Bareos administration console (CLI)
bareos-client	Bareos client Meta-All-In-One package
bareos-common	Common files, required by multiple Bareos packages
bareos-database-common	Generic abstraction libs and files to connect to a database
bareos-database-mysql	Libs and tools for mysql catalog
bareos-database-postgresql	Libs and tools for postgresql catalog
bareos-database-sqlite3	Libs and tools for sqlite3 catalog
bareos-database-tools	Bareos CLI tools with database dependencies (bareos-dbcheck, bscan)
bareos-devel	Devel headers
bareos-director	Bareos Director daemon
bareos-director-python-plugin	Python plugin for Bareos Director daemon
bareos-filedaemon	Bareos File daemon (backup and restore client)
bareos-filedaemon-ceph-plugin	CEPH plugin for Bareos File daemon
bareos-filedaemon-glusterfs-plugin	GlusterFS plugin for Bareos File daemon
bareos-filedaemon-ldap-python-plugin	LDAP Python plugin for Bareos File daemon
bareos-filedaemon-python-plugin	Python plugin for Bareos File daemon
bareos-storage	Bareos Storage daemon
bareos-storage-ceph	CEPH support for the Bareos Storage daemon
bareos-storage-fifo	FIFO support for the Bareos Storage backend
bareos-storage-glusterfs	GlusterFS support for the Bareos Storage daemon
bareos-storage-python-plugin	Python plugin for Bareos Storage daemon
bareos-storage-tape	Tape support for the Bareos Storage daemon
bareos-tools	Bareos CLI tools (bcopy, bextract, bls, bregex, bwild)
bareos-traymonitor	Bareos Tray Monitor (QT)
bareos-vadp-dumper	VADP Dumper - vStorage APIs for Data Protection Dumper program
bareos-vmware-plugin	Bareos VMware plugin
bareos-vmware-vix-disklib	VMware vix disklib distributable libraries
bareos-webui	Bareos Web User Interface

Not all packages (especially optional backends and plugins) are available on all platforms. For details, see Packages for the different Linux platforms.
Additionally, packages containing debug information are available. These are named differently depending on the distribution (`bareos-debuginfo` or `bareos-dbg` or ...).
Not all packages are required to run Bareos.

- For the Bareos Director, the package `bareos-director` and one of `bareos-database-mysql`, `bareos-database-postgresql` or `bareos-database-sqlite3` are required (use `bareos-database-sqlite3` only for testing).
- For the Bareos Storage Daemon, the package `bareos-storage` is required. If you plan to connect tape drives to the storage director, also install the package `bareos-storage-tape`. This is kept separately, because it has additional dependencies for tape tools.
- On a client, only the package `bareos-filedaemon` is required. If you run it on a workstation, the packages `bareos-traymonitor` gives the user information about running backups.
- On a Backup Administration system you need to install at least `bareos-bconsole` to have an interactive console to the Bareos Director.

1.5 Bareos Configuration

In order for Bareos to understand your system, what clients you want backed up and how, you must create a number of configuration files containing resources (or objects).
TODO: add overview picture

1.6 Conventions Used in this Document

Bareos is in a state of evolution, and as a consequence, this manual will not always agree with the code. If an item in this manual is preceded by an asterisk (*), it indicates that the particular feature is not implemented. If it is preceded by a plus sign (+), it indicates that the feature may be partially implemented.
If you are reading this manual as supplied in a released version of the software, the above paragraph holds true. If you are reading the online version of the manual, http://www.bareos.org, please bear in mind that this version describes the current version in development that may contain features not in the released version. Just the same, it generally lags behind the code a bit.
The source of this document is available at https://github.com/bareos/bareos-docs. As with the rest of the Bareos project, you are welcome to participate and improve it.

1.7 Quick Start

To get Bareos up and running quickly, the author recommends that you first scan the Terminology section below, then quickly review the next chapter entitled The Current State of Bareos, then the Installing Bareos, the Getting Started with Bareos, which will give you a quick overview of getting Bareos running. After which, you should proceed to the chapter How to Configure Bareos, and finally the chapter on Running Bareos.

1.8 Terminology

Administrator The person or persons responsible for administrating the Bareos system.

Backup The term Backup refers to a Bareos Job that saves files.

Bootstrap File The bootstrap file is an ASCII file containing a compact form of commands that allow Bareos or the stand-alone file extraction utility (bextract) to restore the contents of one or more Volumes, for example, the current state of a system just backed up. With a bootstrap file, Bareos can restore your system without a Catalog. You can create a bootstrap file from a Catalog to extract any file or files you wish.

Catalog The Catalog is used to store summary information about the Jobs, Clients, and Files that were backed up and on what Volume or Volumes. The information saved in the Catalog permits the administrator or user to determine what jobs were run, their status as well as the important characteristics of each file that was backed up, and most importantly, it permits you to choose what files to restore. The Catalog is an online resource, but does not contain the data for the files backed up. Most of the information stored in the catalog is also stored on the backup volumes (i.e. tapes). Of course, the tapes will also have a copy of the file data in addition to the File Attributes (see below).

The catalog feature is one part of Bareos that distinguishes it from simple backup and archive programs such as dump and tar.

Client In Bareos's terminology, the word Client refers to the machine being backed up, and it is synonymous with the File services or File daemon, and quite often, it is referred to it as the FD. A Client is defined in a configuration file resource.

Console The program that interfaces to the Director allowing the user or system administrator to control Bareos.

Daemon Unix terminology for a program that is always present in the background to carry out a designated task. On Windows systems, as well as some Unix systems, daemons are called Services.

Directive The term directive is used to refer to a statement or a record within a Resource in a configuration file that defines one specific setting. For example, the **Name** directive defines the name of the Resource.

Director The main Bareos server daemon that schedules and directs all Bareos operations. Occasionally, the project refers to the Director as DIR.

Differential A backup that includes all files changed since the last Full save started. Note, other backup programs may define this differently.

File Attributes The File Attributes are all the information necessary about a file to identify it and all its properties such as size, creation date, modification date, permissions, etc. Normally, the attributes are handled entirely by Bareos so that the user never needs to be concerned about them. The attributes do not include the file's data.

File Daemon The daemon running on the client computer to be backed up. This is also referred to as the File services, and sometimes as the Client services or the FD.

FileSet A FileSet is a Resource contained in a configuration file that defines the files to be backed up. It consists of a list of included files or directories, a list of excluded files, and how the file is to be stored (compression, encryption, signatures). For more details, see the FileSet Resource in the Director chapter of this document.

Incremental A backup that includes all files changed since the last Full, Differential, or Incremental backup started. It is normally specified on the **Level** directive within the Job resource definition, or in a Schedule resource.

Job A Bareos Job is a configuration resource that defines the work that Bareos must perform to backup or restore a particular Client. It consists of the **Type** (backup, restore, verify, etc), the **Level** (full, differential, incremental, etc.), the **FileSet**, and **Storage** the files are to be backed up (Storage device, Media Pool). For more details, see the Job Resource in the Director chapter of this document.

Monitor The program that interfaces to all the daemons allowing the user or system administrator to monitor Bareos status.

Resource A resource is a part of a configuration file that defines a specific unit of information that is available to Bareos. It consists of several directives (individual configuration statements). For example, the **Job** resource defines all the properties of a specific Job: name, schedule, Volume pool, backup type, backup level, ...

Restore A restore is a configuration resource that describes the operation of recovering a file from backup media. It is the inverse of a save, except that in most cases, a restore will normally have a small set of files to restore, while normally a Save backs up all the files on the system. Of course, after a disk crash, Bareos can be called upon to do a full Restore of all files that were on the system.

Schedule A Schedule is a configuration resource that defines when the Bareos Job will be scheduled for execution. To use the Schedule, the Job resource will refer to the name of the Schedule. For more details, see the Schedule Resource in the Director chapter of this document.

Service This is a program that remains permanently in memory awaiting instructions. In Unix environments, services are also known as **daemons**.

Storage Coordinates The information returned from the Storage Services that uniquely locates a file on a backup medium. It consists of two parts: one part pertains to each file saved, and the other part pertains to the whole Job. Normally, this information is saved in the Catalog so that the user doesn't need specific knowledge of the Storage Coordinates. The Storage Coordinates include the File Attributes (see above) plus the unique location of the information on the backup Volume.

Storage Daemon The Storage daemon, sometimes referred to as the SD, is the code that writes the attributes and data to a storage Volume (usually a tape or disk).

Session Normally refers to the internal conversation between the File daemon and the Storage daemon. The File daemon opens a **session** with the Storage daemon to save a FileSet or to restore it. A session has a one-to-one correspondence to a Bareos Job (see above).

Verify A verify is a job that compares the current file attributes to the attributes that have previously been stored in the Bareos Catalog. This feature can be used for detecting changes to critical system files similar to what a file integrity checker like Tripwire does. One of the major advantages of using Bareos to do this is that on the machine you want protected such as a server, you can run just the File daemon, and the Director, Storage daemon, and Catalog reside on a different machine. As a consequence, if your server is ever compromised, it is unlikely that your verification database will be tampered with.

Verify can also be used to check that the most recent Job data written to a Volume agrees with what is stored in the Catalog (i.e. it compares the file attributes), *or it can check the Volume contents against the original files on disk.

Retention Period There are various kinds of retention periods that Bareos recognizes. The most important are the **File** Retention Period, **Job** Retention Period, and the **Volume** Retention Period. Each of these retention periods applies to the time that specific records will be kept in the Catalog database. This should not be confused with the time that the data saved to a Volume is valid.

The File Retention Period determines the time that File records are kept in the catalog database. This period is important for two reasons: the first is that as long as File records remain in the database, you can "browse" the database with a console program and restore any individual file. Once the File records are removed or pruned from the database, the individual files of a backup job can no longer be "browsed". The second reason for carefully choosing the File Retention Period is because the volume of the database File records use the most storage space in the database. As a consequence, you must ensure that regular "pruning" of the database file records is done to keep your database from growing too large. (See the Console **prune** command for more details on this subject).

The Job Retention Period is the length of time that Job records will be kept in the database. Note, all the File records are tied to the Job that saved those files. The File records can be purged leaving the Job records. In this case, information will be available about the jobs that ran, but not the details of the files that were backed up. Normally, when a Job record is purged, all its File records will also be purged.

The Volume Retention Period is the minimum of time that a Volume will be kept before it is reused. Bareos will normally never overwrite a Volume that contains the only backup copy of a file. Under ideal conditions, the Catalog would retain entries for all files backed up for all current Volumes. Once a Volume is overwritten, the files that were backed up on that Volume are automatically removed from the Catalog. However, if there is a very large pool of Volumes or a Volume is never overwritten, the Catalog database may become enormous. To keep the Catalog to a manageable size, the backup information should be removed from the Catalog after the defined File Retention Period. Bareos provides the mechanisms for the catalog to be automatically pruned according to the retention periods defined.

Scan A Scan operation causes the contents of a Volume or a series of Volumes to be scanned. These Volumes with the information on which files they contain are restored to the Bareos Catalog. Once the information is restored to the Catalog, the files contained on those Volumes may be easily restored. This function is particularly useful if certain Volumes or Jobs have exceeded their retention period and have been pruned or purged from the Catalog. Scanning data from Volumes into the Catalog is done by using the **bscan** program. See the bscan section of the Bareos Utilities chapter of this manual for more details.

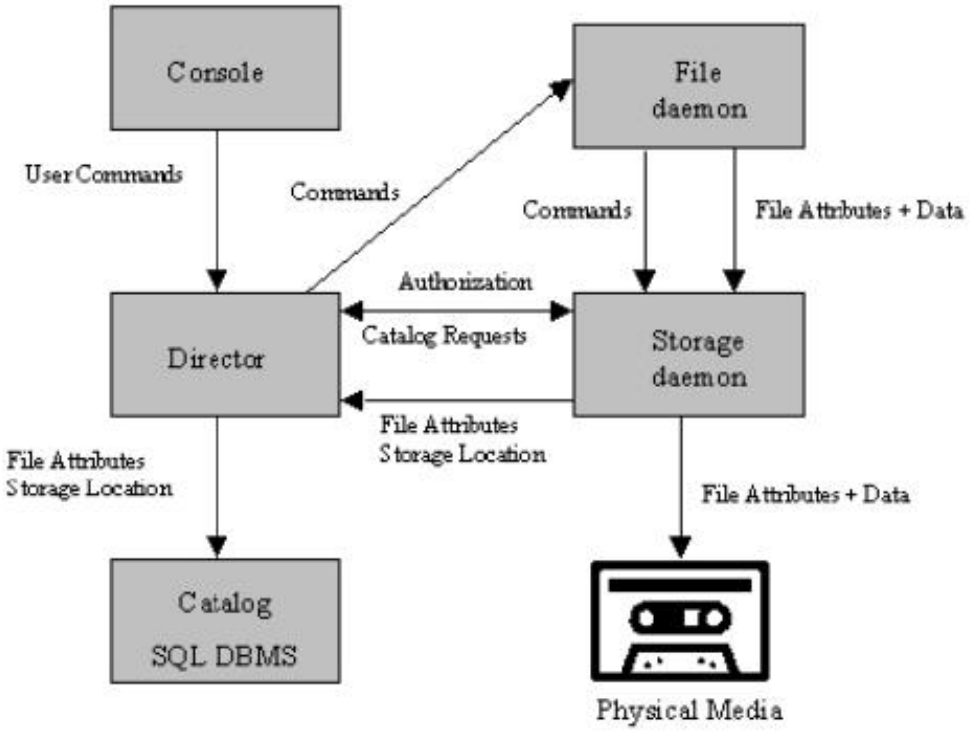
Volume A Volume is an archive unit, normally a tape or a named disk file where Bareos stores the data from one or more backup jobs. All Bareos Volumes have a software label written to the Volume by Bareos so that it identifies what Volume it is really reading. (Normally there should be no confusion with disk files, but with tapes, it is easy to mount the wrong one.)

1.9 What Bareos is Not

Bareos is a backup, restore and verification program and is not a complete disaster recovery system in itself, but it can be a key part of one if you plan carefully and follow the instructions included in the Disaster Recovery chapter of this manual.

1.10 Interactions Between the Bareos Services

The following block diagram shows the typical interactions between the Bareos Services for a backup job. Each block represents in general a separate process (normally a daemon). In general, the Director oversees the flow of information. It also maintains the Catalog.


Console
File daemon
User Commands
Commands
Commands
File Attributes + Data
Authorization
Director
Catalog Requests
Storage daemon
File Attributes
Storage Location
File Attributes
Storage Location
File Attributes + Data
Catalog
SQL DBMS
Physical Media

1.11 The Current State of Bareos

1.11.1 What is Implemented

- Job Control
  - Network backup/restore with centralized Director.
  - Internal scheduler for automatic Job execution.
  - Scheduling of multiple Jobs at the same time.
  - You may run one Job at a time or multiple simultaneous Jobs (sometimes called multiplexing).
  - Job sequencing using priorities.
  - Console interface to the Director allowing complete control. Same GUIs are also available.
- Security
  - Verification of files previously cataloged, permitting a Tripwire like capability (system break-in detection).
  - CRAM-MD5 password authentication between each component (daemon).
  - Configurable TLS (SSL) communications encryption between each component.
  - Configurable Data (on Volume) encryption on a Client by Client basis.
  - Computation of MD5 or SHA1 signatures of the file data if requested.
- Restore Features
  - Restore of one or more files selected interactively either for the current backup or a backup prior to a specified time and date.
  - Listing and Restoration of files using stand-alone `bls` and `bextract` tool programs. Among other things, this permits extraction of files when Bareos and/or the catalog are not available. Note, the recommended way to restore files is using the restore command in the Console. These programs are designed for use as a last resort.
  - Ability to restore the catalog database rapidly by using bootstrap files (previously saved).
  - Ability to recreate the catalog database by scanning backup Volumes using the `bscan` program.
- SQL Catalog
  - Catalog database facility for remembering Volumes, Pools, Jobs, and Files backed up.
  - Support for MySQL, PostgreSQL, and SQLite Catalog databases.
  - User extensible queries to the MySQL, PostgreSQL and SQLite databases.
- Advanced Volume and Pool Management
  - Labeled Volumes, preventing accidental overwriting (at least by Bareos).
  - Any number of Jobs and Clients can be backed up to a single Volume. That is, you can backup and restore Linux, Unix and Windows machines to the same Volume.
  - Multi-volume saves. When a Volume is full, **Bareos** automatically requests the next Volume and continues the backup.
  - Pool and Volume library management providing Volume flexibility (e.g. monthly, weekly, daily Volume sets, Volume sets segregated by Client, ...).
  - Machine independent Volume data format. Linux, Solaris, and Windows clients can all be backed up to the same Volume if desired.
  - The Volume data format is upwards compatible so that old Volumes can always be read.
  - A flexible message handler including routing of messages from any daemon back to the Director and automatic email reporting.
  - Data spooling to disk during backup with subsequent write to tape from the spooled disk files. This prevents tape "shoe shine" during Incremental/Differential backups.
- Advanced Support for most Storage Devices

  - Autochanger support using a simple shell interface that can interface to virtually any autoloader program. A script for `mtx` is provided.
  - Support for autochanger barcodes – automatic tape labeling from barcodes.
  - Automatic support for multiple autochanger magazines either using barcodes or by reading the tapes.
  - Support for multiple drive autochangers.
  - Raw device backup/restore. Restore must be to the same device.
  - All Volume blocks contain a data checksum.
  - Migration support – move data from one Pool to another or one Volume to another.

- Multi-Operating System Support
  - Programmed to handle arbitrarily long filenames and messages.
  - Compression on a file by file basis done by the Client program if requested before network transit.
  - Saves and restores POSIX ACLs and Extended Attributes on most OSes if enabled.
  - Access control lists for Consoles that permit restricting user access to only their data.
  - Support for save/restore of files larger than 2GB.
  - Support ANSI and IBM tape labels.
  - Support for Unicode filenames (e.g. Chinese) on Win32 machines
  - Consistent backup of open files on Win32 systems using Volume Shadow Copy (VSS).
  - Support for path/filename lengths of up to 64K on Win32 machines (unlimited on Unix/Linux machines).

- Miscellaneous
  - Multi-threaded implementation.
  - A comprehensive and extensible configuration file for each daemon.

1.11.2 Advantages Over Other Backup Programs

- Since there is a client for each machine, you can backup and restore clients of any type ensuring that all attributes of files are properly saved and restored.
- It is also possible to backup clients without any client software by using NFS or CIFS. However, if possible, we recommend running a Client File daemon on each machine to be backed up.
- Bareos handles multi-volume backups.
- A full comprehensive SQL standard database of all files backed up. This permits online viewing of files saved on any particular Volume.
- Automatic pruning of the database (removal of old records) thus simplifying database administration.
- Any SQL database engine can be used making Bareos very flexible. Drivers currently exist for MySQL, PostgreSQL, and SQLite.
- The modular but integrated design makes Bareos very scalable.
- Since Bareos uses client file servers, any database or other application can be properly shutdown by Bareos using the native tools of the system, backed up, then restarted (all within a Bareos Job).
- Bareos has a built-in Job scheduler.
- The Volume format is documented and there are simple C programs to read/write it.
- Bareos uses well defined (IANA registered) TCP/IP ports – no rpcs, no shared memory.
- Bareos installation and configuration is relatively simple compared to other comparable products.
- Aside from several GUI administrative interfaces, Bareos has a comprehensive shell administrative interface, which allows the administrator to use tools such as ssh to administrate any part of Bareos from anywhere.

1.11.3 Current Implementation Restrictions

- It is possible to configure the Bareos Director to use multiple Catalogs. However, this is neither adviced, nor supported. Multiple catalogs require more management because in general you must know what catalog contains what data, e.g. currently, all Pools are defined in each catalog.
- Bareos can generally restore any backup made from one client to any other client. However, if the architecture is significantly different (i.e. 32 bit architecture to 64 bit or Win32 to Unix), some restrictions may apply (e.g. Solaris door files do not exist on other Unix/Linux machines; there are reports that Zlib compression written with 64 bit machines does not always read correctly on a 32 bit machine).

1.11.4 Design Limitations or Restrictions

- Names (resource names, volume names, and such) defined in Bareos configuration files are limited to a fixed number of characters. Currently the limit is defined as 127 characters. Note, this does not apply to filenames, which may be arbitrarily long.
- Command line input to some of the stand alone tools – e.g. `btape`, `bconsole` is restricted to several hundred characters maximum. Normally, this is not a restriction, except in the case of listing multiple Volume names for programs such as `bscan`. To avoid this command line length restriction, please use a **.bsr** file to specify the Volume names.
- Bareos configuration files for each of the components can be any length. However, the length of an individual line is limited to 500 characters after which it is truncated. If you need lines longer than 500 characters for directives such as ACLs where they permit a list of names are character strings simply specify multiple short lines repeating the directive on each line but with different list values.

1.11.5 Items to Note

- Bareos's Differential and Incremental *normal* backups are based on time stamps. Consequently, if you move files into an existing directory or move a whole directory into the backup fileset after a Full backup, those files will probably not be backed up by an Incremental save because they will have old dates. This problem is corrected by using Accurate mode backups or by explicitly updating the date/time stamp on all moved files.
- In non Accurate mode, files deleted after a Full save will be included in a restoration. This is typical for most similar backup programs. To avoid this, use Accurate mode backup.

Chapter 2

Installing Bareos

If you are like me, you want to get Bareos running immediately to get a feel for it, then later you want to go back and read about all the details. This chapter attempts to accomplish just that: get you going quickly without all the details.
Bareos comes prepackaged for a number of Linux distributions. So the easiest way to get to a running Bareos installation, is to use a platform where prepacked Bareos packages are available. Additional information can be found in the chapter Operating Systems.
If Bareos is available as a package, only 5 steps are required to get to a running Bareos System:

1. Decide about the Bareos release to use
2. Decide about the Database Backend
3. Install the Bareos Software Packages
4. Prepare Bareos database
5. Start the daemons

This will start a very basic Bareos installation which will regularly backup a directory to disk. In order to fit it to your needs, you'll have to adapt the configuration and might want to backup other clients.

2.1 Decide about the Bareos release to use

- `http://download.bareos.org/bareos/release/latest/`

You'll find Bareos binary package repositories at `http://download.bareos.org/`. The latest stable released version is available at `http://download.bareos.org/bareos/release/latest/`.
The public key to verify the repository is also in repository directory (`Release.key` for Debian based distributions, `repodata/repomd.xml.key` for RPM based distributions).
Section Install the Bareos Software Packages describes how to add the software repository to your system.

2.2 Decide about the Database Backend

Next you have to decide, what database backend you want to use. Bareos supports following database backends:

- PostgreSQL by package `bareos-database-postgresql`
- MySQL by package `bareos-database-mysql`
- Sqlite by package `bareos-database-sqlite3`
  Please note! *The Sqlite backend is only intended for testing, not for productive use.*

The PostgreSQL backend is the default. However, the MySQL backend is also supported, while the Sqlite backend is intended for testing purposes only.
The Bareos database packages have there dependencies only to the database client packages, therefore the database itself must be installed manually.

2.3 Install the Bareos Software Packages

You will have to install the package `bareos` and the database backend package (`bareos-database-*`) you want to use. The corresponding database should already be installed and running, see Decide about the Database Backend.
If you do not explicitly choose a database backend, your operating system installer will choose one for you. The default should be PostgreSQL, but depending on your operating system and the already installed packages, this may differ.
The package `bareos` is only a meta package, that contains dependencies to the main components of Bareos, see Bareos Packages. If you want to setup a distributed environment (like one Director, separate database server, multiple Storage daemons) you have to choose the corresponding Bareos packages to install on each hosts instead of just installing the `bareos` package.

2.3.1 Install on RedHat based Linux Distributions

RHEL≥7, CentOS≥7, Fedora

Bareos Version >= 15.2.0 requires the Jansson library package. On RHEL 7 it is available through the RHEL Server Optional channel. On CentOS 7 and Fedora is it included on the main repository.

```
#
# define parameter
#

DIST=RHEL_7
# or
# DIST=Fedora_22
# DIST=CentOS_7

DATABASE=postgresql
# or
# DATABASE=mysql

# add the Bareos repository
URL=http://download.bareos.org/bareos/release/latest/$DIST
wget -O /etc/yum.repos.d/bareos.repo $URL/bareos.repo

# install Bareos packages
yum install bareos bareos-database-$DATABASE
```

Commands 2.1: Bareos installation on RHEL ≥ 7 / CentOS ≥ 7 / Fedora

RHEL 6, CentOS 6

Bareos Version >= 15.2.0 requires the Jansson library package. This package is available on EPEL 6. Make sure, it is available on your system.

```
#
# define parameter
#

DIST=RHEL_6
# DIST=CentOS_6

DATABASE=postgresql
# or
# DATABASE=mysql

# add the Bareos repository
URL=http://download.bareos.org/bareos/release/latest/$DIST
wget -O /etc/yum.repos.d/bareos.repo $URL/bareos.repo

# install Bareos packages
yum install bareos bareos-database-$DATABASE
```

Commands 2.2: Bareos installation on RHEL ≥ 6 / CentOS ≥ 6

RHEL 5, CentOS 5

yum in RHEL 5/CentOS 5 has slightly different behaviour as far as dependency resolving is concerned: it sometimes install a dependent package after the one that has the dependency defined. To make sure that it works, install the desired Bareos database backend package first in a separate step:

```
#
# define parameter
#

DIST=RHEL_5
# or
# DIST=CentOS_5

DATABASE=postgresql
# or
# DATABASE=mysql

# add the Bareos repository
URL=http://download.bareos.org/bareos/release/latest/$DIST
wget -O /etc/yum.repos.d/bareos.repo $URL/bareos.repo

# install Bareos packages
yum install bareos-database-$DATABASE
yum install bareos
```

Commands 2.3: Bareos installation on RHEL 5 / CentOS 5

2.3.2 Install on SUSE based Linux Distributions

SUSE Linux Enterprise Server (SLES), openSUSE

```
#
# define parameter
#

DIST=SLE_12
# or
# DIST=SLE_11_SP4
# DIST=SLE_11_SP3
# DIST=openSUSE_Leap_42.1
# DIST=openSUSE_13.2
# DIST=openSUSE_13.1

DATABASE=postgresql
# or
# DATABASE=mysql

# add the Bareos repository
URL=http://download.bareos.org/bareos/release/latest/$DIST
zypper addrepo --refresh $URL/bareos.repo

# install Bareos packages
zypper install bareos bareos-database-$DATABASE
```

Commands 2.4: Bareos installation on SLES / openSUSE

2.3.3 Install on Debian based Linux Distributions

Debian / Ubuntu

Bareos Version >= 15.2.0 requires the Jansson library package. On Ubuntu is it available in Ubuntu Universe. In Debian, is it included in the main repository.

```
#
# define parameter
#

DIST=Debian_8.0
# or
# DIST=Debian_7.0
# DIST=xUbuntu_14.04
```

```
# DIST=xUbuntu_12.04

DATABASE=postgresql
# or
# DATABASE=mysql

URL=http://download.bareos.org/bareos/release/latest/$DIST/

# add the Bareos repository
printf "deb $URL /\n" > /etc/apt/sources.list.d/bareos.list

# add package key
wget -q $URL/Release.key -O- | apt-key add -

# install Bareos packages
apt-get update
apt-get install bareos bareos-database-$DATABASE
```

Commands 2.5: Bareos installation on Debian / Ubuntu

If you prefer using the versions of Bareos directly integrated into the distributions, please note that there are some differences, see Limitations of the Debian.org/Ubuntu Universe version of Bareos.

2.3.4 Install on Univention Corporate Server

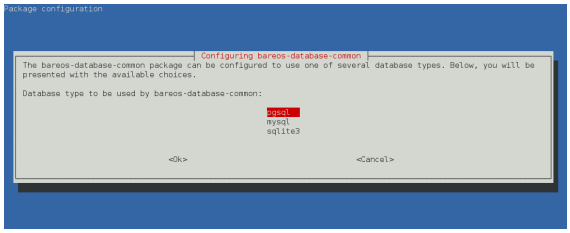
Bareos offers additional functionality and integration into an Univention Corporate Server environment. Please follow the intructions in Univention Corporate Server.
If you are not interessed in this additional functionality, the commands described in Install on Debian based Linux Distributions will also work for Univention Corporate Servers.

2.4 Prepare Bareos database

We assume that you have already your database installed and basically running. Currently the database backends PostgreSQL and MySQL are recommended. The Sqlite database backend is only intended for testing purposes.
The easiest way to set up a database is using an system account that have passwordless local access to the database. Often this is the user `root` for MySQL and the user `postgres` for PostgreSQL.
For details, see chapter Catalog Maintenance.

2.4.1 Debian based Linux Distributions

Since Bareos Version >= 14.2.0 the Debian (and Ubuntu) based packages support the `dbconfig-common` mechanism to create and update the Bareos database.
Follow the instructions during install to configure it according to your needs.



If you decide not to use `dbconfig-common` (selecting `<No>` on the initial dialog), follow the instructions for Other Platforms.
The selectable database backends depend on the `bareos-database-*` packages installed.
For details see dbconfig-common (Debian).

2.4.2 Other Platforms

PostgreSQL

If your are using PostgreSQL and your PostgreSQL administration user is `postgres` (default), use following commands:

```
su postgres -c /usr/lib/bareos/scripts/create_bareos_database
su postgres -c /usr/lib/bareos/scripts/make_bareos_tables
su postgres -c /usr/lib/bareos/scripts/grant_bareos_privileges
```

Commands 2.6: Setup Bareos catalog with PostgreSQL

MySQL/MariaDB

Make sure, that `root` has direct access to the local MySQL server. Check if the command `mysql` connects to the database without defining the password. This is the default on RedHat and SUSE distributions. On other systems (Debian, Ubuntu), create the file `~/.my.cnf` with your authentication informations:

```
[client]
host=localhost
user=root
password=YourPasswordForAccessingMysqlAsRoot
```

Configuration 2.7: MySQL credentials file .my.cnf

It is recommended, to secure the Bareos database connection with a password. See Catalog Maintenance – MySQL about how to archieve this. For testing, using a password-less MySQL connection is probable okay. Setup the Bareos database tables by following commands:

```
/usr/lib/bareos/scripts/create_bareos_database
/usr/lib/bareos/scripts/make_bareos_tables
/usr/lib/bareos/scripts/grant_bareos_privileges
```

Commands 2.8: Setup Bareos catalog with MySQL

As some Bareos updates require a database schema update, therefore the file `/root/.my.cnf` might also be useful in the future.

2.5 Start the daemons

```
service bareos-dir start
service bareos-sd start
service bareos-fd start
```

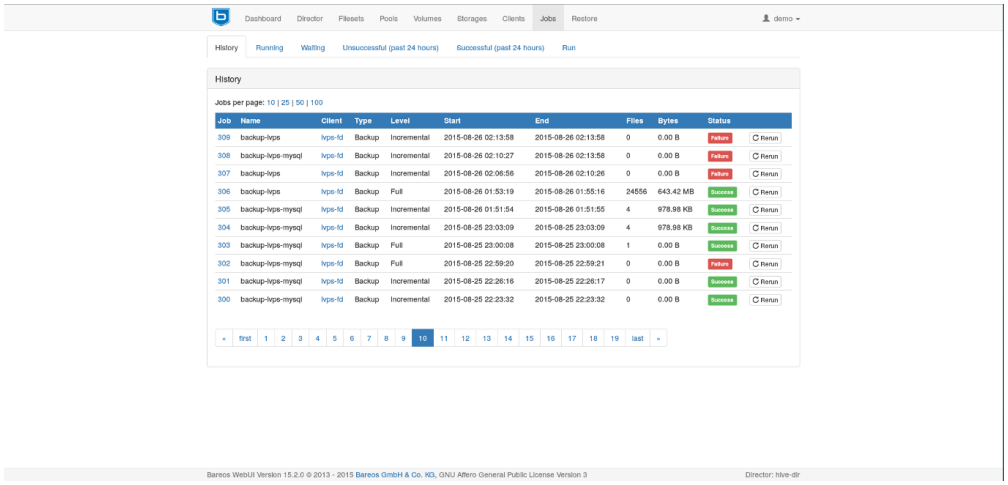
Commands 2.9: Start the Bareos Daemons

You will eventually have to allow access to the ports 9101-9103, used by Bareos.
Now you should be able to access the director using the bconsole.
When you want to use the bareos-webui, please refer to the chapter Installing Bareos Webui.

Chapter 3

Installing Bareos Webui

This chapter addresses the installation process of the Bareos Webui.
Since Version >= 15.2.0 bareos-webui is part of the Bareos project and available for a number of platforms.



3.1 System Requirements

- A working Bareos environment, Bareos >= 15.2.2, including JSON API mode, see jansson.
- A Bareos platform, where bareos-webui packages are provided.
- An Apache 2.x Webserver with mod-rewrite, mod-php5 and mod-setenv
- PHP >= 5.3.3
- Zend Framework 2.2.x or later. **Note:** Unfortunately, not all distributions offer a Zend Framework 2 package. The following list shows where to get the Zend Framework 2 package.
  - RHEL, CentOS
    - https://fedoraproject.org/wiki/EPEL
    - https://apps.fedoraproject.org/packages/php-ZendFramework2
  - Fedora
    - https://apps.fedoraproject.org/packages/php-ZendFramework2
  - SUSE, Debian, Ubuntu
    - http://download.bareos.org/bareos

3.2 Installation

3.2.1 Adding the Bareos Repository

If not already done, add the Bareos repository that is matching your Linux distribution. Please have a look at the chapter Install the Bareos Software Packages for more information on how to achieve this.

3.2.2 Install the bareos-webui package

After adding the repository simply install the bareos-webui package via your package manager.

- RHEL, CentOS and Fedora

```
yum install bareos-webui
```

or

```
dnf install bareos-webui
```

- SUSE Linux Enterprise Server (SLES), openSUSE

```
zypper install bareos-webui
```

- Debian, Ubuntu

```
apt-get install bareos-webui
```

3.2.3 Configuration of restricted consoles and profile resources

You can have multiple consoles with different names and passwords, sort of like multiple users, each with different privileges. As a default, these consoles can do absolutely nothing – no commands whatsoever. You give them privileges or rather access to commands and resources by specifying access control lists (ACLs) in the director's console resource. The ACLs are specified by a directive followed by a list of access names.
It is required to add at least one restricted named console in your director configuration (`bareos-dir.conf`) for bareos-webui. The restricted named consoles, configured in your `bareos-dir.conf`, are used for authentication and access control. The name and password directives of the restricted consoles are the credentials you have to provide during authentication to the webui as username and password.
The bareos-webui package provides a default console and profile configuration under `/etc/bareos/bareos-dir.d/`, which have to be included at the bottom of your `/etc/bareos/bareos-dir.conf` and edited to your needs.

```
echo "@/etc/bareos/bareos-dir.d/webui-consoles.conf" >> /etc/bareos/bareos-dir.conf
echo "@/etc/bareos/bareos-dir.d/webui-profiles.conf" >> /etc/bareos/bareos-dir.conf
```

Commands 3.1: add webui-consoles and webui-profiles to the Bareos Director configuration

```
#
# Restricted console used by bareos-webui
#
Console {
  Name = user1
  Password = "CHANGEME"
  Profile = webui
}
```

Configuration 3.2: webui-consoles.conf

For more details about the console resource configuration, please have a look at the chapter Console Resource.

```
#
# bareos-webui default profile resource
#
Profile {
  Name = webui
  CommandACL = status, messages, show, version, run, rerun, cancel, .api, .bvfs_*, list, llist, use, ↙
    ↪ restore, .jobs, .filesets, .clients
  Job ACL = *all*
  Schedule ACL = *all*
  Catalog ACL = *all*
  Pool ACL = *all*
  Storage ACL = *all*
  Client ACL = *all*
  FileSet ACL = *all*
  Where ACL = *all*
}
```

Configuration 3.3: webui-profiles.conf

For more details about profile resource configuration in bareos, please have a look at the chapter Profile Resource.
Please note! *Do not forget to reload your new director configuration.*

3.2.4 Configure your Apache Webserver

If you have installed from package, a default configuration is provided, please see `/etc/apache2/conf.d/bareos-webui.conf`, `/etc/httpd/conf.d/bareos-webui.conf` or `/etc/apache2/available-conf/bareos-webui.conf`.

The required Apache modules, *setenv*, *rewrite* and *php* are enabled via package postinstall script. You simply need to restart your apache webserver manually.

3.2.5 Configure your /etc/bareos-webui/directors.ini

Configure your directors in `/etc/bareos-webui/directors.ini` to match your settings, which you have chosen in the previous steps.

The configuration file `/etc/bareos-webui/directors.ini` should look similar to this:

```
;
; Bareos WebUI Configuration
; File: /etc/bareos-webui/directors.ini
;

;
; Section localhost-dir
;
[localhost-dir]

; Enable or disable section. Possible values are "yes" or "no", the default is "yes".
enabled = "yes"

; Fill in the IP-Address or FQDN of you director.
diraddress = "localhost"

; Default value is 9101
dirport = 9101

; Note: TLS has not been tested and documented, yet.
;tls_verify_peer = false
;server_can_do_tls = false
;server_requires_tls = false
;client_can_do_tls = false
;client_requires_tls = false
;ca_file = ""
;cert_file = ""
;cert_file_passphrase = ""
;allowed_cns = ""

;
; Section remote-dir
;
[remote-dir]
enabled = "no"
diraddress = "hostname"
dirport = 9101
; Note: TLS has not been tested and documented, yet.
;tls_verify_peer = false
;server_can_do_tls = false
;server_requires_tls = false
;client_can_do_tls = false
;client_requires_tls = false
;ca_file = ""
;cert_file = ""
;cert_file_passphrase = ""
;allowed_cns = ""
```

Configuration 3.4: Bareos-webui directors.ini

You can add as many directors as you want.

Now you are able to login by calling http://HOSTNAME/bareos-webui in your browser of choice. Your login credentials are defined in your Bareos Director Console configuration.

3.3 Additional information

3.3.1 SELinux

To install bareos-webui on a system with SELinux enabled, the following additional steps have to be performed.

- Allow HTTPD scripts and modules to connect to the network

```
setsebool -P httpd_can_network_connect on
```

3.3.2 NGINX

If you prefer to use bareos-webui on Nginx with php5-fpm instead of Apache, a basic working configuration could look like this:

```
server {

        listen       9100;
        server_name  bareos;
        root         /var/www/bareos-webui/public;

        location / {
                index index.php;
                try_files $uri $uri/ /index.php?$query_string;
        }

        location ~ .php$ {

                include snippets/fastcgi-php.conf;

                # With php5-cgi alone pass the PHP
                # scripts to FastCGI server
                # listening on 127.0.0.1:9000

                # fastcgi_pass 127.0.0.1:9000;

                # With php5-fpm:

                fastcgi_pass unix:/var/run/php5-fpm.sock;

        }

}
```

Configuration 3.5: bareos-webui on nginx

3.3.3 Installation from source

For information about installing from source, please refer to https://github.com/bareos/bareos-webui/blob/master/doc/INSTALL.md.

Chapter 4

Updating Bareos

In most cases, a Bareos update is simply done by a package update of the distribution. Please remind, that Bareos Director and Bareos Storage Daemon must always have the same version. The version of the File Daemon may differ, see chapter about backward compatibility.

4.1 Updating the database scheme

Sometimes improvements in Bareos make it neccessary to update the database scheme.
Please note! *If the Bareos catalog database does not have the current schema, the Bareos Director refuses to start.*
Detailed information can then be found in the log file `/var/log/bareos/bareos.log`.
Take a look into the Release Notes to see which Bareos updates do require a database scheme update.

4.1.1 Debian based Linux Distributions

Since Bareos Version >= 14.2.0 the Debian (and Ubuntu) based packages support the `dbconfig-common` mechanism to create and update the Bareos database. If this is properly configured, the database schema will be automatically adapted by the Bareos packages.
Please note! *When using the PostgreSQL backend and updating to Bareos < 14.2.3, it is necessary to manually grant database permissions, normally by using*

```
root@linux:~# su - postgres -c /usr/lib/bareos/scripts/grant_bareos_privileges
```

For details see dbconfig-common (Debian).
If you disabled the usage of `dbconfig-common` , follow the instructions for Other Platforms.

4.1.2 Other Platforms

This has to be done as database administrator. On most platforms Bareos knows only about the credentials to access the Bareos database, but not about the database administrator to modify the database schema.
The task of updating the database schema is done by the script `/usr/lib/bareos/scripts/update_bareos_tables`.
However, this script requires administration access to the database. Depending on your distribution and your database, this requires different preparations. More details can be found in chapter Catalog Maintenance.
Please note! *If you're updating to Bareos <= 13.2.3 and have configured the Bareos database during install using Bareos environment variables (`db_name`, `db_user` or `db_password`, see Catalog Maintenance), make sure to have these variables defined in the same way when calling the update and grant scripts. Newer versions of Bareos read these variables from the Director configuration file `/etc/bareos/bareos-dir.conf`. However, make sure that the user running the database scripts has read access to this file (or set the environment variables). The `postgres` user normally does not have the required permissions.*

PostgreSQL

If your are using PostgreSQL and your PostgreSQL administrator is `postgres` (default), use following commands:

```
su postgres -c /usr/lib/bareos/scripts/update_bareos_tables
su postgres -c /usr/lib/bareos/scripts/grant_bareos_privileges
```

Commands 4.1: Update PostgreSQL database schema

The `grant_bareos_privileges` command is required, if new databases tables are introduced. It does not hurt to run it multiple times.
After this, restart the Bareos Director and verify it starts without problems.

MySQL/MariaDB

Make sure, that `root` has direct access to the local MySQL server. Check if the command `mysql` without parameter connects to the database. If not, you may be required to adapt your local MySQL config file `~/.my.cnf`. It should look similar to this:

```
[client]
host=localhost
user=root
password=YourPasswordForAccessingMysqlAsRoot
```

Configuration 4.2: MySQL credentials file .my.cnf

If you are able to connect via the `mysql` to the database, run the following script from the Unix prompt:

```
/usr/lib/bareos/scripts/update_bareos_tables
```

Commands 4.3: Update MySQL database schema

Currently on MySQL is it not neccessary to run `grant_bareos_privileges`, because access to the database is already given using wildcards.
After this, restart the Bareos Director and verify it starts without problems.

Chapter 5

Getting Started with Bareos

5.1 Understanding Jobs and Schedules

In order to make Bareos as flexible as possible, the directions given to Bareos are specified in several pieces. The main instruction is the job resource, which defines a job. A backup job generally consists of a FileSet, a Client, a Schedule for one or several levels or times of backups, a Pool, as well as additional instructions. Another way of looking at it is the FileSet is what to backup; the Client is who to backup; the Schedule defines when, and the Pool defines where (i.e. what Volume).

Typically one FileSet/Client combination will have one corresponding job. Most of the directives, such as FileSets, Pools, Schedules, can be mixed and matched among the jobs. So you might have two different Job definitions (resources) backing up different servers using the same Schedule, the same Fileset (backing up the same directories on two machines) and maybe even the same Pools. The Schedule will define what type of backup will run when (e.g. Full on Monday, incremental the rest of the week), and when more than one job uses the same schedule, the job priority determines which actually runs first. If you have a lot of jobs, you might want to use JobDefs, where you can set defaults for the jobs, which can then be changed in the job resource, but this saves rewriting the identical parameters for each job. In addition to the FileSets you want to back up, you should also have a job that backs up your catalog.

Finally, be aware that in addition to the backup jobs there are restore, verify, and admin jobs, which have different requirements.

5.2 Understanding Pools, Volumes and Labels

If you have been using a program such as **tar** to backup your system, Pools, Volumes, and labeling may be a bit confusing at first. A Volume is a single physical tape (or possibly a single file) on which Bareos will write your backup data. Pools group together Volumes so that a backup is not restricted to the length of a single Volume (tape). Consequently, rather than explicitly naming Volumes in your Job, you specify a Pool, and Bareos will select the next appendable Volume from the Pool and request you to mount it.

Although the basic Pool options are specified in the Director's Pool resource, the **real** Pool is maintained in the Bareos Catalog. It contains information taken from the Pool resource (bareos-dir.conf) as well as information on all the Volumes that have been added to the Pool. Adding Volumes to a Pool is usually done manually with the Console program using the **label** command.

For each Volume, Bareos maintains a fair amount of catalog information such as the first write date/time, the last write date/time, the number of files on the Volume, the number of bytes on the Volume, the number of Mounts, etc.

Before Bareos will read or write a Volume, the physical Volume must have a Bareos software label so that Bareos can be sure the correct Volume is mounted. This is usually done using the **label** command in the Console program.

The steps for creating a Pool, adding Volumes to it, and writing software labels to the Volumes, may seem tedious at first, but in fact, they are quite simple to do, and they allow you to use multiple Volumes (rather than being limited to the size of a single tape). Pools also give you significant flexibility in your backup process. For example, you can have a "Daily" Pool of Volumes for Incremental backups and a "Weekly" Pool of Volumes for Full backups. By specifying the appropriate Pool in the daily and weekly backup Jobs, you thereby insure that no daily Job ever writes to a Volume in the Weekly Pool and vice versa, and Bareos will tell you what tape is needed and when.

For more on Pools, see the Pool Resource section of the Director Configuration chapter, or simply read on, and we will come back to this subject later.

5.3 Setting Up Bareos Configuration Files

On Unix, Bareos configuration files are usualy location in the `/etc/bareos/` directory and are named accordingly to the programs that use it: bareos-fd.conf, bareos-sd.conf, bareos-dir.conf, bconsole.conf, etc.
For information about Windows configuration files, see the Windows chapter.

5.3.1 Configuring the Console Program

The Console program is used by the administrator to interact with the Director and to manually start/stop Jobs or to obtain Job status information.
The Console configuration file is named **bconsole.conf**.
Normally, for first time users, no change is needed to these files. Reasonable defaults are set.
Further details are in the Console configuration chapter.

5.3.2 Configuring the File daemon

The File daemon is a program that runs on each (Client) machine. At the request of the Director, finds the files to be backed up and sends them (their data) to the Storage daemon.
The File daemon configuration file is named **bareos-fd.conf**. Normally, for first time users, no change is needed to this file. Reasonable defaults are set. However, if you are going to back up more than one machine, you will need to install the File daemon with a unique configuration file on each machine to be backed up. The information about each File daemon must appear in the Director's configuration file.
Further details are in the File daemon configuration chapter.

5.3.3 Configuring the Director

The Director is the central control program for all the other daemons. It schedules and monitors all jobs to be backed up.
The Director configuration file is named **bareos-dir.conf**.
In general, the only change you must make is modify the FileSet resource so that the **Include** configuration directive contains at least one line with a valid name of a directory (or file) to be saved.
You may also want to change the email address for notification from the default **root** to your email address.
Finally, if you have multiple systems to be backed up, you will need a separate File daemon or Client specification for each system, specifying its name, address, and password. We have found that giving your daemons the same name as your system but post fixed with **-fd** helps a lot in debugging. That is, if your system name is **foobaz**, you would give the File daemon the name **foobaz-fd**. For the Director, you should use **foobaz-dir**, and for the storage daemon, you might use **foobaz-sd**. Each of your Bareos components **must** have a unique name. If you make them all the same, aside from the fact that you will not know what daemon is sending what message, if they share the same working directory, the daemons temporary file names will not be unique, and you will get many strange failures.
More information is in the Director Configuration chapter.

5.3.4 Configuring the Storage daemon

The Storage daemon is responsible, at the Director's request, for accepting data from a File daemon and placing it on Storage media, or in the case of a restore request, to find the data and send it to the File daemon.
The Storage daemon's configuration file is named **bareos-sd.conf**. The default configuration comes with backup to disk only, so the Archive device points to a directory in which the Volumes will be created as files when you label the Volume. These Storage resource name and Media Type must be the same as the corresponding ones in the Director's configuration file **bareos-dir.conf**.
Further information is in the Storage daemon configuration chapter.

5.4 Testing your Configuration Files

You can test if your configuration file is syntactically correct by running the appropriate daemon with the `-t` option. The daemon will process the configuration file and print any error messages then terminate.

```
bareos-dir -t -c /etc/bareos/bareos-dir.conf
bareos-fd -t -c /etc/bareos/bareos-fd.conf
bareos-sd -t -c /etc/bareos/bareos-sd.conf
bconsole -t -c /etc/bareos/bconsole.conf
bareos-tray-monitor -t -c /etc/bareos/tray-monitor.conf
```

Commands 5.1: Testing Configuration Files

5.5 Testing Compatibility with Your Tape Drive

Before spending a lot of time on Bareos only to find that it doesn't work with your tape drive, please read the Tape Drive section. If you have a modern standard SCSI tape drive on a Linux or Solaris, most likely it will work, but better test than be sorry. For FreeBSD (and probably other xBSD flavors), reading the above mentioned tape testing chapter is a must.

5.6 Running Bareos

Probably the most important part of running Bareos is being able to restore files. If you haven't tried recovering files at least once, when you actually have to do it, you will be under a lot more pressure, and prone to make errors, than if you had already tried it once.
To get a good idea how to use Bareos in a short time, we **strongly** recommend that you follow the example in the Tutorial chapter of this manual where you will get detailed instructions on how to run Bareos.

Chapter 6

Tutorial

This chapter will guide you through running Bareos. To do so, we assume you have installed Bareos. However, we assume that you have not changed the .conf files. If you have modified the .conf files, please go back and uninstall Bareos, then reinstall it, but do not make any changes. The examples in this chapter use the default configuration files, and will write the volumes to disk in your `/var/lib/bareos/storage/` directory, in addition, the data backed up will be the source directory where you built Bareos. As a consequence, you can run all the Bareos daemons for these tests as non-root. Please note, in production, your File daemon(s) must run as root. See the Security chapter for more information on this subject.
The general flow of running Bareos is:

1. Start the Database (if using MySQL or PostgreSQL)
2. Start the Bareos Daemons
3. Start the Console program to interact with the Director
4. Run a job
5. When the Volume fills, unmount the Volume, if it is a tape, label a new one, and continue running. In this chapter, we will write only to disk files so you won't need to worry about tapes for the moment.
6. Test recovering some files from the Volume just written to ensure the backup is good and that you know how to recover. Better test before disaster strikes
7. Add a second client.

Each of these steps is described in more detail below.

6.1 Installing Bareos

For installing Bareos, follow the instructions from the Installing Bareos chapter.

6.2 Starting the Database

If you are using MySQL or PostgreSQL as the Bareos database, you should start it before you attempt to run a job to avoid getting error messages from Bareos when it starts. If you are using SQLite you need do nothing. SQLite is automatically started by **Bareos**.

6.3 Starting the Daemons

Assuming you have installed the packages, to start the three daemons, from your installation directory, simply enter:

```
service bareos-dir start
service bareos-sd start
service bareos-fd start
```

The **bareos** script starts the Storage daemon, the File daemon, and the Director daemon, which all normally run as daemons in the background. If you are using the autostart feature of Bareos, your daemons will either be automatically started on reboot, or you can control them individually with the files **bareos-dir**, **bareos-fd**, and **bareos-sd**, which are usually located in **/etc/init.d**, though the actual location is system dependent. Some distributions may do this differently.
Note, on Windows, currently only the File daemon is ported, and it must be started differently. Please see the Windows Version of Bareos chapter of this manual.
The rpm packages configure the daemons to run as user=root and group=bareos. The rpm installation also creates the group `bareos` if it does not exist on the system. Any users that you add to the group `bareos` will have access to files created by the daemons. To disable or alter this behavior edit the daemon startup scripts:

- /etc/init.d/bareos-dir
- /etc/init.d/bareos-sd
- /etc/init.d/bareos-fd

and then restart as noted above.
The installation chapter of this manual explains how you can install scripts that will automatically restart the daemons when the system starts.

6.4 Using the Director to Query and Start Jobs

To communicate with the director and to query the state of Bareos or run jobs, from the top level directory, simply enter:
`bconsole`
For simplicity, here we will describe only the `bconsole` program, also there is also a graphical interface called `BAT`.
The **bconsole** runs the Bareos Console program, which connects to the Director daemon. Since Bareos is a network program, you can run the Console program anywhere on your network. Most frequently, however, one runs it on the same machine as the Director. Normally, the Console program will print something similar to the following:

```
root@linux:~# bconsole
Connecting to Director bareos:9101
Enter a period to cancel a command.
*
```

Commands 6.1: bconsole

the asterisk is the console command prompt.
Type **help** to see a list of available commands:

```
* help
  Command      Description
  =======      ===========
  add          Add media to a pool
  autodisplay  Autodisplay console messages
  automount    Automount after label
  cancel       Cancel a job
  create       Create DB Pool from resource
  delete       Delete volume, pool or job
  disable      Disable a job
  enable       Enable a job
  estimate     Performs FileSet estimate, listing gives full listing
  exit         Terminate Bconsole session
  export       Export volumes from normal slots to import/export slots
  gui          Non-interactive gui mode
  help         Print help on specific command
  import       Import volumes from import/export slots to normal slots
  label        Label a tape
  list         List objects from catalog
  llist        Full or long list like list command
  messages     Display pending messages
```

```
  memory          Print current memory usage
  mount           Mount storage
  move            Move slots in an autochanger
  prune           Prune expired records from catalog
  purge           Purge records from catalog
  quit            Terminate Bconsole session
  query           Query catalog
  restore         Restore files
  relabel         Relabel a tape
  release         Release storage
  reload          Reload conf file
  rerun           Rerun a job
  run             Run a job
  status          Report status
  setbandwidth    Sets bandwidth
  setdebug        Sets debug level
  setip           Sets new client address -- if authorized
  show            Show resource records
  sqlquery        Use SQL to query catalog
  time            Print current time
  trace           Turn on/off trace to file
  unmount         Unmount storage
  umount          Umount - for old-time Unix guys, see unmount
  update          Update volume, pool or stats
  use             Use specific catalog
  var             Does variable expansion
  version         Print Director version
  wait            Wait until no jobs are running
```

bconsole 6.2: help

Details of the console program's commands are explained in the Bareos Console chapter.

6.5 Running a Job

At this point, we assume you have done the following:

- Installed Bareos
- Started the Database
- Prepared the database for Bareos
- Started Bareos Director, Storage Daemon and File Daemon
- Invoked the Console program with **bconsole**

Furthermore, we assume for the moment you are using the default configuration files.
At this point, enter the `show filesets` and you should get something similar this:

```
* show filesets
...
FileSet {
  Name = "SelfTest"
  Include {
    Options {
      Signature = MD5
    }
    File = "/usr/sbin"
  }
}

FileSet {
  Name = "Catalog"
  Include {
    Options {
```

```
      Signature = MD5
    }
    File = "/var/lib/bareos/bareos.sql"
    File = "/etc/bareos"
  }
}
...
```

bconsole 6.3: show filesets

One of the FileSets is the pre-defined SelfTest FileSet that will backup the `/usr/sbin` directory. For testing purposes, we have chosen a directory of moderate size (about 30 Megabytes) and complexity without being too big. The FileSet **Catalog** is used for backing up Bareos's catalog and is not of interest to us for the moment. You can change what is backed up by editing `bareos-dir.conf` and changing the **File =** line in the **FileSet** resource.
Now is the time to run your first backup job. We are going to backup your Bareos source directory to a File Volume in your `/var/lib/bareos/storage/` directory just to show you how easy it is. Now enter:

```
* status dir
bareos-dir Version: 13.2.0 (09 April 2013) x86_64-pc-linux-gnu debian Debian ↙
    ↪ GNU/Linux 6.0 (squeeze)
Daemon started 23-May-13 13:17. Jobs: run=0, running=0 mode=0
 Heap: heap=270,336 smbytes=59,285 max_bytes=59,285 bufs=239 max_bufs=239

Scheduled Jobs:
Level          Type     Pri  Scheduled          Name               Volume
===================================================================
Incremental    Backup    10  23-May-13 23:05    BackupClient1      testvol
Full           Backup    11  23-May-13 23:10    BackupCatalog      testvol
====

Running Jobs:
Console connected at 23-May-13 13:34
No Jobs running.
====
```

bconsole 6.4: status dir

where the times and the Director's name will be different according to your setup. This shows that an Incremental job is scheduled to run for the Job **BackupClient1** at 1:05am and that at 1:10, a **BackupCatalog** is scheduled to run. Note, you should probably change the name **BackupClient1** to be the name of your machine, if not, when you add additional clients, it will be very confusing.
Now enter:

```
* status client
Automatically selected Client: bareos-fd
Connecting to Client bareos-fd at bareos:9102

bareos-fd Version: 13.2.0 (09 April 2013)  x86_64-pc-linux-gnu debian Debian ↙
    ↪ GNU/Linux 6.0 (squeeze)
Daemon started 23-May-13 13:17. Jobs: run=0 running=0.
 Heap: heap=135,168 smbytes=26,000 max_bytes=26,147 bufs=65 max_bufs=66
 Sizeof: boffset_t=8 size_t=8 debug=0 trace=0 bwlimit=0kB/s

Running Jobs:
Director connected at: 23-May-13 13:58
No Jobs running.
====
```

bconsole 6.5: status client

In this case, the client is named **bareos-fd** your name will be different, but the line beginning with **bareos-fd Version ...** is printed by your File daemon, so we are now sure it is up and running.
Finally do the same for your Storage daemon with:

```
* status storage
Automatically selected Storage: File
```

```
Connecting to Storage daemon File at bareos:9103

bareos-sd Version: 13.2.0 (09 April 2013) x86_64-pc-linux-gnu debian Debian ↙
    ↪ GNU/Linux 6.0 (squeeze)
Daemon started 23-May-13 13:17. Jobs: run=0, running=0.
 Heap: heap=241,664 smbytes=28,574 max_bytes=88,969 bufs=73 max_bufs=74
 Sizes: boffset_t=8 size_t=8 int32_t=4 int64_t=8 mode=0 bwlimit=0kB/s

Running Jobs:
No Jobs running.
====

Device status:

Device "FileStorage" (/var/lib/bareos/storage) is not open.
==
====

Used Volume status:
====


====
```

bconsole 6.6: status storage

You will notice that the default Storage daemon device is named **File** and that it will use device **/var/lib/bareos/storage**, which is not currently open.
Now, let's actually run a job with:

```
run
```

you should get the following output:

```
Automatically selected Catalog: MyCatalog
Using Catalog "MyCatalog"
A job name must be specified.
The defined Job resources are:
     1: BackupClient1
     2: BackupCatalog
     3: RestoreFiles
Select Job resource (1-3):
```

Here, Bareos has listed the three different Jobs that you can run, and you should choose number **1** and type enter, at which point you will get:

```
Run Backup job
JobName:  BackupClient1
Level:    Incremental
Client:   bareos-fd
Format:   Native
FileSet:  Full Set
Pool:     File (From Job resource)
NextPool: *None* (From unknown source)
Storage:  File (From Job resource)
When:     2013-05-23 14:50:04
Priority: 10
OK to run? (yes/mod/no):
```

At this point, take some time to look carefully at what is printed and understand it. It is asking you if it is OK to run a job named **BackupClient1** with FileSet **Full Set** (we listed above) as an Incremental job on your Client (your client name will be different), and to use Storage **File** and Pool **Default**, and finally, it wants to run it now (the current time should be displayed by your console).
Here we have the choice to run (**yes**), to modify one or more of the above parameters (**mod**), or to not run the job (**no**). Please enter **yes**, at which point you should immediately get the command prompt (an asterisk). If you wait a few seconds, then enter the command **messages** you will get back something like:
TODO: Replace bconsole output by current version of Bareos.

```
28-Apr-2003 14:22 bareos-dir: Last FULL backup time not found. Doing
                  FULL backup.
28-Apr-2003 14:22 bareos-dir: Start Backup JobId 1,
                  Job=Client1.2003-04-28_14.22.33
28-Apr-2003 14:22 bareos-sd: Job Client1.2003-04-28_14.22.33 waiting.
                  Cannot find any appendable volumes.
Please use the "label"  command to create a new Volume for:
    Storage:      FileStorage
    Media type:   File
    Pool:         Default
```

The first message, indicates that no previous Full backup was done, so Bareos is upgrading our Incremental job to a Full backup (this is normal). The second message indicates that the job started with JobId 1., and the third message tells us that Bareos cannot find any Volumes in the Pool for writing the output. This is normal because we have not yet created (labeled) any Volumes. Bareos indicates to you all the details of the volume it needs.
At this point, the job is BLOCKED waiting for a Volume. You can check this if you want by doing a **status dir**. In order to continue, we must create a Volume that Bareos can write on. We do so with:

```
label
```

and Bareos will print:

```
The defined Storage resources are:
     1: File
Item 1 selected automatically.
Enter new Volume name:
```

at which point, you should enter some name beginning with a letter and containing only letters and numbers (period, hyphen, and underscore) are also permitted. For example, enter **TestVolume001**, and you should get back:

```
Defined Pools:
     1: Default
Item 1 selected automatically.
Connecting to Storage daemon File at bareos:8103 ...
Sending label command for Volume "TestVolume001" Slot 0 ...
3000 OK label. Volume=TestVolume001 Device=/var/lib/bareos/storage
Catalog record for Volume "TestVolume002", Slot 0  successfully created.
Requesting mount FileStorage ...
3001 OK mount. Device=/var/lib/bareos/storage
```

Finally, enter **messages** and you should get something like:

```
28-Apr-2003 14:30 bareos-sd: Wrote label to prelabeled Volume
   "TestVolume001" on device /var/lib/bareos/storage
28-Apr-2003 14:30 rufus-dir: Bareos 1.30 (28Apr03): 28-Apr-2003 14:30
JobId:                  1
Job:                    BackupClient1.2003-04-28_14.22.33
FileSet:                Full Set
Backup Level:           Full
Client:                 bareos-fd
Start time:             28-Apr-2003 14:22
End time:               28-Apr-2003 14:30
Files Written:          1,444
Bytes Written:          38,988,877
Rate:                   81.2 KB/s
Software Compression:   None
Volume names(s):        TestVolume001
Volume Session Id:      1
Volume Session Time:    1051531381
Last Volume Bytes:      39,072,359
FD termination status:  OK
SD termination status:  OK
Termination:            Backup OK
28-Apr-2003 14:30 rufus-dir: Begin pruning Jobs.
28-Apr-2003 14:30 rufus-dir: No Jobs found to prune.
28-Apr-2003 14:30 rufus-dir: Begin pruning Files.
28-Apr-2003 14:30 rufus-dir: No Files found to prune.
28-Apr-2003 14:30 rufus-dir: End auto prune.
```

If you don't see the output immediately, you can keep entering **messages** until the job terminates.
Instead of typing `messages` multiple times, you can also ask bconsole to wait, until a specific job is finished:

```
wait jobid=1
```

or just `wait`, which waits for all running jobs to finish.
Another useful command is **autodisplay on**. With autodisplay activated, messages will automatically be displayed as soon as they are ready.
If you do an **ls -l** of your **/var/lib/bareos/storage** directory, you will see that you have the following item:

```
-rw-r-----    1 bareos bareos   39072153 Apr 28 14:30 TestVolume001
```

This is the file Volume that you just wrote and it contains all the data of the job just run. If you run additional jobs, they will be appended to this Volume unless you specify otherwise.
You might ask yourself if you have to label all the Volumes that Bareos is going to use. The answer for disk Volumes, like the one we used, is no. It is possible to have Bareos automatically label volumes. For tape Volumes, you will most likely have to label each of the Volumes you want to use.
If you would like to stop here, you can simply enter **quit** in the Console program.
If you would like to try restoring the files that you just backed up, read the following section.

6.6 Restoring Your Files

If you have run the default configuration and run the job as demonstrated above, you can restore the backed up files in the Console program by entering:

```
restore all
```

where you will get:

```
First you select one or more JobIds that contain files
to be restored. You will be presented several methods
of specifying the JobIds. Then you will be allowed to
select which files from those JobIds are to be restored.

To select the JobIds, you have the following choices:
     1: List last 20 Jobs run
     2: List Jobs where a given File is saved
     3: Enter list of comma separated JobIds to select
     4: Enter SQL list command
     5: Select the most recent backup for a client
     6: Select backup for a client before a specified time
     7: Enter a list of files to restore
     8: Enter a list of files to restore before a specified time
     9: Find the JobIds of the most recent backup for a client
    10: Find the JobIds for a backup for a client before a specified time
    11: Enter a list of directories to restore for found JobIds
    12: Select full restore to a specified Job date
    13: Cancel
Select item:  (1-13):
```

As you can see, there are a number of options, but for the current demonstration, please enter **5** to do a restore of the last backup you did, and you will get the following output:

```
Automatically selected Client: bareos-fd
The defined FileSet resources are:
     1: Catalog
     2: Full Set
Select FileSet resource (1-2):
```

As you can see, Bareos knows what client you have, and since there was only one, it selected it automatically. Select **2**, because you want to restore files from the file set.

```
+-------+-------+----------+------------+---------------------+---------------+
| jobid | level | jobfiles | jobbytes   | starttime           | volumename    |
+-------+-------+----------+------------+---------------------+---------------+
|     1 | F     |      166 | 19,069,526 | 2013-05-05 23:05:02 | TestVolume001 |
+-------+-------+----------+------------+---------------------+---------------+
You have selected the following JobIds: 1

Building directory tree for JobId(s) 1 ...  ++++++++++++++++++++++++++++++++++++++++
165 files inserted into the tree and marked for extraction.

You are now entering file selection mode where you add (mark) and
```

```
remove (unmark) files to be restored. No files are initially added, unless
you used the "all" keyword on the command line.
Enter "done" to leave this mode.

cwd is: /
$
```

where I have truncated the listing on the right side to make it more readable.
Then Bareos produced a listing containing all the jobs that form the current backup, in this case, there is only one, and the Storage daemon was also automatically chosen. Bareos then took all the files that were in Job number 1 and entered them into a **directory tree** (a sort of in memory representation of your filesystem). At this point, you can use the **cd** and **ls** or **dir** commands to walk up and down the directory tree and view what files will be restored. For example, if I enter **cd /usr/sbin** and then enter **dir** I will get a listing of all the files in the Bareos source directory. On your system, the path might be somewhat different. For more information on this, please refer to the Restore Command Chapter of this manual for more details.
To exit this mode, simply enter:

```
done
```

and you will get the following output:

```
Bootstrap records written to
   /home/user/bareos/testbin/working/restore.bsr
The restore job will require the following Volumes:

   TestVolume001
1444 files selected to restore.
Run Restore job
JobName:         RestoreFiles
Bootstrap:      /home/user/bareos/testbin/working/restore.bsr
Where:          /tmp/bareos-restores
Replace:        always
FileSet:        Full Set
Backup Client:  rufus-fd
Restore Client: rufus-fd
Storage:        File
JobId:          *None*
When:           2005-04-28 14:53:54
OK to run? (yes/mod/no):
Bootstrap records written to /var/lib/bareos/bareos-dir.restore.1.bsr

The job will require the following
   Volume(s)                 Storage(s)                SD Device(s)
===========================================================================

    TestVolume001             File                      FileStorage

Volumes marked with "*" are online.


166 files selected to be restored.

Run Restore job
JobName:         RestoreFiles
Bootstrap:       /var/lib/bareos/bareos-dir.restore.1.bsr
Where:           /tmp/bareos-restores
Replace:         Always
FileSet:         Full Set
Backup Client:   bareos-fd
Restore Client:  bareos-fd
Format:          Native
Storage:         File
When:            2013-05-23 15:56:53
Catalog:         MyCatalog
Priority:        10
Plugin Options:  *None*
OK to run? (yes/mod/no):
```

If you answer **yes** your files will be restored to **/tmp/bareos-restores**. If you want to restore the files to their original locations, you must use the **mod** option and explicitly set **Where:** to nothing (or to /). We recommend you go ahead and answer **yes** and after a brief moment, enter **messages**, at which point you

should get a listing of all the files that were restored as well as a summary of the job that looks similar to this:

```
23-May 15:24 bareos-dir JobId 2: Start Restore Job RestoreFiles.2013-05-23_15.24.01_10
23-May 15:24 bareos-dir JobId 2: Using Device "FileStorage" to read.
23-May 15:24 bareos-sd JobId 2: Ready to read from volume "TestVolume001" on device "FileStorage" (/var/lib/bareos/storage).
23-May 15:24 bareos-sd JobId 2: Forward spacing Volume "TestVolume001" to file:block 0:194.
23-May 15:58 bareos-dir JobId 3: Bareos bareos-dir 13.2.0 (09Apr13):
  Build OS:               x86_64-pc-linux-gnu debian Debian GNU/Linux 6.0 (squeeze)
  JobId:                  2
  Job:                    RestoreFiles.2013-05-23_15.58.48_11
  Restore Client:         bareos-fd
  Start time:             23-May-2013 15:58:50
  End time:               23-May-2013 15:58:52
  Files Expected:         166
  Files Restored:         166
  Bytes Restored:         19,069,526
  Rate:                   9534.8 KB/s
  FD Errors:              0
  FD termination status:  OK
  SD termination status:  OK
  Termination:            Restore OK
```

After exiting the Console program, you can examine the files in **/tmp/bareos-restores**, which will contain a small directory tree with all the files. Be sure to clean up at the end with:

```
rm -rf /tmp/bareos-restore
```

6.7 Quitting the Console Program

Simply enter the command **quit**.

6.8 Adding a Second Client

Changes on the Client

If you have gotten the example shown above to work on your system, you may be ready to add a second Client (File daemon). That is you have a second machine that you would like backed up. The only part you need installed on the other machine is the **bareos-filedaemon**.
This packages installs also its configuration file `/etc/bareos/bareos-fd.conf` and sets its hostname + `-fd` as FileDaemon name. However, the client does not known the Bareos Director, so this information must be given manually.
Lets assume, your second client has the hostname **client2** and this name is resolvable by DNS from the client and from the Bareos Director.
Specify the Bareos Director in the File Daemon configuration file `/etc/bareos/bareos-fd.conf`:

```
...
#
# List Directors who are permitted to contact this File daemon
#
Director {
  Name = bareos-dir
  Password = "PASSWORD" # this is the passwort which you need to use within the client resource.
}
...
```

The password is also generated at installation time, but you are free to change it. Just keep in mind, it must be identical on the client and the Bareos Director.
Restart the Bareos File Daemon by

```
root@client2:~ # service bareos-fd restart
```

Changes on the Server (Bareos Director)

Then you need to make some additions to your Director's configuration file to define the new File Daemon (Client).

Starting from our original example which should be installed on your system, you should add the following lines (essentially copies of the existing data but with the names changed) to your Director's configuration file **bareos-dir.conf**.
Add following section makes the new client know to the Bareos Director. Add this section to the existing Bareos Director configuration file `/etc/bareos/bareos-dir.conf`:

```
Client {
  Name = client2-fd
  Address = client2                # the name has to be resolvable through DNS. If this is not possible,
                                   # you can work with IP addresses
  Password = "PASSWORD"            # password for FileDaemon which has to be the same like the password
                                   # in the director resource of the bareos-fd.conf on the backup client.
                                   # Copy it the the client to this line.
}
```

Using this, the client is known to the Bareos Director. Additional you must specify, what to do with this client. Therefore we specify a Job, which mostly takes its settings from the existing DefaultJob:

```
Job {
  JobDefs = "DefaultJob"
  Name    = "client2"
  Client  = "client2-fd"
}
```

Check if the configuration file is correct by

```
root@bareos:~ # bareos-dir -t -c /etc/bareos/bareos-dir.conf
```

If everything is okay, reload the Bareos Director:

```
root@bareos:~ # service bareos-dir reload
```

Now the setup for the second client should be ready.
To test the functionality, you can run a backup and restore job like in the example with the first attached FileDaemon. However, there is an even earier way to check if a connection to a File Daemon is working. This is the `estimate listing` command in bconsole. Using this, the Bareos Director immediately connects to a client and returns all files that will be included in the next backup.
Start `bconsole` and follow the instructions:

```
* estimate listing
```

The result should appear immediately.
To make this a real production installation, you will possibly want to use different Pool, or a different schedule. It is up to you to customize.

6.9 When The Tape Fills

If you have scheduled your job, typically nightly, there will come a time when the tape fills up and **Bareos** cannot continue. In this case, Bareos will send you a message similar to the following:

```
bareos-sd: block.c:337 === Write error errno=28: ERR=No space left on device
```

This indicates that Bareos got a write error because the tape is full. Bareos will then search the Pool specified for your Job looking for an appendable volume. In the best of all cases, you will have properly set your Retention Periods and you will have all your tapes marked to be Recycled, and **Bareos** will automatically recycle the tapes in your pool requesting and overwriting old Volumes. For more information on recycling, please see the Recycling chapter of this manual. If you find that your Volumes were not properly recycled (usually because of a configuration error), please see the Manually Recycling Volumes section of the Recycling chapter.
If like me, you have a very large set of Volumes and you label them with the date the Volume was first writing, or you have not set up your Retention periods, Bareos will not find a tape in the pool, and it will send you a message similar to the following:

```
bareos-sd: Job usersave.2002-09-19.10:50:48 waiting. Cannot find any
          appendable volumes.
Please use the "label"  command to create a new Volume for:
    Storage:      SDT-10000
    Media type:   DDS-4
    Pool:         Default
```

Until you create a new Volume, this message will be repeated an hour later, then two hours later, and so on doubling the interval each time up to a maximum interval of one day.
The obvious question at this point is: What do I do now?
The answer is simple: first, using the Console program, close the tape drive using the **unmount** command. If you only have a single drive, it will be automatically selected, otherwise, make sure you release the one specified on the message (in this case **STD-10000**).
Next, you remove the tape from the drive and insert a new blank tape. Note, on some older tape drives, you may need to write an end of file mark (**mt -f /dev/nst0 weof**) to prevent the drive from running away when Bareos attempts to read the label.
Finally, you use the **label** command in the Console to write a label to the new Volume. The **label** command will contact the Storage daemon to write the software label, if it is successful, it will add the new Volume to the Pool, then issue a **mount** command to the Storage daemon. See the previous sections of this chapter for more details on labeling tapes.
The result is that Bareos will continue the previous Job writing the backup to the new Volume.
If you have a Pool of volumes and Bareos is cycling through them, instead of the above message "Cannot find any appendable volumes.", Bareos may ask you to mount a specific volume. In that case, you should attempt to do just that. If you do not have the volume any more (for any of a number of reasons), you can simply mount another volume from the same Pool, providing it is appendable, and Bareos will use it. You can use the **list volumes** command in the console program to determine which volumes are appendable and which are not.
If like me, you have your Volume retention periods set correctly, but you have no more free Volumes, you can relabel and reuse a Volume as follows:

- Do a **list volumes** in the Console and select the oldest Volume for relabeling.
- If you have setup your Retention periods correctly, the Volume should have VolStatus **Purged**.
- If the VolStatus is not set to Purged, you will need to purge the database of Jobs that are written on that Volume. Do so by using the command **purge jobs volume** in the Console. If you have multiple Pools, you will be prompted for the Pool then enter the VolumeName (or MediaId) when requested.
- Then simply use the **relabel** command to relabel the Volume.

To manually relabel the Volume use the following additional steps:

- To delete the Volume from the catalog use the **delete volume** command in the Console and select the VolumeName (or MediaId) to be deleted.
- Use the **unmount** command in the Console to unmount the old tape.
- Physically relabel the old Volume that you deleted so that it can be reused.
- Insert the old Volume in the tape drive.
- From a command line do: **mt -f /dev/st0 rewind** and **mt -f /dev/st0 weof**, where you need to use the proper tape drive name for your system in place of **/dev/st0**.
- Use the **label** command in the Console to write a new Bareos label on your tape.
- Use the **mount** command in the Console if it is not automatically done, so that Bareos starts using your newly labeled tape.

6.10 Other Useful Console Commands

status dir Print a status of all running jobs and jobs scheduled in the next 24 hours.

status The console program will prompt you to select a daemon type, then will request the daemon's status.

status jobid=nn Print a status of JobId nn if it is running. The Storage daemon is contacted and requested to print a current status of the job as well.

list pools List the pools defined in the Catalog (normally only Default is used).

list media Lists all the media defined in the Catalog.

list jobs Lists all jobs in the Catalog that have run.

list jobid=nn Lists JobId nn from the Catalog.

list jobtotals Lists totals for all jobs in the Catalog.

list files jobid=nn List the files that were saved for JobId nn.

list jobmedia List the media information for each Job run.

messages Prints any messages that have been directed to the console.

unmount storage=storage-name Unmounts the drive associated with the storage device with the name **storage-name** if the drive is not currently being used. This command is used if you wish Bareos to free the drive so that you can use it to label a tape.

mount storage=storage-name Causes the drive associated with the storage device to be mounted again. When Bareos reaches the end of a volume and requests you to mount a new volume, you must issue this command after you have placed the new volume in the drive. In effect, it is the signal needed by Bareos to know to start reading or writing the new volume.

quit Exit or quit the console program.

Most of the commands given above, with the exception of **list**, will prompt you for the necessary arguments if you simply enter the command name.

6.11 Patience When Starting Daemons or Mounting Blank Tapes

When you start the Bareos daemons, the Storage daemon attempts to open all defined storage devices and verify the currently mounted Volume (if configured). Until all the storage devices are verified, the Storage daemon will not accept connections from the Console program. If a tape was previously used, it will be rewound, and on some devices this can take several minutes. As a consequence, you may need to have a bit of patience when first contacting the Storage daemon after starting the daemons. If you can see your tape drive, once the lights stop flashing, the drive will be ready to be used.
The same considerations apply if you have just mounted a blank tape in a drive such as an HP DLT. It can take a minute or two before the drive properly recognizes that the tape is blank. If you attempt to **mount** the tape with the Console program during this recognition period, it is quite possible that you will hang your SCSI driver (at least on my Red Hat Linux system). As a consequence, you are again urged to have patience when inserting blank tapes. Let the device settle down before attempting to access it.

6.12 Difficulties Connecting from the FD to the SD

If you are having difficulties getting one or more of your File daemons to connect to the Storage daemon, it is most likely because you have not used a fully qualified domain name on the **Address** directive in the Director's Storage resource. That is the resolver on the File daemon's machine (not on the Director's) must be able to resolve the name you supply into an IP address. An example of an address that is guaranteed not to work: **localhost**. An example that may work: **megalon**. An example that is more likely to work: **magalon.mydomain.com**. On Win32 if you don't have a good resolver (often true on older Windows systems), you might try using an IP address in place of a name.
If your address is correct, then make sure that no other program is using the port 9103 on the Storage daemon's machine. The Bacula project has reserved these port numbers by IANA, therefore they should only be used by Bacula and its replacements like Bareos. However, apparently some HP printers do use these port numbers. A **netstat -a** on the Storage daemon's machine can determine who is using the 9103 port (used for FD to SD communications in Bareos).

6.13 Creating a Pool

Creating the Pool is automatically done when **Bareos** starts, so if you understand Pools, you can skip to the next section.
When you run a job, one of the things that Bareos must know is what Volumes to use to backup the FileSet. Instead of specifying a Volume (tape) directly, you specify which Pool of Volumes you want Bareos to consult

when it wants a tape for writing backups. Bareos will select the first available Volume from the Pool that is appropriate for the Storage device you have specified for the Job being run. When a volume has filled up with data, **Bareos** will change its VolStatus from **Append** to **Full**, and then **Bareos** will use the next volume and so on. If no appendable Volume exists in the Pool, the Director will attempt to recycle an old Volume, if there are still no appendable Volumes available, **Bareos** will send a message requesting the operator to create an appropriate Volume.
Bareos keeps track of the Pool name, the volumes contained in the Pool, and a number of attributes of each of those Volumes.
When Bareos starts, it ensures that all Pool resource definitions have been recorded in the catalog. You can verify this by entering:

```
list pools
```

to the console program, which should print something like the following:

```
*list pools
Using default Catalog name=MySQL DB=bareos
+--------+---------+---------+---------+----------+-------------+
| PoolId | Name    | NumVols | MaxVols | PoolType | LabelFormat |
+--------+---------+---------+---------+----------+-------------+
| 1      | Default | 3       | 0       | Backup   | *           |
| 2      | File    | 12      | 12      | Backup   | File        |
+--------+---------+---------+---------+----------+-------------+
*
```

If you attempt to create the same Pool name a second time, **Bareos** will print:

```
Error: Pool Default already exists.
Once created, you may use the update command to
modify many of the values in the Pool record.
```

6.14 Labeling Your Volumes

Bareos requires that each Volume contains a software label. There are several strategies for labeling volumes. The one I use is to label them as they are needed by **Bareos** using the console program. That is when Bareos needs a new Volume, and it does not find one in the catalog, it will send me an email message requesting that I add Volumes to the Pool. I then use the **label** command in the Console program to label a new Volume and to define it in the Pool database, after which Bareos will begin writing on the new Volume. Alternatively, I can use the Console **relabel** command to relabel a Volume that is no longer used providing it has VolStatus **Purged**.
Another strategy is to label a set of volumes at the start, then use them as **Bareos** requests them. This is most often done if you are cycling through a set of tapes, for example using an autochanger. For more details on recycling, please see the Automatic Volume Recycling chapter of this manual.
If you run a Bareos job, and you have no labeled tapes in the Pool, Bareos will inform you, and you can create them "on-the-fly" so to speak. In my case, I label my tapes with the date, for example: **DLT-18April02**. See below for the details of using the **label** command.

Labeling Volumes with the Console Program

Labeling volumes is normally done by using the console program.

1. bconsole
2. label

If Bareos complains that you cannot label the tape because it is already labeled, simply **unmount** the tape using the **unmount** command in the console, then physically mount a blank tape and re-issue the **label** command.
Since the physical storage media is different for each device, the **label** command will provide you with a list of the defined Storage resources such as the following:

```
The defined Storage resources are:
     1: File
     2: 8mmDrive
     3: DLTDrive
     4: SDT-10000
Select Storage resource (1-4):
```

At this point, you should have a blank tape in the drive corresponding to the Storage resource that you select.
It will then ask you for the Volume name.

```
Enter new Volume name:
```

If Bareos complains:

```
Media record for Volume xxxx already exists.
```

It means that the volume name **xxxx** that you entered already exists in the Media database. You can list all the defined Media (Volumes) with the **list media** command. Note, the LastWritten column has been truncated for proper printing.

```
+---------------+---------+--------+----------------+-----/~/-+------------+-----+
| VolumeName    | MediaTyp| VolStat| VolBytes       | LastWri | VolReten   | Recy|
+---------------+---------+--------+----------------+---------+------------+-----+
| DLTVol0002    | DLT8000 | Purged | 56,128,042,217 | 2001-10 | 31,536,000 |   0 |
| DLT-07Oct2001 | DLT8000 | Full   | 56,172,030,586 | 2001-11 | 31,536,000 |   0 |
| DLT-08Nov2001 | DLT8000 | Full   | 55,691,684,216 | 2001-12 | 31,536,000 |   0 |
| DLT-01Dec2001 | DLT8000 | Full   | 55,162,215,866 | 2001-12 | 31,536,000 |   0 |
| DLT-28Dec2001 | DLT8000 | Full   | 57,888,007,042 | 2002-01 | 31,536,000 |   0 |
| DLT-20Jan2002 | DLT8000 | Full   | 57,003,507,308 | 2002-02 | 31,536,000 |   0 |
| DLT-16Feb2002 | DLT8000 | Full   | 55,772,630,824 | 2002-03 | 31,536,000 |   0 |
| DLT-12Mar2002 | DLT8000 | Full   | 50,666,320,453 | 1970-01 | 31,536,000 |   0 |
| DLT-27Mar2002 | DLT8000 | Full   | 57,592,952,309 | 2002-04 | 31,536,000 |   0 |
| DLT-15Apr2002 | DLT8000 | Full   | 57,190,864,185 | 2002-05 | 31,536,000 |   0 |
| DLT-04May2002 | DLT8000 | Full   | 60,486,677,724 | 2002-05 | 31,536,000 |   0 |
| DLT-26May02   | DLT8000 | Append |  1,336,699,620 | 2002-05 | 31,536,000 |   1 |
+---------------+---------+--------+----------------+-----/~/-+------------+-----+
```

Once Bareos has verified that the volume does not already exist, it will prompt you for the name of the Pool in which the Volume (tape) is to be created. If there is only one Pool (Default), it will be automatically selected.
If the tape is successfully labeled, a Volume record will also be created in the Pool. That is the Volume name and all its other attributes will appear when you list the Pool. In addition, that Volume will be available for backup if the MediaType matches what is requested by the Storage daemon.
When you labeled the tape, you answered very few questions about it – principally the Volume name, and perhaps the Slot. However, a Volume record in the catalog database (internally known as a Media record) contains quite a few attributes. Most of these attributes will be filled in from the default values that were defined in the Pool (i.e. the Pool holds most of the default attributes used when creating a Volume).
It is also possible to add media to the pool without physically labeling the Volumes. This can be done with the `add` command. For more information, please see the Bareos Console chapter.

Chapter 7

Critical Items to Implement Before Production

We recommend you take your time before implementing a production on a Bareos backup system since Bareos is a rather complex program, and if you make a mistake, you may suddenly find that you cannot restore your files in case of a disaster. This is especially true if you have not previously used a major backup product.
If you follow the instructions in this chapter, you will have covered most of the major problems that can occur. It goes without saying that if you ever find that we have left out an important point, please inform us, so that we can document it to the benefit of everyone.

7.1 Critical Items

The following assumes that you have installed Bareos, you more or less understand it, you have at least worked through the tutorial or have equivalent experience, and that you have set up a basic production configuration. If you haven't done the above, please do so and then come back here. The following is a sort of checklist that points with perhaps a brief explanation of why you should do it. In most cases, you will find the details elsewhere in the manual. The order is more or less the order you would use in setting up a production system (if you already are in production, use the checklist anyway).

- Test your tape drive for compatibility with Bareos by using the test command of the btape program.
- Test the end of tape handling of your tape drive by using the fill command in the btape program.
- Do at least one restore of files. If you backup multiple OS types (Linux, Solaris, HP, MacOS, FreeBSD, Win32, ...), restore files from each system type. The Restoring Files chapter shows you how.
- Write a bootstrap file to a separate system for each backup job. See Write Bootstrap $^{\text{Dir}}_{\text{Job}}$ directive and more details are available in the The Bootstrap File chapter. Also, the default `bareos-dir.conf` comes with a Write Bootstrap directive defined. This allows you to recover the state of your system as of the last backup.
- Backup your catalog. An example of this is found in the default bareos-dir.conf file. The backup script is installed by default and should handle any database, though you may want to make your own local modifications. See also Backing Up Your Bareos Database for more information.
- Write a bootstrap file for the catalog. An example of this is found in the default bareos-dir.conf file. This will allow you to quickly restore your catalog in the event it is wiped out – otherwise it is many excruciating hours of work.
- Make a copy of the bareos-dir.conf, bareos-sd.conf, and bareos-fd.conf files that you are using on your server. Put it in a safe place (on another machine) as these files can be difficult to reconstruct if your server dies.
- Bareos assumes all filenames are in UTF-8 format. This is important when saving the filenames to the catalog. For Win32 machine, Bareos will automatically convert from Unicode to UTF-8, but on Unix, Linux, *BSD, and MacOS X machines, you must explicitly ensure that your locale is set properly. Typically this means that the **LANG** environment variable must end in **.UTF-8**. A full example is

en_US.UTF-8. The exact syntax may vary a bit from OS to OS, and exactly how you define it will also vary.

On most modern Win32 machines, you can edit the conf files with **notepad** and choose output encoding UTF-8.

7.2 Recommended Items

Although these items may not be critical, they are recommended and will help you avoid problems.

- Read the Getting Started with Bareos chapter
- After installing and experimenting with Bareos, read and work carefully through the examples in the Tutorial chapter of this manual.
- Learn what each of the Bareos Programs does.
- Set up reasonable retention periods so that your catalog does not grow to be too big. See the following three chapters:
  Automatic Volume Recycling,
  Volume Management,
  Automated Disk Backup.

If you absolutely must implement a system where you write a different tape each night and take it offsite in the morning. We recommend that you do several things:

- Write a bootstrap file of your backed up data and a bootstrap file of your catalog backup to a external media like CDROM or USB stick, and take that with the tape. If this is not possible, try to write those files to another computer or offsite computer, or send them as email to a friend. If none of that is possible, at least print the bootstrap files and take that offsite with the tape. Having the bootstrap files will make recovery much easier.
- It is better not to force Bareos to load a particular tape each day. Instead, let Bareos choose the tape. If you need to know what tape to mount, you can print a list of recycled and appendable tapes daily, and select any tape from that list. Bareos may propose a particular tape for use that it considers optimal, but it will accept any valid tape from the correct pool.

Part II

Configuration Files

Chapter 8

Customizing the Configuration Files

When each of the Bareos programs starts, it reads a configuration file specified on the command line or the default `bareos-dir.conf`, `bareos-fd.conf`, `bareos-sd.conf`, or `console.conf` for the Director daemon, the File daemon, the Storage daemon, and the Console program respectively.
Each service (Director, Client, Storage, Console) has its own configuration file containing a set of Resource definitions. These resources are very similar from one service to another, but may contain different directives (records) depending on the service. For example, in the Director's resource file, the **Director** resource defines the name of the Director, a number of global Director parameters and his password. In the File daemon configuration file, the **Director** resource specifies which Directors are permitted to use the File daemon.
If you install a full Bareos system (Director, Storage and File Daemon) to one system, the Bareos packages tries there best to generate a working configuration. However, this configuration is very limited and before you will use Bareos in production, it will be required, that you customize the configuration.
The details of each Resource and the directives permitted therein are described in the following chapters.
The following configuration files must be defined:

- Console Configuration – to define the resources for the Console program (user interface to the Director). It defines which Directors are available so that you may interact with them.
- Director Configuration – to define the resources necessary for the Director. You define all the Clients and Storage daemons that you use in this configuration file.
- Client/File Daemon Configuration – to define the resources for each client to be backed up. That is, you will have a separate Client resource file on each machine that runs a File daemon.
- Storage Daemon Configuration – to define the resources to be used by each Storage daemon. Normally, you will have a single Storage daemon that controls your tape drive or tape drives. However, if you have tape drives on several machines, you will have at least one Storage daemon per machine.

8.1 Character Sets

Bareos is designed to handle most character sets of the world, US ASCII, German, French, Chinese, ... However, it does this by encoding everything in UTF-8, and it expects all configuration files (including those read on Win32 machines) to be in UTF-8 format. UTF-8 is typically the default on Linux machines, but not on all Unix machines, nor on Windows, so you must take some care to ensure that your locale is set properly before starting Bareos.
To ensure that Bareos configuration files can be correctly read including foreign characters the **LANG** environment variable must end in **.UTF-8**. A full example is **en_US.UTF-8**. The exact syntax may vary a bit from OS to OS, and exactly how you define it will also vary. On most newer Win32 machines, you can use `notepad` to edit the conf files, then choose output encoding UTF-8.
Bareos assumes that all filenames are in UTF-8 format on Linux and Unix machines. On Win32 they are in Unicode (UTF-16), and will be automatically converted to UTF-8 format.

8.2 Resource Directive Format

Although, you won't need to know the details of all the directives a basic knowledge of Bareos resource directives is essential. Each directive contained within the resource (within the braces) is composed of a

keyword followed by an equal sign (=) followed by one or more values. The keywords must be one of the known Bareos resource record keywords, and it may be composed of upper or lower case characters and spaces.
Each resource definition MUST contain a Name directive, and may optionally contain a Description directive. The Name directive is used to uniquely identify the resource. The Description directive is (will be) used during display of the Resource to provide easier human recognition. For example:

```
Director {
  Name = "MyDir"
  Description = "Main Bareos Director"
  WorkingDirectory = "$HOME/bareos/bin/working"
}
```

Configuration 8.1: Resource example

Defines the Director resource with the name "MyDir" and a working directory `$HOME/bareos/bin/working`.

8.2.1 Quotes

In general, if you want spaces in a name to the right of the first equal sign (=), you must enclose that name within double quotes. Otherwise quotes are not generally necessary because once defined, quoted strings and unquoted strings are all equal.
However, if the configure directive defines a numbers, the number never has surrounding quotes. This is even true if the number is specified together with its unit, like `365 days`.
Also do not prepend numbers by zeros (0), as these are not parsed in the expected manner (write 1 instead of 01).

8.2.2 Comments

When reading the configuration file, blank lines are ignored and everything after a hash sign (#) until the end of the line is taken to be a comment. A semicolon (;) is a logical end of line, and anything after the semicolon is considered as the next statement. If a statement appears on a line by itself, a semicolon is not necessary to terminate it, so generally in the examples in this manual, you will not see many semicolons.

8.2.3 Upper and Lower Case and Spaces

Case (upper/lower) and spaces are totally ignored in the resource directive keywords (the part before the equal sign).
Within the keyword (i.e. before the equal sign), spaces are not significant. Thus the keywords: **name**, **Name**, and **N a m e** are all identical.
Spaces after the equal sign and before the first character of the value are ignored.
In general, spaces within a value are significant (not ignored), and if the value is a name, you must enclose the name in double quotes for the spaces to be accepted. Names may contain up to 127 characters. Currently, a name may contain any ASCII character. Within a quoted string, any character following a backslash (\) is taken as itself (handy for inserting backslashes and double quotes (")).
Please note, however, that Bareos resource names as well as certain other names (e.g. Volume names) must contain only letters (including ISO accented letters), numbers, and a few special characters (space, underscore, ...). All other characters and punctuation are invalid.

8.2.4 Including other Configuration Files

If you wish to break your configuration file into smaller pieces, you can do so by including other files using the syntax @**filename** where **filename** is the full path and filename of another file. The @filename specification can be given anywhere a primitive token would appear.
If you wish include all files in a specific directory, you can use the following:

```
# Include subfiles associated with configuration of clients.
# They define the bulk of the Clients, Jobs, and FileSets.
# Remember to "reload" the Director after adding a client file.
#
@|"sh -c 'for f in /etc/bareos/clientdefs/*.conf ; do echo @${f} ; done'"
```

Configuration 8.2: include configuration files

8.2.5 Data Types

When parsing the resource directives, Bareos classifies the data according to the types listed below. The first time you read this, it may appear a bit overwhelming, but in reality, it is all pretty logical and straightforward.

acl This directive defines what is permitted to access. It does this by a list of strings, separated by **,**.

The special keyword `*all*` allows unrestricted access.

Depending on the type of the ACL, the strings can by either resource names, paths or bconsole commands.

auth-type Specifies the authentication type that must be supplied when connecting to a backup protocol that uses a specific authentication type. Currently only used for NDMP Resource.

The following values are allowed:

1. None - Use no password
2. Clear - Use clear text password
3. MD5 - Use MD5 hashing

directory A directory is either a quoted or non-quoted string. A directory will be passed to your standard shell for expansion when it is scanned. Thus constructs such as **$HOME** are interpreted to be their correct values.

integer A 32 bit integer value. It may be positive or negative.

Don't use quotes around the number, see Quotes.

long integer A 64 bit integer value. Typically these are values such as bytes that can exceed 4 billion and thus require a 64 bit value.

Don't use quotes around the number, see Quotes.

name A keyword or name consisting of alphanumeric characters, including the hyphen, underscore, and dollar characters. The first character of a **name** must be a letter. A name has a maximum length currently set to 127 bytes. Typically keywords appear on the left side of an equal (i.e. they are Bareos keywords – i.e. Resource names or directive names). Keywords may not be quoted.

name-string A name-string is similar to a name, except that the name may be quoted and can thus contain additional characters including spaces. Name strings are limited to 127 characters in length. Name strings are typically used on the right side of an equal (i.e. they are values to be associated with a keyword).

password This is a Bareos password and it is stored internally in MD5 hashed format.

path File name, including path.

positive integer A 32 bit positive integer value.

Don't use quotes around the number, see Quotes.

speed The speed parameter can be specified as k/s, kb/s, m/s or mb/s.

Don't use quotes around the parameter, see Quotes.

string A quoted string containing virtually any character including spaces, or a non-quoted string. A string may be of any length. Strings are typically values that correspond to filenames, directories, or system command names. A backslash (\) turns the next character into itself, so to include a double quote in a string, you precede the double quote with a backslash. Likewise to include a backslash.

string-list Multiple strings, specified in multiple directives, or in a single directive, separated by **,**.

net-address Netaddress is either a domain name or an IP address specified as a dotted quadruple in string or quoted string format. This directive only permits a single address to be specified. The net-portmust be specific separate. If multiple net-addresses are needed, check if it also possible to specify net-addresses(plural).

net-addresses Specify a set of net-addresses and net-ports. Probably the simplest way to explain this is to show an example:

```
Addresses  = {
    ip = { addr = 1.2.3.4; port = 1205;}
    ipv4 = {
        addr = 1.2.3.4; port = http;}
    ipv6 = {
        addr = 1.2.3.4;
        port = 1205;
    }
    ip = {
        addr = 1.2.3.4
        port = 1205
    }
    ip = { addr = 1.2.3.4 }
    ip = { addr = 201:220:222::2 }
    ip = {
        addr = server.example.com
    }
}
```

Configuration 8.3: net-addresses

where ip, ip4, ip6, addr, and port are all keywords. Note, that the address can be specified as either a dotted quadruple, or IPv6 colon notation, or as a symbolic name (only in the ip specification). Also, port can be specified as a number or as the mnemonic value from the `/etc/services` file. If a port is not specified, the default will be used. If an ip section is specified, the resolution can be made either by IPv4 or IPv6. If ip4 is specified, then only IPv4 resolutions will be permitted, and likewise with ip6.

net-port Specify a network port (a positive integer).

Don't use quotes around the parameter, see Quotes.

resource A resource defines a relation to the name of another resource.

size A size specified as bytes. Typically, this is a floating point scientific input format followed by an optional modifier. The floating point input is stored as a 64 bit integer value. If a modifier is present, it must immediately follow the value with no intervening spaces. The following modifiers are permitted:

k 1,024 (kilobytes)

kb 1,000 (kilobytes)

m 1,048,576 (megabytes)

mb 1,000,000 (megabytes)

g 1,073,741,824 (gigabytes)

gb 1,000,000,000 (gigabytes)

Don't use quotes around the parameter, see Quotes.

time A time or duration specified in seconds. The time is stored internally as a 64 bit integer value, but it is specified in two parts: a number part and a modifier part. The number can be an integer or a floating point number. If it is entered in floating point notation, it will be rounded to the nearest integer. The modifier is mandatory and follows the number part, either with or without intervening spaces. The following modifiers are permitted:

seconds seconds

minutes minutes (60 seconds)

hours hours (3600 seconds)

days days (3600*24 seconds)

weeks weeks (3600*24*7 seconds)

months months (3600*24*30 seconds)

quarters quarters (3600*24*91 seconds)

years years (3600*24*365 seconds)

Any abbreviation of these modifiers is also permitted (i.e. **seconds** may be specified as **sec** or **s**). A specification of **m** will be taken as months.

The specification of a time may have as many number/modifier parts as you wish. For example:

```
1 week 2 days 3 hours 10 mins
1 month 2 days 30 sec
```

are valid date specifications.

Don't use quotes around the parameter, see Quotes.

audit-command-list Specifies the commands that should be logged on execution (audited). E.g.

```
Audit Events = label
Audit Events = restore
```

Based on the type string-list.

yes|no Either a `yes` or a `no` (or `true` or `false`).

8.2.6 Variable Expansion

Depending on the type of directive, Bareos will expand following variables:

Variable Expansion on Media Labels When labeling a new media, following Bareos internal variables can be used:

Internal Variable	Description
`Year`	Year
`Month`	Month: 1-12
`Day`	Day: 1-31
`Hour`	Hour: 0-24
`Minute`	Minute: 0-59
`Second`	Second: 0-59
`WeekDay`	Day of the week: 0-6, using 0 for Sunday
`Job`	Name of the Job
`Dir`	Name of the Director
`Level`	Job Level
`Type`	Job Type
`JobId`	JobId
`JobName`	unique name of a job
`Storage`	Name of the Storage Daemon
`Client`	Name of the Clients
`NumVols`	Numbers of volumes in the pool
`Pool`	Name of the Pool
`Catalog`	Name of the Catalog
`MediaType`	Type of the media

Additional, normal environment variables can be used, e.g. `HOME` oder `HOSTNAME`.

Variable Expansion on RunScripts At the configuration of RunScripts following variables can be used:

Variable	Description
\%c	Client's Name
\%d	Director's Name
\%e	Job Exit Code
\%i	JobId
\%j	Unique JobId
\%l	Job Level
\%n	Unadorned Job Name
\%r	Recipients
\%s	Since Time
\%b	Job Bytes
\%B	Job Bytes in human readable format
\%f	Job Files
\%t	Job Type (Backup, ...)
\%v	Read Volume Name (only on Director)
\%V	Write Volume Name (only on Director)

Variable Expansion in Autochanger Commands At the configuration of autochanger commands following variables can be used:

Variable	Description
\%a	Archive Device Name
\%c	Changer Device Name
\%d	Changer Drive Index
\%f	Client's Name
\%j	Job Name
\%o	Command
\%s	Slot Base 0
\%S	Slot Base 1
\%v	Volume Name

Variable Expansion in Mount Commands At the configuration of mount commands following variables can be used:

Variable	Description
\%a	Archive Device Name
\%e	Erase
\%n	Part Number
\%m	Mount Point
\%v	Last Part Name

Variable Expansion in Mail and Operator Commands At the configuration of mail and operator commands following variables can be used:

Variable	Description
\%c	Client's Name
\%d	Director's Name
\%e	Job Exit Code
\%i	JobId
\%j	Unique Job Id
\%l	Job Level
\%n	Unadorned Job Name
\%s	Since Time
\%t	Job Type (Backup, ...)
\%r	Recipients
\%v	Read Volume Name
\%V	Write Volume Name
\%b	Job Bytes
\%B	Job Bytes in human readable format
\%F	Job Files

8.3 Resource Types

The following table lists all current Bareos resource types. It shows what resources must be defined for each service (daemon). The default configuration files will already contain at least one example of each permitted resource, so you need not worry about creating all these kinds of resources from scratch.

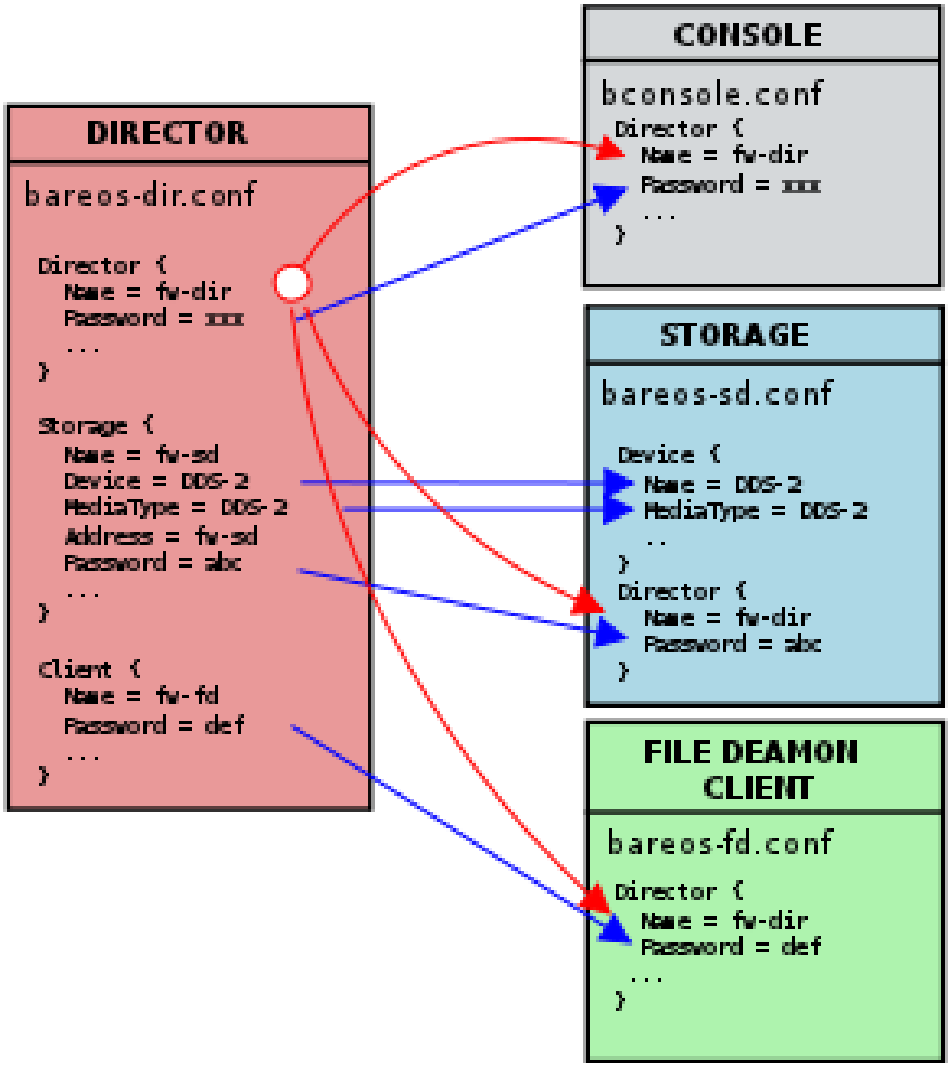
Resource	Director	Client	Storage	Console
Autochanger			x	
Catalog	x			
Client	x	x		
Console	x			x
Device			x	
Director	x	x	x	x
FileSet	x			
Job	x			
JobDefs	x			
Message	x	x	x	
NDMP			x	
Pool	x			
Schedule	x			
Storage	x		x	

8.4 Names, Passwords and Authorization

In order for one daemon to contact another daemon, it must authorize itself with a password. In most cases, the password corresponds to a particular name, so both the name and the password must match to be authorized. Passwords are plain text, any text. They are not generated by any special process; just use random text.

The default configuration files are automatically defined for correct authorization with random passwords. If you add to or modify these files, you will need to take care to keep them consistent.

Here is sort of a picture of what names/passwords in which files/Resources must match up:



In the left column, you will find the Director, Storage, and Client resources, with their names and passwords – these are all in `bareos-dir.conf`. In the right column are where the corresponding values should be found in the Console, Storage daemon (SD), and File daemon (FD) configuration files.
Please note that the address, `fw-sd`, that appears in the Storage resource of the Director, is passed to the File daemon in symbolic form. The File daemon then resolves it to an IP address. For this reason, you must use either an IP address or a resolvable fully qualified name. A name such as `localhost`, not being a fully qualified name, will resolve in the File daemon to the `localhost` of the File daemon, which is most likely not what is desired. The password used for the File daemon to authorize with the Storage daemon is a temporary password unique to each Job created by the daemons and is not specified in any .conf file.

Chapter 9

Director Configuration

Of all the configuration files needed to run **Bareos**, the Director's is the most complicated, and the one that you will need to modify the most often as you add clients or modify the FileSets.
For a general discussion of configuration files and resources including the data types recognized by **Bareos**. Please see the Configuration chapter of this manual.
Director resource type may be one of the following:
Job, JobDefs, Client, Storage, Catalog, Schedule, FileSet, Pool, Director, or Messages. We present them here in the most logical order for defining them:
Note, everything revolves around a job and is tied to a job in one way or another.

- Director Resource – to define the Director's name and its access password used for authenticating the Console program. Only a single Director resource definition may appear in the Director's configuration file. If you have either **/dev/random** or **bc** on your machine, Bareos will generate a random password during the configuration process, otherwise it will be left blank.
- Job Resource – to define the backup/restore Jobs and to tie together the Client, FileSet and Schedule resources to be used for each Job. Normally, you will Jobs of different names corresponding to each client (i.e. one Job per client, but a different one with a different name for each client).
- JobDefs Resource – optional resource for providing defaults for Job resources.
- Schedule Resource – to define when a Job has to run. You may have any number of Schedules, but each job will reference only one.
- FileSet Resource – to define the set of files to be backed up for each Client. You may have any number of FileSets but each Job will reference only one.
- Client Resource – to define what Client is to be backed up. You will generally have multiple Client definitions. Each Job will reference only a single client.
- Storage Resource – to define on what physical device the Volumes should be mounted. You may have one or more Storage definitions.
- Pool Resource – to define the pool of Volumes that can be used for a particular Job. Most people use a single default Pool. However, if you have a large number of clients or volumes, you may want to have multiple Pools. Pools allow you to restrict a Job (or a Client) to use only a particular set of Volumes.
- Catalog Resource – to define in what database to keep the list of files and the Volume names where they are backed up. Most people only use a single catalog. It is possible, however not adviced and not supported to use multiple catalogs, see Current Implementation Restrictions.
- Messages Resource – to define where error and information messages are to be sent or logged. You may define multiple different message resources and hence direct particular classes of messages to different users or locations (files, ...).

9.1 Director Resource

The Director resource defines the attributes of the Directors running on the network. Only a single Director resource is allowed.
The following is an example of a valid Director resource definition:

```
Director {
  Name = bareos-dir
  Password = secretpassword
  QueryFile = "/etc/bareos/query.sql"
  Maximum Concurrent Jobs = 10
  Messages = Daemon
}
```

Configuration 9.1: Director Ressource example

configuration directive name	type of data	default value	remark
Absolute Job Timeout	= positive-integer		
Audit Events	= audit-command-list		
Auditing	= yes|no	no	
Backend Directory	= `DirectoryList`	/usr/lib/bareos/backends *(platform specific)*	
Description	= string		
Dir Address	= net-address	9101	
Dir Addresses	= net-addresses	9101	
Dir Port	= net-port	9101	
Dir Source Address	= net-address	0	
FD Connect Timeout	= time	180	
Heartbeat Interval	= time	0	
Key Encryption Key	= password		
Log Timestamp Format	= string		
Maximum Concurrent Jobs	= positive-integer	1	
Maximum Connections	= positive-integer	30	
Maximum Console Connections	= positive-integer	20	
Messages	= resource-name		
Name	**= name**		**required**
NDMP Log Level	= positive-integer	4	
NDMP Snooping	= yes|no		
Omit Defaults	= yes|no	yes	
Optimize For Size	= yes|no	no	
Optimize For Speed	= yes|no	no	
Password	**= password**		**required**
Pid Directory	= directory	/var/lib/bareos *(platform specific)*	
Plugin Directory	= directory		
Plugin Names	= `PluginNames`		
Query File	**= directory**		**required**
Scripts Directory	= directory		
SD Connect Timeout	= time	1800	
Secure Erase Command	= string		
Statistics Collect Interval	= positive-integer	150	
Statistics Retention	= time	160704000	
Sub Sys Directory	= *directory*		*deprecated*
Subscriptions	= positive-integer	0	
TLS Allowed CN	= string-list		
TLS Authenticate	= yes|no		
TLS CA Certificate Dir	= directory		
TLS CA Certificate File	= directory		
TLS Certificate	= directory		
TLS Certificate Revocation List	= directory		
TLS Cipher List	= string		
TLS DH File	= directory		
TLS Enable	= yes|no		
TLS Key	= directory		
TLS Require	= yes|no		
TLS Verify Peer	= yes|no	yes	
Ver Id	= string		
Working Directory	= directory	/var/lib/bareos *(platform specific)*	

Absolute Job Timeout = <positive-integer>

Version >= 14.2.0

Audit Events = <audit-command-list>
Specify which commands (see Console Commands) will be audited. If nothing is specified (and Auditing Dir Director is enabled), all commands will be audited.
Version >= 14.2.0

Auditing = <yes|no> (default: no)
This directive allows to en- or disable auditing of interaction with the Bareos Director. If enabled, audit messages will be generated. The messages resource configured in Messages Dir Director defines, how these messages are handled.
Version >= 14.2.0

Backend Directory = <DirectoryList> (default: /usr/lib/bareos/backends *(platform specific)*)
This directive specifies a directory from where the Bareos Director loads his dynamic backends.

Description = <string>
The text field contains a description of the Director that will be displayed in the graphical user interface. This directive is optional.

Dir Address = <net-address> (default: 9101)
This directive is optional, but if it is specified, it will cause the Director server (for the Console program) to bind to the specified address. If this and the Dir Addresses Dir Director directives are not specified, the Director will bind to any available address (the default).

Dir Addresses = <net-addresses> (default: 9101)
Specify the ports and addresses on which the Director daemon will listen for Bareos Console connections.

Please note that if you use the Dir Addresses Dir Director directive, you must not use either a Dir Port Dir Director or a Dir Address Dir Director directive in the same resource.

Dir Port = <net-port> (default: 9101)
Specify the port on which the Director daemon will listen for Bareos Console connections. This same port number must be specified in the Director resource of the Console configuration file. The default is 9101, so normally this directive need not be specified. This directive should not be used if you specify Dir Addresses Dir Director (N.B plural) directive.

Dir Source Address = <net-address> (default: 0)
This record is optional, and if it is specified, it will cause the Director server (when initiating connections to a storage or file daemon) to source its connections from the specified address. Only a single IP address may be specified. If this record is not specified, the Director server will source its outgoing connections according to the system routing table (the default).

FD Connect Timeout = <time> (default: 180)
where `time` is the time that the Director should continue attempting to contact the File daemon to start a job, and after which the Director will cancel the job. The default is 3 minutes.

Heartbeat Interval = <time> (default: 0)
This directive is optional and if specified will cause the Director to set a keepalive interval (heartbeat) in seconds on each of the sockets it opens for the Client resource. This value will override any specified at the Director level. It is implemented only on systems that provide the **setsockopt** TCP_KEEPIDLE function (Linux, ...). The default value is zero, which means no change is made to the socket.

Key Encryption Key = <password>
This key is used to encrypt the Security Key that is exchanged between the Director and the Storage Daemon for supporting Application Managed Encryption (AME). For security reasons each Director should have a different Key Encryption Key.

Log Timestamp Format = <string>

Version >= 15.2.3

Maximum Concurrent Jobs = <positive-integer> (default: 1)
where <number> is the maximum number of total Director Jobs that should run concurrently. The default is set to 1, but you may set it to a larger number.

The Volume format becomes more complicated with multiple simultaneous jobs, consequently, restores may take longer if Bareos must sort through interleaved volume blocks from multiple simultaneous jobs. This can be avoided by having each simultaneous job write to a different volume or by using data spooling, which will first spool the data to disk simultaneously, then write one spool file at a time to the volume thus avoiding excessive interleaving of the different job blocks.

See also the section about Concurrent Jobs.

Maximum Connections = <positive-integer> (default: 30)

Maximum Console Connections = <positive-integer> (default: 20)
where `number` is the maximum number of Console Connections that could run concurrently. The default is set to 20, but you may set it to a larger number.

Messages = <resource-name>
The messages resource specifies where to deliver Director messages that are not associated with a specific Job. Most messages are specific to a job and will be directed to the Messages resource specified by the job. However, there are a messages that can occur when no job is running.

Name = <name> (required)
The name of the resource.

The director name used by the system administrator.

NDMP Log Level = <positive-integer> (default: 4)
This directive sets the loglevel for the NDMP protocol library.
Version >= 13.2.0

NDMP Snooping = <yes|no>
This directive enables the Snooping and pretty printing of NDMP protocol information in debugging mode.
Version >= 13.2.0

Omit Defaults = <yes|no> (default: yes)
When showing the configuration, omit those parameter that have there default value assigned.

Optimize For Size = <yes|no> (default: no)
If set to `yes` this directive will use the optimizations for memory size over speed. So it will try to use less memory which may lead to a somewhat lower speed. Its currently mostly used for keeping all hardlinks in memory.

If none of Optimize For Size $^{\text{Dir}}_{\text{Director}}$ and Optimize For Speed $^{\text{Dir}}_{\text{Director}}$ is enabled, Optimize For Size $^{\text{Dir}}_{\text{Director}}$ is enabled by default.

Optimize For Speed = <yes|no> (default: no)
If set to `yes` this directive will use the optimizations for speed over the memory size. So it will try to use more memory which lead to a somewhat higher speed. Its currently mostly used for keeping all hardlinks in memory. Its relates to the Optimize For Size Dir Director option set either one to `yes` as they are mutually exclusive.

Password = <password> (required)
Specifies the password that must be supplied for the default Bareos Console to be authorized. The same password must appear in the **Director** resource of the Console configuration file. For added security, the password is never passed across the network but instead a challenge response hash code created with the password. Bareos tries to generate a random password during the configuration process, otherwise it will be left blank and you must manually supply it.

The password is plain text.

Pid Directory = <directory> (default: /var/lib/bareos *(platform specific)*)
This directive is optional and specifies a directory in which the Director may put its process Id file. The process Id file is used to shutdown Bareos and to prevent multiple copies of Bareos from running simultaneously. Standard shell expansion of the **Directory** is done when the configuration file is read so that values such as **$HOME** will be properly expanded.

The PID directory specified must already exist and be readable and writable by the Bareos daemon referencing it.

Typically on Linux systems, you will set this to: `/var/run`. If you are not installing Bareos in the system directories, you can use the **Working Directory** as defined above.

Plugin Directory = <directory>
Plugins are loaded from this directory. To load only specific plugins, use 'Plugin Names'.

Version >= 14.2.0

Plugin Names = <PluginNames>
List of plugins, that should get loaded from 'Plugin Directory' (only basenames, '-dir.so' is added automatically). If empty, all plugins will get loaded.

If a Plugin Directory Dir Director is specified **Plugin Names** defines, which Director plugins get loaded.

If **Plugin Names** is not defined, all plugins get loaded, otherwise the defined ones.
Version >= 14.2.0

Query File = <directory> (required)
This directive is required and specifies a directory and file in which the Director can find the canned SQL statements for the **Query** command of the Console.

Scripts Directory = <directory>
This directive is currently unused.

SD Connect Timeout = <time> (default: 1800)
where `time` is the time that the Director should continue attempting to contact the Storage daemon to start a job, and after which the Director will cancel the job. The default is 30 minutes.

Secure Erase Command = <string>
Specify command that will be called when bareos unlinks files.

When files are no longer needed, Bareos will delete (unlink) them. With this directive, it will call the specified command to delete these files. See Secure Erase Command for details.
Version >= 15.2.1

Statistics Collect Interval = <positive-integer> (default: 150)
Bareos offers the possibilty to collect statistic information from its connected devices. To do so, Collect Statistics $^{\text{Dir}}_{\text{Storage}}$ must be enabled. This interval defines, how often the Director connects to the attached Storage Daemons to collect the statistic information.
Version >= 14.2.0

Statistics Retention = <time> (default: 160704000)
The **Statistics Retention** directive defines the length of time that Bareos will keep statistics job records in the Catalog database after the Job End time (in `JobHistory` table). When this time period expires, and if user runs `prune stats` command, Bareos will prune (remove) Job records that are older than the specified period.

Theses statistics records aren't use for restore purpose, but mainly for capacity planning, billings, etc. See chapter about how to extract information from the catalog for additional information.

See the Configuration chapter of this manual for additional details of time specification.

Sub Sys Directory = <directory>
Please note! *This directive is deprecated.*

Subscriptions = <positive-integer> (default: 0)
In case you want check that the number of active clients don't exceed a specific number, you can define this number here and check with the `status subscriptions` command.

However, this is only indended to give a hint. No active limiting is implemented.
Version >= 12.4.4

TLS Allowed CN = <string-list>

TLS Authenticate = <yes|no>

TLS CA Certificate Dir = <directory>

TLS CA Certificate File = <directory>

TLS Certificate = <directory>

TLS Certificate Revocation List = <directory>

TLS Cipher List = <string>

TLS DH File = <directory>

TLS Enable = <yes|no>
Bareos can be configured to encrypt all its network traffic. See chapter TLS Configuration Directives to see, how the Bareos Director (and the other components) must be configured to use TLS.

TLS Key = <directory>

TLS Require = <yes|no>

TLS Verify Peer = <yes|no> (default: yes)

Ver Id = <string>
where `string` is an identifier which can be used for support purpose. This string is displayed using the `version` command.

Working Directory = <directory> (default: /var/lib/bareos *(platform specific)*)
This directive is optional and specifies a directory in which the Director may put its status files. This directory should be used only by Bareos but may be shared by other Bareos daemons. Standard shell expansion of the **directory** is done when the configuration file is read so that values such as **$HOME** will be properly expanded.

The working directory specified must already exist and be readable and writable by the Bareos daemon referencing it.

9.2 Job Resource

The Job resource defines a Job (Backup, Restore, ...) that Bareos must perform. Each Job resource definition contains the name of a Client and a FileSet to backup, the Schedule for the Job, where the data are to be stored, and what media Pool can be used. In effect, each Job resource must specify What, Where, How, and When or FileSet, Storage, Backup/Restore/Level, and Schedule respectively. Note, the FileSet must be specified for a restore job for historical reasons, but it is no longer used.
Only a single type (**Backup**, **Restore**, ...) can be specified for any job. If you want to backup multiple FileSets on the same Client or multiple Clients, you must define a Job for each one.
Note, you define only a single Job to do the Full, Differential, and Incremental backups since the different backup levels are tied together by a unique Job name. Normally, you will have only one Job per Client, but if a client has a really huge number of files (more than several million), you might want to split it into to Jobs each with a different FileSet covering only part of the total files.
Multiple Storage daemons are not currently supported for Jobs, so if you do want to use multiple storage daemons, you will need to create a different Job and ensure that for each Job that the combination of Client and FileSet are unique. The Client and FileSet are what Bareos uses to restore a client, so if there are multiple Jobs with the same Client and FileSet or multiple Storage daemons that are used, the restore will not work. This problem can be resolved by defining multiple FileSet definitions (the names must be different, but the contents of the FileSets may be the same).

configuration directive name	type of data	default value	remark
Accurate	= yes|no	no	
Add Prefix	= string		
Add Suffix	= string		
Allow Duplicate Jobs	= yes|no	yes	
Allow Higher Duplicates	= yes|no	yes	
Allow Mixed Priority	= yes|no	no	
Backup Format	= string	Native	
Base	= `ResourceList`		
Bootstrap	= directory		
Cancel Lower Level Duplicates	= yes|no	no	
Cancel Queued Duplicates	= yes|no	no	
Cancel Running Duplicates	= yes|no	no	
Catalog	= resource-name		

Client	= resource-name		
Client Run After Job	= RunscriptShort		
Client Run Before Job	= RunscriptShort		
Description	= string		
Differential Backup Pool	= resource-name		
Differential Max Runtime	= time		
Differential Max Wait Time	= *time*		*deprecated*
Dir Plugin Options	= string-list		
Enabled	= yes|no	yes	
FD Plugin Options	= string-list		
File Set	= resource-name		
Full Backup Pool	= resource-name		
Full Max Runtime	= time		
Full Max Wait Time	= *time*		*deprecated*
Incremental Backup Pool	= resource-name		
Incremental Max Runtime	= time		
Incremental Max Wait Time	= *time*		*deprecated*
Job Defs	= resource-name		
Job To Verify	= resource-name		
Level	= BackupLevel		
Max Concurrent Copies	= positive-integer	100	
Max Diff Interval	= time		
Max Full Interval	= time		
Max Run Time	= time		
Max Start Delay	= time		
Max Virtual Full Interval	= time		
Max Wait Time	= time		
Maximum Bandwidth	= speed		
Maximum Concurrent Jobs	= positive-integer	1	
Maxrun Sched Time	= time		
Messages	**= resource-name**		**required**
Name	**= name**		**required**
Next Pool	= resource-name		
Plugin Options	= *string-list*		*alias, deprecated*
Pool	**= resource-name**		**required**
Prefer Mounted Volumes	= yes|no	yes	
Prefix Links	= yes|no	no	
Priority	= positive-integer	10	
Protocol	= ProtocolType	Native	
Prune Files	= yes|no	no	
Prune Jobs	= yes|no	no	
Prune Volumes	= yes|no	no	
Purge Migration Job	= yes|no	no	
Regex Where	= string		
Replace	= ReplaceOption	Always	
Rerun Failed Levels	= yes|no	no	
Reschedule Interval	= time	1800	
Reschedule On Error	= yes|no	no	
Reschedule Times	= positive-integer	5	
Run	= string-list		
Run After Failed Job	= RunscriptShort		
Run After Job	= RunscriptShort		
Run Before Job	= RunscriptShort		
Run Script	{ Runscript }		
Save File History	= yes|no	yes	
Schedule	= resource-name		
SD Plugin Options	= string-list		
Selection Pattern	= string		
Selection Type	= MigrationType		
Spool Attributes	= yes|no	no	

Spool Data	= yes|no	no	
Spool Size	= Size64		
Storage	= ResourceList		
Strip Prefix	= string		
Type	**= JobType**		**required**
Verify Job	*= resource-name*		*alias*
Virtual Full Backup Pool	= resource-name		
Where	= directory		
Write Bootstrap	= directory		
Write Part After Job	*= yes|no*		*deprecated*
Write Verify List	= directory		

Accurate = <yes|no> (default: no)

In accurate mode, the File daemon knowns exactly which files were present after the last backup. So it is able to handle deleted or renamed files.

When restoring a FileSet for a specified date (including "most recent"), Bareos is able to restore exactly the files and directories that existed at the time of the last backup prior to that date including ensuring that deleted files are actually deleted, and renamed directories are restored properly.

When doing VirtualFull backups, it is advised to use the accurate mode, otherwise the VirtualFull might contain already deleted files.

However, using the accurate mode has also disadvantages:

- The File daemon must keep data concerning all files in memory. So If you do not have sufficient memory, the backup may either be terribly slow or fail. For 500.000 files (a typical desktop linux system), it will require approximately 64 Megabytes of RAM on your File daemon to hold the required information.

Add Prefix = <string>

This directive applies only to a Restore job and specifies a prefix to the directory name of all files being restored. This will use File Relocation feature.

Add Suffix = <string>

This directive applies only to a Restore job and specifies a suffix to all files being restored. This will use File Relocation feature.

Using `Add Suffix=.old`, `/etc/passwd` will be restored to `/etc/passwsd.old`

Allow Duplicate Jobs = <yes|no> (default: yes)

A duplicate job in the sense we use it here means a second or subsequent job with the same name starts. This happens most frequently when the first job runs longer than expected because no tapes are available.

If this directive is enabled duplicate jobs will be run. If the directive is set to `no` then only one job of a given name may run at one time. The action that Bareos takes to ensure only one job runs is determined by the directives

- Cancel Lower Level Duplicates Dir Job
- Cancel Queued Duplicates Dir Job
- Cancel Running Duplicates Dir Job

If none of these directives is set to `yes`, **Allow Duplicate Jobs** is set to `no` and two jobs are present, then the current job (the second one started) will be cancelled.

Allow Higher Duplicates = <yes|no> (default: yes)

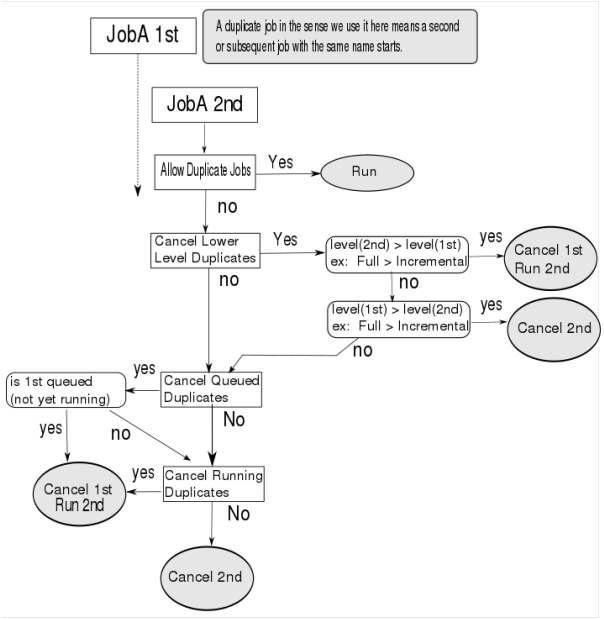


Figure 9.1: Allow Duplicate Jobs usage

Allow Mixed Priority = <yes|no> (default: no)

When set to `yes`, this job may run even if lower priority jobs are already running. This means a high priority job will not have to wait for other jobs to finish before starting. The scheduler will only mix priorities when all running jobs have this set to true.

Note that only higher priority jobs will start early. Suppose the director will allow two concurrent jobs, and that two jobs with priority 10 are running, with two more in the queue. If a job with priority 5 is added to the queue, it will be run as soon as one of the running jobs finishes. However, new priority 10 jobs will not be run until the priority 5 job has finished.

Backup Format = <string> (default: Native)

The backup format used for protocols which support multiple formats. By default, it uses the Bareos `Native` Backup format. Other protocols, like NDMP supports different backup formats for instance:

- Dump
- Tar
- SMTape

Base = <ResourceList>

The Base directive permits to specify the list of jobs that will be used during Full backup as base. This directive is optional. See the Base Job chapter for more information.

Bootstrap = <directory>

The Bootstrap directive specifies a bootstrap file that, if provided, will be used during **Restore** Jobs and is ignored in other Job types. The **bootstrap** file contains the list of tapes to be used in a restore Job as well as which files are to be restored. Specification of this directive is optional, and if specified,

it is used only for a restore job. In addition, when running a Restore job from the console, this value can be changed.

If you use the restore command in the Console program, to start a restore job, the **bootstrap** file will be created automatically from the files you select to be restored.

For additional details see The Bootstrap File chapter.

Cancel Lower Level Duplicates = <yes|no> (default: no)
If Allow Duplicate Jobs [Dir Job] is set to `no` and this directive is set to `yes`, Bareos will choose between duplicated jobs the one with the highest level. For example, it will cancel a previous Incremental to run a Full backup. It works only for Backup jobs. If the levels of the duplicated jobs are the same, nothing is done and the directives Cancel Queued Duplicates [Dir Job] and Cancel Running Duplicates [Dir Job] will be examined.

Cancel Queued Duplicates = <yes|no> (default: no)
If Allow Duplicate Jobs [Dir Job] is set to `no` and if this directive is set to `yes` any job that is already queued to run but not yet running will be canceled.

Cancel Running Duplicates = <yes|no> (default: no)
If Allow Duplicate Jobs [Dir Job] is set to `no` and if this directive is set to `yes` any job that is already running will be canceled.

Catalog = <resource-name>
This specifies the name of the catalog resource to be used for this Job. When a catalog is defined in a Job it will override the definition in the client.
Version >= 13.4.0

Client = <resource-name>
The Client directive specifies the Client (File daemon) that will be used in the current Job. Only a single Client may be specified in any one Job. The Client runs on the machine to be backed up, and sends the requested files to the Storage daemon for backup, or receives them when restoring. For additional details, see the Client Resource of this chapter. This directive is required For versions before 13.3.0, this directive is required for all Jobtypes. For Version >= 13.3.0 it is required for all Jobtypes but Copy or Migrate jobs.

Client Run After Job = <RunscriptShort>
This is a shortcut for the Run Script [Dir Job] resource, that run on the client after a backup job.

Client Run Before Job = <RunscriptShort>
This is basically a shortcut for the Run Script [Dir Job] resource, that run on the client before the backup job.

Please note! *For compatibility reasons, with this shortcut, the command is executed directly when the client receive it. And if the command is in error, other remote runscripts will be discarded. To be sure that all commands will be sent and executed, you have to use Run Script [Dir Job] syntax.*

Description = <string>

Differential Backup Pool = <resource-name>
The Differential Backup Pool specifies a Pool to be used for Differential backups. It will override any Pool [Dir Job] specification during a Differential backup.

Differential Max Runtime = <time>
The time specifies the maximum allowed time that a Differential backup job may run, counted from when the job starts (**not** necessarily the same as when the job was scheduled).

Differential Max Wait Time = <time>
Please note! *This directive is deprecated.*
This directive has been deprecated in favor of Differential Max Runtime Dir Job.

Dir Plugin Options = <string-list>
These settings are plugin specific, see Director Plugins.

Enabled = <yes|no> (default: yes)
En- or disable this resource.

This directive allows you to enable or disable automatic execution via the scheduler of a Job.

FD Plugin Options = <string-list>
These settings are plugin specific, see File Daemon Plugins.

File Set = <resource-name>
The FileSet directive specifies the FileSet that will be used in the current Job. The FileSet specifies which directories (or files) are to be backed up, and what options to use (e.g. compression, ...). Only a single FileSet resource may be specified in any one Job. For additional details, see the FileSet Resource section of this chapter. This directive is required (For versions before 13.3.0 for all Jobtypes and for versions after that for all Jobtypes but Copy and Migrate).

Full Backup Pool = <resource-name>
The Full Backup Pool specifies a Pool to be used for Full backups. It will override any Pool Dir Job specification during a Full backup.

Full Max Runtime = <time>
The time specifies the maximum allowed time that a Full backup job may run, counted from when the job starts (**not** necessarily the same as when the job was scheduled).

Full Max Wait Time = <time>
Please note! *This directive is deprecated.*
This directive has been deprecated in favor of Full Max Runtime Dir Job.

Incremental Backup Pool = <resource-name>
The Incremental Backup Pool specifies a Pool to be used for Incremental backups. It will override any Pool Dir Job specification during an Incremental backup.

Incremental Max Runtime = <time>
The time specifies the maximum allowed time that an Incremental backup job may run, counted from when the job starts, (**not** necessarily the same as when the job was scheduled).

Incremental Max Wait Time = <time>
Please note! *This directive is deprecated.*
This directive has been deprecated in favor of Incremental Max Runtime Dir Job

Job Defs = <resource-name>
If a Job Defs resource name is specified, all the values contained in the named JobDefs resource will be used as the defaults for the current Job. Any value that you explicitly define in the current Job resource, will override any defaults specified in the JobDefs resource. The use of this directive permits writing much more compact Job resources where the bulk of the directives are defined in one or more JobDefs. This is particularly useful if you have many similar Jobs but with minor variations such as different Clients.

Job To Verify = <resource-name>

Level = <BackupLevel>

The Level directive specifies the default Job level to be run. Each different Job Type (Backup, Restore, Verify, ...) has a different set of Levels that can be specified. The Level is normally overridden by a different value that is specified in the **Schedule** resource. This directive is not required, but must be specified either by a **Level** directive or as an override specified in the **Schedule** resource.

Backup

For a **Backup** Job, the Level may be one of the following:

Full

When the Level is set to Full all files in the FileSet whether or not they have changed will be backed up.

Incremental

When the Level is set to Incremental all files specified in the FileSet that have changed since the last successful backup of the the same Job using the same FileSet and Client, will be backed up. If the Director cannot find a previous valid Full backup then the job will be upgraded into a Full backup. When the Director looks for a valid backup record in the catalog database, it looks for a previous Job with:

- The same Job name.
- The same Client name.
- The same FileSet (any change to the definition of the FileSet such as adding or deleting a file in the Include or Exclude sections constitutes a different FileSet.
- The Job was a Full, Differential, or Incremental backup.
- The Job terminated normally (i.e. did not fail or was not canceled).
- The Job started no longer ago than **Max Full Interval**.

If all the above conditions do not hold, the Director will upgrade the Incremental to a Full save. Otherwise, the Incremental backup will be performed as requested.
The File daemon (Client) decides which files to backup for an Incremental backup by comparing start time of the prior Job (Full, Differential, or Incremental) against the time each file was last "modified" (st_mtime) and the time its attributes were last "changed"(st_ctime). If the file was modified or its attributes changed on or after this start time, it will then be backed up.
Some virus scanning software may change st_ctime while doing the scan. For example, if the virus scanning program attempts to reset the access time (st_atime), which Bareos does not use, it will cause st_ctime to change and hence Bareos will backup the file during an Incremental or Differential backup. In the case of Sophos virus scanning, you can prevent it from resetting the access time (st_atime) and hence changing st_ctime by using the `--no-reset-atime` option. For other software, please see their manual.
When Bareos does an Incremental backup, all modified files that are still on the system are backed up. However, any file that has been deleted since the last Full backup remains in the Bareos catalog, which means that if between a Full save and the time you do a restore, some files are deleted, those deleted files will also be restored. The deleted files will no longer appear in the catalog after doing another Full save.
In addition, if you move a directory rather than copy it, the files in it do not have their modification time (st_mtime) or their attribute change time (st_ctime) changed. As a consequence, those files will probably not be backed up by an Incremental or Differential backup which depend solely on these time stamps. If you move a directory, and wish it to be properly backed up, it is generally preferable to copy it, then delete the original.
However, to manage deleted files or directories changes in the catalog during an Incremental backup you can use Job Resource. This is quite memory consuming process.

Differential

When the Level is set to Differential all files specified in the FileSet that have changed since the last successful Full backup of the same Job will be backed up. If the Director cannot find a valid previous Full backup for the same Job, FileSet, and Client, backup, then the Differential job will be upgraded into a Full backup. When the Director looks for a valid Full backup record in the catalog database, it looks for a previous Job with:

- The same Job name.
- The same Client name.
- The same FileSet (any change to the definition of the FileSet such as adding or deleting a file in the Include or Exclude sections constitutes a different FileSet.
- The Job was a FULL backup.
- The Job terminated normally (i.e. did not fail or was not canceled).
- The Job started no longer ago than **Max Full Interval**.

If all the above conditions do not hold, the Director will upgrade the Differential to a Full save. Otherwise, the Differential backup will be performed as requested.
The File daemon (Client) decides which files to backup for a differential backup by comparing the start time of the prior Full backup Job against the time each file was last "modified" (st_mtime) and the time its attributes were last "changed" (st_ctime). If the file was modified or its attributes were changed on or after this start time, it will then be backed up. The start time used is displayed after the **Since** on the Job report. In rare cases, using the start time of the prior backup may cause some files to be backed up twice, but it ensures that no change is missed.
When Bareos does a Differential backup, all modified files that are still on the system are backed up. However, any file that has been deleted since the last Full backup remains in the Bareos catalog, which means that if between a Full save and the time you do a restore, some files are deleted, those deleted files will also be restored. The deleted files will no longer appear in the catalog after doing another Full save. However, to remove deleted files from the catalog during a Differential backup is quite a time consuming process and not currently implemented in Bareos. It is, however, a planned future feature.
As noted above, if you move a directory rather than copy it, the files in it do not have their modification time (st_mtime) or their attribute change time (st_ctime) changed. As a consequence, those files will probably not be backed up by an Incremental or Differential backup which depend solely on these time stamps. If you move a directory, and wish it to be properly backed up, it is generally preferable to copy it, then delete the original. Alternatively, you can move the directory, then use the **touch** program to update the timestamps.
However, to manage deleted files or directories changes in the catalog during an Differential backup you can use accurate mode. This is quite memory consuming process. See for more details.
Every once and a while, someone asks why we need Differential backups as long as Incremental backups pickup all changed files. There are possibly many answers to this question, but the one that is the most important for me is that a Differential backup effectively merges all the Incremental and Differential backups since the last Full backup into a single Differential backup. This has two effects: 1. It gives some redundancy since the old backups could be used if the merged backup cannot be read. 2. More importantly, it reduces the number of Volumes that are needed to do a restore effectively eliminating the need to read all the volumes on which the preceding Incremental and Differential backups since the last Full are done.

VirtualFull
When the Level is set to VirtualFull, a new Full backup is generated from the last existing Full backup and the matching Differential- and Incremental-Backups. It matches this according the Name $^{\text{Dir}}_{\text{Client}}$ and Name $^{\text{Dir}}_{\text{FileSet}}$. This means, a new Full backup get created without transfering all the data from the client to the backup server again. The new Full backup will be stored in the pool defined in Next Pool $^{\text{Dir}}_{\text{Pool}}$.
Please note! *Opposite to the offer backup levels, VirtualFull may require read and write access to multiple volumes. In most cases you have to make sure, that Bareos does not try to read and write to the same Volume.*

Restore
For a **Restore** Job, no level needs to be specified.

Verify
For a **Verify** Job, the Level may be one of the following:

InitCatalog
does a scan of the specified **FileSet** and stores the file attributes in the Catalog database. Since no file data is saved, you might ask why you would want to do this. It turns out to be a very simple and easy way to have a **Tripwire** like feature using **Bareos**. In other words,

it allows you to save the state of a set of files defined by the **FileSet** and later check to see if those files have been modified or deleted and if any new files have been added. This can be used to detect system intrusion. Typically you would specify a **FileSet** that contains the set of system files that should not change (e.g. /sbin, /boot, /lib, /bin, ...). Normally, you run the **InitCatalog** level verify one time when your system is first setup, and then once again after each modification (upgrade) to your system. Thereafter, when your want to check the state of your system files, you use a **Verify level = Catalog**. This compares the results of your **InitCatalog** with the current state of the files.

Catalog

Compares the current state of the files against the state previously saved during an **InitCatalog**. Any discrepancies are reported. The items reported are determined by the **verify** options specified on the **Include** directive in the specified **FileSet** (see the **FileSet** resource below for more details). Typically this command will be run once a day (or night) to check for any changes to your system files.

Please note! *If you run two Verify Catalog jobs on the same client at the same time, the results will certainly be incorrect. This is because Verify Catalog modifies the Catalog database while running in order to track new files.*

VolumeToCatalog

This level causes Bareos to read the file attribute data written to the Volume from the last backup Job for the job specified on the **VerifyJob** directive. The file attribute data are compared to the values saved in the Catalog database and any differences are reported. This is similar to the **DiskToCatalog** level except that instead of comparing the disk file attributes to the catalog database, the attribute data written to the Volume is read and compared to the catalog database. Although the attribute data including the signatures (MD5 or SHA1) are compared, the actual file data is not compared (it is not in the catalog).

VolumeToCatalog jobs need a client to extract the metadata, but this client does not have to be the original client. We suggest to use the client on the backup server itself for maximum performance.

Please note! *If you run two Verify VolumeToCatalog jobs on the same client at the same time, the results will certainly be incorrect. This is because the Verify VolumeToCatalog modifies the Catalog database while running.*

DiskToCatalog

This level causes Bareos to read the files as they currently are on disk, and to compare the current file attributes with the attributes saved in the catalog from the last backup for the job specified on the **VerifyJob** directive. This level differs from the **VolumeToCatalog** level described above by the fact that it doesn't compare against a previous Verify job but against a previous backup. When you run this level, you must supply the verify options on your Include statements. Those options determine what attribute fields are compared.

This command can be very useful if you have disk problems because it will compare the current state of your disk against the last successful backup, which may be several jobs.

Note, the current implementation does not identify files that have been deleted.

Max Concurrent Copies = <positive-integer> (default: 100)

Max Diff Interval = <time>

The time specifies the maximum allowed age (counting from start time) of the most recent successful Differential backup that is required in order to run Incremental backup jobs. If the most recent Differential backup is older than this interval, Incremental backups will be upgraded to Differential backups automatically. If this directive is not present, or specified as 0, then the age of the previous Differential backup is not considered.

Max Full Interval = <time>

The time specifies the maximum allowed age (counting from start time) of the most recent successful Full backup that is required in order to run Incremental or Differential backup jobs. If the most recent Full backup is older than this interval, Incremental and Differential backups will be upgraded to Full

backups automatically. If this directive is not present, or specified as 0, then the age of the previous Full backup is not considered.

Max Run Time = <time>
The time specifies the maximum allowed time that a job may run, counted from when the job starts, (**not** necessarily the same as when the job was scheduled).

By default, the the watchdog thread will kill any Job that has run more than 6 days. The maximum watchdog timeout is independent of MaxRunTime and cannot be changed.

Max Start Delay = <time>
The time specifies the maximum delay between the scheduled time and the actual start time for the Job. For example, a job can be scheduled to run at 1:00am, but because other jobs are running, it may wait to run. If the delay is set to 3600 (one hour) and the job has not begun to run by 2:00am, the job will be canceled. This can be useful, for example, to prevent jobs from running during day time hours. The default is 0 which indicates no limit.

Max Virtual Full Interval = <time>
The time specifies the maximum allowed age (counting from start time) of the most recent successful Virtual Full backup that is required in order to run Incremental or Differential backup jobs. If the most recent Virtual Full backup is older than this interval, Incremental and Differential backups will be upgraded to Virtual Full backups automatically. If this directive is not present, or specified as 0, then the age of the previous Virtual Full backup is not considered.
Version >= 14.4.0

Max Wait Time = <time>
The time specifies the maximum allowed time that a job may block waiting for a resource (such as waiting for a tape to be mounted, or waiting for the storage or file daemons to perform their duties), counted from the when the job starts, (**not** necessarily the same as when the job was scheduled).

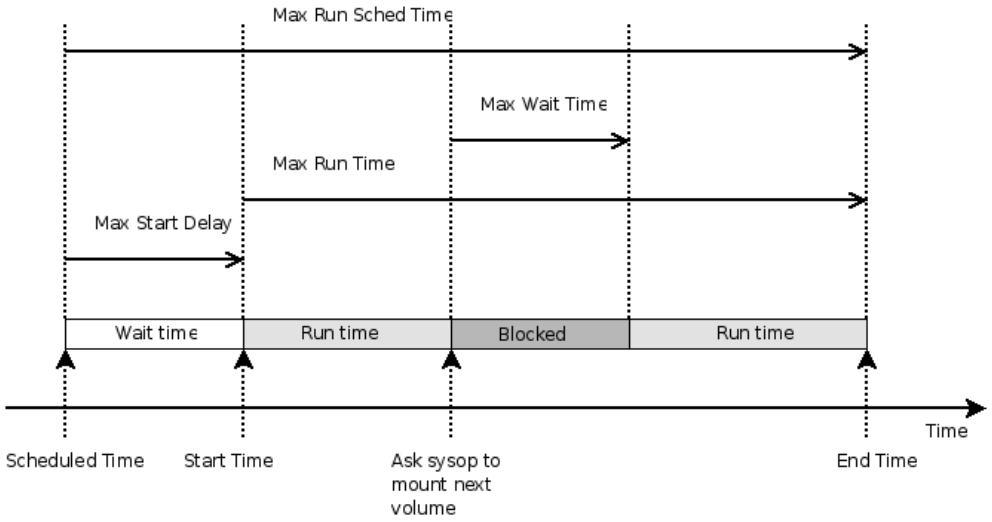


Figure 9.2: Job time control directives

Maximum Bandwidth = <speed>
The speed parameter specifies the maximum allowed bandwidth that a job may use.

Maximum Concurrent Jobs = <positive-integer> (default: 1)
Specifies the maximum number of Jobs from the current Job resource that can run concurrently. Note, this directive limits only Jobs with the same name as the resource in which it appears. Any other restrictions on the maximum concurrent jobs such as in the Director, Client, or Storage resources will

also apply in addition to the limit specified here. The default is set to 1, but you may set it to a larger number. We strongly recommend that you read the WARNING documented under Director Resource.

Maxrun Sched Time = <time>
The time specifies the maximum allowed time that a job may run, counted from when the job was scheduled. This can be useful to prevent jobs from running during working hours. We can see it like `Max Start Delay + Max Run Time`.

Messages = <resource-name> (required)
The Messages directive defines what Messages resource should be used for this job, and thus how and where the various messages are to be delivered. For example, you can direct some messages to a log file, and others can be sent by email. For additional details, see the Messages Resource Chapter of this manual. This directive is required.

Name = <name> (required)
The name of the resource.

The Job name. This name can be specified on the **Run** command in the console program to start a job. If the name contains spaces, it must be specified between quotes. It is generally a good idea to give your job the same name as the Client that it will backup. This permits easy identification of jobs.

When the job actually runs, the unique Job Name will consist of the name you specify here followed by the date and time the job was scheduled for execution. This directive is required.

Next Pool = <resource-name>
A Next Pool override used for Migration/Copy and Virtual Backup Jobs.

Plugin Options = <string-list>
Please note! *This directive is deprecated.*
This directive is an alias.

Pool = <resource-name> (required)
The Pool directive defines the pool of Volumes where your data can be backed up. Many Bareos installations will use only the **Default** pool. However, if you want to specify a different set of Volumes for different Clients or different Jobs, you will probably want to use Pools. For additional details, see the Pool Resource of this chapter. This directive is required.

In case of a Copy or Migration job, this setting determines what Pool will be examined for finding JobIds to migrate. The exception to this is when Selection Type $^{\text{Dir}}_{\text{Job}}$ = SQLQuery, and although a Pool directive must still be specified, no Pool is used, unless you specifically include it in the SQL query. Note, in any case, the Pool resource defined by the Pool directive must contain a Next Pool $^{\text{Dir}}_{\text{Pool}}$ = ... directive to define the Pool to which the data will be migrated.

Prefer Mounted Volumes = <yes|no> (default: yes)
If the Prefer Mounted Volumes directive is set to **yes**, the Storage daemon is requested to select either an Autochanger or a drive with a valid Volume already mounted in preference to a drive that is not ready. This means that all jobs will attempt to append to the same Volume (providing the Volume is appropriate – right Pool, ... for that job), unless you are using multiple pools. If no drive with a suitable Volume is available, it will select the first available drive. Note, any Volume that has been requested to be mounted, will be considered valid as a mounted volume by another job. This if multiple jobs start at the same time and they all prefer mounted volumes, the first job will request the mount, and the other jobs will use the same volume.

If the directive is set to **no**, the Storage daemon will prefer finding an unused drive, otherwise, each job started will append to the same Volume (assuming the Pool is the same for all jobs). Setting Prefer Mounted Volumes to no can be useful for those sites with multiple drive autochangers that prefer to

maximize backup throughput at the expense of using additional drives and Volumes. This means that the job will prefer to use an unused drive rather than use a drive that is already in use.

Despite the above, we recommend against setting this directive to **no** since it tends to add a lot of swapping of Volumes between the different drives and can easily lead to deadlock situations in the Storage daemon. We will accept bug reports against it, but we cannot guarantee that we will be able to fix the problem in a reasonable time.

A better alternative for using multiple drives is to use multiple pools so that Bareos will be forced to mount Volumes from those Pools on different drives.

Prefix Links = <yes|no> (default: no)

If a **Where** path prefix is specified for a recovery job, apply it to absolute links as well. The default is **No**. When set to **Yes** then while restoring files to an alternate directory, any absolute soft links will also be modified to point to the new alternate directory. Normally this is what is desired – i.e. everything is self consistent. However, if you wish to later move the files to their original locations, all files linked with absolute names will be broken.

Priority = <positive-integer> (default: 10)

This directive permits you to control the order in which your jobs will be run by specifying a positive non-zero number. The higher the number, the lower the job priority. Assuming you are not running concurrent jobs, all queued jobs of priority 1 will run before queued jobs of priority 2 and so on, regardless of the original scheduling order.

The priority only affects waiting jobs that are queued to run, not jobs that are already running. If one or more jobs of priority 2 are already running, and a new job is scheduled with priority 1, the currently running priority 2 jobs must complete before the priority 1 job is run, unless Allow Mixed Priority is set.

If you want to run concurrent jobs you should keep these points in mind:

- See Concurrent Jobs on how to setup concurrent jobs.
- Bareos concurrently runs jobs of only one priority at a time. It will not simultaneously run a priority 1 and a priority 2 job.
- If Bareos is running a priority 2 job and a new priority 1 job is scheduled, it will wait until the running priority 2 job terminates even if the Maximum Concurrent Jobs settings would otherwise allow two jobs to run simultaneously.
- Suppose that bareos is running a priority 2 job and a new priority 1 job is scheduled and queued waiting for the running priority 2 job to terminate. If you then start a second priority 2 job, the waiting priority 1 job will prevent the new priority 2 job from running concurrently with the running priority 2 job. That is: as long as there is a higher priority job waiting to run, no new lower priority jobs will start even if the Maximum Concurrent Jobs settings would normally allow them to run. This ensures that higher priority jobs will be run as soon as possible.

If you have several jobs of different priority, it may not best to start them at exactly the same time, because Bareos must examine them one at a time. If by Bareos starts a lower priority job first, then it will run before your high priority jobs. If you experience this problem, you may avoid it by starting any higher priority jobs a few seconds before lower priority ones. This insures that Bareos will examine the jobs in the correct order, and that your priority scheme will be respected.

Protocol = <ProtocolType> (default: Native)

The backup protocol to use to run the Job. If not set it will default to **Native** currently the director understand the following protocols:

1. Native - The native Bareos protocol
2. NDMP - The NDMP protocol

Prune Files = <yes|no> (default: no)
Normally, pruning of Files from the Catalog is specified on a Client by Client basis in the Client resource with the **AutoPrune** directive. If this directive is specified (not normally) and the value is **yes**, it will override the value specified in the Client resource.

Prune Jobs = <yes|no> (default: no)
Normally, pruning of Jobs from the Catalog is specified on a Client by Client basis in the Client resource with the **AutoPrune** directive. If this directive is specified (not normally) and the value is **yes**, it will override the value specified in the Client resource.

Prune Volumes = <yes|no> (default: no)
Normally, pruning of Volumes from the Catalog is specified on a Pool by Pool basis in the Pool resource with the **AutoPrune** directive. Note, this is different from File and Job pruning which is done on a Client by Client basis. If this directive is specified (not normally) and the value is **yes**, it will override the value specified in the Pool resource.

Purge Migration Job = <yes|no> (default: no)
This directive may be added to the Migration Job definition in the Director configuration file to purge the job migrated at the end of a migration.

Regex Where = <string>
This directive applies only to a Restore job and specifies a regex filename manipulation of all files being restored. This will use File Relocation feature.

For more informations about how use this option, see RegexWhere Format.

Replace = <ReplaceOption> (default: Always)
This directive applies only to a Restore job and specifies what happens when Bareos wants to restore a file or directory that already exists. You have the following options for **replace-option**:

always when the file to be restored already exists, it is deleted and then replaced by the copy that was backed up. This is the default value.

ifnewer if the backed up file (on tape) is newer than the existing file, the existing file is deleted and replaced by the back up.

ifolder if the backed up file (on tape) is older than the existing file, the existing file is deleted and replaced by the back up.

never if the backed up file already exists, Bareos skips restoring this file.

Rerun Failed Levels = <yes|no> (default: no)
If this directive is set to **yes** (default no), and Bareos detects that a previous job at a higher level (i.e. Full or Differential) has failed, the current job level will be upgraded to the higher level. This is particularly useful for Laptops where they may often be unreachable, and if a prior Full save has failed, you wish the very next backup to be a Full save rather than whatever level it is started as.

There are several points that must be taken into account when using this directive: first, a failed job is defined as one that has not terminated normally, which includes any running job of the same name (you need to ensure that two jobs of the same name do not run simultaneously); secondly, the **Ignore FileSet Changes** directive is not considered when checking for failed levels, which means that any FileSet change will trigger a rerun.

Reschedule Interval = <time> (default: 1800)
If you have specified **Reschedule On Error = yes** and the job terminates in error, it will be rescheduled after the interval of time specified by **time-specification**. See the time specification formats in the Configure chapter for details of time specifications. If no interval is specified, the job will not be rescheduled on error.

Reschedule On Error = <yes|no> (default: no)

If this directive is enabled, and the job terminates in error, the job will be rescheduled as determined by the **Reschedule Interval** and **Reschedule Times** directives. If you cancel the job, it will not be rescheduled. The default is **no** (i.e. the job will not be rescheduled).

This specification can be useful for portables, laptops, or other machines that are not always connected to the network or switched on.

Reschedule Times = <positive-integer> (default: 5)

This directive specifies the maximum number of times to reschedule the job. If it is set to zero (the default) the job will be rescheduled an indefinite number of times.

Run = <string-list>

The Run directive (not to be confused with the Run option in a Schedule) allows you to start other jobs or to clone jobs. By using the cloning keywords (see below), you can backup the same data (or almost the same data) to two or more drives at the same time. The **job-name** is normally the same name as the current Job resource (thus creating a clone). However, it may be any Job name, so one job may start other related jobs.

The part after the equal sign must be enclosed in double quotes, and can contain any string or set of options (overrides) that you can specify when entering the Run command from the console. For example **storage=DDS-4 ...**. In addition, there are two special keywords that permit you to clone the current job. They are **level=%l** and **since=%s**. The %l in the level keyword permits entering the actual level of the current job and the %s in the since keyword permits putting the same time for comparison as used on the current job. Note, in the case of the since keyword, the %s must be enclosed in double quotes, and thus they must be preceded by a backslash since they are already inside quotes. For example:

```
run = "Nightly-backup level=%l since=\"%s\" storage=DDS-4"
```

A cloned job will not start additional clones, so it is not possible to recurse.

Please note that all cloned jobs, as specified in the Run directives are submitted for running before the original job is run (while it is being initialized). This means that any clone job will actually start before the original job, and may even block the original job from starting until the original job finishes unless you allow multiple simultaneous jobs. Even if you set a lower priority on the clone job, if no other jobs are running, it will start before the original job.

If you are trying to prioritize jobs by using the clone feature (Run directive), you will find it much easier to do using a Run Script Dir Job resource, or a Run Before Job Dir Job directive.

Run After Failed Job = <RunscriptShort>

This is a shortcut for the Run Script Dir Job resource, that runs a command after a failed job.

If the exit code of the program run is non-zero, Bareos will print a warning message.

```
Run Script {
  Command = "echo test"
  Runs When = After
  Runs On Failure = yes
  Runs On Client  = no
  Runs On Success = yes    # default, you can drop this line
}
```

Run After Job = <RunscriptShort>

This is a shortcut for the Run Script Dir Job resource, that runs a command after a successful job (without error or without being canceled).

If the exit code of the program run is non-zero, Bareos will print a warning message.

Run Before Job = <RunscriptShort>

This is a shortcut for the Run Script Dir Job resource, that runs a command before a job.

If the exit code of the program run is non-zero, the current Bareos job will be canceled.

```
Run Before Job = "echo test"
```

is equivalent to:

```
Run Script {
  Command = "echo test"
  Runs On Client = No
  Runs When = Before
}
```

Run Script = <Runscript>

The RunScript directive behaves like a resource in that it requires opening and closing braces around a number of directives that make up the body of the runscript.

The specified **Command** (see below for details) is run as an external program prior or after the current Job. This is optional. By default, the program is executed on the Client side like in `ClientRunXXXJob`.

Console options are special commands that are sent to the director instead of the OS. At this time, console command ouputs are redirected to log with the jobid 0.

You can use following console command: `delete`, `disable`, `enable`, `estimate`, `list`, `llist`, `memory`, `prune`, `purge`, `reload`, `status`, `setdebug`, `show`, `time`, `trace`, `update`, `version`, `.client`, `.jobs`, `.pool`, `.storage`. See Bareos Console for more information. You need to specify needed information on command line, nothing will be prompted. Example:

```
Console = "prune files client=\%c"
Console = "update stats age=3"
```

You can specify more than one Command/Console option per RunScript.

You can use following options may be specified in the body of the runscript:

Options	Value	Information
Runs On Success	**Yes** | No	run if JobStatus is successful
Runs On Failure	Yes | **No**	run if JobStatus isn't successful
Runs On Client	**Yes** | No	run command on client
Runs When	`Never` | `Before` | `After` | `Always` | *`AfterVSS`*	When to run
Fail Job On Error	**Yes** | No	Fail job if script returns something different from 0
Command		External command
Console		Console command

Any output sent by the command to standard output will be included in the Bareos job report. The command string must be a valid program name or name of a shell script.

Please note! *The command string is parsed then fed to the OS, which means that the path will be searched to execute your specified command, but there is no shell interpretation. As a consequence, if you invoke complicated commands or want any shell features such as redirection or piping, you must call a shell script and do it inside that script. Alternatively, it is possible to use* `sh -c '...'` *in the command definition to force shell interpretation, see example below.*

Before executing the specified command, Bareos performs character substitution of the following characters:

%% %
%b Job Bytes
%B Job Bytes in human readable format
%c Client's name

%d	Daemon's name (Such as host-dir or host-fd)
%D	Director's name (Also valid on file daemon)
%e	Job Exit Status
%f	Job FileSet (Only on director side)
%F	Job Files
%h	Client address
%i	Job Id
%j	Unique Job Id
%l	Job Level
%n	Job name
%p	Pool name (Only on director side)
%P	Daemon PID
%s	Since time
%t	Job type (Backup, ...)
%v	Read Volume name(s) (Only on director side)
%V	Write Volume name(s) (Only on director side)
%w	Storage name (Only on director side)
%x	Spooling enabled? ("yes" or "no")

Some character substitutions are not available in all situations. The Job Exit Status code %e edits the following values:

- OK
- Error
- Fatal Error
- Canceled
- Differences
- Unknown term code

Thus if you edit it on a command line, you will need to enclose it within some sort of quotes.

You can use these following shortcuts:

Keyword	RunsOnSuccess	RunsOnFailure	FailJobOnError	Runs On Client	RunsWhen
Run Before Job $^{\text{Dir}}_{\text{Job}}$			Yes	No	Before
Run After Job $^{\text{Dir}}_{\text{Job}}$	Yes	No		No	After
Run After Failed Job $^{\text{Dir}}_{\text{Job}}$	No	Yes		No	After
Client Run Before Job $^{\text{Dir}}_{\text{Job}}$			Yes	Yes	Before
Client Run After Job $^{\text{Dir}}_{\text{Job}}$	Yes	No		Yes	After

Examples:

```
Run Script {
  RunsWhen = Before
  FailJobOnError = No
  Command = "/etc/init.d/apache stop"
}

RunScript {
  RunsWhen = After
  RunsOnFailure = Yes
  Command = "/etc/init.d/apache start"
}

RunScript {
  RunsWhen = Before
  FailJobOnError = Yes
  Command = "sh -c 'top -b -n 1 > /var/backup/top.out'"
}
```

Special Windows Considerations

You can run scripts just after snapshots initializations with *AfterVSS* keyword.

In addition, for a Windows client, please take note that you must ensure a correct path to your script. The script or program can be a .com, .exe or a .bat file. If you just put the program name in then Bareos will search using the same rules that cmd.exe uses (current directory, Bareos bin directory, and

PATH). It will even try the different extensions in the same order as cmd.exe. The command can be anything that cmd.exe or command.com will recognize as an executable file.

However, if you have slashes in the program name then Bareos figures you are fully specifying the name, so you must also explicitly add the three character extension.

The command is run in a Win32 environment, so Unix like commands will not work unless you have installed and properly configured Cygwin in addition to and separately from Bareos.

The System %Path% will be searched for the command. (under the environment variable dialog you have have both System Environment and User Environment, we believe that only the System environment will be available to bareos-fd, if it is running as a service.)

System environment variables can be referenced with %var% and used as either part of the command name or arguments.

So if you have a script in the Bareos
bin directory then the following lines should work fine:

```
        Client Run Before Job = "systemstate"
or
        Client Run Before Job = "systemstate.bat"
or
        Client Run Before Job = "\"C:/Program Files/Bareos/systemstate.bat\""
```

The outer set of quotes is removed when the configuration file is parsed. You need to escape the inner quotes so that they are there when the code that parses the command line for execution runs so it can tell what the program name is.

The special characters `&<>()@^|` will need to be quoted, if they are part of a filename or argument.

If someone is logged in, a blank "command" window running the commands will be present during the execution of the command.

Some Suggestions from Phil Stracchino for running on Win32 machines with the native Win32 File daemon:

1. You might want the ClientRunBeforeJob directive to specify a .bat file which runs the actual client-side commands, rather than trying to run (for example) regedit /e directly.
2. The batch file should explicitly 'exit 0' on successful completion.
3. The path to the batch file should be specified in Unix form:
   `Client Run Before Job = "c:/bareos/bin/systemstate.bat"`
   rather than DOS/Windows form:
   INCORRECT: `Client Run Before Job = "c:\bareos \bin \systemstate .bat"`

For Win32, please note that there are certain limitations:

`Client Run Before Job = "C:/Program Files/Bareos/bin/pre-exec.bat"`

Lines like the above do not work because there are limitations of cmd.exe that is used to execute the command. Bareos prefixes the string you supply with `cmd.exe /c`. To test that your command works you should type `cmd /c "C:/Program Files/test.exe"` at a cmd prompt and see what happens. Once the command is correct insert a backslash (\) before each double quote ("), and then put quotes around the whole thing when putting it in the director's .conf file. You either need to have only one set of quotes or else use the short name and don't put quotes around the command path.

Below is the output from cmd's help as it relates to the command line passed to the /c option.

If /C or /K is specified, then the remainder of the command line after the switch is processed as a command line, where the following logic is used to process quote (") characters:

1. If all of the following conditions are met, then quote characters on the command line are preserved:
   - no /S switch.
   - exactly two quote characters.
   - no special characters between the two quote characters, where special is one of: `&<>()@^|`
   - there are one or more whitespace characters between the the two quote characters.
   - the string between the two quote characters is the name of an executable file.

2. Otherwise, old behavior is to see if the first character is a quote character and if so, strip the leading character and remove the last quote character on the command line, preserving any text after the last quote character.

Save File History = <yes|no> (default: yes)
Allow disabling storing the file history, as this causes problems problems with some implementations of NDMP (out-of-order metadata).

Please note! *The File History is required to do a single file restore from NDMP backups. With this disabled, only full restores are possible.*
Version >= 14.2.0

Schedule = <resource-name>
The Schedule directive defines what schedule is to be used for the Job. The schedule in turn determines when the Job will be automatically started and what Job level (i.e. Full, Incremental, ...) is to be run. This directive is optional, and if left out, the Job can only be started manually using the Console program. Although you may specify only a single Schedule resource for any one job, the Schedule resource may contain multiple **Run** directives, which allow you to run the Job at many different times, and each **run** directive permits overriding the default Job Level Pool, Storage, and Messages resources. This gives considerable flexibility in what can be done with a single Job. For additional details, see Schedule Resource.

SD Plugin Options = <string-list>
These settings are plugin specific, see Storage Daemon Plugins.

Selection Pattern = <string>
Selection Patterns is only used for Copy and Migration jobs, see Migration and Copy. The interpretation of its value depends on the selected Selection Type $^{\text{Dir}}_{\text{Job}}$.

For the OldestVolume and SmallestVolume, this Selection pattern is not used (ignored).

For the Client, Volume, and Job keywords, this pattern must be a valid regular expression that will filter the appropriate item names found in the Pool.

For the SQLQuery keyword, this pattern must be a valid `SELECT` SQL statement that returns JobIds.

Selection Type = <MigrationType>
Selection Type is only used for Copy and Migration jobs, see Migration and Copy. It determines how a migration job will go about selecting what JobIds to migrate. In most cases, it is used in conjunction with a Selection Pattern $^{\text{Dir}}_{\text{Job}}$ to give you fine control over exactly what JobIds are selected. The possible values are:

SmallestVolume This selection keyword selects the volume with the fewest bytes from the Pool to be migrated. The Pool to be migrated is the Pool defined in the Migration Job resource. The migration control job will then start and run one migration backup job for each of the Jobs found on this Volume. The Selection Pattern, if specified, is not used.

OldestVolume This selection keyword selects the volume with the oldest last write time in the Pool to be migrated. The Pool to be migrated is the Pool defined in the Migration Job resource. The migration control job will then start and run one migration backup job for each of the Jobs found on this Volume. The Selection Pattern, if specified, is not used.

Client The Client selection type, first selects all the Clients that have been backed up in the Pool specified by the Migration Job resource, then it applies the Selection Pattern $^{\text{Dir}}_{\text{Job}}$ as a regular expression to the list of Client names, giving a filtered Client name list. All jobs that were backed up for those filtered (regexed) Clients will be migrated. The migration control job will then start and run one migration backup job for each of the JobIds found for those filtered Clients.

Volume The Volume selection type, first selects all the Volumes that have been backed up in the Pool specified by the Migration Job resource, then it applies the Selection Pattern $^{\text{Dir}}_{\text{Job}}$ as a regular expression to the list of Volume names, giving a filtered Volume list. All JobIds that were backed

up for those filtered (regexed) Volumes will be migrated. The migration control job will then start and run one migration backup job for each of the JobIds found on those filtered Volumes.

Job The Job selection type, first selects all the Jobs (as defined on the Name Dir Job directive in a Job resource) that have been backed up in the Pool specified by the Migration Job resource, then it applies the Selection Pattern Dir Job as a regular expression to the list of Job names, giving a filtered Job name list. All JobIds that were run for those filtered (regexed) Job names will be migrated. Note, for a given Job named, they can be many jobs (JobIds) that ran. The migration control job will then start and run one migration backup job for each of the Jobs found.

SQLQuery The SQLQuery selection type, used the Selection Pattern Dir Job as an SQL query to obtain the JobIds to be migrated. The Selection Pattern must be a valid SELECT SQL statement for your SQL engine, and it must return the JobId as the first field of the SELECT.

PoolOccupancy This selection type will cause the Migration job to compute the total size of the specified pool for all Media Types combined. If it exceeds the Migration High Bytes Dir Pool defined in the Pool, the Migration job will migrate all JobIds beginning with the oldest Volume in the pool (determined by Last Write time) until the Pool bytes drop below the Migration Low Bytes Dir Pool defined in the Pool. This calculation should be consider rather approximative because it is made once by the Migration job before migration is begun, and thus does not take into account additional data written into the Pool during the migration. In addition, the calculation of the total Pool byte size is based on the Volume bytes saved in the Volume (Media) database entries. The bytes calculate for Migration is based on the value stored in the Job records of the Jobs to be migrated. These do not include the Storage daemon overhead as is in the total Pool size. As a consequence, normally, the migration will migrate more bytes than strictly necessary.

PoolTime The PoolTime selection type will cause the Migration job to look at the time each JobId has been in the Pool since the job ended. All Jobs in the Pool longer than the time specified on Migration Time Dir Pool directive in the Pool resource will be migrated.

PoolUncopiedJobs This selection which copies all jobs from a pool to an other pool which were not copied before is available only for copy Jobs.

Spool Attributes = <yes|no> (default: no)

Is Spool Attributes is disabled, the File attributes are sent by the Storage daemon to the Director as they are stored on tape. However, if you want to avoid the possibility that database updates will slow down writing to the tape, you may want to set the value to `yes`, in which case the Storage daemon will buffer the File attributes and Storage coordinates to a temporary file in the Working Directory, then when writing the Job data to the tape is completed, the attributes and storage coordinates will be sent to the Director.

NOTE: When Spool Data Dir Job is set to yes, Spool Attributes is also automatically set to yes.

For details, see Data Spooling.

Spool Data = <yes|no> (default: no)

If this directive is set to `yes`, the Storage daemon will be requested to spool the data for this Job to disk rather than write it directly to the Volume (normally a tape).

Thus the data is written in large blocks to the Volume rather than small blocks. This directive is particularly useful when running multiple simultaneous backups to tape. Once all the data arrives or the spool files' maximum sizes are reached, the data will be despooled and written to tape.

Spooling data prevents interleaving data from several job and reduces or eliminates tape drive stop and start commonly known as "shoe-shine".

We don't recommend using this option if you are writing to a disk file using this option will probably just slow down the backup jobs.

NOTE: When this directive is set to yes, Spool Attributes Dir Job is also automatically set to yes.

For details, see Data Spooling.

Spool Size = <Size64>
This specifies the maximum spool size for this job. The default is taken from Maximum Spool Size Sd Device limit.

Storage = <ResourceList>
The Storage directive defines the name of the storage services where you want to backup the FileSet data. For additional details, see the Storage Resource of this manual. The Storage resource may also be specified in the Job's Pool resource, in which case the value in the Pool resource overrides any value in the Job. This Storage resource definition is not required by either the Job resource or in the Pool, but it must be specified in one or the other, if not an error will result.

Strip Prefix = <string>
This directive applies only to a Restore job and specifies a prefix to remove from the directory name of all files being restored. This will use the File Relocation feature.

Using `Strip Prefix=/etc`, `/etc/passwd` will be restored to `/passwd`

Under Windows, if you want to restore `c:/files` to `d:/files`, you can use:

```
Strip Prefix = c:
Add Prefix = d:
```

Type = <JobType> (required)
The **Type** directive specifies the Job type, which may be one of the following: **Backup**, **Restore**, **Verify**, or **Admin**. This directive is required. Within a particular Job Type, there are also Levels as discussed in the next item.

Backup
Run a backup Job. Normally you will have at least one Backup job for each client you want to save. Normally, unless you turn off cataloging, most all the important statistics and data concerning files backed up will be placed in the catalog.

Restore
Run a restore Job. Normally, you will specify only one Restore job which acts as a sort of prototype that you will modify using the console program in order to perform restores. Although certain basic information from a Restore job is saved in the catalog, it is very minimal compared to the information stored for a Backup job – for example, no File database entries are generated since no Files are saved.

Restore jobs cannot be automatically started by the scheduler as is the case for Backup, Verify and Admin jobs. To restore files, you must use the **restore** command in the console.

Verify
Run a verify Job. In general, **verify** jobs permit you to compare the contents of the catalog to the file system, or to what was backed up. In addition, to verifying that a tape that was written can be read, you can also use **verify** as a sort of tripwire intrusion detection.

Admin
Run an admin Job. An **Admin** job can be used to periodically run catalog pruning, if you do not want to do it at the end of each **Backup** Job. Although an Admin job is recorded in the catalog, very little data is saved.

Migrate defines the job that is run as being a Migration Job. A Migration Job is a sort of control job and does not have any Files associated with it, and in that sense they are more or less like an Admin job. Migration jobs simply check to see if there is anything to Migrate then possibly start and control new Backup jobs to migrate the data from the specified Pool to another Pool. Note, any original JobId that is migrated will be marked as having been migrated, and the original JobId can nolonger be used for restores; all restores will be done from the new migrated Job.

Copy defines the job that is run as being a Copy Job. A Copy Job is a sort of control job and does not have any Files associated with it, and in that sense they are more or less like an Admin job. Copy jobs simply check to see if there is anything to Copy then possibly start and control new Backup jobs to copy the data from the specified Pool to another Pool. Note that when a copy

is made, the original JobIds are left unchanged. The new copies can not be used for restoration unless you specifically choose them by JobId. If you subsequently delete a JobId that has a copy, the copy will be automatically upgraded to a Backup rather than a Copy, and it will subsequently be used for restoration.

Verify Job = <resource-name>

This directive is an alias.

If you run a verify job without this directive, the last job run will be compared with the catalog, which means that you must immediately follow a backup by a verify command. If you specify a **Verify Job** Bareos will find the last job with that name that ran. This permits you to run all your backups, then run Verify jobs on those that you wish to be verified (most often a **VolumeToCatalog**) so that the tape just written is re-read.

Virtual Full Backup Pool = <resource-name>

Where = <directory>

This directive applies only to a Restore job and specifies a prefix to the directory name of all files being restored. This permits files to be restored in a different location from which they were saved. If **Where** is not specified or is set to backslash (/), the files will be restored to their original location. By default, we have set **Where** in the example configuration files to be **/tmp/bareos-restores**. This is to prevent accidental overwriting of your files.

Please note! *To use Where on NDMP backups, please read Restore files to different path.*

Write Bootstrap = <directory>

The **writebootstrap** directive specifies a file name where Bareos will write a **bootstrap** file for each Backup job run. This directive applies only to Backup Jobs. If the Backup job is a Full save, Bareos will erase any current contents of the specified file before writing the bootstrap records. If the Job is an Incremental or Differential save, Bareos will append the current bootstrap record to the end of the file.

Using this feature, permits you to constantly have a bootstrap file that can recover the current state of your system. Normally, the file specified should be a mounted drive on another machine, so that if your hard disk is lost, you will immediately have a bootstrap record available. Alternatively, you should copy the bootstrap file to another machine after it is updated. Note, it is a good idea to write a separate bootstrap file for each Job backed up including the job that backs up your catalog database.

If the **bootstrap-file-specification** begins with a vertical bar (|), Bareos will use the specification as the name of a program to which it will pipe the bootstrap record. It could for example be a shell script that emails you the bootstrap record.

Before opening the file or executing the specified command, Bareos performs character substitution like in RunScript directive. To automatically manage your bootstrap files, you can use this in your **JobDefs** resources:

```
Job Defs {
  ...
  Write Bootstrap = "%c_%n.bsr"
  ...
}
```

For more details on using this file, please see chapter The Bootstrap File.

Write Part After Job = <yes|no>

Please note! *This directive is deprecated.*

Write Verify List = <directory>

The following is an example of a valid Job resource definition:

```
Job {
  Name = "Minou"
  Type = Backup
  Level = Incremental                 # default
  Client = Minou
  FileSet="Minou Full Set"
  Storage = DLTDrive
  Pool = Default
  Schedule = "MinouWeeklyCycle"
  Messages = Standard
}
```

Configuration 9.2: Job Resource Example

9.3 JobDefs Resource

The JobDefs resource permits all the same directives that can appear in a Job resource. However, a JobDefs resource does not create a Job, rather it can be referenced within a Job to provide defaults for that Job. This permits you to concisely define several nearly identical Jobs, each one referencing a JobDefs resource which contains the defaults. Only the changes from the defaults need to be mentioned in each Job.

9.4 Schedule Resource

The Schedule resource provides a means of automatically scheduling a Job as well as the ability to override the default Level, Pool, Storage and Messages resources. If a Schedule resource is not referenced in a Job, the Job can only be run manually. In general, you specify an action to be taken and when.

configuration directive name	type of data	default value	remark
Description	= string		
Enabled	= yes|no	yes	
Name	**= name**		**required**
Run	= job-overrides> <date-time-specification		

Description = <string>

Enabled = <yes|no> (default: yes)

En- or disable this resource.

Name = <name> (required)

The name of the resource.

The name of the schedule being defined.

Run = <job-overrides> <date-time-specification>

The Run directive defines when a Job is to be run, and what overrides if any to apply. You may specify multiple **run** directives within a **Schedule** resource. If you do, they will all be applied (i.e. multiple schedules). If you have two **Run** directives that start at the same time, two Jobs will start at the same time (well, within one second of each other).

The **Job-overrides** permit overriding the Level, the Storage, the Messages, and the Pool specifications provided in the Job resource. In addition, the FullPool, the IncrementalPool, and the DifferentialPool specifications permit overriding the Pool specification according to what backup Job Level is in effect.

By the use of overrides, you may customize a particular Job. For example, you may specify a Messages override for your Incremental backups that outputs messages to a log file, but for your weekly or monthly Full backups, you may send the output by email by using a different Messages override.

Job-overrides are specified as: **keyword=value** where the keyword is Level, Storage, Messages, Pool, FullPool, DifferentialPool, or IncrementalPool, and the **value** is as defined on the respective directive formats for the Job resource. You may specify multiple **Job-overrides** on one **Run** directive by separating them with one or more spaces or by separating them with a trailing comma. For example:

Level=Full is all files in the FileSet whether or not they have changed.

Level=Incremental is all files that have changed since the last backup.

Pool=Weekly specifies to use the Pool named **Weekly**.

Storage=DLT_Drive specifies to use **DLT_Drive** for the storage device.

Messages=Verbose specifies to use the **Verbose** message resource for the Job.

FullPool=Full specifies to use the Pool named **Full** if the job is a full backup, or is upgraded from another type to a full backup.

DifferentialPool=Differential specifies to use the Pool named **Differential** if the job is a differential backup.

IncrementalPool=Incremental specifies to use the Pool named **Incremental** if the job is an incremental backup.

Accurate=yes|no tells Bareos to use or not the Accurate code for the specific job. It can allow you to save memory and and CPU resources on the catalog server in some cases.

Date-time-specification determines when the Job is to be run. The specification is a repetition, and as a default Bareos is set to run a job at the beginning of the hour of every hour of every day of every week of every month of every year. This is not normally what you want, so you must specify or limit when you want the job to run. Any specification given is assumed to be repetitive in nature and will serve to override or limit the default repetition. This is done by specifying masks or times for the hour, day of the month, day of the week, week of the month, week of the year, and month when you want the job to run. By specifying one or more of the above, you can define a schedule to repeat at almost any frequency you want.

Basically, you must supply a **month**, **day**, **hour**, and **minute** the Job is to be run. Of these four items to be specified, **day** is special in that you may either specify a day of the month such as 1, 2, ... 31, or you may specify a day of the week such as Monday, Tuesday, ... Sunday. Finally, you may also specify a week qualifier to restrict the schedule to the first, second, third, fourth, or fifth week of the month.

For example, if you specify only a day of the week, such as **Tuesday** the Job will be run every hour of every Tuesday of every Month. That is the **month** and **hour** remain set to the defaults of every month and all hours.

Note, by default with no other specification, your job will run at the beginning of every hour. If you wish your job to run more than once in any given hour, you will need to specify multiple **run** specifications each with a different minute.

The date/time to run the Job can be specified in the following way in pseudo-BNF:

```
<week-keyword>          ::= 1st | 2nd | 3rd | 4th | 5th | first | second | third | fourth
                            | fifth | last
<wday-keyword>          ::= sun | mon | tue | wed | thu | fri | sat | sunday | monday
                            | tuesday | wednesday | thursday | friday | saturday
<week-of-year-keyword> ::= w00 | w01 | ... w52 | w53
<month-keyword>         ::= jan | feb | mar | apr | may | jun | jul | aug | sep | oct |
                            nov | dec | january | february | ... | december
<digit>                 ::= 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0
<number>                ::= <digit> | <digit><number>
<12hour>                ::= 0 | 1 | 2 | ... 12
```

```
<hour>              ::= 0 | 1 | 2 | ... 23
<minute>            ::= 0 | 1 | 2 | ... 59
<day>               ::= 1 | 2 | ... 31
<time>              ::= <hour>:<minute> | <12hour>:<minute>am |
                        <12hour>:<minute>pm
<time-spec>         ::= at <time> | hourly
<day-range>         ::= <day>-<day>
<month-range>       ::= <month-keyword>-<month-keyword>
<wday-range>        ::= <wday-keyword>-<wday-keyword>
<range>             ::= <day-range> | <month-range> | <wday-range>
<modulo>            ::= <day>/<day> | <week-of-year-keyword>/<week-of-
                        year-keyword>
<date>              ::= <date-keyword> | <day> | <range>
<date-spec>         ::= <date> | <date-spec>
<day-spec>          ::= <day> | <wday-keyword> | <day> | <wday-
                        range> | <week-keyword> <wday-keyword> | <week-
                        keyword> <wday-range> | daily
<month-spec>        ::= <month-keyword> | <month-range> | monthly
<date-time-spec>    ::= <month-spec> <day-spec> <time-spec>
```

Note, the Week of Year specification wnn follows the ISO standard definition of the week of the year, where Week 1 is the week in which the first Thursday of the year occurs, or alternatively, the week which contains the 4th of January. Weeks are numbered w01 to w53. w00 for Bareos is the week that precedes the first ISO week (i.e. has the first few days of the year if any occur before Thursday). w00 is not defined by the ISO specification. A week starts with Monday and ends with Sunday.
According to the NIST (US National Institute of Standards and Technology), 12am and 12pm are ambiguous and can be defined to anything. However, 12:01am is the same as 00:01 and 12:01pm is the same as 12:01, so Bareos defines 12am as 00:00 (midnight) and 12pm as 12:00 (noon). You can avoid this abiguity (confusion) by using 24 hour time specifications (i.e. no am/pm).
An example schedule resource that is named **WeeklyCycle** and runs a job with level full each Sunday at 2:05am and an incremental job Monday through Saturday at 2:05am is:

```
Schedule {
  Name = "WeeklyCycle"
  Run = Level=Full sun at 2:05
  Run = Level=Incremental mon-sat at 2:05
}
```

Configuration 9.3: Schedule Example

An example of a possible monthly cycle is as follows:

```
Schedule {
  Name = "MonthlyCycle"
  Run = Level=Full Pool=Monthly 1st sun at 2:05
  Run = Level=Differential 2nd-5th sun at 2:05
  Run = Level=Incremental Pool=Daily mon-sat at 2:05
}
```

The first of every month:

```
Schedule {
  Name = "First"
  Run = Level=Full on 1 at 2:05
  Run = Level=Incremental on 2-31 at 2:05
}
```

The last friday of the month (i.e. the last friday in the last week of the month)

```
Schedule {
  Name = "Last Friday"
  Run = Level=Full last fri at 21:00
}
```

Every 10 minutes:

```
Schedule {
  Name = "TenMinutes"
  Run = Level=Full hourly at 0:05
  Run = Level=Full hourly at 0:15
  Run = Level=Full hourly at 0:25
  Run = Level=Full hourly at 0:35
  Run = Level=Full hourly at 0:45
  Run = Level=Full hourly at 0:55
}
```

The **modulo scheduler** makes it easy to specify schedules like odd or even days/weeks, or more generally every n days or weeks. It is called modulo scheduler because it uses the modulo to determine if the schedule must be run or not. The second variable behind the slash lets you determine in which cycle of days/weeks a job should be run. The first part determines on which day/week the job should be run first. E.g. if you want to run a backup in a 5-week-cycle, starting on week 3, you set it up as w03/w05.

```
Schedule {
  Name = "Odd Days"
  Run = 1/2 at 23:10
}

Schedule {
  Name = "Even Days"
  Run = 2/2 at 23:10
}

Schedule {
  Name = "On the 3rd week in a 5-week-cycle"
  Run = w03/w05 at 23:10
}

Schedule {
  Name = "Odd Weeks"
  Run = w01/w02 at 23:10
}

Schedule {
  Name = "Even Weeks"
  Run = w02/w02 at 23:10
}
```

Configuration 9.4: Schedule Examples: modulo

9.4.1 Technical Notes on Schedules

Internally Bareos keeps a schedule as a bit mask. There are six masks and a minute field to each schedule. The masks are hour, day of the month (mday), month, day of the week (wday), week of the month (wom), and week of the year (woy). The schedule is initialized to have the bits of each of these masks set, which means that at the beginning of every hour, the job will run. When you specify a month for the first time, the mask will be cleared and the bit corresponding to your selected month will be selected. If you specify a second month, the bit corresponding to it will also be added to the mask. Thus when Bareos checks the masks to see if the bits are set corresponding to the current time, your job will run only in the two months you have set. Likewise, if you set a time (hour), the hour mask will be cleared, and the hour you specify will be set in the bit mask and the minutes will be stored in the minute field.
For any schedule you have defined, you can see how these bits are set by doing a **show schedules** command in the Console program. Please note that the bit mask is zero based, and Sunday is the first day of the week (bit zero).

9.5 FileSet Resource

The FileSet resource defines what files are to be included or excluded in a backup job. A **FileSet** resource is required for each backup Job. It consists of a list of files or directories to be included, a list of files or directories to be excluded and the various backup options such as compression, encryption, and signatures that are to be applied to each file.
Any change to the list of the included files will cause Bareos to automatically create a new FileSet (defined by the name and an MD5 checksum of the Include/Exclude contents). Each time a new FileSet is created, Bareos will ensure that the next backup is always a Full save.

configuration directive name	type of data	default value	remark
Description	= string		
Enable VSS	= yes|no	yes	
Exclude	{ IncludeExcludeItem }		
Ignore File Set Changes	= yes|no	no	
Include	{ IncludeExcludeItem }		
Name	**= name**		**required**

Description = <string>
Information only.

Enable VSS = <yes|no> (default: yes)
If this directive is set to `yes` the File daemon will be notified that the user wants to use a Volume Shadow Copy Service (VSS) backup for this job. This directive is effective only on the Windows File Daemon. It permits a consistent copy of open files to be made for cooperating writer applications, and for applications that are not VSS away, Bareos can at least copy open files. The Volume Shadow Copy will only be done on Windows drives where the drive (e.g. C:, D:, ...) is explicitly mentioned in a **File** directive. For more information, please see the Windows chapter of this manual.

Exclude = <IncludeExcludeItem>
Describe the files, that should get excluded from a backup, see section about the FileSet Exclude Ressource.

Ignore File Set Changes = <yes|no> (default: no)
Normally, if you modify the FileSet Include or Exclude lists, the next backup will be forced to a Full so that Bareos can guarantee that any additions or deletions are properly saved.

We strongly recommend against setting this directive to yes, since doing so may cause you to have an incomplete set of backups.

If this directive is set to **yes**, any changes you make to the FileSet Include or Exclude lists, will not force a Full during subsequent backups.

The default is **no**, in which case, if you change the Include or Exclude, Bareos will force a Full backup to ensure that everything is properly backed up.

Include = <IncludeExcludeItem>
Describe the files, that should get included to a backup, see section about the FileSet Include Ressource.

Name = <name> (required)
The name of the resource.

The name of the FileSet resource.

9.5.1 FileSet Include Ressource

The Include resource must contain a list of directories and/or files to be processed in the backup job. Normally, all files found in all subdirectories of any directory in the Include File list will be backed up. Note, see below for the definition of <file-list>. The Include resource may also contain one or more Options resources that specify options such as compression to be applied to all or any subset of the files found when processing the file-list for backup. Please see below for more details concerning Options resources.
There can be any number of **Include** resources within the FileSet, each having its own list of directories or files to be backed up and the backup options defined by one or more Options resources.
Please take note of the following items in the FileSet syntax:

1. There is no equal sign (=) after the Include and before the opening brace ({). The same is true for the Exclude.
2. Each directory (or filename) to be included or excluded is preceded by a **File =**. Previously they were simply listed on separate lines.
3. The Exclude resource does not accept Options.
4. When using wild-cards or regular expressions, directory names are always terminated with a slash (/) and filenames have no trailing slash.

File = < filename | dirname | |command | \<includefile-client | <includefile-server >
The file list consists of one file or directory name per line. Directory names should be specified without a trailing slash with Unix path notation.

Windows users, please take note to specify directories (even c:/...) in Unix path notation. If you use Windows conventions, you will most likely not be able to restore your files due to the fact that the Windows path separator was defined as an escape character long before Windows existed, and Bareos adheres to that convention (i.e. means the next character appears as itself).

You should always specify a full path for every directory and file that you list in the FileSet. In addition, on Windows machines, you should **always** prefix the directory or filename with the drive specification (e.g. **c:/xxx**) using Unix directory name separators (forward slash). The drive letter itself can be upper or lower case (e.g. c:/xxx or C:/xxx).

Bareos's default for processing directories is to recursively descend in the directory saving all files and subdirectories. Bareos will not by default cross filesystems (or mount points in Unix parlance). This means that if you specify the root partition (e.g. /), Bareos will save only the root partition and not any of the other mounted filesystems. Similarly on Windows systems, you must explicitly specify each of the drives you want saved (e.g. **c:/** and **d:/** ...). In addition, at least for Windows systems, you will most likely want to enclose each specification within double quotes particularly if the directory (or file) name contains spaces. The **df** command on Unix systems will show you which mount points you must specify to save everything. See below for an example.

Take special care not to include a directory twice or Bareos will backup the same files two times wasting a lot of space on your archive device. Including a directory twice is very easy to do. For example:

```
Include {
  Options {
    compression=GZIP
  }
  File = /
  File = /usr
}
```

Configuration 9.5: File Set

on a Unix system where /usr is a subdirectory (rather than a mounted filesystem) will cause /usr to be backed up twice.

<file-list> is a list of directory and/or filename names specified with a **File =** directive. To include names containing spaces, enclose the name between double-quotes. Wild-cards are not interpreted in file-lists. They can only be specified in Options resources.

There are a number of special cases when specifying directories and files in a **file-list**. They are:

- Any name preceded by an at-sign (@) is assumed to be the name of a file, which contains a list of files each preceded by a "File =". The named file is read once when the configuration file is parsed during the Director startup. Note, that the file is read on the Director's machine and not on the Client's. In fact, the @filename can appear anywhere within the conf file where a token would be read, and the contents of the named file will be logically inserted in the place of the @filename. What must be in the file depends on the location the @filename is specified in the conf file. For example:

```
Include {
  Options {
    compression=GZIP
  }
  @/home/files/my-files
}
```

Configuration 9.6: File Set with Include File

- Any name beginning with a vertical bar (|) is assumed to be the name of a program. This program will be executed on the Director's machine at the time the Job starts (not when the Director reads the configuration file), and any output from that program will be assumed to be a list of files or directories, one per line, to be included. Before submitting the specified command Bareos will performe character substitution.

  This allows you to have a job that, for example, includes all the local partitions even if you change the partitioning by adding a disk. The examples below show you how to do this. However, please note two things:
  1. if you want the local filesystems, you probably should be using the **fstype** directive and set **onefs=no**.

  2. the exact syntax of the command needed in the examples below is very system dependent. For example, on recent Linux systems, you may need to add the -P option, on FreeBSD systems, the options will be different as well.

  In general, you will need to prefix your command or commands with a **sh -c** so that they are invoked by a shell. This will not be the case if you are invoking a script as in the second example below. Also, you must take care to escape (precede with a \) wild-cards, shell character, and to ensure that any spaces in your command are escaped as well. If you use a single quotes (') within a double quote ("), Bareos will treat everything between the single quotes as one field so it will not be necessary to escape the spaces. In general, getting all the quotes and escapes correct is a real pain as you can see by the next example. As a consequence, it is often easier to put everything in a file and simply use the file name within Bareos. In that case the **sh -c** will not be necessary providing the first line of the file is **#!/bin/sh**.

  As an example:

```
Include {
   Options {
     signature = SHA1
   }
   File = "|sh -c 'df -l | grep \"^/dev/hd[ab]\" | grep -v \".*/tmp\" | awk \"{print \\$6}\"'"
}
```

Configuration 9.7: File Set with inline script

will produce a list of all the local partitions on a Linux system. Quoting is a real problem because you must quote for Bareos which consists of preceding every \ and every " with a \, and you must also quote for the shell command. In the end, it is probably easier just to execute a script file with:

```
Include {
  Options {
    signature=MD5
  }
  File = "|my_partitions"
}
```

Configuration 9.8: File Set with external script

where `my_partitions` has:

```
#!/bin/sh
df -l | grep "^/dev/hd[ab]" | grep -v ".*/tmp" \
      | awk "{print \$6}"
```

If the vertical bar (|) in front of `my_partitions` is preceded by a backslash as in \|, the program will be executed on the Client's machine instead of on the Director's machine. Please note that if the filename is given within quotes, you will need to use two slashes. An example, provided by John Donagher, that backs up all the local UFS partitions on a remote system is:

```
FileSet {
  Name = "All local partitions"
  Include {
    Options {
      signature=SHA1
```

```
      onefs=yes
    }
    File = "\\|bash -c \"df -klF ufs | tail +2 | awk '{print \$6}'\""
  }
}
```

Configuration 9.9: File Set with inline script in quotes

The above requires two backslash characters after the double quote (one preserves the next one). If you are a Linux user, just change the **ufs** to **ext3** (or your preferred filesystem type), and you will be in business.

If you know what filesystems you have mounted on your system, e.g. for Linux only using ext2, ext3 or ext4, you can backup all local filesystems using something like:

```
Include {
   Options {
     signature = SHA1
     onfs=no
     fstype=ext2
   }
   File = /
}
```

Configuration 9.10: File Set to backup all extfs partions

- Any file-list item preceded by a less-than sign (<) will be taken to be a file. This file will be read on the Director's machine (see below for doing it on the Client machine) at the time the Job starts, and the data will be assumed to be a list of directories or files, one per line, to be included. The names should start in column 1 and should not be quoted even if they contain spaces. This feature allows you to modify the external file and change what will be saved without stopping and restarting Bareos as would be necessary if using the @ modifier noted above. For example:

```
Include {
  Options {
    signature = SHA1
  }
  File = "</home/files/local-filelist"
}
```

If you precede the less-than sign (<) with a backslash as in \<, the file-list will be read on the Client machine instead of on the Director's machine. Please note that if the filename is given within quotes, you will need to use two slashes.

```
Include {
  Options {
    signature = SHA1
  }
  File = "\\</home/xxx/filelist-on-client"
}
```

- If you explicitly specify a block device such as **/dev/hda1**, then Bareos will assume that this is a raw partition to be backed up. In this case, you are strongly urged to specify a **sparse=yes** include option, otherwise, you will save the whole partition rather than just the actual data that the partition contains. For example:

```
Include {
  Options {
    signature=MD5
    sparse=yes
  }
  File = /dev/hd6
}
```

Configuration 9.11: Backup Raw Partitions

will backup the data in device /dev/hd6. Note, the bf /dev/hd6 must be the raw partition itself. Bareos will not back it up as a raw device if you specify a symbolic link to a raw device such as my be created by the LVM Snapshot utilities.

- A file-list may not contain wild-cards. Use directives in the Options resource if you wish to specify wild-cards or regular expression matching.

Exclude Dir Containing = <filename>

This directive can be added to the Include section of the FileSet resource. If the specified filename (**filename-string**) is found on the Client in any directory to be backed up, the whole directory will be ignored (not backed up). We recommend to use the filename `.nobackup`, as it is a hidden file on unix systems, and explains what is the purpose of the file.

For example:

```
# List of files to be backed up
FileSet {
    Name = "MyFileSet"
    Include {
        Options {
            signature = MD5
        }
        File = /home
        Exclude Dir Containing = .nobackup
    }
}
```

Configuration 9.12: Exlude Directories containing the file .nobackup

But in /home, there may be hundreds of directories of users and some people want to indicate that they don't want to have certain directories backed up. For example, with the above FileSet, if the user or sysadmin creates a file named **.nobackup** in specific directories, such as

```
/home/user/www/cache/.nobackup
/home/user/temp/.nobackup
```

then Bareos will not backup the two directories named:

```
/home/user/www/cache
/home/user/temp
```

NOTE: subdirectories will not be backed up. That is, the directive applies to the two directories in question and any children (be they files, directories, etc).

Plugin = <plugin-name:plugin-parameter1:plugin-parameter2:...>

Instead of only specifying files, a file set can also use plugins. Plugins are additional libraries that handle specific requirements. The purpose of plugins is to provide an interface to any system program for backup and restore. That allows you, for example, to do database backups without a local dump.

The syntax and semantics of the Plugin directive require the first part of the string up to the colon to be the name of the plugin. Everything after the first colon is ignored by the File daemon but is passed to the plugin. Thus the plugin writer may define the meaning of the rest of the string as he wishes.

The program bpluginfo can be used, to retreive information about a specific plugin.

Examples about the bpipe- and the mssql-plugin can be found in the sections about the bpipe Plugin and the Backup of MSSQL Databases with Bareos Plugin.

Note: It is also possible to define more than one plugin directive in a FileSet to do several database dumps at once.

Options = <...>

See the FileSet Options Ressource section.

FileSet Options Ressource

The Options resource is optional, but when specified, it will contain a list of **keyword=value** options to be applied to the file-list. See below for the definition of file-list. Multiple Options resources may be specified one after another. As the files are found in the specified directories, the Options will applied to the filenames to determine if and how the file should be backed up. The wildcard and regular expression pattern matching parts of the Options resources are checked in the order they are specified in the FileSet until the first one

that matches. Once one matches, the compression and other flags within the Options specification will apply to the pattern matched.
A key point is that in the absence of an Option or no other Option is matched, every file is accepted for backing up. This means that if you want to exclude something, you must explicitly specify an Option with an **exclude = yes** and some pattern matching.
Once Bareos determines that the Options resource matches the file under consideration, that file will be saved without looking at any other Options resources that may be present. This means that any wild cards must appear before an Options resource without wild cards.
If for some reason, Bareos checks all the Options resources to a file under consideration for backup, but there are no matches (generally because of wild cards that don't match), Bareos as a default will then backup the file. This is quite logical if you consider the case of no Options clause is specified, where you want everything to be backed up, and it is important to keep in mind when excluding as mentioned above.
However, one additional point is that in the case that no match was found, Bareos will use the options found in the last Options resource. As a consequence, if you want a particular set of "default" options, you should put them in an Options resource after any other Options.
It is a good idea to put all your wild-card and regex expressions inside double quotes to prevent conf file scanning problems.
This is perhaps a bit overwhelming, so there are a number of examples included below to illustrate how this works.
You find yourself using a lot of Regex statements, which will cost quite a lot of CPU time, we recommend you simplify them if you can, or better yet convert them to Wild statements which are much more efficient.
The directives within an Options resource may be one of the following:

AutoExclude = <yes|no> (default: yes)

Automatically exclude files not intended for backup. Currently only used for Windows, to exclude files defined in the registry key `HKEY_LOCAL_MACHINE\SYSTEM \CurrentControlSet \Control \BackupRestore \FilesNotToBackup` , see section FilesNotToBackup Registry Key.
Version >= 14.2.2

compression=<GZIP|GZIP1|...|GZIP9|LZO|LZFAST|LZ4|LZ4HC>

Configures the software compression to be used by the File Daemon. The compression is done on a file by file basis.

Software compression gets important if you are writing to a device that does not support compression by itself (e.g. hard disks). Otherwise, all modern tape drive do support hardware compression. Software compression can also be helpful to reduce the required network bandwidth, as compression is done on the File Daemon. However, using Bareos software compression and device hardware compression together is not advised, as trying to compress precompressed data is a very CPU-intense task and probably end up in even larger data.

You can overwrite this option per Storage resource using the Allow Compression $^{\text{Dir}}_{\text{Storage}}$ = no option.

compression=GZIP

All files saved will be software compressed using the GNU ZIP compression format.

Specifying **GZIP** uses the default compression level 6 (i.e. **GZIP** is identical to **GZIP6**). If you want a different compression level (1 through 9), you can specify it by appending the level number with no intervening spaces to **GZIP**. Thus **compression=GZIP1** would give minimum compression but the fastest algorithm, and **compression=GZIP9** would give the highest level of compression, but requires more computation. According to the GZIP documentation, compression levels greater than six generally give very little extra compression and are rather CPU intensive.

compression=LZO

All files saved will be software compressed using the LZO compression format. The compression is done on a file by file basis by the File daemon. Everything else about GZIP is true for LZO.

LZO provides much faster compression and decompression speed but lower compression ratio than GZIP. If your CPU is fast enough you should be able to compress your data without making the backup duration longer.

Note that Bareos only use one compression level LZO1X-1 specified by LZO.

compression=LZFAST

All files saved will be software compressed using the LZFAST compression format. The compression is done on a file by file basis by the File daemon. Everything else about GZIP is true for LZFAST.

LZFAST provides much faster compression and decompression speed but lower compression ratio than GZIP. If your CPU is fast enough you should be able to compress your data without making the backup duration longer.

compression=LZ4
All files saved will be software compressed using the LZ4 compression format. The compression is done on a file by file basis by the File daemon. Everything else about GZIP is true for LZ4.

LZ4 provides much faster compression and decompression speed but lower compression ratio than GZIP. If your CPU is fast enough you should be able to compress your data without making the backup duration longer.

Both LZ4 and LZ4HC have the same decompression speed which is about twice the speed of the LZO compression. So for a restore both LZ4 and LZ4HC are good candidates.

Please note! *As LZ4 compression is not supported by Bacula, make sure Compatible* $^{Fd}_{Client}$ *= no.*

compression=LZ4HC
All files saved will be software compressed using the LZ4HC compression format. The compression is done on a file by file basis by the File daemon. Everything else about GZIP is true for LZ4.

LZ4HC is the High Compression version of the LZ4 compression. It has a higher compression ratio than LZ4 and is more comparable to GZIP-6 in both compression rate and cpu usage.

Both LZ4 and LZ4HC have the same decompression speed which is about twice the speed of the LZO compression. So for a restore both LZ4 and LZ4HC are good candidates.

Please note! *As LZ4 compression is not supported by Bacula, make sure Compatible* $^{Fd}_{Client}$ *= no.*

signature=<SHA1|MD5>

signature=SHA1
An SHA1 signature will be computed for all The SHA1 algorithm is purported to be some what slower than the MD5 algorithm, but at the same time is significantly better from a cryptographic point of view (i.e. much fewer collisions, much lower probability of being hacked.) It adds four more bytes than the MD5 signature. We strongly recommend that either this option or MD5 be specified as a default for all files. Note, only one of the two options MD5 or SHA1 can be computed for any file.

signature=MD5
An MD5 signature will be computed for all files saved. Adding this option generates about 5% extra overhead for each file saved. In addition to the additional CPU time, the MD5 signature adds 16 more bytes per file to your catalog. We strongly recommend that this option or the SHA1 option be specified as a default for all files.

basejob=<options> The options letters specified are used when running a **Backup Level=Full** with BaseJobs. The options letters are the same than in the **verify=** option below.

accurate=<options> The options letters specified are used when running a **Backup Level=Incremental/Differential** in Accurate mode. The options letters are the same than in the **verify=** option below.

verify=<options>
The options letters specified are used when running a **Verify Level=Catalog** as well as the **DiskToCatalog** level job. The options letters may be any combination of the following:

i compare the inodes

p compare the permission bits

n compare the number of links

u compare the user id

g compare the group id

s compare the size

a compare the access time

m compare the modification time (st_mtime)

c compare the change time (st_ctime)

d report file size decreases

5 compare the MD5 signature

1 compare the SHA1 signature

A Only for Accurate option, it allows to always backup the file

A useful set of general options on the **Level=Catalog** or **Level=DiskToCatalog** verify is **pins5** i.e. compare permission bits, inodes, number of links, size, and MD5 changes.

onefs=yes|no

If set to **yes** (the default), **Bareos** will remain on a single file system. That is it will not backup file systems that are mounted on a subdirectory. If you are using a *nix system, you may not even be aware that there are several different filesystems as they are often automatically mounted by the OS (e.g. /dev, /net, /sys, /proc, ...). Bareos will inform you when it decides not to traverse into another filesystem. This can be very useful if you forgot to backup a particular partition. An example of the informational message in the job report is:

```
rufus-fd: /misc is a different filesystem. Will not descend from / into /misc
rufus-fd: /net is a different filesystem. Will not descend from / into /net
rufus-fd: /var/lib/nfs/rpc_pipefs is a different filesystem. Will not descend from /var/lib/nfs into /var/lib/nfs/rpc_
rufus-fd: /selinux is a different filesystem. Will not descend from / into /selinux
rufus-fd: /sys is a different filesystem. Will not descend from / into /sys
rufus-fd: /dev is a different filesystem. Will not descend from / into /dev
rufus-fd: /home is a different filesystem. Will not descend from / into /home
```

If you wish to backup multiple filesystems, you can explicitly list each filesystem you want saved. Otherwise, if you set the onefs option to **no**, Bareos will backup all mounted file systems (i.e. traverse mount points) that are found within the **FileSet**. Thus if you have NFS or Samba file systems mounted on a directory listed in your FileSet, they will also be backed up. Normally, it is preferable to set **onefs=yes** and to explicitly name each filesystem you want backed up. Explicitly naming the filesystems you want backed up avoids the possibility of getting into a infinite loop recursing filesystems. Another possibility is to use **onefs=no** and to set **fstype=ext2, ...**. See the example below for more details.

If you think that Bareos should be backing up a particular directory and it is not, and you have **onefs=no** set, before you complain, please do:

```
stat /
stat <filesystem>
```

where you replace **filesystem** with the one in question. If the **Device:** number is different for / and for your filesystem, then they are on different filesystems. E.g.

```
stat /
  File: '/'
  Size: 4096            Blocks: 16         IO Block: 4096   directory
Device: 302h/770d       Inode: 2           Links: 26
Access: (0755/drwxr-xr-x)  Uid: (    0/    root)   Gid: (    0/    root)
Access: 2005-11-10 12:28:01.000000000 +0100
Modify: 2005-09-27 17:52:32.000000000 +0200
Change: 2005-09-27 17:52:32.000000000 +0200

stat /net
  File: '/home'
  Size: 4096            Blocks: 16         IO Block: 4096   directory
Device: 308h/776d       Inode: 2           Links: 7
Access: (0755/drwxr-xr-x)  Uid: (    0/    root)   Gid: (    0/    root)
Access: 2005-11-10 12:28:02.000000000 +0100
Modify: 2005-11-06 12:36:48.000000000 +0100
Change: 2005-11-06 12:36:48.000000000 +0100
```

Also be aware that even if you include **/home** in your list of files to backup, as you most likely should, you will get the informational message that "/home is a different filesystem" when Bareos is processing the / directory. This message does not indicate an error. This message means that while examining the **File** = referred to in the second part of the message, Bareos will not descend into the directory mentioned in the first part of the message. However, it is possible that the separate filesystem will be backed up despite the message. For example, consider the following FileSet:

```
File = /
File = /var
```

where **/var** is a separate filesystem. In this example, you will get a message saying that Bareos will not decend from / into **/var**. But it is important to realise that Bareos will descend into **/var** from the second File directive shown above. In effect, the warning is bogus, but it is supplied to alert you to possible omissions from your FileSet. In this example, **/var** will be backed up. If you changed the FileSet such that it did not specify **/var**, then **/var** will not be backed up.

honor nodump flag=<yes|no>
If your file system supports the **nodump** flag (e. g. most BSD-derived systems) Bareos will honor the setting of the flag when this option is set to **yes**. Files having this flag set will not be included in the backup and will not show up in the catalog. For directories with the **nodump** flag set recursion is turned off and the directory will be listed in the catalog. If the **honor nodump flag** option is not defined or set to **no** every file and directory will be eligible for backup.

portable=yes|no
If set to **yes** (default is **no**), the Bareos File daemon will backup Win32 files in a portable format, but not all Win32 file attributes will be saved and restored. By default, this option is set to **no**, which means that on Win32 systems, the data will be backed up using Windows API calls and on WinNT/2K/XP, all the security and ownership attributes will be properly backed up (and restored). However this format is not portable to other systems – e.g. Unix, Win95/98/Me. When backing up Unix systems, this option is ignored, and unless you have a specific need to have portable backups, we recommend accept the default (**no**) so that the maximum information concerning your files is saved.

recurse=yes|no
If set to **yes** (the default), Bareos will recurse (or descend) into all subdirectories found unless the directory is explicitly excluded using an **exclude** definition. If you set **recurse=no**, Bareos will save the subdirectory entries, but not descend into the subdirectories, and thus will not save the files or directories contained in the subdirectories. Normally, you will want the default (**yes**).

sparse=yes|no
Enable special code that checks for sparse files such as created by ndbm. The default is **no**, so no checks are made for sparse files. You may specify **sparse=yes** even on files that are not sparse file. No harm will be done, but there will be a small additional overhead to check for buffers of all zero, and if there is a 32K block of all zeros (see below), that block will become a hole in the file, which may not be desirable if the original file was not a sparse file.

Restrictions: Bareos reads files in 32K buffers. If the whole buffer is zero, it will be treated as a sparse block and not written to tape. However, if any part of the buffer is non-zero, the whole buffer will be written to tape, possibly including some disk sectors (generally 4098 bytes) that are all zero. As a consequence, Bareos's detection of sparse blocks is in 32K increments rather than the system block size. If anyone considers this to be a real problem, please send in a request for change with the reason.

If you are not familiar with sparse files, an example is say a file where you wrote 512 bytes at address zero, then 512 bytes at address 1 million. The operating system will allocate only two blocks, and the empty space or hole will have nothing allocated. However, when you read the sparse file and read the addresses where nothing was written, the OS will return all zeros as if the space were allocated, and if you backup such a file, a lot of space will be used to write zeros to the volume. Worse yet, when you restore the file, all the previously empty space will now be allocated using much more disk space. By turning on the **sparse** option, Bareos will specifically look for empty space in the file, and any empty space will not be written to the Volume, nor will it be restored. The price to pay for this is that Bareos must search each block it reads before writing it. On a slow system, this may be important. If you suspect you have sparse files, you should benchmark the difference or set sparse for only those files that are really sparse.

You probably should not use this option on files or raw disk devices that are not really sparse files (i.e. have holes in them).

readfifo=yes|no
If enabled, tells the Client to read the data on a backup and write the data on a restore to any FIFO (pipe) that is explicitly mentioned in the FileSet. In this case, you must have a program already running that writes into the FIFO for a backup or reads from the FIFO on a restore. This can be accomplished with the **RunBeforeJob** directive. If this is not the case, Bareos will hang indefinitely

on reading/writing the FIFO. When this is not enabled (default), the Client simply saves the directory entry for the FIFO.

Normally, when Bareos runs a RunBeforeJob, it waits until that script terminates, and if the script accesses the FIFO to write into it, the Bareos job will block and everything will stall. However, Vladimir Stavrinov as supplied tip that allows this feature to work correctly. He simply adds the following to the beginning of the RunBeforeJob script:

```
exec > /dev/null
```

```
Include {
  Options {
    signature=SHA1
    readfifo=yes
  }
  File = /home/abc/fifo
}
```

Configuration 9.13: FileSet with Fifo

This feature can be used to do a "hot" database backup. You can use the **RunBeforeJob** to create the fifo and to start a program that dynamically reads your database and writes it to the fifo. Bareos will then write it to the Volume.

During the restore operation, the inverse is true, after Bareos creates the fifo if there was any data stored with it (no need to explicitly list it or add any options), that data will be written back to the fifo. As a consequence, if any such FIFOs exist in the fileset to be restored, you must ensure that there is a reader program or Bareos will block, and after one minute, Bareos will time out the write to the fifo and move on to the next file.

If you are planing to use a Fifo for backup, better take a look to the bpipe Plugin section.

noatime=yes|no
If enabled, and if your Operating System supports the O_NOATIME file open flag, Bareos will open all files to be backed up with this option. It makes it possible to read a file without updating the inode atime (and also without the inode ctime update which happens if you try to set the atime back to its previous value). It also prevents a race condition when two programs are reading the same file, but only one does not want to change the atime. It's most useful for backup programs and file integrity checkers (and Bareos can fit on both categories).

This option is particularly useful for sites where users are sensitive to their MailBox file access time. It replaces both the **keepatime** option without the inconveniences of that option (see below).

If your Operating System does not support this option, it will be silently ignored by Bareos.

mtimeonly=yes|no
If enabled, tells the Client that the selection of files during Incremental and Differential backups should based only on the st_mtime value in the stat() packet. The default is **no** which means that the selection of files to be backed up will be based on both the st_mtime and the st_ctime values. In general, it is not recommended to use this option.

keepatime=yes|no
The default is **no**. When enabled, Bareos will reset the st_atime (access time) field of files that it backs up to their value prior to the backup. This option is not generally recommended as there are very few programs that use st_atime, and the backup overhead is increased because of the additional system call necessary to reset the times. However, for some files, such as mailboxes, when Bareos backs up the file, the user will notice that someone (Bareos) has accessed the file. In this, case keepatime can be useful. (I'm not sure this works on Win32).

Note, if you use this feature, when Bareos resets the access time, the change time (st_ctime) will automatically be modified by the system, so on the next incremental job, the file will be backed up even if it has not changed. As a consequence, you will probably also want to use **mtimeonly = yes** as well as keepatime (thanks to Rudolf Cejka for this tip).

checkfilechanges=yes|no
If enabled, the Client will check size, age of each file after their backup to see if they have changed during backup. If time or size mismatch, an error will raise.

```
zog-fd: Client1.2007-03-31_09.46.21 Error: /tmp/test mtime changed during backup.
```

In general, it is recommended to use this option.

hardlinks=yes|no
When enabled (default), this directive will cause hard links to be backed up. However, the File daemon keeps track of hard linked files and will backup the data only once. The process of keeping track of the hard links can be quite expensive if you have lots of them (tens of thousands or more). This doesn't occur on normal Unix systems, but if you use a program like BackupPC, it can create hundreds of thousands, or even millions of hard links. Backups become very long and the File daemon will consume a lot of CPU power checking hard links. In such a case, set **hardlinks=no** and hard links will not be backed up. Note, using this option will most likely backup more data and on a restore the file system will not be restored identically to the original.

wild=<string>
Specifies a wild-card string to be applied to the filenames and directory names. Note, if **Exclude** is not enabled, the wild-card will select which files are to be included. If **Exclude=yes** is specified, the wild-card will select which files are to be excluded. Multiple wild-card directives may be specified, and they will be applied in turn until the first one that matches. Note, if you exclude a directory, no files or directories below it will be matched.

You may want to test your expressions prior to running your backup by using the bwild program. Please see the Utilities chapter of this manual for more. You can also test your full FileSet definition by using the estimate command in the Console chapter of this manual. It is recommended to enclose the string in double quotes.

wilddir=<string>
Specifies a wild-card string to be applied to directory names only. No filenames will be matched by this directive. Note, if **Exclude** is not enabled, the wild-card will select directories to be included. If **Exclude=yes** is specified, the wild-card will select which directories are to be excluded. Multiple wild-card directives may be specified, and they will be applied in turn until the first one that matches. Note, if you exclude a directory, no files or directories below it will be matched.

It is recommended to enclose the string in double quotes.

You may want to test your expressions prior to running your backup by using the bwild program. Please see the Utilities chapter of this manual for more. You can also test your full FileSet definition by using the estimate command in the Console chapter of this manual. An example of excluding with the WildDir option on Win32 machines is presented below.

wildfile=<string>
Specifies a wild-card string to be applied to non-directories. That is no directory entries will be matched by this directive. However, note that the match is done against the full path and filename, so your wild-card string must take into account that filenames are preceded by the full path. If **Exclude** is not enabled, the wild-card will select which files are to be included. If **Exclude=yes** is specified, the wild-card will select which files are to be excluded. Multiple wild-card directives may be specified, and they will be applied in turn until the first one that matches.

It is recommended to enclose the string in double quotes.

You may want to test your expressions prior to running your backup by using the bwild program. Please see the Utilities chapter of this manual for more. You can also test your full FileSet definition by using the estimate command in the Console chapter of this manual. An example of excluding with the WildFile option on Win32 machines is presented below.

regex=<string>

Specifies a POSIX extended regular expression to be applied to the filenames and directory names, which include the full path. If **Exclude** is not enabled, the regex will select which files are to be included. If **Exclude=yes** is specified, the regex will select which files are to be excluded. Multiple regex directives may be specified within an Options resource, and they will be applied in turn until the first one that matches. Note, if you exclude a directory, no files or directories below it will be matched.

It is recommended to enclose the string in double quotes.

The regex libraries differ from one operating system to another, and in addition, regular expressions are complicated, so you may want to test your expressions prior to running your backup by using the

bregex program. Please see the Utilities chapter of this manual for more. You can also test your full FileSet definition by using the estimate command in the Console chapter of this manual.

You find yourself using a lot of Regex statements, which will cost quite a lot of CPU time, we recommend you simplify them if you can, or better yet convert them to Wild statements which are much more efficient.

regexfile=<string>
Specifies a POSIX extended regular expression to be applied to non-directories. No directories will be matched by this directive. However, note that the match is done against the full path and filename, so your regex string must take into account that filenames are preceded by the full path. If **Exclude** is not enabled, the regex will select which files are to be included. If **Exclude=yes** is specified, the regex will select which files are to be excluded. Multiple regex directives may be specified, and they will be applied in turn until the first one that matches.

It is recommended to enclose the string in double quotes.

The regex libraries differ from one operating system to another, and in addition, regular expressions are complicated, so you may want to test your expressions prior to running your backup by using the bregex program. Please see the Utilities chapter of this manual for more.

regexdir=<string>
Specifies a POSIX extended regular expression to be applied to directory names only. No filenames will be matched by this directive. Note, if **Exclude** is not enabled, the regex will select directories files are to be included. If **Exclude=yes** is specified, the regex will select which files are to be excluded. Multiple regex directives may be specified, and they will be applied in turn until the first one that matches. Note, if you exclude a directory, no files or directories below it will be matched.

It is recommended to enclose the string in double quotes.

The regex libraries differ from one operating system to another, and in addition, regular expressions are complicated, so you may want to test your expressions prior to running your backup by using the bregex program. Please see the Utilities chapter of this manual for more.

Exclude = <yes|no> (default: no)
When enabled, any files matched within the Options will be excluded from the backup.

aclsupport=yes|no
The default is **no**. If this option is set to yes, and you have the POSIX **libacl** installed on your Linux system, Bareos will backup the file and directory Unix Access Control Lists (ACL) as defined in IEEE Std 1003.1e draft 17 and "POSIX.1e" (abandoned). This feature is available on Unix systems only and requires the Linux ACL library. Bareos is automatically compiled with ACL support if the **libacl** library is installed on your Linux system (shown in config.out). While restoring the files Bareos will try to restore the ACLs, if there is no ACL support available on the system, Bareos restores the files and directories but not the ACL information. Please note, if you backup an EXT3 or XFS filesystem with ACLs, then you restore them to a different filesystem (perhaps reiserfs) that does not have ACLs, the ACLs will be ignored.

For other operating systems there is support for either POSIX ACLs or the more extensible NFSv4 ACLs.

The ACL stream format between Operation Systems is **not** compatible so for example an ACL saved on Linux cannot be restored on Solaris.

The following Operating Systems are currently supported:

1. AIX (pre-5.3 (POSIX) and post 5.3 (POSIX and NFSv4) ACLs)
2. Darwin
3. FreeBSD (POSIX and NFSv4/ZFS ACLs)
4. HPUX
5. IRIX
6. Linux
7. Solaris (POSIX and NFSv4/ZFS ACLs)
8. Tru64

xattrsupport=yes|no

The default is **no**. If this option is set to yes, and your operating system support either so called Extended Attributes or Extensible Attributes Bareos will backup the file and directory XATTR data. This feature is available on UNIX only and depends on support of some specific library calls in libc.

The XATTR stream format between Operating Systems is **not** compatible so an XATTR saved on Linux cannot for example be restored on Solaris.

On some operating systems ACLs are also stored as Extended Attributes (Linux, Darwin, FreeBSD) Bareos checks if you have the aclsupport option enabled and if so will not save the same info when saving extended attribute information. Thus ACLs are only saved once.

The following Operating Systems are currently supported:

1. AIX (Extended Attributes)
2. Darwin (Extended Attributes)
3. FreeBSD (Extended Attributes)
4. IRIX (Extended Attributes)
5. Linux (Extended Attributes)
6. NetBSD (Extended Attributes)
7. Solaris (Extended Attributes and Extensible Attributes)
8. Tru64 (Extended Attributes)

ignore case=yes|no

The default is **no**. On Windows systems, you will almost surely want to set this to **yes**. When this directive is set to **yes** all the case of character will be ignored in wild-card and regex comparisons. That is an uppercase A will match a lowercase a.

fstype=filesystem-type

This option allows you to select files and directories by the filesystem type. The permitted filesystem-type names are:

ext2, jfs, ntfs, proc, reiserfs, xfs, usbdevfs, sysfs, smbfs, iso9660.

You may have multiple Fstype directives, and thus permit matching of multiple filesystem types within a single Options resource. If the type specified on the fstype directive does not match the filesystem for a particular directive, that directory will not be backed up. This directive can be used to prevent backing up non-local filesystems. Normally, when you use this directive, you would also set **onefs=no** so that Bareos will traverse filesystems.

This option is not implemented in Win32 systems.

DriveType=Windows-drive-type

This option is effective only on Windows machines and is somewhat similar to the Unix/Linux **fstype** described above, except that it allows you to select what Windows drive types you want to allow. By default all drive types are accepted.

The permitted drivetype names are:

removable, fixed, remote, cdrom, ramdisk

You may have multiple Driveype directives, and thus permit matching of multiple drive types within a single Options resource. If the type specified on the drivetype directive does not match the filesystem for a particular directive, that directory will not be backed up. This directive can be used to prevent backing up non-local filesystems. Normally, when you use this directive, you would also set **onefs=no** so that Bareos will traverse filesystems.

This option is not implemented in Unix/Linux systems.

hfsplussupport=yes|no

This option allows you to turn on support for Mac OSX HFS plus finder information.

strippath=<integer>

This option will cause **integer** paths to be stripped from the front of the full path/filename being backed up. This can be useful if you are migrating data from another vendor or if you have taken a snapshot into some subdirectory. This directive can cause your filenames to be overlayed with regular backup data, so should be used only by experts and with great care.

size=sizeoption
This option will allow you to select files by their actual size. You can select either files smaller than a certain size or bigger then a certain size, files of a size in a certain range or files of a size which is within 1 % of its actual size.

The following settings can be used:

1. **<size>-<size>** - Select file in range size - size.
2. **<size** - Select files smaller than size.
3. **>size** - Select files bigger than size.
4. **size** - Select files which are within 1 % of size.

shadowing=none|localwarn|localremove|globalwarn|globalremove
The default is **none**. This option performs a check within the fileset for any file-list entries which are shadowing each other. Lets say you specify / and /usr but /usr is not a separate filesystem. Then in the normal situation both / and /usr would lead to data being backed up twice.

The following settings can be used:

1. none - Do NO shadowing check
2. localwarn - Do shadowing check within one include block and warn
3. localremove - Do shadowing check within one include block and remove duplicates
4. globalwarn - Do shadowing check between all include blocks and warn
5. globalremove - Do shadowing check between all include blocks and remove duplicates

The local and global part of the setting relate to the fact if the check should be performed only within one include block (local) or between multiple include blocks of the same fileset (global). The warn and remove part of the keyword sets the action e.g. warn the user about shadowing or remove the entry shadowing the other.

Example for a fileset resource with fileset shadow warning enabled:

```
FileSet {
  Name = "Test Set"
  Include {
    Options {
      signature = MD5
      shadowing = localwarn
    }
  File = /
  File = /usr
  }
}
```

Configuration 9.14: FileSet resource with fileset shadow warning enabled

meta=tag
This option will add a meta tag to a fileset. These meta tags are used by the Native NDMP protocol to pass NDMP backup or restore environment variables via the Data Management Agent (DMA) in Bareos to the remote NDMP Data Agent. You can have zero or more metatags which are all passed to the remote NDMP Data Agent.

9.5.2 FileSet Exclude Ressource

FileSet Exclude-Ressources very similar to Include-Ressources, except that they only allow following directives:

File = < filename | directory | |command | \<includefile-client | <includefile-server >
Files to exclude are descripted in the same way as at the FileSet Include Ressource.

For example:

```
FileSet {
  Name = Exclusion_example
  Include {
    Options {
      Signature = SHA1
    }
    File = /
    File = /boot
    File = /home
    File = /rescue
    File = /usr
  }
  Exclude {
    File = /proc
    File = /tmp                          # Don't add trailing /
    File = .journal
    File = .autofsck
  }
}
```

Configuration 9.15: FileSet using Exclude

Another way to exclude files and directories is to use the **Exclude** option from the Include section.

9.5.3 FileSet Examples

The following is an example of a valid FileSet resource definition. Note, the first Include pulls in the contents of the file `/etc/backup.list` when Bareos is started (i.e. the @), and that file must have each filename to be backed up preceded by a **File =** and on a separate line.

```
FileSet {
  Name = "Full Set"
  Include {
    Options {
      Compression=GZIP
      signature=SHA1
      Sparse = yes
    }
    @/etc/backup.list
  }
  Include {
     Options {
        wildfile = "*.o"
        wildfile = "*.exe"
        Exclude = yes
     }
     File = /root/myfile
     File = /usr/lib/another_file
  }
}
```

Configuration 9.16: FileSet using import

In the above example, all the files contained in `/etc/backup.list` will be compressed with GZIP compression, an SHA1 signature will be computed on the file's contents (its data), and sparse file handling will apply.
The two directories `/root/myfile` and `/usr/lib/another_file` will also be saved without any options, but all files in those directories with the extensions `.o` and `.exe` will be excluded.
Let's say that you now want to exclude the directory `/tmp`. The simplest way to do so is to add an exclude directive that lists `/tmp`. The example above would then become:

```
FileSet {
  Name = "Full Set"
  Include {
    Options {
      Compression=GZIP
      signature=SHA1
      Sparse = yes
    }
    @/etc/backup.list
  }
  Include {
     Options {
```

```
        wildfile = "*.o"
        wildfile = "*.exe"
        Exclude = yes
     }
     File = /root/myfile
     File = /usr/lib/another_file
  }
  Exclude {
     File = /tmp                          # don't add trailing /
  }
}
```

Configuration 9.17: extended FileSet excluding /tmp

You can add wild-cards to the File directives listed in the Exclude directory, but you need to take care because if you exclude a directory, it and all files and directories below it will also be excluded.
Now lets take a slight variation on the above and suppose you want to save all your whole filesystem except `/tmp`. The problem that comes up is that Bareos will not normally cross from one filesystem to another. Doing a `df` command, you get the following output:

```
root@linux:~# df
Filesystem      1k-blocks      Used Available Use% Mounted on
/dev/hda5         5044156    439232   4348692  10% /
/dev/hda1           62193      4935     54047   9% /boot
/dev/hda9        20161172   5524660  13612372  29% /home
/dev/hda2           62217      6843     52161  12% /rescue
/dev/hda8         5044156     42548   4745376   1% /tmp
/dev/hda6         5044156   2613132   2174792  55% /usr
none               127708         0    127708   0% /dev/shm
//minimatou/c$   14099200   9895424   4203776  71% /mnt/mmatou
lmatou:/          1554264    215884   1258056  15% /mnt/matou
lmatou:/home      2478140   1589952    760072  68% /mnt/matou/home
lmatou:/usr       1981000   1199960    678628  64% /mnt/matou/usr
lpmatou:/          995116    484112    459596  52% /mnt/pmatou
lpmatou:/home    19222656   2787880  15458228  16% /mnt/pmatou/home
lpmatou:/usr      2478140   2038764    311260  87% /mnt/pmatou/usr
deuter:/          4806936     97684   4465064   3% /mnt/deuter
deuter:/home      4806904    280100   4282620   7% /mnt/deuter/home
deuter:/files    44133352  27652876  14238608  67% /mnt/deuter/files
```

Commands 9.18: df

And we see that there are a number of separate filesystems (/ /boot /home /rescue /tmp and /usr not to mention mounted systems). If you specify only `/` in your Include list, Bareos will only save the Filesystem **/dev/hda5**. To save all filesystems except **/tmp** with out including any of the Samba or NFS mounted systems, and explicitly excluding a /tmp, /proc, .journal, and .autofsck, which you will not want to be saved and restored, you can use the following:

```
FileSet {
  Name = Include_example
  Include {
    Options {
       wilddir = /proc
       wilddir = /tmp
       wildfile = "/.journal"
       wildfile = "/.autofsck"
       exclude = yes
    }
    File = /
    File = /boot
    File = /home
    File = /rescue
    File = /usr
  }
}
```

Configuration 9.19: FileSet mount points

Since `/tmp` is on its own filesystem and it was not explicitly named in the Include list, it is not really needed in the exclude list. It is better to list it in the Exclude list for clarity, and in case the disks are changed so that it is no longer in its own partition.
Now, lets assume you only want to backup .Z and .gz files and nothing else. This is a bit trickier because Bareos by default will select everything to backup, so we must exclude everything but .Z and .gz files. If

we take the first example above and make the obvious modifications to it, we might come up with a FileSet that looks like this:

```
FileSet {
  Name = "Full Set"
  Include {                    !!!!!!!!!!!!
     Options {                    This
        wildfile = "*.Z"          example
        wildfile = "*.gz"         doesn't
                                  work
     }                           !!!!!!!!!!!!
     File = /myfile
  }
}
```

Configuration 9.20: Non-working example

The *.Z and *.gz files will indeed be backed up, but all other files that are not matched by the Options directives will automatically be backed up too (i.e. that is the default rule).
To accomplish what we want, we must explicitly exclude all other files. We do this with the following:

```
FileSet {
  Name = "Full Set"
  Include {
     Options {
        wildfile = "*.Z"
        wildfile = "*.gz"
     }
     Options {
        Exclude = yes
        RegexFile = ".*"
     }
     File = /myfile
  }
}
```

Configuration 9.21: Exclude all except specific wildcards

The "trick" here was to add a RegexFile expression that matches all files. It does not match directory names, so all directories in /myfile will be backed up (the directory entry) and any *.Z and *.gz files contained in them. If you know that certain directories do not contain any *.Z or *.gz files and you do not want the directory entries backed up, you will need to explicitly exclude those directories. Backing up a directory entries is not very expensive.
Bareos uses the system regex library and some of them are different on different OSes. The above has been reported not to work on FreeBSD. This can be tested by using the **estimate job=job-name listing** command in the console and adapting the RegexFile expression appropriately.
Please be aware that allowing Bareos to traverse or change file systems can be **very** dangerous. For example, with the following:

```
FileSet {
  Name = "Bad example"
  Include {
    Options {
      onefs=no
    }
    File = /mnt/matou
  }
}
```

Configuration 9.22: backup all filesystem below /mnt/matou (use with care)

you will be backing up an NFS mounted partition (**/mnt/matou**), and since **onefs** is set to **no**, Bareos will traverse file systems. Now if **/mnt/matou** has the current machine's file systems mounted, as is often the case, you will get yourself into a recursive loop and the backup will never end.
As a final example, let's say that you have only one or two subdirectories of /home that you want to backup. For example, you want to backup only subdirectories beginning with the letter a and the letter b – i.e. `/home/a*` and `/home/b*`. Now, you might first try:

```
FileSet {
  Name = "Full Set"
  Include {
     Options {
        wilddir = "/home/a*"
```

```
        wilddir = "/home/b*"
     }
     File = /home
  }
}
```

Configuration 9.23: Non-working example

The problem is that the above will include everything in /home. To get things to work correctly, you need to start with the idea of exclusion instead of inclusion. So, you could simply exclude all directories except the two you want to use:

```
FileSet {
  Name = "Full Set"
  Include {
     Options {
        RegexDir = "^/home/[c-z]"
        exclude = yes
     }
     File = /home
  }
}
```

Configuration 9.24: Exclude by regex

And assuming that all subdirectories start with a lowercase letter, this would work.
An alternative would be to include the two subdirectories desired and exclude everything else:

```
FileSet {
  Name = "Full Set"
  Include {
     Options {
        wilddir = "/home/a*"
        wilddir = "/home/b*"
     }
     Options {
        RegexDir = ".*"
        exclude = yes
     }
     File = /home
  }
}
```

Configuration 9.25: Include and Exclude

The following example shows how to back up only the My Pictures directory inside the My Documents directory for all users in C:/Documents and Settings, i.e. everything matching the pattern:
`C:/Documents and Settings/*/My Documents/My Pictures/*`
To understand how this can be achieved, there are two important points to remember:
Firstly, Bareos walks over the filesystem depth-first starting from the File = lines. It stops descending when a directory is excluded, so you must include all ancestor directories of each directory containing files to be included.
Secondly, each directory and file is compared to the Options clauses in the order they appear in the FileSet. When a match is found, no further clauses are compared and the directory or file is either included or excluded.
The FileSet resource definition below implements this by including specifc directories and files and excluding everything else.

```
FileSet {
  Name = "AllPictures"

  Include {

    File  = "C:/Documents and Settings"

    Options {
      signature = SHA1
      verify = s1
      IgnoreCase = yes

      # Include all users' directories so we reach the inner ones.  Unlike a
      # WildDir pattern ending in *, this RegExDir only matches the top-level
      # directories and not any inner ones.
      RegExDir = "^C:/Documents and Settings/[^/]+$"
```

```
      # Ditto all users' My Documents directories.
      WildDir = "C:/Documents and Settings/*/My Documents"

      # Ditto all users' My Documents/My Pictures directories.
      WildDir = "C:/Documents and Settings/*/My Documents/My Pictures"

      # Include the contents of the My Documents/My Pictures directories and
      # any subdirectories.
      Wild = "C:/Documents and Settings/*/My Documents/My Pictures/*"
    }

    Options {
      Exclude = yes
      IgnoreCase = yes

      # Exclude everything else, in particular any files at the top level and
      # any other directories or files in the users' directories.
      Wild = "C:/Documents and Settings/*"
    }
  }
}
```

Configuration 9.26: Include/Exclude example

9.5.4 Windows FileSets

If you are entering Windows file names, the directory path may be preceded by the drive and a colon (as in c:). However, the path separators must be specified in Unix convention (i.e. forward slash (/)). If you wish to include a quote in a file name, precede the quote with a backslash (\). For example you might use the following for a Windows machine to backup the "My Documents" directory:

```
FileSet {
  Name = "Windows Set"
  Include {
    Options {
       WildFile = "*.obj"
       WildFile = "*.exe"
       exclude = yes
     }
     File = "c:/My Documents"
  }
}
```

Configuration 9.27: Windows FileSet

For exclude lists to work correctly on Windows, you must observe the following rules:

- Filenames are case sensitive, so you must use the correct case.
- To exclude a directory, you must not have a trailing slash on the directory name.
- If you have spaces in your filename, you must enclose the entire name in double-quote characters ("). Trying to use a backslash before the space will not work.
- If you are using the old Exclude syntax (noted below), you may not specify a drive letter in the exclude. The new syntax noted above should work fine including driver letters.

Thanks to Thiago Lima for summarizing the above items for us. If you are having difficulties getting includes or excludes to work, you might want to try using the **estimate job=xxx listing** command documented in the Console chapter of this manual.
On Win32 systems, if you move a directory or file or rename a file into the set of files being backed up, and a Full backup has already been made, Bareos will not know there are new files to be saved during an Incremental or Differential backup (blame Microsoft, not us). To avoid this problem, please **copy** any new directory or files into the backup area. If you do not have enough disk to copy the directory or files, move them, but then initiate a Full backup.

Example Fileset for Windows The following example demostrates a Windows FileSet. It backups all data from all fixed drives and only excludes some Windows temporary data.

```
FileSet {
  Name = "Windows All Drives"
  Enable VSS = yes
  Include {
    Options {
      Signature = MD5
      Drive Type = fixed
      IgnoreCase = yes
      WildFile = "[A-Z]:/pagefile.sys"
      WildDir = "[A-Z]:/RECYCLER"
      WildDir = "[A-Z]:/$RECYCLE.BIN"
      WildDir = "[A-Z]:/System Volume Information"
      Exclude = yes
    }
    File = /
  }
}
```

Configuration 9.28: Windows All Drives FileSet

`File = /` includes all Windows drives. Using `Drive Type = fixed` excludes drives like USB-Stick or CD-ROM Drive. Using `WildDir = "[A-Z]:/RECYCLER"` excludes the backup of the directory `RECYCLER` from all drives.

9.5.5 Testing Your FileSet

If you wish to get an idea of what your FileSet will really backup or if your exclusion rules will work correctly, you can test it by using the **estimate** command in the Console program. See the estimate in the Console chapter of this manual.
As an example, suppose you add the following test FileSet:

```
FileSet {
  Name = Test
  Include {
    File = /home/xxx/test
    Options {
       regex = ".*\\.c$"
    }
  }
}
```

Configuration 9.29: FileSet for all *.c files

You could then add some test files to the directory **/home/xxx/test** and use the following command in the console:

```
estimate job=<any-job-name> listing client=<desired-client> fileset=Test
```

bconsole 9.30: estimate

to give you a listing of all files that match. In the above example, it should be only files with names ending in **.c**.

9.6 Client Resource

The Client (or FileDaemon) resource defines the attributes of the Clients that are served by this Director; that is the machines that are to be backed up. You will need one Client resource definition for each machine to be backed up.

configuration directive name	type of data	default value	remark
Address	**= string**		**required**
Allow Client Connect	= yes|no	no	
Auth Type	= None|Clear|MD5	None	
Auto Prune	= yes|no	no	
Catalog	= resource-name		

Description	= string		
Enabled	= yes|no	yes	
FD Address	= *string*		*alias*
FD Password	= *password*		*alias*
FD Port	= *positive-integer*	*9102*	*alias*
File Retention	= time	5184000	
Hard Quota	= Size64	0	
Heartbeat Interval	= time	0	
Job Retention	= time	15552000	
Maximum Bandwidth Per Job	= speed		
Maximum Concurrent Jobs	= positive-integer	1	
Name	**= name**		**required**
NDMP Block Size	= positive-integer	64512	
NDMP Log Level	= positive-integer	4	
Passive	= yes|no	no	
Password	**= password**		**required**
Port	= positive-integer	9102	
Protocol	= AuthProtocolType	Native	
Quota Include Failed Jobs	= yes|no	yes	
Soft Quota	= Size64	0	
Soft Quota Grace Period	= time	0	
Strict Quotas	= yes|no	no	
TLS Allowed CN	= string-list		
TLS Authenticate	= yes|no		
TLS CA Certificate Dir	= directory		
TLS CA Certificate File	= directory		
TLS Certificate	= directory		
TLS Certificate Revocation List	= directory		
TLS Cipher List	= string		
TLS Enable	= yes|no		
TLS Key	= directory		
TLS Require	= yes|no		
TLS Verify Peer	= yes|no	yes	
Username	= string		

Address = <string> (required)

Where the address is a host name, a fully qualified domain name, or a network address in dotted quad notation for a Bareos File server daemon. This directive is required.

Allow Client Connect = <yes|no> (default: no)

Auth Type = <None|Clear|MD5> (default: None)

Specifies the authentication type that must be supplied when connecting to a backup protocol that uses a specific authentication type.

Auto Prune = <yes|no> (default: no)

If AutoPrune is set to **yes**, Bareos will automatically apply the File retention period and the Job retention period for the Client at the end of the Job. If you leave the default **AutoPrune = no**, pruning will not be done, and your Catalog will grow in size each time you run a Job. Pruning affects only information in the catalog and not data stored in the backup archives (on Volumes), but if pruning deletes all data referring to a certain volume, the volume is regarded as empty and will possibly be overwritten before the volume retention has expired.

Catalog = <resource-name>

This specifies the name of the catalog resource to be used for this Client. If none is specified the first

defined catalog is used.

Description = <string>

Enabled = <yes|no> (default: yes)
En- or disable this resource.

FD Address = <string>
Alias for Address.

FD Password = <password>
This directive is an alias.

FD Port = <positive-integer> (default: 9102)
This directive is an alias.

Where the port is a port number at which the Bareos File server daemon can be contacted. The default is 9102. For NDMP backups set this to 10000.

File Retention = <time> (default: 5184000)
The File Retention directive defines the length of time that Bareos will keep File records in the Catalog database after the End time of the Job corresponding to the File records. When this time period expires, and if **AutoPrune** is set to **yes** Bareos will prune (remove) File records that are older than the specified File Retention period. Note, this affects only records in the catalog database. It does not affect your archive backups.

File records may actually be retained for a shorter period than you specify on this directive if you specify either a shorter Job Retention $^{\text{Dir}}_{\text{Client}}$ or a shorter Volume Retention $^{\text{Dir}}_{\text{Pool}}$ period. The shortest retention period of the three takes precedence. The time may be expressed in seconds, minutes, hours, days, weeks, months, quarters, or years. See the Configuration chapter of this manual for additional details of time specification.

The default is 60 days.

Hard Quota = <Size64> (default: 0)
The amount of data determined by the Hard Quota directive sets the hard limit of backup space that cannot be exceeded. This is the maximum amount this client can back up before any backup job will be aborted.

If the Hard Quota is exceeded, the running job is terminated:

```
Fatal error: append.c:218 Quota Exceeded. Job Terminated.
```

Heartbeat Interval = <time> (default: 0)
This directive is optional and if specified will cause the Director to set a keepalive interval (heartbeat) in seconds on each of the sockets it opens for the Storage resource. This value will override any specified at the Director level. It is implemented only on systems (Linux, ...) that provide the **setsockopt** TCP_KEEPIDLE function. The default value is zero, which means no change is made to the socket.

Job Retention = <time> (default: 15552000)

The Job Retention directive defines the length of time that Bareos will keep Job records in the Catalog database after the Job End time. When this time period expires, and if **AutoPrune** is set to **yes** Bareos will prune (remove) Job records that are older than the specified File Retention period. As with the other retention periods, this affects only records in the catalog and not data in your archive backup.

If a Job record is selected for pruning, all associated File and JobMedia records will also be pruned regardless of the File Retention period set. As a consequence, you normally will set the File retention period to be less than the Job retention period. The Job retention period can actually be less than the value you specify here if you set the **Volume Retention** directive in the Pool resource to a smaller duration. This is because the Job retention period and the Volume retention period are independently applied, so the smaller of the two takes precedence.

The Job retention period is specified as seconds, minutes, hours, days, weeks, months, quarters, or years. See the Configuration chapter of this manual for additional details of time specification.

The default is 180 days.

Maximum Bandwidth Per Job = <speed>

The speed parameter specifies the maximum allowed bandwidth that a job may use when started for this Client. The speed parameter should be specified in k/s, Kb/s, m/s or Mb/s.

Maximum Concurrent Jobs = <positive-integer> (default: 1)

where <number> is the maximum number of Jobs with the current Client that can run concurrently. Note, this directive limits only Jobs for Clients with the same name as the resource in which it appears. Any other restrictions on the maximum concurrent jobs such as in the Director, Job, or Storage resources will also apply in addition to any limit specified here. The default is set to 1, but you may set it to a larger number.

Name = <name> (required)

The name of the resource.

The client name which will be used in the Job resource directive or in the console run command.

NDMP Block Size = <positive-integer> (default: 64512)

This directive sets the default NDMP blocksize for this client.

NDMP Log Level = <positive-integer> (default: 4)

This directive sets the loglevel for the NDMP protocol library.

Passive = <yes|no> (default: no)

The normal way of initializing the data channel (the channel where the backup data itself is transported) is done by the file daemon (client) that connects to the storage daemon.

By using the client passive mode, the initialization of the datachannel is reversed, so that the storage daemon connects to the filedaemon.

See chapter Passive Client.
Version >= 13.2.0

Password = <password> (required)

This is the password to be used when establishing a connection with the File services, so the Client configuration file on the machine to be backed up must have the same password defined for this Director. If you have either `/dev/random` or **bc** on your machine, Bareos will generate a random password during the configuration process, otherwise it will be left blank.

The password is plain text. It is not generated through any special process, but it is preferable for security reasons to make the text random.

Port = <positive-integer> (default: 9102)

Protocol = <Native|NDMP> (default: Native)

The backup protocol to use to run the Job.

Currently the director understands the following protocols:

1. Native - The native Bareos protocol
2. NDMP - The NDMP protocol

Version >= 13.2.0

Quota Include Failed Jobs = <yes|no> (default: yes)

When calculating the amount a client used take into consideration any failed Jobs.

Soft Quota = <Size64> (default: 0)

This is the amount after which there will be a warning issued that a client is over his softquota. A client can keep doing backups until it hits the hard quota or when the Soft Quota Grace Period $^{\text{Dir}}_{\text{Client}}$ is expired.

Soft Quota Grace Period = <time> (default: 0)

Time allowed for a client to be over its Soft Quota $^{\text{Dir}}_{\text{Client}}$ before it will be enforced.

When the amount of data backed up by the client outruns the value specified by the Soft Quota directive, the next start of a backup job will start the soft quota grace time period. This is written to the job log:

```
Error: Softquota Exceeded, Grace Period starts now.
```

In the Job Overview, the value of Grace Expiry Date: will then change from `Soft Quota was never exceeded` to the date when the grace time expires, e.g. `11-Dec-2012 04:09:05`.

During that period, it is possible to do backups even if the total amount of stored data exceeds the limit specified by soft quota.

If in this state, the job log will write:

```
Error: Softquota Exceeded, will be enforced after Grace Period expires.
```

After the grace time expires, in the next backup job of the client, the value for Burst Quota will be set to the value that the client has stored at this point in time. Also, the job will be terminated. The following information in the job log shows what happened:

```
Warning: Softquota Exceeded and Grace Period expired.
Setting Burst Quota to 122880000 Bytes.
Fatal error: Soft Quota Exceeded / Grace Time expired. Job terminated.
```

At this point, it is not possible to do any backup of the client. To be able to do more backups, the amount of stored data for this client has to fall under the burst quota value.

Strict Quotas = <yes|no> (default: no)

The directive Strict Quotas determines whether, after the Grace Time Period is over, to enforce the Burst Limit (Strict Quotas = **No**) or the Soft Limit (Strict Quotas = **Yes**).

The Job Log shows either

```
Softquota Exceeded, enforcing Burst Quota Limit.
```

or

```
Softquota Exceeded, enforcing Strict Quota Limit.
```

TLS Allowed CN = <string-list>

TLS Authenticate = <yes|no>

TLS CA Certificate Dir = <directory>

TLS CA Certificate File = <directory>

TLS Certificate = <directory>

TLS Certificate Revocation List = <directory>

TLS Cipher List = <string>

TLS Enable = <yes|no>
Bareos can be configured to encrypt all its network traffic. See chapter TLS Configuration Directives to see, how the Bareos Director (and the other components) must be configured to use TLS.

TLS Key = <directory>

TLS Require = <yes|no>

TLS Verify Peer = <yes|no> (default: yes)

Username = <string>
Specifies the username that must be supplied when authenticating. Only used for the non Native protocols at the moment.

The following is an example of a valid Client resource definition:

```
Client {
  Name = client1-fd
  Address = client1.example.com
  Password = "secret"
}
```

Configuration 9.31: Minimal client resource definition in bareos-dir.conf

The following is an example of a Quota Configuration in Client resource:

```
Client {
  Name = client1-fd
  Address = client1.example.com
  Password = "secret"

  # Quota
  Soft Quota = 50 mb
  Soft Quota Grace Period = 2 days
  Strict Quotas = Yes
  Hard Quota = 150 mb
  Quota Include Failed Jobs = yes
}
```

Configuration 9.32: Quota Configuration in Client resource

9.7 Storage Resource

The Storage resource defines which Storage daemons are available for use by the Director.

configuration directive name	type of data	default value	remark
Address	**= string**		**required**
Allow Compression	= yes|no	yes	
Auth Type	= None|Clear|MD5	None	
Auto Changer	= yes|no	no	
Collect Statistics	= yes|no	no	
Description	= string		
Device	**= Device**		**required**
Enabled	= yes|no	yes	
Heartbeat Interval	= time	0	
Maximum Bandwidth Per Job	= speed		
Maximum Concurrent Jobs	= positive-integer	1	
Maximum Concurrent Read Jobs	= positive-integer	0	
Media Type	**= Strname**		**required**
Name	**= name**		**required**
Paired Storage	= resource-name		
Password	**= password**		**required**
Port	= positive-integer	9103	
Protocol	= AuthProtocolType	Native	
SD Address	= *string*		*alias*
SD Password	= *password*		*alias*
SD Port	= *positive-integer*	*9103*	*alias*
Sdd Port	= *positive-integer*		*deprecated*
TLS Authenticate	= yes|no		
TLS CA Certificate File	= directory		
TLS Cacertificate Dir	= directory		
TLS Certificate	= directory		
TLS Certificate Revocation List	= directory		
TLS Cipher List	= string		
TLS Enable	= yes|no		
TLS Key	= directory		
TLS Require	= yes|no		
TLS Verify Peer	= yes|no	yes	
Username	= string		

Address = <string> (required)

Where the address is a host name, a **fully qualified domain name**, or an **IP address**. Please note that the <address> as specified here will be transmitted to the File daemon who will then use it to contact the Storage daemon. Hence, it is **not**, a good idea to use **localhost** as the name but rather a

fully qualified machine name or an IP address. This directive is required.

Allow Compression = <yes|no> (default: yes)
This directive is optional, and if you specify **No**, it will cause backups jobs running on this storage resource to run without client File Daemon compression. This effectively overrides compression options in FileSets used by jobs which use this storage resource.

Auth Type = <None|Clear|MD5> (default: None)
Specifies the authentication type that must be supplied when connecting to a backup protocol that uses a specific authentication type.

Auto Changer = <yes|no> (default: no)
If you specify **yes** for this command, when you use the **label** command or the **add** command to create a new Volume, **Bareos** will also request the Autochanger Slot number. This simplifies creating database entries for Volumes in an autochanger. If you forget to specify the Slot, the autochanger will not be used. However, you may modify the Slot associated with a Volume at any time by using the **update volume** or **update slots** command in the console program. When **autochanger** is enabled, the algorithm used by Bareos to search for available volumes will be modified to consider only Volumes that are known to be in the autochanger's magazine. If no **in changer** volume is found, Bareos will attempt recycling, pruning, ..., and if still no volume is found, Bareos will search for any volume whether or not in the magazine. By privileging in changer volumes, this procedure minimizes operator intervention.

For the autochanger to be used, you must also specify **Autochanger = yes** in the Autochanger $^{\text{Sd}}_{\text{Device}}$ in the Storage daemon's configuration file as well as other important Storage daemon configuration information. Please consult the Autochanger Support chapter for the details of using autochangers.

Collect Statistics = <yes|no> (default: no)
Collect statistic information. These information will be collected by the Director (see Statistics Collect Interval $^{\text{Dir}}_{\text{Director}}$) and stored in the Catalog.

Description = <string>
Information.

Device = <Device> (required)
This directive specifies the Storage daemon's name of the device resource to be used for the storage. If you are using an Autochanger, the name specified here should be the name of the Storage daemon's Autochanger resource rather than the name of an individual device. This name is not the physical device name, but the logical device name as defined on the **Name** directive contained in the **Device** or the **Autochanger** resource definition of the **Storage daemon** configuration file. You can specify any name you would like (even the device name if you prefer) up to a maximum of 127 characters in length. The physical device name associated with this device is specified in the **Storage daemon** configuration file (as **Archive Device**). Please take care not to define two different Storage resource directives in the Director that point to the same Device in the Storage daemon. Doing so may cause the Storage daemon to block (or hang) attempting to open the same device that is already open. This directive is required.

Enabled = <yes|no> (default: yes)
En- or disable this resource.

Heartbeat Interval = <time> (default: 0)
This directive is optional and if specified will cause the Director to set a keepalive interval (heartbeat) in seconds on each of the sockets it opens for the Storage resource. This value will override any specified at the Director level. It is implemented only on systems (Linux, ...) that provide the **setsockopt** TCP_KEEPIDLE function. The default value is zero, which means no change is made to

the socket.

Maximum Bandwidth Per Job = <speed>

Maximum Concurrent Jobs = <positive-integer> (default: 1)

where <number> is the maximum number of Jobs with the current Storage resource that can run concurrently. Note, this directive limits only Jobs for Jobs using this Storage daemon. Any other restrictions on the maximum concurrent jobs such as in the Director, Job, or Client resources will also apply in addition to any limit specified here. The default is set to 1, but you may set it to a larger number. However, if you set the Storage daemon's number of concurrent jobs greater than one, we recommend that you read the waring documented under Maximum Concurrent Jobs in the Director's resource or simply turn data spooling on as documented in the Data Spooling chapter of this manual.

Maximum Concurrent Read Jobs = <positive-integer> (default: 0)

where <number> is the maximum number of Jobs with the current Storage resource that can read concurrently.

Media Type = <Strname> (required)

This directive specifies the Media Type to be used to store the data. This is an arbitrary string of characters up to 127 maximum that you define. It can be anything you want. However, it is best to make it descriptive of the storage media (e.g. File, DAT, "HP DLT8000", 8mm, ...). In addition, it is essential that you make the **Media Type** specification unique for each storage media type. If you have two DDS-4 drives that have incompatible formats, or if you have a DDS-4 drive and a DDS-4 autochanger, you almost certainly should specify different **Media Types**. During a restore, assuming a **DDS-4** Media Type is associated with the Job, Bareos can decide to use any Storage daemon that supports Media Type **DDS-4** and on any drive that supports it.

If you are writing to disk Volumes, you must make doubly sure that each Device resource defined in the Storage daemon (and hence in the Director's conf file) has a unique media type. Otherwise Bareos may assume, these Volumes can be mounted and read by any Storage daemon File device.

Currently Bareos permits only a single Media Type per Storage Device definition. Consequently, if you have a drive that supports more than one Media Type, you can give a unique string to Volumes with different intrinsic Media Type (Media Type = DDS-3-4 for DDS-3 and DDS-4 types), but then those volumes will only be mounted on drives indicated with the dual type (DDS-3-4).

If you want to tie Bareos to using a single Storage daemon or drive, you must specify a unique Media Type for that drive. This is an important point that should be carefully understood. Note, this applies equally to Disk Volumes. If you define more than one disk Device resource in your Storage daemon's conf file, the Volumes on those two devices are in fact incompatible because one can not be mounted on the other device since they are found in different directories. For this reason, you probably should use two different Media Types for your two disk Devices (even though you might think of them as both being File types). You can find more on this subject in the Basic Volume Management chapter of this manual.

The **MediaType** specified in the Director's Storage resource, **must** correspond to the **Media Type** specified in the **Device** resource of the **Storage daemon** configuration file. This directive is required, and it is used by the Director and the Storage daemon to ensure that a Volume automatically selected from the Pool corresponds to the physical device. If a Storage daemon handles multiple devices (e.g. will write to various file Volumes on different partitions), this directive allows you to specify exactly which device.

As mentioned above, the value specified in the Director's Storage resource must agree with the value specified in the Device resource in the **Storage daemon's** configuration file. It is also an additional check so that you don't try to write data for a DLT onto an 8mm device.

Name = <name> (required)

The name of the resource.

The name of the storage resource. This name appears on the Storage directive specified in the Job resource and is required.

Paired Storage = <resource-name>
For NDMP backups this points to the definition of the Native Storage that is accesses via the NDMP protocol. For now we only support NDMP backups and restores to access Native Storage Daemons via the NDMP protocol. In the future we might allow to use Native NDMP storage which is not bound to a Bareos Storage Daemon.

Password = <password> (required)
This is the password to be used when establishing a connection with the Storage services. This same password also must appear in the Director resource of the Storage daemon's configuration file. This directive is required.

The password is plain text.

Port = <positive-integer> (default: 9103)
Where port is the port to use to contact the storage daemon for information and to start jobs. This same port number must appear in the Storage resource of the Storage daemon's configuration file.

Protocol = <AuthProtocolType> (default: Native)

SD Address = <string>
Alias for Address.

SD Password = <password>
Alias for Password.

SD Port = <positive-integer> (default: 9103)
Alias for Port.

Sdd Port = <positive-integer>
Please note! *This directive is deprecated.*

TLS Authenticate = <yes|no>

TLS CA Certificate File = <directory>

TLS Cacertificate Dir = <directory>

TLS Certificate = <directory>

TLS Certificate Revocation List = <directory>

TLS Cipher List = <string>

TLS Enable = <yes|no>
Bareos can be configured to encrypt all its network traffic. See chapter TLS Configuration Directives to see, how the Bareos Director (and the other components) must be configured to use TLS.

TLS Key = <directory>

TLS Require = <yes|no>

TLS Verify Peer = <yes|no> (default: yes)

Username = <string>

The following is an example of a valid Storage resource definition:

```
Storage {
  Name = DLTDrive
  Address = lpmatou
  Password = storage_password # password for Storage daemon
  Device = "HP DLT 80"    # same as Device in Storage daemon
  Media Type = DLT8000    # same as MediaType in Storage daemon
}
```

Configuration 9.33: Storage resource (tape) example

9.8 Pool Resource

The Pool resource defines the set of storage Volumes (tapes or files) to be used by Bareos to write the data. By configuring different Pools, you can determine which set of Volumes (media) receives the backup data. This permits, for example, to store all full backup data on one set of Volumes and all incremental backups on another set of Volumes. Alternatively, you could assign a different set of Volumes to each machine that you backup. This is most easily done by defining multiple Pools.
Another important aspect of a Pool is that it contains the default attributes (Maximum Jobs, Retention Period, Recycle flag, ...) that will be given to a Volume when it is created. This avoids the need for you to answer a large number of questions when labeling a new Volume. Each of these attributes can later be changed on a Volume by Volume basis using the **update** command in the console program. Note that you must explicitly specify which Pool Bareos is to use with each Job. Bareos will not automatically search for the correct Pool.
Most often in Bareos installations all backups for all machines (Clients) go to a single set of Volumes. In this case, you will probably only use the **Default** Pool. If your backup strategy calls for you to mount a different tape each day, you will probably want to define a separate Pool for each day. For more information on this subject, please see the Backup Strategies chapter of this manual.
To use a Pool, there are three distinct steps. First the Pool must be defined in the Director's configuration file. Then the Pool must be written to the Catalog database. This is done automatically by the Director each time that it starts, or alternatively can be done using the **create** command in the console program. Finally, if you change the Pool definition in the Director's configuration file and restart Bareos, the pool will be updated alternatively you can use the **update pool** console command to refresh the database image. It is

this database image rather than the Director's resource image that is used for the default Volume attributes. Note, for the pool to be automatically created or updated, it must be explicitly referenced by a Job resource. Next the physical media must be labeled. The labeling can either be done with the **label** command in the **console** program or using the **btape** program. The preferred method is to use the **label** command in the **console** program.
Finally, you must add Volume names (and their attributes) to the Pool. For Volumes to be used by Bareos they must be of the same **Media Type** as the archive device specified for the job (i.e. if you are going to back up to a DLT device, the Pool must have DLT volumes defined since 8mm volumes cannot be mounted on a DLT drive). The **Media Type** has particular importance if you are backing up to files. When running a Job, you must explicitly specify which Pool to use. Bareos will then automatically select the next Volume to use from the Pool, but it will ensure that the **Media Type** of any Volume selected from the Pool is identical to that required by the Storage resource you have specified for the Job.
If you use the **label** command in the console program to label the Volumes, they will automatically be added to the Pool, so this last step is not normally required.
It is also possible to add Volumes to the database without explicitly labeling the physical volume. This is done with the **add** console command.
As previously mentioned, each time Bareos starts, it scans all the Pools associated with each Catalog, and if the database record does not already exist, it will be created from the Pool Resource definition. **Bareos** probably should do an **update pool** if you change the Pool definition, but currently, you must do this manually using the **update pool** command in the Console program.
The Pool Resource defined in the Director's configuration file (`bareos-dir.conf`) may contain the following directives:

configuration directive name	type of data	default value	remark
Action On Purge	= `ActionOnPurge`		
Auto Prune	= yes|no	yes	
Catalog	= resource-name		
Catalog Files	= yes|no	yes	
Cleaning Prefix	= `Strname`	CLN	
Description	= string		
File Retention	= time		
Job Retention	= time		
Label Format	= `Strname`		
Label Type	= `Label`		
Maximum Block Size	= positive-integer		
Maximum Volume Bytes	= `Size64`		
Maximum Volume Files	= positive-integer		
Maximum Volume Jobs	= positive-integer		
Maximum Volumes	= positive-integer		
Migration High Bytes	= `Size64`		
Migration Low Bytes	= `Size64`		
Migration Time	= time		
Minimum Block Size	= positive-integer		
Name	**= name**		**required**
Next Pool	= resource-name		
Pool Type	**= `Strname`**		**required**
Purge Oldest Volume	= yes|no		
Recycle	= yes|no	yes	
Recycle Current Volume	= yes|no		
Recycle Oldest Volume	= yes|no		
Recycle Pool	= resource-name		
Scratch Pool	= resource-name		
Storage	= `ResourceList`		
Use Catalog	= yes|no	yes	
Use Volume Once	*= yes|no*		*deprecated*
Volume Retention	= time	31536000	
Volume Use Duration	= time		

Action On Purge = <ActionOnPurge>

This directive `Action On Purge=Truncate` instructs Bareos to truncate the volume when it is purged with the `Purge Volume Action=Truncate` command. It is useful to prevent disk based volumes from consuming too much space.

```
Pool {
  Name = Default
  Action On Purge = Truncate
  ...
}
```

You can schedule the truncate operation at the end of your CatalogBackup job like in this example:

```
Job {
  Name = CatalogBackup
  ...
  RunScript {
    RunsWhen=After
    RunsOnClient=No
    Console = "purge volume action=all allpools storage=File"
  }
}
```

Auto Prune = <yes|no> (default: yes)

If AutoPrune is set to **yes**, Bareos will automatically apply the Volume Retention period when new Volume is needed and no appendable Volumes exist in the Pool. Volume pruning causes expired Jobs (older than the **Volume Retention** period) to be deleted from the Catalog and permits possible recycling of the Volume.

Catalog = <resource-name>

This specifies the name of the catalog resource to be used for this Pool. When a catalog is defined in a Pool it will override the definition in the client (and the Catalog definition in a Job since Version >= 13.4.0). e.g. this catalog setting takes precedence over any other definition.

Catalog Files = <yes|no> (default: yes)

This directive defines whether or not you want the names of the files that were saved to be put into the catalog. The default is **yes**. The advantage of specifying **Catalog Files = No** is that you will have a significantly smaller Catalog database. The disadvantage is that you will not be able to produce a Catalog listing of the files backed up for each Job (this is often called Browsing). Also, without the File entries in the catalog, you will not be able to use the Console **restore** command nor any other command that references File entries.

Cleaning Prefix = <Strname> (default: CLN)

This directive defines a prefix string, which if it matches the beginning of a Volume name during labeling of a Volume, the Volume will be defined with the VolStatus set to **Cleaning** and thus Bareos will never attempt to use this tape. This is primarily for use with autochangers that accept barcodes where the convention is that barcodes beginning with **CLN** are treated as cleaning tapes.

The default value for this directive is consequently set to **CLN**, so that in most cases the cleaning tapes are automatically recognized without configuration. If you use another prefix for your cleaning tapes, you can set this directive accordingly.

Description = <string>

File Retention = <time>

The File Retention directive defines the length of time that Bareos will keep File records in the Catalog database after the End time of the Job corresponding to the File records.

This directive takes precedence over Client directives of the same name. For example, you can decide to increase Retention times for Archive or OffSite Pool.

Note, this affects only records in the catalog database. It does not affect your archive backups.

For more information see Client documentation about File Retention Dir Client

Job Retention = <time>

The Job Retention directive defines the length of time that Bareos will keep Job records in the Catalog database after the Job End time. As with the other retention periods, this affects only records in the catalog and not data in your archive backup.

This directive takes precedence over Client directives of the same name. For example, you can decide to increase Retention times for Archive or OffSite Pool.

For more information see Client side documentation Job Retention Dir Client

Label Format = <Strname>

This directive specifies the format of the labels contained in this pool. The format directive is used as a sort of template to create new Volume names during automatic Volume labeling.

The **format** should be specified in double quotes, and consists of letters, numbers and the special characters hyphen (-), underscore (_), colon (:), and period (.), which are the legal characters for a Volume name. The format should be enclosed in double quotes (").

In addition, the format may contain a number of variable expansion characters which will be expanded by a complex algorithm allowing you to create Volume names of many different formats. In all cases, the expansion process must resolve to the set of characters noted above that are legal Volume names. Generally, these variable expansion characters begin with a dollar sign ($) or a left bracket ([). If you specify variable expansion characters, you should always enclose the format with double quote characters ("). For more details on variable expansion, please see the Variable Expansion Chapter of this manual.

If no variable expansion characters are found in the string, the Volume name will be formed from the **format** string appended with the a unique number that increases. If you do not remove volumes from the pool, this number should be the number of volumes plus one, but this is not guaranteed. The unique number will be edited as four digits with leading zeros. For example, with a **Label Format = "File-"**, the first volumes will be named File-0001, File-0002, ...

With the exception of Job specific variables, you can test your **Label Format** by using the var command the Console Chapter of this manual.

In almost all cases, you should enclose the format specification (part after the equal sign) in double quotes.

Label Type = <ANSI|IBM|Bareos>

This directive is implemented in the Director Pool resource and in the SD Device resource (Label Type Sd Device). If it is specified in the SD Device resource, it will take precedence over the value passed from the Director to the SD.

Maximum Block Size = <positive-integer>

The **Maximum Block Size** can be defined here to define different block sizes per volume or statically for all volumes at Maximum Block Size Sd Device. If not defined, its default is 63 KB. Increasing this value could improve the throughput of writing to tapes.

Please note! *However make sure to read the Setting Block Sizes chapter carefully before applying any changes.*
Version >= 14.2.0

Maximum Volume Bytes = <Size64>

This directive specifies the maximum number of bytes that can be written to the Volume. If you specify zero (the default), there is no limit except the physical size of the Volume. Otherwise, when the number of bytes written to the Volume equals **size** the Volume will be marked **Used**. When the Volume is marked **Used** it can no longer be used for appending Jobs, much like the **Full** status but it

can be recycled if recycling is enabled, and thus the Volume can be re-used after recycling. This value is checked and the **Used** status set while the job is writing to the particular volume.

This directive is particularly useful for restricting the size of disk volumes, and will work correctly even in the case of multiple simultaneous jobs writing to the volume.

The value defined by this directive in the bareos-dir.conf file is the default value used when a Volume is created. Once the volume is created, changing the value in the bareos-dir.conf file will not change what is stored for the Volume. To change the value for an existing Volume you must use the **update** command in the Console.

Maximum Volume Files = <positive-integer>

This directive specifies the maximum number of files that can be written to the Volume. If you specify zero (the default), there is no limit. Otherwise, when the number of files written to the Volume equals **positive-integer** the Volume will be marked **Used**. When the Volume is marked **Used** it can no longer be used for appending Jobs, much like the **Full** status but it can be recycled if recycling is enabled and thus used again. This value is checked and the **Used** status is set only at the end of a job that writes to the particular volume.

The value defined by this directive in the bareos-dir.conf file is the default value used when a Volume is created. Once the volume is created, changing the value in the bareos-dir.conf file will not change what is stored for the Volume. To change the value for an existing Volume you must use the **update** command in the Console.

Maximum Volume Jobs = <positive-integer>

This directive specifies the maximum number of Jobs that can be written to the Volume. If you specify zero (the default), there is no limit. Otherwise, when the number of Jobs backed up to the Volume equals **positive-integer** the Volume will be marked **Used**. When the Volume is marked **Used** it can no longer be used for appending Jobs, much like the **Full** status but it can be recycled if recycling is enabled, and thus used again. By setting **MaximumVolumeJobs** to one, you get the same effect as setting **UseVolumeOnce = yes**.

The value defined by this directive in the bareos-dir.conf file is the default value used when a Volume is created. Once the volume is created, changing the value in the bareos-dir.conf file will not change what is stored for the Volume. To change the value for an existing Volume you must use the **update** command in the Console.

If you are running multiple simultaneous jobs, this directive may not work correctly because when a drive is reserved for a job, this directive is not taken into account, so multiple jobs may try to start writing to the Volume. At some point, when the Media record is updated, multiple simultaneous jobs may fail since the Volume can no longer be written.

Maximum Volumes = <positive-integer>

This directive specifies the maximum number of volumes (tapes or files) contained in the pool. This directive is optional, if omitted or set to zero, any number of volumes will be permitted. In general, this directive is useful for Autochangers where there is a fixed number of Volumes, or for File storage where you wish to ensure that the backups made to disk files do not become too numerous or consume too much space.

Migration High Bytes = <Size64>

This directive specifies the number of bytes in the Pool which will trigger a migration if Selection Type $^{\text{Dir}}_{\text{Job}}$ = PoolOccupancy has been specified. The fact that the Pool usage goes above this level does not automatically trigger a migration job. However, if a migration job runs and has the PoolOccupancy selection type set, the Migration High Bytes will be applied. Bareos does not currently restrict a pool to have only a single Media Type $^{\text{Dir}}_{\text{Storage}}$, so you must keep in mind that if you mix Media Types in a Pool, the results may not be what you want, as the Pool count of all bytes will be for all Media Types combined.

Migration Low Bytes = <Size64>

This directive specifies the number of bytes in the Pool which will stop a migration if Selection Type

Dir Job = PoolOccupancy has been specified and triggered by more than Migration High Bytes Dir Pool being in the pool. In other words, once a migration job is started with **PoolOccupancy** migration selection and it determines that there are more than Migration High Bytes, the migration job will continue to run jobs until the number of bytes in the Pool drop to or below Migration Low Bytes.

Migration Time = <time>

If Selection Type Dir Job = PoolTime, the time specified here will be used. If the previous Backup Job or Jobs selected have been in the Pool longer than the specified time, then they will be migrated.

Minimum Block Size = <positive-integer>

The **Minimum Block Size** can be defined here to define different block sizes per volume or statically for all volumes at Minimum Block Size Sd Device. For details, see chapter Setting Block Sizes.

Name = <name> (required)

The name of the resource.

The name of the pool.

Next Pool = <resource-name>

This directive specifies the pool a Migration or Copy Job and a Virtual Backup Job will write their data too. This directive is required to define the Pool into which the data will be migrated. Without this directive, the migration job will terminate in error.

Pool Type = <Strname> (required)

This directive defines the pool type, which corresponds to the type of Job being run. It is required and may be one of the following:

Backup

***Archive**

***Cloned**

***Migration**

***Copy**

***Save**

Note, only Backup is currently implemented.

Purge Oldest Volume = <yes|no>

This directive instructs the Director to search for the oldest used Volume in the Pool when another Volume is requested by the Storage daemon and none are available. The catalog is then **purged** irrespective of retention periods of all Files and Jobs written to this Volume. The Volume is then recycled and will be used as the next Volume to be written. This directive overrides any Job, File, or Volume retention periods that you may have specified.

This directive can be useful if you have a fixed number of Volumes in the Pool and you want to cycle through them and reusing the oldest one when all Volumes are full, but you don't want to worry about setting proper retention periods. However, by using this option you risk losing valuable data.

Please be aware that **Purge Oldest Volume** disregards all retention periods. If you have only a single Volume defined and you turn this variable on, that Volume will always be immediately overwritten when it fills! So at a minimum, ensure that you have a decent number of Volumes in your Pool before running any jobs. If you want retention periods to apply do not use this directive. To specify a retention period, use the **Volume Retention** directive (see above).

We **highly** recommend against using this directive, because it is sure that some day, Bareos will recycle a Volume that contains current data. The default is **no**.

Recycle = <yes|no> (default: yes)

This directive specifies whether or not Purged Volumes may be recycled. If it is set to **yes** (default) and Bareos needs a volume but finds none that are appendable, it will search for and recycle (reuse) Purged Volumes (i.e. volumes with all the Jobs and Files expired and thus deleted from the Catalog). If the Volume is recycled, all previous data written to that Volume will be overwritten. If Recycle is set to **no**, the Volume will not be recycled, and hence, the data will remain valid. If you want to reuse (re-write) the Volume, and the recycle flag is no (0 in the catalog), you may manually set the recycle flag (update command) for a Volume to be reused.

Please note that the value defined by this directive in the bareos-dir.conf file is the default value used when a Volume is created. Once the volume is created, changing the value in the bareos-dir.conf file will not change what is stored for the Volume. To change the value for an existing Volume you must use the **update** command in the Console.

When all Job and File records have been pruned or purged from the catalog for a particular Volume, if that Volume is marked as Append, Full, Used, or Error, it will then be marked as Purged. Only Volumes marked as Purged will be considered to be converted to the Recycled state if the **Recycle** directive is set to **yes**.

Recycle Current Volume = <yes|no>

If Bareos needs a new Volume, this directive instructs Bareos to Prune the volume respecting the Job and File retention periods. If all Jobs are pruned (i.e. the volume is Purged), then the Volume is recycled and will be used as the next Volume to be written. This directive respects any Job, File, or Volume retention periods that you may have specified, and thus it is **much** better to use it rather than the Purge Oldest Volume directive.

This directive can be useful if you have: a fixed number of Volumes in the Pool, you want to cycle through them, and you have specified retention periods that prune Volumes before you have cycled through the Volume in the Pool.

However, if you use this directive and have only one Volume in the Pool, you will immediately recycle your Volume if you fill it and Bareos needs another one. Thus your backup will be totally invalid. Please use this directive with care. The default is **no**.

Recycle Oldest Volume = <yes|no>

This directive instructs the Director to search for the oldest used Volume in the Pool when another Volume is requested by the Storage daemon and none are available. The catalog is then **pruned** respecting the retention periods of all Files and Jobs written to this Volume. If all Jobs are pruned (i.e. the volume is Purged), then the Volume is recycled and will be used as the next Volume to be written. This directive respects any Job, File, or Volume retention periods that you may have specified, and as such it is **much** better to use this directive than the Purge Oldest Volume.

This directive can be useful if you have a fixed number of Volumes in the Pool and you want to cycle through them and you have specified the correct retention periods.

However, if you use this directive and have only one Volume in the Pool, you will immediately recycle your Volume if you fill it and Bareos needs another one. Thus your backup will be totally invalid. Please use this directive with care. The default is **no**.

Recycle Pool = <resource-name>

This directive defines to which pool the Volume will be placed (moved) when it is recycled. Without this directive, a Volume will remain in the same pool when it is recycled. With this directive, it can be moved automatically to any existing pool during a recycle. This directive is probably most useful when defined in the Scratch pool, so that volumes will be recycled back into the Scratch pool. For more on the see the Scratch Pool section of this manual.

Although this directive is called RecyclePool, the Volume in question is actually moved from its current pool to the one you specify on this directive when Bareos prunes the Volume and discovers that there are no records left in the catalog and hence marks it as **Purged**.

Scratch Pool = <resource-name>

This directive permits to specify a dedicate *Scratch* for the current pool. This pool will replace the

special pool named *Scrach* for volume selection. For more information about *Scratch* see Scratch Pool section of this manual. This is useful when using multiple storage sharing the same mediatype or when you want to dedicate volumes to a particular set of pool.

Storage = <ResourceList>
The Storage directive defines the name of the storage services where you want to backup the FileSet data. For additional details, see the Storage Resource of this manual. The Storage resource may also be specified in the Job resource, but the value, if any, in the Pool resource overrides any value in the Job. This Storage resource definition is not required by either the Job resource or in the Pool, but it must be specified in one or the other. If not configuration error will result. We highly recommend that you define the Storage resource to be used in the Pool rather than elsewhere (job, schedule run, ...). Be aware that you theoretically can give a list of storages here but only the first item from the list is actually used for backup and restore jobs.

Use Catalog = <yes|no> (default: yes)
Store information into Catalog. In all pratical use cases, leave this value to its defaults.

Use Volume Once = <yes|no>
Please note! *This directive is deprecated.*
Use Maximum Volume Jobs $^{\text{Dir}}_{\text{Pool}}$ = 1 instead.

Volume Retention = <time> (default: 31536000)
The Volume Retention directive defines the length of time that Bareos will keep records associated with the Volume in the Catalog database after the End time of each Job written to the Volume. When this time period expires, and if **AutoPrune** is set to **yes** Bareos may prune (remove) Job records that are older than the specified Volume Retention period if it is necessary to free up a Volume. Recycling will not occur until it is absolutely necessary to free up a volume (i.e. no other writable volume exists). All File records associated with pruned Jobs are also pruned. The time may be specified as seconds, minutes, hours, days, weeks, months, quarters, or years. The **Volume Retention** is applied independently of the **Job Retention** and the **File Retention** periods defined in the Client resource. This means that all the retentions periods are applied in turn and that the shorter period is the one that effectively takes precedence. Note, that when the **Volume Retention** period has been reached, and it is necessary to obtain a new volume, Bareos will prune both the Job and the File records. This pruning could also occur during a **status dir** command because it uses similar algorithms for finding the next available Volume.

It is important to know that when the Volume Retention period expires, Bareos does not automatically recycle a Volume. It attempts to keep the Volume data intact as long as possible before over writing the Volume.

By defining multiple Pools with different Volume Retention periods, you may effectively have a set of tapes that is recycled weekly, another Pool of tapes that is recycled monthly and so on. However, one must keep in mind that if your **Volume Retention** period is too short, it may prune the last valid Full backup, and hence until the next Full backup is done, you will not have a complete backup of your system, and in addition, the next Incremental or Differential backup will be promoted to a Full backup. As a consequence, the minimum **Volume Retention** period should be at twice the interval of your Full backups. This means that if you do a Full backup once a month, the minimum Volume retention period should be two months.

The default Volume retention period is 365 days, and either the default or the value defined by this directive in the bareos-dir.conf file is the default value used when a Volume is created. Once the volume is created, changing the value in the `bareos-dir.conf` file will not change what is stored for the Volume. To change the value for an existing Volume you must use the **update** command in the Console.

Volume Use Duration = <time>
The Volume Use Duration directive defines the time period that the Volume can be written beginning from the time of first data write to the Volume. If the time-period specified is zero (the default), the

Volume can be written indefinitely. Otherwise, the next time a job runs that wants to access this Volume, and the time period from the first write to the volume (the first Job written) exceeds the time-period-specification, the Volume will be marked **Used**, which means that no more Jobs can be appended to the Volume, but it may be recycled if recycling is enabled. Once the Volume is recycled, it will be available for use again.

You might use this directive, for example, if you have a Volume used for Incremental backups, and Volumes used for Weekly Full backups. Once the Full backup is done, you will want to use a different Incremental Volume. This can be accomplished by setting the Volume Use Duration for the Incremental Volume to six days. I.e. it will be used for the 6 days following a Full save, then a different Incremental volume will be used. Be careful about setting the duration to short periods such as 23 hours, or you might experience problems of Bareos waiting for a tape over the weekend only to complete the backups Monday morning when an operator mounts a new tape.

Please note that the value defined by this directive in the bareos-dir.conf file is the default value used when a Volume is created. Once the volume is created, changing the value in the bareos-dir.conf file will not change what is stored for the Volume. To change the value for an existing Volume you must use the **update volume** command in the Console.

In order for a Pool to be used during a Backup Job, the Pool must have at least one Volume associated with it. Volumes are created for a Pool using the **label** or the **add** commands in the **Bareos Console**, program. In addition to adding Volumes to the Pool (i.e. putting the Volume names in the Catalog database), the physical Volume must be labeled with a valid Bareos software volume label before **Bareos** will accept the Volume. This will be automatically done if you use the **label** command. Bareos can automatically label Volumes if instructed to do so, but this feature is not yet fully implemented.
The following is an example of a valid Pool resource definition:

```
Pool {
  Name = Default
  Pool Type = Backup
}
```

Configuration 9.34: Pool resource example

9.8.1 Scratch Pool

In general, you can give your Pools any name you wish, but there is one important restriction: the Pool named **Scratch**, if it exists behaves like a scratch pool of Volumes in that when Bareos needs a new Volume for writing and it cannot find one, it will look in the Scratch pool, and if it finds an available Volume, it will move it out of the Scratch pool into the Pool currently being used by the job.

9.9 Catalog Resource

The Catalog Resource defines what catalog to use for the current job. Currently, Bareos can only handle a single database server (SQLite, MySQL, PostgreSQL) that is defined when configuring **Bareos**. However, there may be as many Catalogs (databases) defined as you wish. For example, you may want each Client to have its own Catalog database, or you may want backup jobs to use one database and verify or restore jobs to use another database.
Since SQLite is compiled in, it always runs on the same machine as the Director and the database must be directly accessible (mounted) from the Director. However, since both MySQL and PostgreSQL are networked databases, they may reside either on the same machine as the Director or on a different machine on the network. See below for more details.

configuration directive name	type of data	default value	remark
Address	= *string*		*alias*
DB Address	= string		
DB Driver	**= string**		**required**
DB Name	**= string**		**required**
DB Password	= password		
DB Port	= positive-integer		
DB Socket	= string		

DB User	= string		
Description	= string		
Disable Batch Insert	= yes|no	no	
Exit On Fatal	= yes|no	no	
Idle Timeout	= positive-integer	30	
Inc Connections	= positive-integer	1	
Max Connections	= positive-integer	5	
Min Connections	= positive-integer	1	
Multiple Connections	= yes|no		
Name	**= name**		**required**
Password	*= password*		*alias*
Reconnect	= yes|no	no	
User	*= string*		*alias*
Validate Timeout	= positive-integer	120	

Address = <string>
This directive is an alias.

Alias for DB Address Dir Catalog.

DB Address = <string>
This is the host address of the database server. Normally, you would specify this instead of DB Socket Dir Catalog if the database server is on another machine. In that case, you will also specify DB Port Dir Catalog. This directive is used only by MySQL and PostgreSQL and is ignored by SQLite if provided.

DB Driver = <postgresql | mysql | sqlite> (required)
Selects the database type to use.

DB Name = <string> (required)
This specifies the name of the database.

DB Password = <password>
This specifies the password to use when login into the database.

DB Port = <positive-integer>
This defines the port to be used in conjunction with DB Address Dir Catalog to access the database if it is on another machine. This directive is used only by MySQL and PostgreSQL and is ignored by SQLite if provided.

DB Socket = <string>
This is the name of a socket to use on the local host to connect to the database. This directive is used only by MySQL and is ignored by SQLite. Normally, if neither DB Socket Dir Catalog or DB Address Dir Catalog are specified, MySQL will use the default socket. If the DB Socket is specified, the MySQL server must reside on the same machine as the Director.

DB User = <string>
This specifies what user name to use to log into the database.

Description = <string>

Disable Batch Insert = <yes|no> (default: no)
This directive allows you to override at runtime if the Batch insert should be enabled or disabled. Normally this is determined by querying the database library if it is thread-safe. If you think that disabling Batch insert will make your backup run faster you may disable it using this option and set it to `Yes`.

Exit On Fatal = <yes|no> (default: no)
Make any fatal error in the connection to the database exit the program

Version >= 15.1.0

Idle Timeout = <positive-integer> (default: 30)
This directive is used by the experimental database pooling functionality. Only use this for non production sites. This sets the idle time after which a database pool should be shrinked.

Inc Connections = <positive-integer> (default: 1)
This directive is used by the experimental database pooling functionality. Only use this for non production sites. This sets the number of connections to add to a database pool when not enough connections are available on the pool anymore.

Max Connections = <positive-integer> (default: 5)
This directive is used by the experimental database pooling functionality. Only use this for non production sites. This sets the maximum number of connections to a database to keep in this database pool.

Min Connections = <positive-integer> (default: 1)
This directive is used by the experimental database pooling functionality. Only use this for non production sites. This sets the minimum number of connections to a database to keep in this database pool.

Multiple Connections = <yes|no>
Not yet implemented.

Name = <name> (required)
The name of the resource.

The name of the Catalog. No necessary relation to the database server name. This name will be specified in the Client resource directive indicating that all catalog data for that Client is maintained in this Catalog.

Password = <password>
This directive is an alias.

Alias for DB Password $^{\text{Dir}}_{\text{Catalog}}$.

Reconnect = <yes|no> (default: no)
Try to reconnect a database connection when its dropped

Version >= 15.1.0

User = <string>
This directive is an alias.

Alias for DB User $^{\text{Dir}}_{\text{Catalog}}$.

Validate Timeout = <positive-integer> (default: 120)
This directive is used by the experimental database pooling functionality. Only use this for non production sites. This sets the validation timeout after which the database connection is polled to see if its still alive.

The following is an example of a valid Catalog resource definition:

```
Catalog
{
  Name = SQLite
  DB Driver = sqlite
  DB Name = bareos;
  DB User = bareos;
  DB Password = ""
}
```

Configuration 9.35: Catalog Resource for Sqlite

or for a Catalog on another machine:

```
Catalog
{
  Name = MySQL
  DB Driver = mysql
  DB Name = bareos
  DB User = bareos
  DB Password = "secret"
  DB Address = remote.example.com
  DB Port = 1234
}
```

Configuration 9.36: Catalog Resource for remote MySQL

9.10 Messages Resource

For the details of the Messages Resource, please see the Messages Resource of this manual.

9.11 Console Resource

There are three different kinds of consoles, which the administrator or user can use to interact with the Director. These three kinds of consoles comprise three different security levels.

Default Console the first console type is an "anonymous" or "default" console, which has full privileges. There is no console resource necessary for this type since the password is specified in the Director's resource and consequently such consoles do not have a name as defined on a **Name** directive. Typically you would use it only for administrators.

Named Console the second type of console, is a "named" console (also called "Restricted Console") defined within a Console resource in both the Director's configuration file and in the Console's configuration file. Both the names and the passwords in these two entries must match much as is the case for Client programs.

This second type of console begins with absolutely no privileges except those explicitly specified in the Director's Console resource. Thus you can have multiple Consoles with different names and passwords, sort of like multiple users, each with different privileges. As a default, these consoles can do absolutely nothing – no commands whatsoever. You give them privileges or rather access to commands and resources by specifying access control lists in the Director's Console resource. The ACLs are specified by a directive followed by a list of access names. Examples of this are shown below.

- The third type of console is similar to the above mentioned one in that it requires a Console resource definition in both the Director and the Console. In addition, if the console name, provided on the Name $^{\text{Dir}}_{\text{Console}}$ directive, is the same as a Client name, that console is permitted to use the `SetIP` command to change the Address directive in the Director's client resource to the IP address of the Console. This permits portables or other machines using DHCP (non-fixed IP addresses) to "notify" the Director of their current IP address.

The Console resource is optional and need not be specified. The following directives are permitted within the Director's configuration resource:

configuration directive name	type of data	default value	remark
Catalog ACL	= acl		
Client ACL	= acl		
Command ACL	= acl		
Description	= string		
File Set ACL	= acl		
Job ACL	= acl		
Name	**= name**		**required**
Password	**= password**		**required**
Plugin Options ACL	= acl		
Pool ACL	= acl		
Profile	= ResourceList		
Run ACL	= acl		
Schedule ACL	= acl		
Storage ACL	= acl		
TLS Allowed CN	= string-list		
TLS Authenticate	= yes|no		
TLS CA Certificate Dir	= directory		
TLS CA Certificate File	= directory		
TLS Certificate	= directory		
TLS Certificate Revocation List	= directory		
TLS Cipher List	= string		
TLS DH File	= directory		
TLS Enable	= yes|no		
TLS Key	= directory		
TLS Require	= yes|no		
TLS Verify Peer	= yes|no	yes	
Where ACL	= acl		

Catalog ACL = <acl>
This directive is used to specify a list of Catalog resource names that can be accessed by the console.

Client ACL = <acl>
This directive is used to specify a list of Client resource names that can be accessed by the console.

Command ACL = <acl>
This directive is used to specify a list of of console commands that can be executed by the console.

Description = <string>

File Set ACL = <acl>
This directive is used to specify a list of FileSet resource names that can be accessed by the console.

Job ACL = <acl>
This directive is used to specify a list of Job resource names that can be accessed by the console. Without this directive, the console cannot access any of the Director's Job resources. Multiple Job resource names may be specified by separating them with commas, and/or by specifying multiple JobACL directives. For example, the directive may be specified as:

```
JobACL = "Backup client 1", "Backup client 2"
JobACL = "RestoreFiles"
```

With the above specification, the console can access the Director's resources for the four jobs named on the JobACL directives, but for no others.

Name = <name> (required)
The name of the console. This name must match the name specified in the Console's configuration resource (much as is the case with Client definitions).

Password = <password> (required)
Specifies the password that must be supplied for a named Bareos Console to be authorized. The same password must appear in the **Console** resource of the Console configuration file. For added security, the password is never actually passed across the network but rather a challenge response hash code created with the password. This directive is required.

The password is plain text. It is preferable for security reasons to choose random text.

Plugin Options ACL = <acl>

Pool ACL = <acl>
This directive is used to specify a list of Pool resource names that can be accessed by the console.

Profile = <ResourceList>
Profiles can be assigned to a Console. ACL are checked until either a deny ACL is found or an allow ACL. First the console ACL is checked then any profile the console is linked to.

One or more Profile names can be assigned to a Console. If an ACL is not defined in the Console, the profiles of the Console will be checked in the order as specified here. The first found ACL will be used.
See Profile Resource.
Version >= 14.2.3

Run ACL = <acl>

Schedule ACL = <acl>
This directive is used to specify a list of Schedule resource names that can be accessed by the console.

Storage ACL = <acl>
This directive is used to specify a list of Storage resource names that can be accessed by the console.

TLS Allowed CN = <string-list>

TLS Authenticate = <yes|no>

TLS CA Certificate Dir = <directory>

TLS CA Certificate File = <directory>

TLS Certificate = <directory>

TLS Certificate Revocation List = <directory>

TLS Cipher List = <string>

TLS DH File = <directory>

TLS Enable = <yes|no>
Bareos can be configured to encrypt all its network traffic. See chapter TLS Configuration Directives to see, how the Bareos Director (and the other components) must be configured to use TLS.

TLS Key = <directory>

TLS Require = <yes|no>

TLS Verify Peer = <yes|no> (default: yes)

Where ACL = <acl>
This directive permits you to specify where a restricted console can restore files. If this directive is not specified, only the default restore location is permitted (normally `/tmp/bareos-restores`. If **all** is specified any path the user enters will be accepted (not very secure), any other value specified (there may be multiple WhereACL directives) will restrict the user to use that path. For example, on a Unix system, if you specify "/", the file will be restored to the original location. This directive is untested.

Aside from Director resource names and console command names, the special keyword `*all*` can be specified in any of the above access control lists. When this keyword is present, any resource or command name (which ever is appropriate) will be accepted. For an example configuration file, please see the Console Configuration chapter of this manual.

9.12 Profile Resource

The Profile Resource defines a set of ACLs. Console Resources can be tight to one or more profiles (Profile $^{\text{Dir}}_{\text{Console}}$), making it easier to use a common set of ACLs.

configuration directive name	type of data	default value	remark
Catalog ACL	= acl		
Client ACL	= acl		
Command ACL	= acl		
Description	= string		
File Set ACL	= acl		
Job ACL	= acl		
Name	**= name**		**required**
Plugin Options ACL	= acl		
Pool ACL	= acl		
Schedule ACL	= acl		
Storage ACL	= acl		
Where ACL	= acl		

Catalog ACL = <acl>
Lists the Catalog resources, this resource has access to. The special keyword *all* allows access to all Catalog resources.

Client ACL = <acl>
Lists the Client resources, this resource has access to. The special keyword *all* allows access to all Client resources.

Command ACL = <acl>
Lists the commands, this resource has access to. The special keyword *all* allows using commands.

Description = <string>
Additional information about the resource. Only used for UIs.

File Set ACL = <acl>
Lists the File Set resources, this resource has access to. The special keyword *all* allows access to all File Set resources.

Job ACL = <acl>
Lists the Job resources, this resource has access to. The special keyword *all* allows access to all Job resources.

Name = <name> (required)
The name of the resource.

Plugin Options ACL = <acl>
Specifies the allowed plugin options. An empty strings allows all Plugin Options.

Pool ACL = <acl>
Lists the Pool resources, this resource has access to. The special keyword *all* allows access to all Pool resources.

Schedule ACL = <acl>
Lists the Schedule resources, this resource has access to. The special keyword *all* allows access to all Schedule resources.

Storage ACL = <acl>
Lists the Storage resources, this resource has access to. The special keyword *all* allows access to all Storage resources.

Where ACL = <acl>
Specifies the base directories, where files could be restored. An empty string allows restores to all directories.

9.13 Counter Resource

The Counter Resource defines a counter variable that can be accessed by variable expansion used for creating Volume labels with the Label Format $^{\text{Dir}}_{\text{Pool}}$ directive.

configuration directive name	type of data	default value	remark
Catalog	= resource-name		
Description	= string		
Maximum	= positive-integer	2147483647	
Minimum	= Int32	0	
Name	**= name**		**required**
Wrap Counter	= resource-name		

Catalog = <resource-name>
If this directive is specified, the counter and its values will be saved in the specified catalog. If this directive is not present, the counter will be redefined each time that Bareos is started.

Description = <string>

Maximum = <positive-integer> (default: 2147483647)
This is the maximum value value that the counter can have. If not specified or set to zero, the counter can have a maximum value of 2,147,483,648 (2 to the 31 power). When the counter is incremented past this value, it is reset to the Minimum.

Minimum = <Int32> (default: 0)
This specifies the minimum value that the counter can have. It also becomes the default. If not supplied, zero is assumed.

Name = <name> (required)
The name of the resource.

The name of the Counter. This is the name you will use in the variable expansion to reference the counter value.

Wrap Counter = <resource-name>
If this value is specified, when the counter is incremented past the maximum and thus reset to the minimum, the counter specified on the Wrap Counter $^{\text{Dir}}_{\text{Counter}}$ is incremented. (This is currently not implemented).

9.14 Example Director Configuration File

See below an example of a full Director configuration file:

```
#
# Default Bareos Director configuration file for disk-only backup
# (C) 2013 Bareos GmbH & Co.KG
#
# Each configuration item has a reference number that shows
# where this property can be changed in the configuration file.
# Search for the number to find the correct line.
#
# You have to configure the following accoring to your environment:
#
# (#01)Email Address for bareos disaster recovery.
#      Specify a mailaddress outside of your backupserver.
#      There will be one mail per day.
#
# (#02)Email Address for bareos reports. (Mail Command)
#      This mail address will recieve a report about each backup job.
#      It will be sent after the backupjob is complete.
#      Has to be configured twice ("Standard" and "Daemon" Message Ressources)
#
# (#03)Email Address for bareos operator. (Operator Command)
#      This mail address will recieve a mail immediately when the
#      bareos system needs an operator intervention.
#      May be the same address as in (#02)
#
#
# This disk-only setup stores all data into @archivedir@
#
# The preconfigured backup scheme is as follows:
#
#   Full Backups are done on first Saturday at 21:00              (#04)
#   Full Backups are written into the "Full" Pool                 (#05)
#   Full Backups are kept for 365 Days                            (#06)
#
#   Differential Backups are done on 2nd to 5th Saturday at 21:00 (#07)
#   Differential Backups are written into the "Differential" Pool (#08)
#   Differential Backups are kept for 90 Days                     (#09)
#
#   Incremental Backups are done monday to friday at 21:00        (#10)
#   Incremental Backups are written into the "Incremental" Pool   (#11)
#   Incremental Backups are kept for 30 Days                      (#12)
#
#   What you also have to do is to change the default fileset     (#13)
#   to either one of the demo filesets given or create our own fileset.
#
#
#
#  For Bareos release @VERSION@ (@DATE@) -- @DISTNAME@ @DISTVER@
#
#
Director {                            # define myself
  Name = @basename@-dir
  QueryFile = "@scriptdir@/query.sql"
  Maximum Concurrent Jobs = 10
  Password = "@dir_password@"         # Console password
  Messages = Daemon

  # remove comment in next line to load plugins from specified directory
  # Plugin Directory = @plugindir@
}

JobDefs {
  Name = "DefaultJob"
  Type = Backup
  Level = Incremental
  Client = @basename@-fd
  FileSet = "SelfTest"                    # selftest fileset                          (#13)
  Schedule = "WeeklyCycle"
  Storage = File
  Messages = Standard
  Pool = Incremental
  Priority = 10
  Write Bootstrap = "@working_dir@/%c.bsr"
```

```
  Full Backup Pool = Full                  # write Full Backups into "Full" Pool         (#05)
  Differential Backup Pool = Differential  # write Diff Backups into "Differential" Pool (#08)
  Incremental Backup Pool = Incremental    # write Incr Backups into "Incremental" Pool  (#11)
}

#
# Define the main nightly save backup job
#   By default, this job will back up to disk in @archivedir@
Job {
  Name = "BackupClient1"
  JobDefs = "DefaultJob"
}

#
# Backup the catalog database (after the nightly save)
#
Job {
  Name = "BackupCatalog"
  JobDefs = "DefaultJob"
  Level = Full
  FileSet="Catalog"
  Schedule = "WeeklyCycleAfterBackup"

  # This creates an ASCII copy of the catalog
  # Arguments to make_catalog_backup.pl are:
  #  make_catalog_backup.pl <catalog-name>
  RunBeforeJob = "@scriptdir@/make_catalog_backup.pl MyCatalog"

  # This deletes the copy of the catalog
  RunAfterJob  = "@scriptdir@/delete_catalog_backup"

  # This sends the bootstrap via mail for disaster recovery.
  # Should be sent to another system, please change recipient accordingly
  Write Bootstrap = "|@sbindir@/bsmtp -h @smtp_host@ -f \"\(Bareos\) \" -s \"Bootstrap for Job %j\" @job_email@" # (#01)
  Priority = 11                   # run after main backup
}

#
# Standard Restore template, to be changed by Console program
#  Only one such job is needed for all Jobs/Clients/Storage ...
#
Job {
  Name = "RestoreFiles"
  Type = Restore
  Client=@basename@-fd
  FileSet = "Linux All"
  Storage = File
  Pool = Incremental
  Messages = Standard
  Where = /tmp/bareos-restores
}


FileSet {
  Name = "Windows All Drives"
  Enable VSS = yes
  Include {
    Options {
      Signature = MD5
      Drive Type = fixed
      IgnoreCase = yes
      WildFile = "[A-Z]:/pagefile.sys"
      WildDir = "[A-Z]:/RECYCLER"
      WildDir = "[A-Z]:/$RECYCLE.BIN"
      WildDir = "[A-Z]:/System Volume Information"
      Exclude = yes
    }
    File = /
  }
}


FileSet {
  Name = "Linux All"
  Include {
    Options {
```

```
      Signature = MD5 # calculate md5 checksum per file
      One FS = No     # change into other filessytems
      FS Type = ext2  # filesystems of given types will be backed up
      FS Type = ext3  # others will be ignored
      FS Type = ext4
      FS Type = xfs
      FS Type = reiserfs
      FS Type = jfs
      FS Type = btrfs
    }
    File = /
  }
  # Things that usually have to be excluded
  # You have to exclude @archivedir@
  # on your bareos server
  Exclude {
    File = @working_dir@
    File = @archivedir@
    File = /proc
    File = /tmp
    File = /.journal
    File = /.fsck
  }

}

# fileset just to backup some files for selftest
FileSet {
  Name = "SelfTest"
  Include {
    Options {
      Signature = MD5 # calculate md5 checksum per file
    }
    File = @sbindir@
  }
}

Schedule {
  Name = "WeeklyCycle"
  Run = Full 1st sat at 21:00                  # (#04)
  Run = Differential 2nd-5th sat at 21:00      # (#07)
  Run = Incremental mon-fri at 21:00           # (#10)
}

# This schedule does the catalog. It starts after the WeeklyCycle
Schedule {
  Name = "WeeklyCycleAfterBackup"
  Run = Full mon-fri at 21:10
}

# This is the backup of the catalog
FileSet {
  Name = "Catalog"
  Include {
    Options {
      signature = MD5
    }
    File = "@working_dir@/@db_name@.sql" # database dump
    File = "@sysconfdir@"                # configuration
  }
}

# Client (File Services) to backup
Client {
  Name = @basename@-fd
  Address = @hostname@
  Password = "@fd_password@"          # password for FileDaemon
  File Retention = 30 days            # 30 days
  Job Retention = 6 months            # six months
  AutoPrune = no                      # Prune expired Jobs/Files
}

#
# Definition of file storage device
#
Storage {
```

```
  Name = File
# Do not use "localhost" here
  Address = @hostname@                # N.B. Use a fully qualified name here
  Password = "@sd_password@"
  Device = FileStorage
  Media Type = File
}

#
# Generic catalog service
#
Catalog {
  Name = MyCatalog
  # Uncomment the following lines if you want the dbi driver
  @uncomment_dbi@ dbdriver = "dbi:@DEFAULT_DB_TYPE@"; dbaddress = 127.0.0.1; dbport = @db_port@
  #dbdriver = "@DEFAULT_DB_TYPE@"
  dbdriver = "XXX_REPLACE_WITH_DATABASE_DRIVER_XXX"
  dbname = "@db_name@"
  dbuser = "@db_user@"
  dbpassword = "@db_password@"
}

#
# Reasonable message delivery -- send most everything to email address and to the console
#
Messages {
  Name = Standard
  mailcommand = "@sbindir@/bsmtp -h @smtp_host@ -f \"\(Bareos\) \<%r\>\" -s \"Bareos: %t %e of %c %l\" %r"
  operatorcommand = "@sbindir@/bsmtp -h @smtp_host@ -f \"\(Bareos\) \<%r\>\" -s \"Bareos: Intervention needed for %j\" %r"
  mail = @job_email@ = all, !skipped # (#02)
  operator = @job_email@ = mount     # (#03)
  console = all, !skipped, !saved
  append = "@logdir@/bareos.log" = all, !skipped
  catalog = all
}

#
# Message delivery for daemon messages (no job).
#
Messages {
  Name = Daemon
  mailcommand = "@sbindir@/bsmtp -h @smtp_host@ -f \"\(Bareos\) \<%r\>\" -s \"Bareos daemon message\" %r"
  mail = @job_email@ = all, !skipped # (#02)
  console = all, !skipped, !saved
  append = "@logdir@/bareos.log" = all, !skipped
}


#
# Full Pool definition
#
Pool {
  Name = Full
  Pool Type = Backup
  Recycle = yes                       # Bareos can automatically recycle Volumes
  AutoPrune = yes                     # Prune expired volumes
  Volume Retention = 365 days         # How long should the Full Backups be kept? (#06)
  Maximum Volume Bytes = 50G          # Limit Volume size to something reasonable
  Maximum Volumes = 100               # Limit number of Volumes in Pool
  Label Format = "Full-"              # Volumes will be labeled "Full-<volume-id>"
}

#
# Differential Pool definition
#
Pool {
  Name = Differential
  Pool Type = Backup
  Recycle = yes                       # Bareos can automatically recycle Volumes
  AutoPrune = yes                     # Prune expired volumes
  Volume Retention = 90 days          # How long should the Differential Backups be kept? (#09)
  Maximum Volume Bytes = 10G          # Limit Volume size to something reasonable
  Maximum Volumes = 100               # Limit number of Volumes in Pool
  Label Format = "Differential-"      # Volumes will be labeled "Differential-<volume-id>"
}
```

```
#
# Incremental Pool definition
#
Pool {
  Name = Incremental
  Pool Type = Backup
  Recycle = yes                       # Bareos can automatically recycle Volumes
  AutoPrune = yes                     # Prune expired volumes
  Volume Retention = 30 days          # How long should the Incremental Backups be kept?  (#12)
  Maximum Volume Bytes = 1G           # Limit Volume size to something reasonable
  Maximum Volumes = 100               # Limit number of Volumes in Pool
  Label Format = "Incremental-"       # Volumes will be labeled "Incremental-<volume-id>"
}

#
# Scratch pool definition
#
Pool {
  Name = Scratch
  Pool Type = Backup
}

#
# Restricted console used by tray-monitor to get the status of the director
#
Console {
  Name = @basename@-mon
  Password = "@mon_dir_password@"
  CommandACL = status, .status
}
```

Chapter 10

Storage Daemon Configuration

The Bareos Storage Daemon configuration file has relatively few resource definitions. However, due to the great variation in backup media and system capabilities, the storage daemon must be highly configurable. As a consequence, there are quite a large number of directives in the Device Resource definition that allow you to define all the characteristics of your Storage device (normally a tape drive). Fortunately, with modern storage devices, the defaults are sufficient, and very few directives are actually needed.
For a general discussion of configuration file and resources including the data types recognized by **Bareos**, please see the Configuration chapter of this manual. The following Storage Resource definitions must be defined:

- Storage – to define the name of the Storage daemon.
- Director – to define the Director's name and his access password.
- Device – to define the characteristics of your storage device (tape drive).
- Messages – to define where error and information messages are to be sent.

Following resources are optional:

- Autochanger Resource – to define Autochanger devices.
- NDMP Resource – to define the NDMP authentication context.

10.1 Storage Resource

In general, the properties specified under the Storage resource define global properties of the Storage daemon. Each Storage daemon configuration file must have one and only one Storage resource definition.

configuration directive name	type of data	default value	remark
Absolute Job Timeout	= positive-integer		
Allow Bandwidth Bursting	= yes|no	no	
Auto XFlate On Replication	= yes|no	no	
Backend Directory	= `DirectoryList`	/usr/lib/bareos/backends *(platform specific)*	
Client Connect Wait	= time	1800	
Collect Device Statistics	= yes|no	no	
Collect Job Statistics	= yes|no	no	
Compatible	= yes|no	no	
Description	= string		
Device Reserve By Media Type	= yes|no	no	
FD Connect Timeout	= time	1800	
File Device Concurrent Read	= yes|no	no	
Heartbeat Interval	= time	0	
Log Timestamp Format	= string		
Maximum Bandwidth Per Job	= speed		
Maximum Concurrent Jobs	= positive-integer	20	
Maximum Connections	= positive-integer	42	

Maximum Network Buffer Size	= positive-integer		
Messages	= resource-name		
Name	**= name**		**required**
NDMP Address	= net-address	10000	
NDMP Addresses	= net-addresses	10000	
NDMP Enable	= yes|no	no	
NDMP Log Level	= positive-integer	4	
NDMP Port	= net-port	10000	
NDMP Snooping	= yes|no	no	
Pid Directory	= directory	/var/lib/bareos *(platform specific)*	
Plugin Directory	= directory		
Plugin Names	= `PluginNames`		
Scripts Directory	= directory		
SD Address	= net-address	9103	
SD Addresses	= net-addresses	9103	
SD Connect Timeout	= time	1800	
SD Port	= net-port	9103	
SD Source Address	= net-address	0	
Secure Erase Command	= string		
Statistics Collect Interval	= positive-integer	30	
Sub Sys Directory	= directory		
TLS Allowed CN	= string-list		
TLS Authenticate	= yes|no		
TLS CA Certificate Dir	= directory		
TLS CA Certificate File	= directory		
TLS Certificate	= directory		
TLS Certificate Revocation List	= directory		
TLS Cipher List	= string		
TLS DH File	= directory		
TLS Enable	= yes|no		
TLS Key	= directory		
TLS Require	= yes|no		
TLS Verify Peer	= yes|no	yes	
Ver Id	= string		
Working Directory	= directory	/var/lib/bareos *(platform specific)*	

Absolute Job Timeout = <positive-integer>

Allow Bandwidth Bursting = <yes|no> (default: no)

Auto XFlate On Replication = <yes|no> (default: no)

This directive controls the autoxflate-sd plugin plugin when replicating data inside one or between two storage daemons (Migration/Copy Jobs). Normally the storage daemon will use the autoinflate/autodeflate setting of the device when reading and writing data to it which could mean that while reading it inflates the compressed data and the while writing the other deflates it again. If you just want the data to be exactly the same e.g. don't perform any on the fly uncompression and compression while doing the replication of data you can set this option to no and it will override any setting on the device for doing auto inflation/deflation when doing data replication. This will not have any impact on any normal backup or restore jobs.
Version >= 13.4.0

Backend Directory = <DirectoryList> (default: /usr/lib/bareos/backends *(platform specific)*)

Client Connect Wait = <time> (default: 1800)
This directive defines an interval of time in seconds that the Storage daemon will wait for a Client (the File daemon) to connect. Be aware that the longer the Storage daemon waits for a Client, the more resources will be tied up.

Collect Device Statistics = <yes|no> (default: no)

Collect Job Statistics = <yes|no> (default: no)

Compatible = <yes|no> (default: no)
This directive enables the compatible mode of the storage daemon. In this mode the storage daemon will try to write the storage data in a compatible way with Bacula of which Bareos is a fork. This only works for the data streams both share and not for any new datastreams which are Bareos specific. Which may be read when used by a Bareos storage daemon but might not be understood by any of the Bacula components (dir/sd/fd).

The default setting of this directive was changed to no since Bareos Version >= 15.2.0 .

Description = <string>

Device Reserve By Media Type = <yes|no> (default: no)

FD Connect Timeout = <time> (default: 1800)

File Device Concurrent Read = <yes|no> (default: no)

Heartbeat Interval = <time> (default: 0)
This directive defines an interval of time in seconds. When the Storage daemon is waiting for the operator to mount a tape, each time interval, it will send a heartbeat signal to the File daemon. The default interval is zero which disables the heartbeat. This feature is particularly useful if you have a router that does not follow Internet standards and times out an valid connection after a short duration despite the fact that keepalive is set. This usually results in a broken pipe error message.

Log Timestamp Format = <string>

Version >= 15.2.3

Maximum Bandwidth Per Job = <speed>

Maximum Concurrent Jobs = <positive-integer> (default: 20)
where <number> is the maximum number of Jobs that may run concurrently. The default is set to 10, but you may set it to a larger number. Each contact from the Director (e.g. status request, job start request) is considered as a Job, so if you want to be able to do a **status** request in the console at the same time as a Job is running, you will need to set this value greater than 1. To run simultaneous Jobs, you will need to set a number of other directives in the Director's configuration file. Which ones you set depend on what you want, but you will almost certainly need to set the **Maximum Concurrent Jobs** in the Storage resource in the Director's configuration file and possibly those in the Job and Client resources.

Maximum Connections = <positive-integer> (default: 42)

Version >= 15.2.3

Maximum Network Buffer Size = <positive-integer>

Messages = <resource-name>

Name = <name> (required)
Specifies the Name of the Storage daemon.

NDMP Address = <net-address> (default: 10000)
This directive is optional, and if it is specified, it will cause the Storage daemon server (for NDMP Tape Server connections) to bind to the specified **IP-Address**, which is either a domain name or an IP address specified as a dotted quadruple. If this directive is not specified, the Storage daemon will bind to any available address (the default).

NDMP Addresses = <net-addresses> (default: 10000)
Specify the ports and addresses on which the Storage daemon will listen for NDMP Tape Server connections. Normally, the default is sufficient and you do not need to specify this directive.

NDMP Enable = <yes|no> (default: no)
This directive enables the Native NDMP Tape Agent.

NDMP Log Level = <positive-integer> (default: 4)
This directive sets the loglevel for the NDMP protocol library.

NDMP Port = <net-port> (default: 10000)
Specifies port number on which the Storage daemon listens for NDMP Tape Server connections.

NDMP Snooping = <yes|no> (default: no)
This directive enables the Snooping and pretty printing of NDMP protocol information in debugging mode.

Pid Directory = <directory> (default: /var/lib/bareos *(platform specific)*)
This directive specifies a directory in which the Storage Daemon may put its process Id file files. The process Id file is used to shutdown Bareos and to prevent multiple copies of Bareos from running simultaneously. Standard shell expansion of the **directory** is done when the configuration file is read so that values such as **$HOME** will be properly expanded.

Plugin Directory = <directory>
This directive specifies a directory in which the Storage Daemon searches for plugins with the name **<pluginname>-sd.so** which it will load at startup.

Plugin Names = <PluginNames>

Scripts Directory = <directory>
This directive is currently unused.

SD Address = <net-address> (default: 9103)
This directive is optional, and if it is specified, it will cause the Storage daemon server (for Director and File daemon connections) to bind to the specified IP-Address, which is either a domain name or an IP address specified as a dotted quadruple. If this and the SD Addresses $^{\text{Sd}}_{\text{Storage}}$ directives are not specified, the Storage daemon will bind to any available address (the default).

SD Addresses = <net-addresses> (default: 9103)
Specify the ports and addresses on which the Storage daemon will listen for Director connections. Using this directive, you can replace both the SD Port $^{\text{Sd}}_{\text{Storage}}$ and SD Address $^{\text{Sd}}_{\text{Storage}}$ directives.

SD Connect Timeout = <time> (default: 1800)

SD Port = <net-port> (default: 9103)
Specifies port number on which the Storage daemon listens for Director connections.

SD Source Address = <net-address> (default: 0)

Secure Erase Command = <string>
Specify command that will be called when bareos unlinks files.

When files are no longer needed, Bareos will delete (unlink) them. With this directive, it will call the specified command to delete these files. See Secure Erase Command for details.
Version >= 15.2.1

Statistics Collect Interval = <positive-integer> (default: 30)

Sub Sys Directory = <directory>

TLS Allowed CN = <string-list>

TLS Authenticate = <yes|no>

TLS CA Certificate Dir = <directory>

TLS CA Certificate File = <directory>

TLS Certificate = <directory>

TLS Certificate Revocation List = <directory>

TLS Cipher List = <string>

TLS DH File = <directory>

TLS Enable = <yes|no>
Bareos can be configured to encrypt all its network traffic. Chapter TLS Configuration Directives explains how the Bareos components must be configured to use TLS.

TLS Key = <directory>

TLS Require = <yes|no>

TLS Verify Peer = <yes|no> (default: yes)

Ver Id = <string>

Working Directory = <directory> (default: /var/lib/bareos *(platform specific)*)
This directive specifies a directory in which the Storage daemon may put its status files. This directory should be used only by **Bareos**, but may be shared by other Bareos daemons provided the names given to each daemon are unique.

The following is a typical Storage daemon storage resource definition.

```
#
# "Global" Storage daemon configuration specifications appear
# under the Storage resource.
#
Storage {
  Name = "Storage daemon"
  Address = localhost
}
```

Configuration 10.1: Storage daemon storage definition

10.2 Director Resource

The Director resource specifies the Name of the Director which is permitted to use the services of the Storage daemon. There may be multiple Director resources. The Director Name and Password must match the corresponding values in the Director's configuration file.

configuration directive name	type of data	default value	remark
Description	= string		
Key Encryption Key	= password		
Maximum Bandwidth Per Job	= speed		
Monitor	= yes|no		
Name	**= name**		**required**
Password	**= password**		**required**
TLS Allowed CN	= string-list		
TLS Authenticate	= yes|no		
TLS CA Certificate Dir	= directory		
TLS CA Certificate File	= directory		
TLS Certificate	= directory		
TLS Certificate Revocation List	= directory		

TLS Cipher List	= string		
TLS DH File	= directory		
TLS Enable	= yes|no		
TLS Key	= directory		
TLS Require	= yes|no		
TLS Verify Peer	= yes|no	yes	

Description = <string>

Key Encryption Key = <password>
This key is used to encrypt the Security Key that is exchanged between the Director and the Storage Daemon for supporting Application Managed Encryption (AME). For security reasons each Director should have a different Key Encryption Key.

Maximum Bandwidth Per Job = <speed>

Monitor = <yes|no>
If Monitor is set to **no** (default), this director will have full access to this Storage daemon. If Monitor is set to **yes**, this director will only be able to fetch the current status of this Storage daemon.

Please note that if this director is being used by a Monitor, we highly recommend to set this directive to **yes** to avoid serious security problems.

Name = <name> (required)
Specifies the Name of the Director allowed to connect to the Storage daemon. This directive is required.

Password = <password> (required)
Specifies the password that must be supplied by the above named Director. This directive is required.

TLS Allowed CN = <string-list>

TLS Authenticate = <yes|no>

TLS CA Certificate Dir = <directory>

TLS CA Certificate File = <directory>

TLS Certificate = <directory>

TLS Certificate Revocation List = <directory>

TLS Cipher List = <string>

TLS DH File = <directory>

TLS Enable = <yes|no>
Bareos can be configured to encrypt all its network traffic. Chapter TLS Configuration Directives explains how the Bareos components must be configured to use TLS.

TLS Key = <directory>

TLS Require = <yes|no>

TLS Verify Peer = <yes|no> (default: yes)

The following is an example of a valid Director resource definition:

```
Director {
  Name = MainDirector
  Password = my_secret_password
}
```

Configuration 10.2: Storage daemon Director definition

10.3 NDMP Resource

The NDMP Resource specifies the authentication details of each NDMP client. There may be multiple NDMP resources for a single Storage daemon. In general, the properties specified within the NDMP resource are specific to one client.

configuration directive name	type of data	default value	remark
Auth Type	= None|Clear|MD5	None	
Description	= string		
Log Level	= positive-integer	4	
Name	**= name**		**required**
Password	**= password**		**required**
Username	**= string**		**required**

Auth Type = <None|Clear|MD5> (default: None)
Specifies the authentication type that must be supplied by the above named NDMP Client. This directive is required.

The following values are allowed:

1. None - Use no password
2. Clear - Use clear text password
3. MD5 - Use MD5 hashing

Description = <string>

Log Level = <positive-integer> (default: 4)
Specifies the NDMP Loglevel which overrides the global NDMP loglevel for this client.

Name = <name> (required)
Specifies the name of the NDMP Client allowed to connect to the Storage daemon. This directive is required.

Password = <password> (required)
Specifies the password that must be supplied by the above named NDMP Client. This directive is required.

Username = <string> (required)
Specifies the username that must be supplied by the above named NDMP Client. This directive is required.

10.4 Device Resource

The Device Resource specifies the details of each device (normally a tape drive) that can be used by the Storage daemon. There may be multiple Device resources for a single Storage daemon. In general, the properties specified within the Device resource are specific to the Device.

configuration directive name	type of data	default value	remark
Alert Command	= Strname		
Always Open	= yes|no	yes	
Archive Device	= Strname		**required**
Auto Deflate	= IoDirection		
Auto Deflate Algorithm	= CompressionAlgorithm		
Auto Deflate Level	= positive-integer	6	
Auto Inflate	= IoDirection		
Auto Select	= yes|no	yes	
Autochanger	= yes|no	no	
Automatic Mount	= yes|no	no	
Backward Space File	= yes|no	yes	
Backward Space Record	= yes|no	yes	
Block Checksum	= yes|no	yes	
Block Positioning	= yes|no	yes	
Bsf At Eom	= yes|no	no	
Changer Command	= Strname		
Changer Device	= Strname		
Check Labels	= yes|no	no	
Close On Poll	= yes|no	no	
Collect Statistics	= yes|no	yes	
Description	= string		
Device Options	= string		
Device Type	= DeviceType		
Diagnostic Device	= Strname		
Drive Crypto Enabled	= yes|no		
Drive Index	= positive-integer		
Drive Tape Alert Enabled	= yes|no		
Fast Forward Space File	= yes|no	yes	
Forward Space File	= yes|no	yes	
Forward Space Record	= yes|no	yes	

Free Space Command	= *Strname*		*deprecated*
Hardware End Of File	= yes|no	yes	
Hardware End Of Medium	= yes|no	yes	
Label Block Size	= positive-integer	64512	
Label Media	= yes|no	no	
Label Type	= Label		
Maximum Block Size	= MaxBlocksize		
Maximum Changer Wait	= time	300	
Maximum Concurrent Jobs	= positive-integer		
Maximum File Size	= Size64	1000000000	
Maximum Job Spool Size	= Size64		
Maximum Network Buffer Size	= positive-integer		
Maximum Open Volumes	= positive-integer	1	
Maximum Open Wait	= time	300	
Maximum Part Size	= *Size64*		*deprecated*
Maximum Rewind Wait	= time	300	
Maximum Spool Size	= Size64		
Maximum Volume Size	= *Size64*		*deprecated*
Media Type	= Strname		**required**
Minimum Block Size	= positive-integer		
Mount Command	= Strname		
Mount Point	= Strname		
Name	= **name**		**required**
No Rewind On Close	= yes|no	yes	
Offline On Unmount	= yes|no	no	
Query Crypto Status	= yes|no		
Random Access	= yes|no	no	
Removable Media	= yes|no	yes	
Requires Mount	= yes|no	no	
Spool Directory	= directory		
Two Eof	= yes|no	no	
Unmount Command	= Strname		
Use Mtiocget	= yes|no	yes	
Volume Capacity	= Size64		
Volume Poll Interval	= time	300	
Write Part Command	= *Strname*		*deprecated*

Alert Command = <Strname>

The **name-string** specifies an external program to be called at the completion of each Job after the device is released. The purpose of this command is to check for Tape Alerts, which are present when something is wrong with your tape drive (at least for most modern tape drives). The same substitution characters that may be specified in the Changer Command may also be used in this string. For more information, please see the Autochangers chapter of this manual.

Note, it is not necessary to have an autochanger to use this command. The example below uses the **tapeinfo** program that comes with the **mtx** package, but it can be used on any tape drive. However, you will need to specify a **Changer Device** directive in your Device resource (see above) so that the generic SCSI device name can be edited into the command (with the %c).

An example of the use of this command to print Tape Alerts in the Job report is:

```
Alert Command = "sh -c 'tapeinfo -f %c | grep TapeAlert'"
```

and an example output when there is a problem could be:

```
bareos-sd  Alert: TapeAlert[32]: Interface: Problem with SCSI interface
                  between tape drive and initiator.
```

Always Open = <yes|no> (default: yes)

If **Yes**, Bareos will always keep the device open unless specifically **unmounted** by the Console program. This permits Bareos to ensure that the tape drive is always available, and properly positioned. If you set **AlwaysOpen** to **no Bareos** will only open the drive when necessary, and at the end of the Job if no other Jobs are using the drive, it will be freed. The next time Bareos wants to append to a tape on a drive that was freed, Bareos will rewind the tape and position it to the end. To avoid unnecessary tape positioning and to minimize unnecessary operator intervention, it is highly recommended that **Always Open = yes**. This also ensures that the drive is available when Bareos needs it.

If you have **Always Open = yes** (recommended) and you want to use the drive for something else, simply use the **unmount** command in the Console program to release the drive. However, don't forget to remount the drive with **mount** when the drive is available or the next Bareos job will block.

For File storage, this directive is ignored. For a FIFO storage device, you must set this to **No**.

Please note that if you set this directive to **No** Bareos will release the tape drive between each job, and thus the next job will rewind the tape and position it to the end of the data. This can be a very time consuming operation. In addition, with this directive set to no, certain multiple drive autochanger operations will fail. We strongly recommend to keep **Always Open** set to **Yes**

Archive Device = <Strname> (required)

Specifies where to read and write the backup data. The type of the Archive Device can be specified by the Device Type $^{\text{Sd}}_{\text{Device}}$ directive. If Device Type is not specified, Bareos tries to guess the Device Type accordingly to the type of the specified Archive Device file type.

There are different types that are supported:

device Usually the device file name of a removable storage device (tape drive), for example `/dev/nst0` or `/dev/rmt/0mbn`, preferably in the "non-rewind" variant. In addition, on systems such as Sun, which have multiple tape access methods, you must be sure to specify to use Berkeley I/O conventions with the device. The **b** in the Solaris (Sun) archive specification `/dev/rmt/0mbn` is what is needed in this case. Bareos does not support SysV tape drive behavior.

directory If a directory is specified, it is used as file storage. The directory must be existing and be specified as absolute path. Bareos will write to file storage in the specified directory and the filename used will be the Volume name as specified in the Catalog. If you want to write into more than one directory (i.e. to spread the load to different disk drives), you will need to define two Device resources, each containing an Archive Device with a different directory.

fifo A FIFO is a special kind of file that connects two programs via kernel memory. If a FIFO device is specified for a backup operation, you must have a program that reads what Bareos writes into the FIFO. When the Storage daemon starts the job, it will wait for Maximum Open Wait $^{\text{Sd}}_{\text{Device}}$ seconds for the read program to start reading, and then time it out and terminate the job. As a consequence, it is best to start the read program at the beginning of the job perhaps with the Run Before Job $^{\text{Dir}}_{\text{Job}}$ directive. For this kind of device, you always want to specify Always Open $^{\text{Sd}}_{\text{Device}}$ = no, because you want the Storage daemon to open it only when a job starts. Since a FIFO is a one way device, Bareos will not attempt to read a label of a FIFO device, but will simply write on it. To create a FIFO Volume in the catalog, use the **add** command rather than the **label** command to avoid attempting to write a label.

```
Device {
  Name = FifoStorage
  Media Type = Fifo
  Device Type = Fifo
  Archive Device = /tmp/fifo
  LabelMedia = yes
  Random Access = no
  AutomaticMount = no
  RemovableMedia = no
  MaximumOpenWait = 60
  AlwaysOpen = no
}
```

During a restore operation, if the Archive Device is a FIFO, Bareos will attempt to read from the FIFO, so you must have an external program that writes into the FIFO. Bareos will wait Maximum Open Wait $^{\text{Sd}}_{\text{Device}}$ seconds for the program to begin writing and will then time it out

and terminate the job. As noted above, you may use the Run Before Job Dir Job to start the writer program at the beginning of the job.

A FIFO device can also be used to test your configuration, see the Howto section.

GlusterFS Storage don't use this directive, but only Device Type Sd Device and Device Options Sd Device (this behavior have changed with Version >= 15.2.0).

Ceph Object Store don't use this directive, but only Device Type Sd Device and Device Options Sd Device. (this behavior have changed with Version >= 15.2.0).

Auto Deflate = <IoDirection>

This is a parameter used by autoxflate-sd which allow you to transform a non compressed piece of data into a compressed piece of data on the storage daemon. e.g. Storage Daemon compression. You can either enable compression on the client and use the CPU cyclces there to compress your data with one of the supported compression algorithms. The value of this parameter specifies a so called io-direction currently you can use the following io-directions:

- in - compress data streams while reading the data from a device.
- out - compress data streams while writing the data to a device.
- both - compress data streams both when reading and writing to a device.

Currently only plain data streams are compressed (so things that are already compressed or encrypted will not be considered for compression.) Also meta-data streams are not compressed. The compression is done in a way that the stream is transformed into a native compressed data stream. So if you enable this and send the data to a filedaemon it will know its a compressed stream and will do the decompression itself. This also means that you can turn this option on and off at any time without having any problems with data already written.

This option could be used if your clients doesn't have enough power to do the compression/decompression itself and you have enough network bandwidth. Or when your filesystem doesn't have the option to transparently compress data you write to it but you want the data to be compressed when written.
Version >= 13.4.0

Auto Deflate Algorithm = <CompressionAlgorithm>

This option specifies the compression algorithm used for the autodeflate option which is performed by the autoxflate-sd plugin. The algorithms supported are:

- GZIP - gzip level 1–9
- LZO
- LZFAST
- LZ4
- LZ4HC

Version >= 13.4.0

Auto Deflate Level = <positive-integer> (default: 6)

This option specifies the level to be used when compressing when you select a compression algorithm that has different levels.
Version >= 13.4.0

Auto Inflate = <IoDirection>

This is a parameter used by autoxflate-sd which allow you to transform a compressed piece of data into a non compressed piece of data on the storage daemon. e.g. Storage Daemon decompression. You can either enable decompression on the client and use the CPU cyclces there to decompress your data with one of the supported compression algorithms. The value of this parameter specifies a so called io-direction currently you can use the following io-directions:

- in - decompress data streams while reading the data from a device.
- out - decompress data streams while writing the data to a device.

- both - decompress data streams both when reading and writing to a device.

This option allows you to write uncompressed data to for instance a tape drive that has hardware compression even when you compress your data on the client with for instance a low cpu load compression method (LZ4 for instance) to transfer less data over the network. It also allows you to restore data in a compression format that the client might not support but the storage daemon does. This only works on normal compressed datastreams not on encrypted datastreams or meta data streams.
Version >= 13.4.0

Auto Select = <yes|no> (default: yes)
If this directive is set to **yes**, and the Device belongs to an autochanger, then when the Autochanger is referenced by the Director, this device can automatically be selected. If this directive is set to **no**, then the Device can only be referenced by directly using the Device name in the Director. This is useful for reserving a drive for something special such as a high priority backup or restore operations.

Autochanger = <yes|no> (default: no)
If **Yes**, this device belongs to an automatic tape changer, and you must specify an **Autochanger** resource that points to the **Device** resources. You must also specify a Changer Device [Sd Device]. If the Autochanger directive is set to **No**, the volume must be manually changed. You should also have an identical directive to the Auto Changer [Dir Storage] in the Director's configuration file so that when labeling tapes you are prompted for the slot.

Automatic Mount = <yes|no> (default: no)
If **Yes**, permits the daemon to examine the device to determine if it contains a Bareos labeled volume. This is done initially when the daemon is started, and then at the beginning of each job. This directive is particularly important if you have set **Always Open = no** because it permits Bareos to attempt to read the device before asking the system operator to mount a tape. However, please note that the tape must be mounted before the job begins.

Backward Space File = <yes|no> (default: yes)
If **Yes**, the archive device supports the **MTBSF** and **MTBSF ioctl**s to backspace over an end of file mark and to the start of a file. If **No**, these calls are not used and the device must be rewound and advanced forward to the desired position.

Backward Space Record = <yes|no> (default: yes)
If **Yes**, the archive device supports the `MTBSR ioctl` to backspace records. If **No**, this call is not used and the device must be rewound and advanced forward to the desired position. This function if enabled is used at the end of a Volume after writing the end of file and any ANSI/IBM labels to determine whether or not the last block was written correctly. If you turn this function off, the test will not be done. This causes no harm as the re-read process is precautionary rather than required.

Block Checksum = <yes|no> (default: yes)
You may turn off the Block Checksum (CRC32) code that Bareos uses when writing blocks to a Volume. Doing so can reduce the Storage daemon CPU usage slightly. It will also permit Bareos to read a Volume that has corrupted data.

It is not recommend to turn this off, particularly on older tape drives or for disk Volumes where doing so may allow corrupted data to go undetected.

Block Positioning = <yes|no> (default: yes)
This directive tells Bareos not to use block positioning when doing restores. Turning this directive off can cause Bareos to be **extremely** slow when restoring files. You might use this directive if you wrote your tapes with Bareos in variable block mode (the default), but your drive was in fixed block mode.

Bsf At Eom = <yes|no> (default: no)
If **No**, no special action is taken by Bareos with the End of Medium (end of tape) is reached because the tape will be positioned after the last EOF tape mark, and Bareos can append to the tape as

desired. However, on some systems, such as FreeBSD, when Bareos reads the End of Medium (end of tape), the tape will be positioned after the second EOF tape mark (two successive EOF marks indicated End of Medium). If Bareos appends from that point, all the appended data will be lost. The solution for such systems is to specify **BSF at EOM** which causes Bareos to backspace over the second EOF mark. Determination of whether or not you need this directive is done using the **test** command in the **btape** program.

Changer Command = <Strname>
The **name-string** specifies an external program to be called that will automatically change volumes as required by **Bareos**. Normally, this directive will be specified only in the **AutoChanger** resource, which is then used for all devices. However, you may also specify the different **Changer Command** in each Device resource. Most frequently, you will specify the Bareos supplied **mtx-changer** script as follows:

```
Changer Command = "/usr/lib/bareos/scripts/mtx-changer %c %o %S %a %d"
```

and you will install the `mtx` on your system. An example of this command is in the default `bareos-sd.conf` file. For more details on the substitution characters that may be specified to configure your autochanger please see the Autochanger Support chapter of this manual.

Changer Device = <Strname>
The specified **name-string** must be the **generic SCSI** device name of the autochanger that corresponds to the normal read/write **Archive Device** specified in the Device resource. This generic SCSI device name should be specified if you have an autochanger or if you have a standard tape drive and want to use the **Alert Command** (see below). For example, on Linux systems, for an Archive Device name of **/dev/nst0**, you would specify **/dev/sg0** for the Changer Device name. Depending on your exact configuration, and the number of autochangers or the type of autochanger, what you specify here can vary. This directive is optional. See the Using Autochangers chapter of this manual for more details of using this and the following autochanger directives.

Check Labels = <yes|no> (default: no)
If you intend to read ANSI or IBM labels, this **must** be set. Even if the volume is not ANSI labeled, you can set this to yes, and Bareos will check the label type. Without this directive set to yes, Bareos will assume that labels are of Bareos type and will not check for ANSI or IBM labels. In other words, if there is a possibility of Bareos encountering an ANSI/IBM label, you must set this to yes.

Close On Poll = <yes|no> (default: no)
If **Yes**, Bareos close the device (equivalent to an unmount except no mount is required) and reopen it at each poll. Normally this is not too useful unless you have the **Offline on Unmount** directive set, in which case the drive will be taken offline preventing wear on the tape during any future polling. Once the operator inserts a new tape, Bareos will recognize the drive on the next poll and automatically continue with the backup. Please see above for more details.

Collect Statistics = <yes|no> (default: yes)

Description = <string>
The Description directive provides easier human recognition, but is not used by Bareos directly.

Device Options = <string>
Some Device Type $^{\text{Sd Device}}$ require additional configuration. This can be specified in this directive, e.g. for

`GFAPI` **(GlusterFS)** A GlusterFS Storage can be used as Storage backend of Bareos. Prerequistes are a working GlusterFS storage system and the package `bareos-storage-glusterfs` . See

http://www.gluster.org/ for more information regarding GlusterFS installation and configuration and specifically https://gluster.readthedocs.org/en/latest/Administrator Guide/Bareos/ for Bareos integration. You can use following snippet to configure it as storage device:

```
Device {
  Name = GlusterStorage
  Archive Device = "Gluster Device"
  Device Options = "uri=gluster://server.example.com/volumename/bareos"
  Device Type = gfapi
  Media Type = GlusterFile
  Label Media = yes
  Random Access = yes
  Automatic Mount = yes
  Removable Media = no
  Always Open = no
}
```

Adapt server and volume name to your environment.

Version >= 15.2.0

`Rados` **(Ceph Object Store)** Here you configure the Ceph object store, which is accessed by the SD using the Rados library. Prerequistes are a working Ceph object store and the package `bareos-storage-ceph` . See http://ceph.com for more information regarding Ceph installation and configuration. Assuming that you have an object store with name `poolname` and your Ceph access is configured in `/etc/ceph/ceph.conf`, you can use following snippet to configure it as storage device:

```
Device {
  Name = RadosStorage
  Archive Device = "Rados Device"
  Device Options = "conffile=/etc/ceph/ceph.conf,poolname=poolname"
  Device Type = rados
  Media Type = RadosFile
  Label Media = yes
  Random Access = yes
  Automatic Mount = yes
  Removable Media = no
  Always Open = no
}
```

Version >= 15.2.0

Before the Device Options directive have been introduced, these options have to be configured in the Archive Device $^{\text{Sd}}_{\text{Device}}$ directive. This behavior have changed with Version >= 15.2.0 .
Version >= 15.2.0

Device Type = <DeviceType>

The Device Type specification allows you to explicitly define the kind of device you want to use. It may be one of the following:

`Tape` is used to access tape device and thus has sequential access. Tape devices are controlled using ioctl() calls.

`File` tells Bareos that the device is a file. It may either be a file defined on fixed medium or a removable filesystem such as USB. All files must be random access devices.

`Fifo` is a first-in-first-out sequential access read-only or write-only device.

`GFAPI` **(GlusterFS)** is used to access a GlusterFS storage. It must be configured using Device Options $^{\text{Sd}}_{\text{Device}}$. Version >= 14.2.2

`Rados` **(Ceph Object Store)** is used to access a Ceph object store. It must be configured using Device Options $^{\text{Sd}}_{\text{Device}}$. Version >= 14.2.2

The Device Type directive is not required in all cases. If it is not specified, Bareos will attempt to guess what kind of device has been specified using the Archive Device $^{\text{Sd}}_{\text{Device}}$ specification supplied. There are several advantages to explicitly specifying the Device Type. First, on some systems, block and character devices have the same type. Secondly, if you explicitly specify the Device Type, the mount point need not be defined until the device is opened. This is the case with most removable devices such as USB. If the Device Type is not explicitly specified, then the mount point must exist when the Storage daemon starts.

Diagnostic Device = <Strname>

Drive Crypto Enabled = <yes|no>
The default for this directive is **No**. If **Yes** the storage daemon can perform so called Application Managed Encryption (AME) using a special Storage Daemon plugin which loads and clears the Encryption key using the SCSI SPIN/SPOUT protocol.

Drive Index = <positive-integer>
The **Drive Index** that you specify is passed to the **mtx-changer** script and is thus passed to the **mtx** program. By default, the Drive Index is zero, so if you have only one drive in your autochanger, everything will work normally. However, if you have multiple drives, you must specify multiple Bareos Device resources (one for each drive). The first Device should have the Drive Index set to 0, and the second Device Resource should contain a Drive Index set to 1, and so on. This will then permit you to use two or more drives in your autochanger.

Drive Tape Alert Enabled = <yes|no>

Fast Forward Space File = <yes|no> (default: yes)
If **No**, the archive device is not required to support keeping track of the file number (**MTIOCGET** ioctl) during forward space file. If **Yes**, the archive device must support the `ioctl MTFSF` call, which virtually all drivers support, but in addition, your SCSI driver must keep track of the file number on the tape and report it back correctly by the **MTIOCGET** ioctl. Note, some SCSI drivers will correctly forward space, but they do not keep track of the file number or more seriously, they do not report end of medium.

Forward Space File = <yes|no> (default: yes)
If **Yes**, the archive device must support the `MTFSF ioctl` to forward space by file marks. If **No**, data must be read to advance the position on the device.

Forward Space Record = <yes|no> (default: yes)
If **Yes**, the archive device must support the **MTFSR ioctl** to forward space over records. If **No**, data must be read in order to advance the position on the device.

Free Space Command = <Strname>
Please note! *This directive is deprecated.*

Hardware End Of File = <yes|no> (default: yes)

Hardware End Of Medium = <yes|no> (default: yes)
All modern (after 1998) tape drives should support this feature. In doubt, use the **btape** program to test your drive to see whether or not it supports this function. If the archive device does not support the end of medium ioctl request `MTEOM`, set this parameter to **No**. The storage daemon will then use the forward space file function to find the end of the recorded data. In addition, your SCSI driver must keep track of the file number on the tape and report it back correctly by the **MTIOCGET** ioctl. Note, some SCSI drivers will correctly forward space to the end of the recorded data, but they do not keep track of the file number. On Linux machines, the SCSI driver has a **fast-eod** option, which if set will cause the driver to lose track of the file number. You should ensure that this option is always turned off using the **mt** program.

Label Block Size = <64512> (default: 64512)
The storage daemon will write the label blocks with the size configured here. Usually, you will not need to change this directive.

For more information on this directive, please see Tapespeed and blocksizes.
Version >= 14.2.0

Label Media = <yes|no> (default: no)
If **Yes**, permits this device to automatically label blank media without an explicit operator command. It does so by using an internal algorithm as defined on the Label Format $^{\text{Dir}}_{\text{Pool}}$ record in each Pool resource. If this is **No** as by default, Bareos will label tapes only by specific operator command (`label` in the Console) or when the tape has been recycled. The automatic labeling feature is most useful when writing to disk rather than tape volumes.

Label Type = <Label>
Defines the label type to use, see section Tape Labels: ANSI or IBM. This directive is implemented in the Director Pool resource (Label Type $^{\text{Dir}}_{\text{Pool}}$) and in the SD Device resource. If it is specified in the the SD Device resource, it will take precedence over the value passed from the Director to the SD. If it is set to a non-default value, make sure to also enable Check Labels $^{\text{Sd}}_{\text{Device}}$.

Maximum Block Size = <64512>
The Storage daemon will always attempt to write blocks of the specified size (in-bytes) to the archive device. As a consequence, this statement specifies both the default block size and the maximum block size. The size written never exceed the given size. If adding data to a block would cause it to exceed the given maximum size, the block will be written to the archive device, and the new data will begin a new block.

If no value is specified or zero is specified, the Storage daemon will use a default block size of 64,512 bytes (126 * 512).

Please note! *If your are using LTO drives, changing the block size after labeling the tape will result into unreadable tapes.*

Please read chapter Tapespeed and blocksizes, to see how to tune this value in a safe manner.

Maximum Changer Wait = <time> (default: 300)
This directive specifies the maximum time in seconds for Bareos to wait for an autochanger to change the volume. If this time is exceeded, Bareos will invalidate the Volume slot number stored in the catalog and try again. If no additional changer volumes exist, Bareos will ask the operator to intervene.

Maximum Concurrent Jobs = <positive-integer>
This directive specifies the maximum number of Jobs that can run concurrently on a specified Device. Using this directive, it is possible to have different Jobs using multiple drives, because when the Maximum Concurrent Jobs limit is reached, the Storage Daemon will start new Jobs on any other available compatible drive. This facilitates writing to multiple drives with multiple Jobs that all use the same Pool.

Maximum File Size = <Size64> (default: 1000000000)
No more than **size** bytes will be written into a given logical file on the volume. Once this size is reached, an end of file mark is written on the volume and subsequent data are written into the next file. Breaking long sequences of data blocks with file marks permits quicker positioning to the start of a given stream of data and can improve recovery from read errors on the volume. The default is one Gigabyte. This directive creates EOF marks only on tape media. However, regardless of the medium type (tape, disk, USB ...) each time a the Maximum File Size is exceeded, a record is put into the catalog database that permits seeking to that position on the medium for restore operations. If you set this to a small value (e.g. 1MB), you will generate lots of database records (JobMedia) and may significantly increase CPU/disk overhead.

If you are configuring an modern drive like LTO-4 or newer, you probably will want to set the **Maximum File Size** to 20GB or bigger to avoid making the drive stop to write an EOF mark.

For more info regarding this parameter, read the tape speed whitepaper: Bareos Whitepaper Tape Speed Tuning

Note, this directive does not limit the size of Volumes that Bareos will create regardless of whether they are tape or disk volumes. It changes only the number of EOF marks on a tape and the number of block positioning records that are generated. If you want to limit the size of all Volumes for a particular device, use the use the Maximum Volume Bytes $^{\text{Dir}}_{\text{Pool}}$ directive.

Maximum Job Spool Size = <Size64>
where the bytes specify the maximum spool size for any one job that is running. The default is no limit.

Maximum Network Buffer Size = <positive-integer>
where **bytes** specifies the initial network buffer size to use with the File daemon. This size will be adjusted down if it is too large until it is accepted by the OS. Please use care in setting this value since if it is too large, it will be trimmed by 512 bytes until the OS is happy, which may require a large number of system calls. The default value is 32,768 bytes.

The default size was chosen to be relatively large but not too big in the case that you are transmitting data over Internet. It is clear that on a high speed local network, you can increase this number and improve performance. For example, some users have found that if you use a value of 65,536 bytes they get five to ten times the throughput. Larger values for most users don't seem to improve performance. If you are interested in improving your backup speeds, this is definitely a place to experiment. You will probably also want to make the corresponding change in each of your File daemons conf files.

Maximum Open Volumes = <positive-integer> (default: 1)

Maximum Open Wait = <time> (default: 300)
This directive specifies the maximum amount of time that Bareos will wait for a device that is busy. If the device cannot be obtained, the current Job will be terminated in error. Bareos will re-attempt to open the drive the next time a Job starts that needs the the drive.

Maximum Part Size = <Size64>
Please note! *This directive is deprecated.*

Maximum Rewind Wait = <time> (default: 300)
This directive specifies the maximum time in seconds for Bareos to wait for a rewind before timing out. If this time is exceeded, Bareos will cancel the job.

Maximum Spool Size = <Size64>
where the bytes specify the maximum spool size for all jobs that are running. The default is no limit.

Maximum Volume Size = <Size64>
Please note! *This directive is deprecated.*
Normally, Maximum Volume Bytes $^{\text{Dir}}_{\text{Pool}}$ should be used instead. Limit the number of bytes that will be written onto a given volume on the archive device. This directive is used mainly in testing Bareos to simulate a small Volume.

Media Type = <Strname> (required)
The specified value names the type of media supported by this device, for example, "DLT7000". Media type names are arbitrary in that you set them to anything you want, but they must be known to the volume database to keep track of which storage daemons can read which volumes. In general, each different storage type should have a unique Media Type associated with it. The same **name-string** must appear in the appropriate Storage resource definition in the Director's configuration file.

Even though the names you assign are arbitrary (i.e. you choose the name you want), you should take care in specifying them because the Media Type is used to determine which storage device Bareos will select during restore. Thus you should probably use the same Media Type specification for all drives where the Media can be freely interchanged. This is not generally an issue if you have a single Storage daemon, but it is with multiple Storage daemons, especially if they have incompatible media.

For example, if you specify a Media Type of "DDS-4" then during the restore, Bareos will be able to choose any Storage Daemon that handles "DDS-4". If you have an autochanger, you might want to name the Media Type in a way that is unique to the autochanger, unless you wish to possibly use the Volumes in other drives. You should also ensure to have unique Media Type names if the Media is not compatible between drives. This specification is required for all devices.

In addition, if you are using disk storage, each Device resource will generally have a different mount point or directory. In order for Bareos to select the correct Device resource, each one must have a unique Media Type.

Minimum Block Size = <positive-integer>

This statement applies only to non-random access devices (e.g. tape drives). Blocks written by the storage daemon to a non-random archive device will never be smaller than the given size. The Storage daemon will attempt to efficiently fill blocks with data received from active sessions but will, if necessary, add padding to a block to achieve the required minimum size.

To force the block size to be fixed, as is the case for some non-random access devices (tape drives), set the **Minimum block size** and the **Maximum block size** to the same value. The default is that both the minimum and maximum block size are zero and the default block size is 64,512 bytes.

For example, suppose you want a fixed block size of 100K bytes, then you would specify:

```
Minimum block size = 100K
Maximum block size = 100K
```

Please note that if you specify a fixed block size as shown above, the tape drive must either be in variable block size mode, or if it is in fixed block size mode, the block size (generally defined by `mt`) **must** be identical to the size specified in Bareos – otherwise when you attempt to re-read your Volumes, you will get an error.

If you want the block size to be variable but with a 63K minimum and 200K maximum (and default as well), you would specify:

```
Minimum block size =  63K
Maximum block size = 200K
```

Mount Command = <Strname>

This directive specifies the command that must be executed to mount devices such as many USB devices. Before the command is executed, %a is replaced with the Archive Device, and %m with the Mount Point.

See the Edit Codes for Mount and Unmount Directives section below for more details of the editing codes that can be used in this directive.

If you need to specify multiple commands, create a shell script.

Mount Point = <Strname>

Directory where the device can be mounted. This directive is used only for devices that have **Requires Mount** enabled such as USB file devices.

Name = <name> (required)

Unique identifier of the resource.

Specifies the Name that the Director will use when asking to backup or restore to or from to this device. This is the logical Device name, and may be any string up to 127 characters in length. It is generally a good idea to make it correspond to the English name of the backup device. The

physical name of the device is specified on the Archive Device Sd Device directive. The name you specify here is also used in your Director's configuration file on the Storage Resource in its Storage resource.

No Rewind On Close = <yes|no> (default: yes)
If **Yes** the storage daemon will not try to rewind the device on closing the device e.g. when shutting down the Storage daemon. This allows you to do an emergency shutdown of the Daemon without the need to wait for the device to rewind. On restarting and opening the device it will get a rewind anyhow and this way services don't have to wait forever for a tape to spool back.

Offline On Unmount = <yes|no> (default: no)
If **Yes** the archive device must support the `MTOFFL ioctl` to rewind and take the volume offline. In this case, Bareos will issue the offline (eject) request before closing the device during the **unmount** command. If **No** Bareos will not attempt to offline the device before unmounting it. After an offline is issued, the cassette will be ejected thus **requiring operator intervention** to continue, and on some systems require an explicit load command to be issued (**mt -f /dev/xxx load**) before the system will recognize the tape. If you are using an autochanger, some devices require an offline to be issued prior to changing the volume. However, most devices do not and may get very confused.

If you are using a Linux 2.6 kernel or other OSes such as FreeBSD or Solaris, the Offline On Unmount will leave the drive with no tape, and Bareos will not be able to properly open the drive and may fail the job.

Query Crypto Status = <yes|no>
The default for this directive is **No**. If **Yes** the storage daemon may query the tape device for it security status. This only makes sense when Drive Crypto Enabled is also set to **yes** as the actual query is performed by the same Storage Daemon plugin and using the same SCSI SPIN protocol.

Random Access = <yes|no> (default: no)
If **Yes**, the archive device is assumed to be a random access medium which supports the **lseek** (or **lseek64** if Largefile is enabled during configuration) facility. This should be set to **Yes** for all file systems such as USB, and fixed files. It should be set to **No** for non-random access devices such as tapes and named pipes.

Removable Media = <yes|no> (default: yes)
If **Yes**, this device supports removable media (for example tapes). If **No**, media cannot be removed (for example, an intermediate backup area on a hard disk). If **Removable media** is enabled on a File device (as opposed to a tape) the Storage daemon will assume that device may be something like a USB device that can be removed or a simply a removable harddisk. When attempting to open such a device, if the Volume is not found (for File devices, the Volume name is the same as the Filename), then the Storage daemon will search the entire device looking for likely Volume names, and for each one found, it will ask the Director if the Volume can be used. If so, the Storage daemon will use the first such Volume found. Thus it acts somewhat like a tape drive – if the correct Volume is not found, it looks at what actually is found, and if it is an appendable Volume, it will use it.

If the removable medium is not automatically mounted (e.g. udev), then you might consider using additional Storage daemon device directives such as **Requires Mount**, **Mount Point**, **Mount Command**, and **Unmount Command**, all of which can be used in conjunction with **Removable Media**.

Requires Mount = <yes|no> (default: no)
When this directive is enabled, the Storage daemon will submit a **Mount Command** before attempting to open the device. You must set this directive to **yes** for removable file systems such as USB devices that are not automatically mounted by the operating system when plugged in or opened by Bareos. It should be set to **no** for all other devices such as tapes and fixed filesystems. It should also be set to **no** for any removable device that is automatically mounted by the operating system when opened (e.g. USB devices mounted by udev or hotplug). This directive indicates if the device requires to be mounted using the **Mount Command**. To be able to write devices need a mount, the following directives must also be defined: **Mount Point**, **Mount Command**, and **Unmount Command**.

Spool Directory = <directory>
specifies the name of the directory to be used to store the spool files for this device. This directory is also used to store temporary part files when writing to a device that requires mount (USB). The default is to use the working directory.

Two Eof = <yes|no> (default: no)
If **Yes**, Bareos will write two end of file marks when terminating a tape – i.e. after the last job or at the end of the medium. If **No**, Bareos will only write one end of file to terminate the tape.

Unmount Command = <Strname>
This directive specifies the command that must be executed to unmount devices such as many USB devices. Before the command is executed, %a is replaced with the Archive Device, and %m with the Mount Point.

Most frequently, you will define it as follows:

```
Unmount Command = "/bin/umount %m"
```

See the Edit Codes for Mount and Unmount Directives section below for more details of the editing codes that can be used in this directive.

If you need to specify multiple commands, create a shell script.

Use Mtiocget = <yes|no> (default: yes)
If **No**, the operating system is not required to support keeping track of the file number and reporting it in the (**MTIOCGET** ioctl). If you must set this to No, Bareos will do the proper file position determination, but it is very unfortunate because it means that tape movement is very inefficient. Fortunately, this operation system deficiency seems to be the case only on a few *BSD systems. Operating systems known to work correctly are Solaris, Linux and FreeBSD.

Volume Capacity = <Size64>

Volume Poll Interval = <time> (default: 300)
If the time specified on this directive is non-zero, Bareos will periodically poll (or read) the drive at the specified interval to see if a new volume has been mounted. If the time interval is zero, no polling will occur. This directive can be useful if you want to avoid operator intervention via the console. Instead, the operator can simply remove the old volume and insert the requested one, and Bareos on the next poll will recognize the new tape and continue. Please be aware that if you set this interval too small, you may excessively wear your tape drive if the old tape remains in the drive, since Bareos will read it on each poll.

Write Part Command = <Strname>
Please note! *This directive is deprecated.*

10.4.1 Edit Codes for Mount and Unmount Directives

Before submitting the **Mount Command**, or **Unmount Command** directives to the operating system, Bareos performs character substitution of the following characters:

```
%% = %
%a = Archive device name
%e = erase (set if cannot mount and first part)
%n = part number
%m = mount point
%v = last part name (i.e. filename)
```

10.4.2 Devices that require a mount (USB)

Requires Mount Sd Device You must set this directive to **yes** for removable devices such as USB unless they are automounted, and to **no** for all other devices (tapes/files). This directive indicates if the device requires to be mounted to be read, and if it must be written in a special way. If it set, Mount Point Sd Device, Mount Command Sd Device and Unmount Command Sd Device directives must also be defined.

Mount Point Sd Device Directory where the device can be mounted.

Mount Command Sd Device Command that must be executed to mount the device. Before the command is executed, %a is replaced with the Archive Device, and %m with the Mount Point.

Most frequently, you will define it as follows:

```
Mount Command = "/bin/mount -t iso9660 -o ro %a %m"
```

For some media, you may need multiple commands. If so, it is recommended that you use a shell script instead of putting them all into the Mount Command. For example, instead of this:

```
Mount Command = "/usr/local/bin/mymount"
```

Where that script contains:

```
#!/bin/sh
ndasadmin enable -s 1 -o w
sleep 2
mount /dev/ndas-00323794-0p1 /backup
```

Similar consideration should be given to all other Command parameters.

Unmount Command Sd Device Command that must be executed to unmount the device. Before the command is executed, %a is replaced with the Archive Device, and %m with the Mount Point.

Most frequently, you will define it as follows:

```
Unmount Command = "/bin/umount %m"
```

If you need to specify multiple commands, create a shell script.

10.5 Autochanger Resource

The Autochanger resource supports single or multiple drive autochangers by grouping one or more Device resources into one unit called an autochanger in Bareos (often referred to as a "tape library" by autochanger manufacturers).
If you have an Autochanger, and you want it to function correctly, you **must** have an Autochanger resource in your Storage conf file, and your Director's Storage directives that want to use an Autochanger must refer to the Autochanger resource name.

configuration directive name	type of data	default value	remark
Changer Command	= Strname		**required**
Changer Device	= Strname		**required**
Description	= string		
Device	= ResourceList		**required**
Name	= **name**		**required**

Changer Command = <Strname> (required)
This command specifies an external program to be called that will automatically change volumes as required by Bareos. Most frequently, you will specify the Bareos supplied `mtx-changer` script as follows. If it is specified here, it needs not to be specified in the Device resource. If it is also specified in the Device resource, it will take precedence over the one specified in the Autochanger resource.

Changer Device = <Strname> (required)

The specified **name-string** gives the system file name of the autochanger device name. If specified in this resource, the Changer Device name is not needed in the Device resource. If it is specified in the Device resource (see above), it will take precedence over one specified in the Autochanger resource.

Description = <string>

Device = <ResourceList> (required)
Specifies the names of the Device resource or resources that correspond to the autochanger drive. If you have a multiple drive autochanger, you must specify multiple Device names, each one referring to a separate Device resource that contains a Drive Index specification that corresponds to the drive number base zero. You may specify multiple device names on a single line separated by commas, and/or you may specify multiple Device directives.

Name = <name> (required)
Specifies the Name of the Autochanger. This name is used in the Director's Storage definition to refer to the autochanger.

The following is an example of a valid Autochanger resource definition:

```
Autochanger {
  Name = "DDS-4-changer"
  Device = DDS-4-1, DDS-4-2, DDS-4-3
  Changer Device = /dev/sg0
  Changer Command = "/usr/lib/bareos/scripts/mtx-changer %c %o %S %a %d"
}
Device {
  Name = "DDS-4-1"
  Drive Index = 0
  Autochanger = yes
  ...
}
Device {
  Name = "DDS-4-2"
  Drive Index = 1
  Autochanger = yes
  ...
Device {
  Name = "DDS-4-3"
  Drive Index = 2
  Autochanger = yes
  Autoselect = no
  ...
}
```

Please note that it is important to include the **Autochanger = yes** directive in each Device definition that belongs to an Autochanger. A device definition should not belong to more than one Autochanger resource. Also, your Device directive in the Storage resource of the Director's conf file should have the Autochanger's resource name rather than a name of one of the Devices.
If you have a drive that physically belongs to an Autochanger but you don't want to have it automatically used when Bareos references the Autochanger for backups, for example, you want to reserve it for restores, you can add the directive:

```
Autoselect = no
```

to the Device resource for that drive. In that case, Bareos will not automatically select that drive when accessing the Autochanger. You can still use the drive by referencing it by the Device name directly rather than the Autochanger name. An example of such a definition is shown above for the Device DDS-4-3, which will not be selected when the name DDS-4-changer is used in a Storage definition, but will be used if DDS-4-3 is used.

10.6 Messages Resource

For a description of the Messages Resource, please see the Messages Resource chapter of this manual.

10.7 Example Storage Daemon Configuration File

A example Storage Daemon configuration file might be the following:

```
#
# Default Bareos Storage Daemon Configuration file
#
#  For Bareos release 12.4.4 (12 June 2013) -- suse SUSE Linux Enterprise Server 11 (x86_64)
#
# You may need to change the name of your tape drive
#   on the "Archive Device" directive in the Device
#   resource.  If you change the Name and/or the
#   "Media Type" in the Device resource, please ensure
#   that dird.conf has corresponding changes.
#

Storage {                             # definition of myself
  Name = bareos-storage-sd
  Maximum Concurrent Jobs = 20

  # remove comment in next line to load plugins from specified directory
  # Plugin Directory = /usr/lib64/bareos/plugins
}

#
# List Directors who are permitted to contact Storage daemon
#
Director {
  Name = bareos-dir
  Password = "XXX_REPLACE_WITH_STORAGE_PASSWORD_XXX"
}

#
# Restricted Director, used by tray-monitor to get the
#   status of the storage daemon
#
Director {
  Name = bareos-storage-mon
  Password = "XXX_REPLACE_WITH_STORAGE_MONITOR_PASSWORD_XXX"
  Monitor = yes
}

#
# Note, for a list of additional Device templates please
#  see the directory <bareos-source>/examples/devices
# Or follow the following link:
#  http://bareos.svn.sourceforge.net/viewvc/bareos/trunk/bareos/examples/devices/
#

#
# Devices supported by this Storage daemon
# To connect, the Director's bareos-dir.conf must have the
#  same Name and MediaType.
#

Device {
  Name = FileStorage
  Media Type = File
  Archive Device = /var/lib/bareos/storage
  LabelMedia = yes;                   # lets Bareos label unlabeled media
  Random Access = Yes;
  AutomaticMount = yes;               # when device opened, read it
  RemovableMedia = no;
  AlwaysOpen = no;
}

#
# An autochanger device with two drives
#
#Autochanger {
#  Name = Autochanger
#  Device = Drive-1
#  Device = Drive-2
#  Changer Command = "/usr/lib/bareos/scripts/mtx-changer %c %o %S %a %d"
#  Changer Device = /dev/sg0
#}
```

```
#Device {
#  Name = Drive-1                       #
#  Drive Index = 0
#  Media Type = DLT-8000
#  Archive Device = /dev/nst0
#  AutomaticMount = yes;                # when device opened, read it
#  AlwaysOpen = yes;
#  RemovableMedia = yes;
#  RandomAccess = no;
#  AutoChanger = yes
#  #
#  # Enable the Alert command only if you have the mtx package loaded
#  # Note, apparently on some systems, tapeinfo resets the SCSI controller
#  #  thus if you turn this on, make sure it does not reset your SCSI
#  #  controller.  I have never had any problems, and smartctl does
#  #  not seem to cause such problems.
#  #
#  Alert Command = "sh -c 'tapeinfo -f %c |grep TapeAlert|cat'"
#  If you have smartctl, enable this, it has more info than tapeinfo
#  Alert Command = "sh -c 'smartctl -H -l error %c'"
#}

#Device {
#  Name = Drive-2                       #
#  Drive Index = 1
#  Media Type = DLT-8000
#  Archive Device = /dev/nst1
#  AutomaticMount = yes;                # when device opened, read it
#  AlwaysOpen = yes;
#  RemovableMedia = yes;
#  RandomAccess = no;
#  AutoChanger = yes
#  # Enable the Alert command only if you have the mtx package loaded
#  Alert Command = "sh -c 'tapeinfo -f %c |grep TapeAlert|cat'"
#  If you have smartctl, enable this, it has more info than tapeinfo
#  Alert Command = "sh -c 'smartctl -H -l error %c'"
#}

#
# A Linux or Solaris LTO-2 tape drive
#
#Device {
#  Name = LTO-2
#  Media Type = LTO-2
#  Archive Device = /dev/nst0
#  AutomaticMount = yes;                # when device opened, read it
#  AlwaysOpen = yes;
#  RemovableMedia = yes;
#  RandomAccess = no;
#  Maximum File Size = 3GB
## Changer Command = "/usr/lib/bareos/scripts/mtx-changer %c %o %S %a %d"
## Changer Device = /dev/sg0
## AutoChanger = yes
#  # Enable the Alert command only if you have the mtx package loaded
## Alert Command = "sh -c 'tapeinfo -f %c |grep TapeAlert|cat'"
## If you have smartctl, enable this, it has more info than tapeinfo
## Alert Command = "sh -c 'smartctl -H -l error %c'"
#}

#
# A Linux or Solaris LTO-3 tape drive
#
#Device {
#  Name = LTO-3
#  Media Type = LTO-3
#  Archive Device = /dev/nst0
#  AutomaticMount = yes;                # when device opened, read it
#  AlwaysOpen = yes;
#  RemovableMedia = yes;
#  RandomAccess = no;
#  Maximum File Size = 4GB
## Changer Command = "/usr/lib/bareos/scripts/mtx-changer %c %o %S %a %d"
## Changer Device = /dev/sg0
## AutoChanger = yes
#  # Enable the Alert command only if you have the mtx package loaded
```

```
## Alert Command = "sh -c 'tapeinfo -f %c |grep TapeAlert|cat'"
## If you have smartctl, enable this, it has more info than tapeinfo
## Alert Command = "sh -c 'smartctl -H -l error %c'"
#}

#
# A Linux or Solaris LTO-4 tape drive
#
#Device {
#  Name = LTO-4
#  Media Type = LTO-4
#  Archive Device = /dev/nst0
#  AutomaticMount = yes;               # when device opened, read it
#  AlwaysOpen = yes;
#  RemovableMedia = yes;
#  RandomAccess = no;
#  Maximum File Size = 5GB
## Changer Command = "/usr/lib/bareos/scripts/mtx-changer %c %o %S %a %d"
## Changer Device = /dev/sg0
## AutoChanger = yes
#  # Enable the Alert command only if you have the mtx package loaded
## Alert Command = "sh -c 'tapeinfo -f %c |grep TapeAlert|cat'"
## If you have smartctl, enable this, it has more info than tapeinfo
## Alert Command = "sh -c 'smartctl -H -l error %c'"
#}




#
# A FreeBSD tape drive
#
#Device {
#  Name = DDS-4
#  Description = "DDS-4 for FreeBSD"
#  Media Type = DDS-4
#  Archive Device = /dev/nsa1
#  AutomaticMount = yes;               # when device opened, read it
#  AlwaysOpen = yes
#  Offline On Unmount = no
#  Hardware End of Medium = no
#  BSF at EOM = yes
#  Backward Space Record = no
#  Fast Forward Space File = no
#  TWO EOF = yes
#  If you have smartctl, enable this, it has more info than tapeinfo
#  Alert Command = "sh -c 'smartctl -H -l error %c'"
#}

#
# Send all messages to the Director,
# mount messages also are sent to the email address
#
Messages {
  Name = Standard
  director = bareos-dir = all
}
```

Chapter 11

Client/File Daemon Configuration

The Client (or File Daemon) Configuration is one of the simpler ones to specify. Generally, other than changing the Client name so that error messages are easily identified, you will not need to modify the default Client configuration file.
For a general discussion of configuration file and resources including the data types recognized by **Bareos**, please see the Configuration chapter of this manual. The following Client Resource definitions must be defined:

- Client – to define what Clients are to be backed up.
- Director – to define the Director's name and its access password.
- Messages – to define where error and information messages are to be sent.

11.1 Client Resource

The Client Resource (or FileDaemon) resource defines the name of the Client (as used by the Director) as well as the port on which the Client listens for Director connections.
Start of the Client records. There must be one and only one Client resource in the configuration file, since it defines the properties of the current client program.

configuration directive name	type of data	default value	remark
Absolute Job Timeout	= positive-integer		
Allow Bandwidth Bursting	= yes|no	no	
Allowed Job Command	= string-list		
Allowed Script Dir	= `DirectoryList`		
Always Use LMDB	= yes|no	no	
Compatible	= yes|no	no	
Description	= string		
FD Address	= net-address	9102	
FD Addresses	= net-addresses	9102	
FD Port	= net-port	9102	
FD Source Address	= net-address	0	
Heartbeat Interval	= time	0	
LMDB Threshold	= positive-integer		
Log Timestamp Format	= string		
Maximum Bandwidth Per Job	= speed		
Maximum Concurrent Jobs	= positive-integer	20	
Maximum Connections	= positive-integer	42	
Maximum Network Buffer Size	= positive-integer		
Messages	= resource-name		
Name	**= name**		**required**
Pid Directory	= directory	/var/lib/bareos *(platform specific)*	
Pki Cipher	= `EncryptionCipher`	aes128	
Pki Encryption	= yes|no	no	
Pki Key Pair	= directory		

Pki Master Key	= DirectoryList		
Pki Signatures	= yes|no	no	
Pki Signer	= DirectoryList		
Plugin Directory	= directory		
Plugin Names	= PluginNames		
Scripts Directory	= directory		
SD Connect Timeout	= time	1800	
Secure Erase Command	= string		
Sub Sys Directory	= *directory*		*deprecated*
TLS Allowed CN	= string-list		
TLS Authenticate	= yes|no		
TLS CA Certificate Dir	= directory		
TLS CA Certificate File	= directory		
TLS Certificate	= directory		
TLS Certificate Revocation List	= directory		
TLS Cipher List	= string		
TLS Enable	= yes|no		
TLS Key	= directory		
TLS Require	= yes|no		
TLS Verify Peer	= yes|no	yes	
Ver Id	= string		
Working Directory	= directory	/var/lib/bareos *(platform specific)*	

Absolute Job Timeout = <positive-integer>

Allow Bandwidth Bursting = <yes|no> (default: no)

This option sets if there is Bandwidth Limiting in effect if the limiting code can use bursting e.g. when from a certain timeslice not all bandwidth is used this bandwidth can be used in a next timeslice. Which mean you will get a smoother limiting which will be much closer to the actual limit set but it also means that sometimes the bandwidth will be above the setting here.

Allowed Job Command = <string-list>

This directive filters what type of jobs the filedaemon should allow. Until now we had the -b (backup only) and -r (restore only) flags which could be specified at the startup of the filedaemon.

Allowed Job Command can be defined globally for all directors by adding it to the global filedaemon resource or for a specific director when added to the director resource.

You specify all commands you want to be executed by the filedaemon. When you don't specify the option it will be empty which means all commands are allowed.
The following example shows how to use this functionality:

```
Director {
  Name = <name>
  Password = <password>
  Allowed Job Command = "backup"
  Allowed Job Command = "runscript"
}
```

All commands that are allowed are specified each on a new line with the Allowed Job Command keyword.

The following job commands are recognized:

backup allow backups to be made

restore allow restores to be done

verify allow verify jobs to be done

estimate allow estimate cmds to be executed

runscript allow runscripts to run

Only the important commands the filedaemon can perform are filtered, as some commands are part of the above protocols and by disallowing the action the other commands are not invoked at all.

If runscripts are not needed it would be recommended as a security measure to disable running those or only allow the commands that you really want to be used.

Runscripts are particularly a problem as they allow the filedaemon to run arbitrary commands. You may also look into the Allowed Script Dir $^{\text{Fd}}_{\text{Client}}$ keyword to limit the impact of the runscript command.

Allowed Script Dir = <DirectoryList>

This directive limits the impact of the runscript command of the filedaemon.

It can be specified either for all directors by adding it to the global filedaemon resource or for a specific director when added to the director resource.

All directories in which the scripts or commands are located that you allow to be run by the runscript command of the filedaemon. Any program not in one of these paths (or subpaths) cannot be used. The implementation checks if the full path of the script starts with one of the specified paths.

The following example shows how to use this functionality:

```
# bareos-fd.conf
Director {
  Name = <name>
  Password = <password>
  Allowed Script Dir = "/etc/bareos"
  Allowed Script Dir = "/path/that/is/also/allowed"
}



# bareos-dir.conf
Job {
   Name = "<name>"
   JobDefs = "DefaultJob"
   Client Run Before Job = "/etc/bareos/runbeforejob.sh"   # this will run
   Client Run Before Job = "/tmp/runbeforejob.sh"          # this will be blocked
}
```

Always Use LMDB = <yes|no> (default: no)

Compatible = <yes|no> (default: no)

This directive enables the compatible mode of the file daemon. In this mode the file daemon will try to be as compatible to a native Bacula file daemon as possible. Enabling this option means that certain new options available in Bareos cannot be used as they would lead to data not being able to be restored by a Native Bareos file daemon.

The default value for this directive was changed from yes to no since Bareos Version >= 15.2.0 .

When you want to use bareos-only features, the value of compatible must be no.

Description = <string>

FD Address = <net-address> (default: 9102)

This record is optional, and if it is specified, it will cause the File daemon server (for Director connections) to bind to the specified **IP-Address**, which is either a domain name or an IP address specified as a dotted quadruple.

FD Addresses = <net-addresses> (default: 9102)

Specify the ports and addresses on which the File daemon listens for Director connections. Probably the simplest way to explain is to show an example:

```
FDAddresses  = {
  ip = { addr = 1.2.3.4; port = 1205; }
  ipv4 = {
    addr = 1.2.3.4; port = http; }
  ipv6 = {
    addr = 1.2.3.4;
    port = 1205;
  }
  ip = {
    addr = 1.2.3.4
    port = 1205
  }
  ip = { addr = 1.2.3.4 }
  ip = {
    addr = 201:220:222::2
  }
  ip = {
    addr = bluedot.thun.net
  }
}
```

where ip, ip4, ip6, addr, and port are all keywords. Note, that the address can be specified as either a dotted quadruple, or IPv6 colon notation, or as a symbolic name (only in the ip specification). Also, the port can be specified as a number or as the mnemonic value from the /etc/services file. If a port is not specified, the default will be used. If an ip section is specified, the resolution can be made either by IPv4 or IPv6. If ip4 is specified, then only IPv4 resolutions will be permitted, and likewise with ip6.

FD Port = <net-port> (default: 9102)
This specifies the port number on which the Client listens for Director connections. It must agree with the FDPort specified in the Client resource of the Director's configuration file.

FD Source Address = <net-address> (default: 0)
This record is optional, and if it is specified, it will cause the File daemon server (for Storage connections) to bind to the specified **IP-Address**, which is either a domain name or an IP address specified as a dotted quadruple. If this record is not specified, the kernel will choose the best address according to the routing table (the default).

Heartbeat Interval = <time> (default: 0)
This record defines an interval of time in seconds. For each heartbeat that the File daemon receives from the Storage daemon, it will forward it to the Director. In addition, if no heartbeat has been received from the Storage daemon and thus forwarded the File daemon will send a heartbeat signal to the Director and to the Storage daemon to keep the channels active. Setting the interval to 0 (zero) disables the heartbeat. This feature is particularly useful if you have a router that does not follow Internet standards and times out a valid connection after a short duration despite the fact that keepalive is set. This usually results in a broken pipe error message.

LMDB Threshold = <positive-integer>

Log Timestamp Format = <string>

Version >= 15.2.3

Maximum Bandwidth Per Job = <speed>
The speed parameter specifies the maximum allowed bandwidth that a job may use. The speed parameter should be specified in k/s, kb/s, m/s or mb/s.

Maximum Concurrent Jobs = <positive-integer> (default: 20)
where <number> is the maximum number of Jobs that should run concurrently. Each contact from

the Director (e.g. status request, job start request) is considered as a Job, so if you want to be able to do a **status** request in the console at the same time as a Job is running, you will need to set this value greater than 1.

Maximum Connections = <positive-integer> (default: 42)

Version >= 15.2.3

Maximum Network Buffer Size = <positive-integer>
where <bytes> specifies the initial network buffer size to use with the File daemon. This size will be adjusted down if it is too large until it is accepted by the OS. Please use care in setting this value since if it is too large, it will be trimmed by 512 bytes until the OS is happy, which may require a large number of system calls. The default value is 65,536 bytes.

Note, on certain Windows machines, there are reports that the transfer rates are very slow and this seems to be related to the default 65,536 size. On systems where the transfer rates seem abnormally slow compared to other systems, you might try setting the Maximum Network Buffer Size to 32,768 in both the File daemon and in the Storage daemon.

Messages = <resource-name>

Name = <name> (required)
The name of this resource. It is used to reference to it.

The client name that must be used by the Director when connecting. Generally, it is a good idea to use a name related to the machine so that error messages can be easily identified if you have multiple Clients. This directive is required.

Pid Directory = <directory> (default: /var/lib/bareos *(platform specific)*)
This directive specifies a directory in which the File Daemon may put its process Id file files. The process Id file is used to shutdown Bareos and to prevent multiple copies of Bareos from running simultaneously.

The Bareos file daemon uses a platform specific default value, that is defined at compile time. Typically on Linux systems, it is set to `/var/lib/bareos/` or `/var/run/`.

Pki Cipher = <EncryptionCipher> (default: aes128)
See the Data Encryption chapter of this manual.

Depending on the openssl library version different ciphers are available. To choose the desired cipher, you can use the PKI Cipher option in the filedaemon configuration. Note that you have to set Compatible $^{\text{Fd}}_{\text{Client}}$ = no:

```
FileDaemon {
   Name = client1-fd

   # encryption configuration
   PKI Signatures = Yes                          # Enable Data Signing
   PKI Encryption = Yes                          # Enable Data Encryption
   PKI Keypair    = "/etc/bareos/client1-fd.pem" # Public and Private Keys
   PKI Master Key = "/etc/bareos/master.cert"    # ONLY the Public Key
   PKI Cipher     = aes128                       # specify desired PKI Cipher here
}
```

The available options (and ciphers) are:

- aes128
- aes192
- aes256
- camellia128
- camellia192

- camellia256
- aes128hmacsha1
- aes256hmacsha1
- blowfish

They depend on the version of the openssl library installed.

For decryption of encrypted data, the right decompression algorithm should be automatically chosen.

Pki Encryption = <yes|no> (default: no)
See Data Encryption.

Pki Key Pair = <directory>
See Data Encryption.

Pki Master Key = <DirectoryList>
See Data Encryption.

Pki Signatures = <yes|no> (default: no)
See Data Encryption.

Pki Signer = <DirectoryList>
See Data Encryption.

Plugin Directory = <directory>
This directive specifies a directory in which the File Daemon searches for plugins with the name **<pluginname>-fd.so** which it will load at startup. Typically on Linux systems, it is set to `/usr/lib/bareos/plugins/` or `/usr/lib64/bareos/plugins/`.

Plugin Names = <PluginNames>

Scripts Directory = <directory>

SD Connect Timeout = <time> (default: 1800)
This record defines an interval of time that the File daemon will try to connect to the Storage daemon. If no connection is made in the specified time interval, the File daemon cancels the Job.

Secure Erase Command = <string>
Specify command that will be called when bareos unlinks files.

When files are no longer needed, Bareos will delete (unlink) them. With this directive, it will call the specified command to delete these files. See Secure Erase Command for details.
Version >= 15.2.1

Sub Sys Directory = <directory>
Please note! *This directive is deprecated.*

TLS Allowed CN = <string-list>

TLS Authenticate = <yes|no>

TLS CA Certificate Dir = <directory>

TLS CA Certificate File = <directory>

TLS Certificate = <directory>

TLS Certificate Revocation List = <directory>

TLS Cipher List = <string>

TLS Enable = <yes|no>
Bareos can be configured to encrypt all its network traffic. See chapter TLS Configuration Directives to see how the Bareos Director (and the other components) have to be configured to use TLS.

TLS Key = <directory>

TLS Require = <yes|no>

TLS Verify Peer = <yes|no> (default: yes)

Ver Id = <string>

Working Directory = <directory> (default: /var/lib/bareos *(platform specific)*)
This directive is optional and specifies a directory in which the File daemon may put its status files.

On Win32 systems, in some circumstances you may need to specify a drive letter in the specified working directory path. Also, please be sure that this directory is writable by the SYSTEM user otherwise restores may fail (the bootstrap file that is transferred to the File daemon from the Director is temporarily put in this directory before being passed to the Storage daemon).

The following is an example of a valid Client resource definition:

```
Client {                            # this is me
  Name = rufus-fd
}
```

11.2 Director Resource

The Director resource defines the name and password of the Directors that are permitted to contact this Client.

configuration directive name	type of data	default value	remark
Address	= string		
Allowed Job Command	= string-list		
Allowed Script Dir	= DirectoryList		
Description	= string		
Maximum Bandwidth Per Job	= speed		
Monitor	= yes|no	no	
Name	**= name**		**required**
Password	**= Md5password**		**required**
TLS Allowed CN	= string-list		
TLS Authenticate	= yes|no		
TLS CA Certificate Dir	= directory		
TLS CA Certificate File	= directory		
TLS Certificate	= directory		
TLS Certificate Revocation List	= directory		
TLS Cipher List	= string		
TLS DH File	= directory		
TLS Enable	= yes|no		
TLS Key	= directory		
TLS Require	= yes|no		
TLS Verify Peer	= yes|no	yes	

Address = <string>

Allowed Job Command = <string-list>
see Allowed Job Command Fd Client

Allowed Script Dir = <DirectoryList>
see Allowed Script Dir Fd Client

Description = <string>

Maximum Bandwidth Per Job = <speed>
The speed parameter specifies the maximum allowed bandwidth that a job may use when started from this Director. The speed parameter should be specified in k/s, Kb/s, m/s or Mb/s.

Monitor = <yes|no> (default: no)
If Monitor is set to **no**, this director will have full access to this Client. If Monitor is set to **yes**, this director will only be able to fetch the current status of this Client.

Please note that if this director is being used by a Monitor, we highly recommend to set this directive to **yes** to avoid serious security problems.

Name = <name> (required)
The name of the Director that may contact this Client. This name must be the same as the name specified on the Director resource in the Director's configuration file. Note, the case (upper/lower) of the characters in the name are significant (i.e. S is not the same as s). This directive is required.

Password = <Md5password> (required)
Specifies the password that must be supplied for a Director to be authorized. This password must be the same as the password specified in the Client resource in the Director's configuration file. This

directive is required.

TLS Allowed CN = <string-list>

TLS Authenticate = <yes|no>

TLS CA Certificate Dir = <directory>

TLS CA Certificate File = <directory>

TLS Certificate = <directory>

TLS Certificate Revocation List = <directory>

TLS Cipher List = <string>

TLS DH File = <directory>

TLS Enable = <yes|no>
Bareos can be configured to encrypt all its network traffic. See chapter TLS Configuration Directives to see how the Bareos Director (and the other components) have to be configured to use TLS.

TLS Key = <directory>

TLS Require = <yes|no>

TLS Verify Peer = <yes|no> (default: yes)

Thus multiple Directors may be authorized to use this Client's services. Each Director will have a different name, and normally a different password as well.
The following is an example of a valid Director resource definition:

```
#
# List Directors who are permitted to contact the File daemon
#
Director {
  Name = HeadMan
  Password = very_good                # password HeadMan must supply
}
Director {
  Name = Worker
  Password = not_as_good
  Monitor = Yes
}
```

11.3 Messages Resource

Please see the Messages Resource Chapter of this manual for the details of the Messages Resource. There must be at least one Message resource in the Client configuration file.

11.4 Example Client Configuration File

An example File Daemon configuration file might be the following:

```
#
# Default  Bareos File Daemon Configuration file
#
#  For Bareos release 12.4.4 (12 June 2013)
#
# There is not much to change here except perhaps the
# File daemon Name to
#

#
# List Directors who are permitted to contact this File daemon
#
Director {
  Name = bareos-dir
  Password = "aEODFz89JgUbWpuG6hP4OTuAoMvfM1PaJwO+ShXGqXsP"
}

#
# Restricted Director, used by tray-monitor to get the
#   status of the file daemon
#
Director {
  Name = client1-mon
  Password = "8BoVwTju2TQlafdHFExRIJmUcHUMoIyIqPJjbvcSO61P"
  Monitor = yes
}

#
# "Global" File daemon configuration specifications
#
FileDaemon {                          # this is me
  Name = client1-fd
  Maximum Concurrent Jobs = 20

  # remove comment in next line to load plugins from specified directory
  # Plugin Directory = /usr/lib64/bareos/plugins
}

# Send all messages except skipped files back to Director
Messages {
  Name = Standard
  director = client1-dir = all, !skipped, !restored
}
```

Chapter 12

Messages Resource

The Messages resource defines how messages are to be handled and destinations to which they should be sent.
Even though each daemon has a full message handler, within the File daemon and the Storage daemon, you will normally choose to send all the appropriate messages back to the Director. This permits all the messages associated with a single Job to be combined in the Director and sent as a single email message to the user, or logged together in a single file.
Each message that Bareos generates (i.e. that each daemon generates) has an associated type such as INFO, WARNING, ERROR, FATAL, etc. Using the message resource, you can specify which message types you wish to see and where they should be sent. In addition, a message may be sent to multiple destinations. For example, you may want all error messages both logged as well as sent to you in an email. By defining multiple messages resources, you can have different message handling for each type of Job (e.g. Full backups versus Incremental backups).
In general, messages are attached to a Job and are included in the Job report. There are some rare cases, where this is not possible, e.g. when no job is running, or if a communications error occurs between a daemon and the director. In those cases, the message may remain in the system, and should be flushed at the end of the next Job. However, since such messages are not attached to a Job, any that are mailed will be sent to **/usr/lib/sendmail**. On some systems, such as FreeBSD, if your sendmail is in a different place, you may want to link it to the the above location.
The records contained in a Messages resource consist of a **destination** specification followed by a list of **message-types** in the format:

destination = message-type1, message-type2, message-type3, ...

or for those destinations that need and address specification (e.g. email):

destination = address = message-type1, message-type2, message-type3, ...

where

destination is one of a predefined set of keywords that define where the message is to be sent (Append $^{\text{Dir}}_{\text{Messages}}$, Console $^{\text{Dir}}_{\text{Messages}}$, File $^{\text{Dir}}_{\text{Messages}}$, Mail $^{\text{Dir}}_{\text{Messages}}$, ...),

address varies according to the **destination** keyword, but is typically an email address or a filename,

message-type is one of a predefined set of keywords that define the type of message generated by Bareos: **ERROR**, **WARNING**, **FATAL**, ...

configuration directive name	type of data	default value	remark
Append	= [address =] message-type [, message-type]*		
Catalog	= [address =] message-type [, message-type]*		
Console	= [address =] message-type [, message-type]*		
Description	= string		
Director	= [address =] message-type [, message-type]*		
File	= [address =] message-type [, message-type]*		
Mail	= [address =] message-type [, message-type]*		
Mail Command	= string		

Mail On Error	= [address =] message-type [, message-type]*		
Mail On Success	= [address =] message-type [, message-type]*		
Name	= name		
Operator	= [address =] message-type [, message-type]*		
Operator Command	= string		
Stderr	= [address =] message-type [, message-type]*		
Stdout	= [address =] message-type [, message-type]*		
Syslog	= [address =] message-type [, message-type]*		
Timestamp Format	= string		

Append = <[address =] message-type [, message-type]* >
Append the message to the filename given in the **address** field. If the file already exists, it will be appended to. If the file does not exist, it will be created.

Catalog = <[address =] message-type [, message-type]* >
Send the message to the Catalog database. The message will be written to the table named **Log** and a timestamp field will also be added. This permits Job Reports and other messages to be recorded in the Catalog so that they can be accessed by reporting software. Bareos will prune the Log records associated with a Job when the Job records are pruned. Otherwise, Bareos never uses these records internally, so this destination is only used for special purpose programs (e.g. frontend programs).

Console = <[address =] message-type [, message-type]* >
Send the message to the Bareos console. These messages are held until the console program connects to the Director.

Description = <string>

Director = <[address =] message-type [, message-type]* >
Send the message to the Director whose name is given in the **address** field. Note, in the current implementation, the Director Name is ignored, and the message is sent to the Director that started the Job.

File = <[address =] message-type [, message-type]* >
Send the message to the filename given in the **address** field. If the file already exists, it will be overwritten.

Mail = <[address =] message-type [, message-type]* >
Send the message to the email addresses that are given as a comma separated list in the **address** field. Mail messages are grouped together during a job and then sent as a single email message when the job terminates. The advantage of this destination is that you are notified about every Job that runs. However, if you backup mutliple machines every night, the number of email messages can be annoying. Some users use filter programs such as `procmail` to automatically file this email based on the Job termination code (see Mail Command Dir Messages).

Mail Command = <string>
In the absence of this resource, Bareos will send all mail using the following command:

mail -s "Bareos Message" <recipients>

In many cases, depending on your machine, this command may not work. However, by using the **Mail Command**, you can specify exactly how to send the mail. During the processing of the **command** part, normally specified as a quoted string, the following substitutions will be used:

- %% = %
- %c = Client's name

- %d = Director's name
- %e = Job Exit code (OK, Error, ...)
- %h = Client address
- %i = Job Id
- %j = Unique Job name
- %l = Job level
- %n = Job name
- %r = Recipients
- %s = Since time
- %t = Job type (e.g. Backup, ...)
- %v = Read Volume name (Only on director side)
- %V = Write Volume name (Only on director side)

Please note: any **Mail Command** directive must be specified in the **Messages** resource **before** the desired Mail Dir Messages, Mail On Success Dir Messages or Mail On Error Dir Messages directive. In fact, each of those directives may be preceded by a different **Mail Command**.

A default installation will use the program **bsmtp** as **Mail Command**. The program `bsmtp` is provided by Bareos and unifies the usage of a mail client to a certain degree:

```
Mail Command = "/usr/sbin/bsmtp -h mail.example.com -f \"\(Bareos\) \%r\" -s \"Bareos: \%t \%e of \%c \%l\" \%r"
```

The `bsmtp` program is provided as part of Bareos. For additional details, please see the bsmtp section. Please test any **Mail Command** that you use to ensure that your smtp gateway accepts the addressing form that you use. Certain programs such as Exim can be very selective as to what forms are permitted particularly in the from part.

Mail On Error = <[address =] message-type [, message-type]* >
Send the message to the email addresses that are given as a comma separated list in the **address** field if the Job terminates with an error condition. **Mail On Error** messages are grouped together during a job and then sent as a single email message when the job terminates. This destination differs from the **mail** destination in that if the Job terminates normally, the message is totally discarded (for this destination). If the Job terminates in error, it is emailed. By using other destinations such as **append** you can ensure that even if the Job terminates normally, the output information is saved.

Mail On Success = <[address =] message-type [, message-type]* >
Send the message to the email addresses that are given as a comma separated list in the **address** field if the Job terminates normally (no error condition). **Mail On Success** messages are grouped together during a job and then sent as a single email message when the job terminates. This destination differs from the **mail** destination in that if the Job terminates abnormally, the message is totally discarded (for this destination). If the Job terminates normally, it is emailed.

Name = <name>
The name of the Messages resource. The name you specify here will be used to tie this Messages resource to a Job and/or to the daemon.

Operator = <[address =] message-type [, message-type]* >
Send the message to the email addresses that are specified as a comma separated list in the **address** field. This is similar to **mail** above, except that each message is sent as received. Thus there is one email per message. This is most useful for **mount** messages (see below).

Operator Command = <string>
This resource specification is similar to the Mail Command Dir Messages except that it is used for Operator messages. The substitutions performed for the Mail Command Dir Messages are also done for this command. Normally, you will set this command to the same value as specified for the Mail Command Dir Messages.

The **Operator Command** directive must appear in the **Messages** resource before the Operator Dir Messages directive.

Stderr = <[address =] message-type [, message-type]* >
Send the message to the standard error output (normally not used).

Stdout = <[address =] message-type [, message-type]* >
Send the message to the standard output (normally not used).

Syslog = <[address =] message-type [, message-type]* >
Send the message to the system log (syslog).

Since Version >= 14.4.0 the facility can be specified in the **address** field and the loglevel correspond to the Bareos Message Types. The defaults are `DAEMON` and `LOG_ERR`.

Although the **syslog** destination is not used in the default Bareos config files, in certain cases where Bareos encounters errors in trying to deliver a message, as a last resort, it will send it to the system **syslog** to prevent loss of the message, so you might occassionally check the **syslog** for Bareos output.

Timestamp Format = <string>

12.1 Message Types

For any destination, the **message-type** field is a comma separated list of the following types or classes of messages:

info
General information messages.

warning
Warning messages. Generally this is some unusual condition but not expected to be serious.

error
Non-fatal error messages. The job continues running. Any error message should be investigated as it means that something went wrong.

fatal
Fatal error messages. Fatal errors cause the job to terminate.

terminate
Message generated when the daemon shuts down.

notsaved
Files not saved because of some error. Usually because the file cannot be accessed (i.e. it does not exist or is not mounted).

skipped
Files that were skipped because of a user supplied option such as an incremental backup or a file that matches an exclusion pattern. This is not considered an error condition such as the files listed for the **notsaved** type because the configuration file explicitly requests these types of files to be skipped. For example, any unchanged file during an incremental backup, or any subdirectory if the no recursion option is specified.

mount
Volume mount or intervention requests from the Storage daemon. These requests require a specific operator intervention for the job to continue.

restored
The **ls** style listing generated for each file restored is sent to this message class.

all
All message types.

security
Security info/warning messages principally from unauthorized connection attempts.

alert
Alert messages. These are messages generated by tape alerts.

volmgmt
Volume management messages. Currently there are no volume mangement messages generated.

audit
Audit messages. Interacting with the Bareos Director will be audited. Can be configured with in resource Auditing $^{\text{Dir}}_{\text{Director}}$.

The following is an example of a valid Messages resource definition, where all messages except files explicitly skipped or daemon termination messages are sent by email to backupoperator@example.com. In addition all mount messages are sent to the operator (i.e. emailed to backupoperator@example.com). Finally all messages other than explicitly skipped files and files saved are sent to the console:

```
Messages {
  Name = Standard
  Mail = backupoperator@example.com = all, !skipped, !terminate
  Operator = backupoperator@example.com = mount
  Console = all, !skipped, !saved
}
```

Configuration 12.1: Message resource

With the exception of the email address, an example Director's Messages resource is as follows:

```
Messages {
  Name = Standard
  Mail Command = "/usr/sbin/bsmtp -h mail.example.com  -f \"\(Bareos\) %r\" -s \"Bareos: %t %e of %c %l\" % ↙
    ↪ r"
  Operator Command = "/usr/sbin/bsmtp -h mail.example.com -f \"\(Bareos\) %r\" -s \"Bareos: Intervention  ↙
    ↪ needed for %j\" %r"
  Mail On Error = backupoperator@example.com = all, !skipped, !terminate
  Append = "/var/log/bareos/bareos.log" = all, !skipped, !terminate
  Operator = backupoperator@example.com = mount
  Console = all, !skipped, !saved
}
```

Configuration 12.2: Message resource

Chapter 13

Console Configuration

The Console configuration file is the simplest of all the configuration files, and in general, you should not need to change it except for the password. It simply contains the information necessary to contact the Director or Directors.
For a general discussion of the syntax of configuration files and their resources including the data types recognized by **Bareos**, please see the Configuration chapter of this manual.
The following Console Resource definition must be defined:

13.1 Director Resource

The Director resource defines the attributes of the Director running on the network. You may have multiple Director resource specifications in a single Console configuration file. If you have more than one, you will be prompted to choose one when you start the **Console** program.

configuration directive name	type of data	default value	remark
Address	= string		
Description	= string		
Dir Port	= positive-integer	9101	
Heartbeat Interval	= time	0	
Name	**= name**		**required**
Password	**= Md5password**		**required**
TLS Allowed CN	= string-list		
TLS Authenticate	= yes|no		
TLS CA Certificate Dir	= directory		
TLS CA Certificate File	= directory		
TLS Certificate	= directory		
TLS Certificate Revocation List	= directory		
TLS Cipher List	= string		
TLS Enable	= yes|no		
TLS Key	= directory		
TLS Require	= yes|no		
TLS Verify Peer	= yes|no	yes	

Address = <string>
Where the address is a host name, a fully qualified domain name, or a network address used to connect to the Director.

Description = <string>

Dir Port = <positive-integer> (default: 9101)
This port must be identical to the Dir Port $^{\text{Dir}}_{\text{Director}}$ specified in the **Director** resource of the Director

Configuration file.

Heartbeat Interval = <time> (default: 0)

Name = <name> (required)
The director name used to select among different Directors, otherwise, this name is not used.

Password = <Md5password> (required)
Where the password is the password needed for the Director to accept the Console connection. This password must be identical to the **Password** specified in the **Director** resource of the Director Configuration file. This directive is required.

TLS Allowed CN = <string-list>

TLS Authenticate = <yes|no>

TLS CA Certificate Dir = <directory>

TLS CA Certificate File = <directory>

TLS Certificate = <directory>

TLS Certificate Revocation List = <directory>

TLS Cipher List = <string>

TLS Enable = <yes|no>
Bareos can be configured to encrypt all its network traffic. See chapter TLS Configuration Directives to see how the Bareos Director (and the other components) have to be configured to use TLS.

TLS Key = <directory>

TLS Require = <yes|no>

TLS Verify Peer = <yes|no> (default: yes)

An actual example might be:

```
Director {
  Name = HeadMan
  address = rufus.cats.com
  password = xyz1erploit
}
```

13.2 Console Resource

There are three different kinds of consoles, which the administrator or user can use to interact with the Director. These three kinds of consoles comprise three different security levels.

- The first console type is an **anonymous** or **default** console, which has full privileges. There is no console resource necessary for this type since the password is specified in the Director resource. Typically you would use this **anonymous** console only for administrators.
- The second type of console is a "named" or "restricted" console defined within a Console resource in both the Director's configuration file and in the Console's configuration file. Both the names and the passwords in these two entries must match much as is the case for Client programs.

  This second type of console begins with absolutely no privileges except those explicitly specified in the Director's Console resource. Note, the definition of what these restricted consoles can do is determined by the Director's conf file.

  Thus you may define within the Director's conf file multiple Consoles with different names and passwords, sort of like multiple users, each with different privileges. As a default, these consoles can do absolutely nothing – no commands what so ever. You give them privileges or rather access to commands and resources by specifying access control lists in the Director's Console resource. This gives the administrator fine grained control over what particular consoles (or users) can do.
- The third type of console is similar to the above mentioned restricted console in that it requires a Console resource definition in both the Director and the Console. In addition, if the console name, provided on the **Name =** directive, is the same as a Client name, the user of that console is permitted to use the **SetIP** command to change the Address directive in the Director's client resource to the IP address of the Console. This permits portables or other machines using DHCP (non-fixed IP addresses) to "notify" the Director of their current IP address.

The Console resource is optional and need not be specified. However, if it is specified, you can use ACLs (Access Control Lists) in the Director's configuration file to restrict the particular console (or user) to see only information pertaining to his jobs or client machine.
You may specify as many Console resources in the console's conf file. If you do so, generally the first Console resource will be used. However, if you have multiple Director resources (i.e. you want to connect to different directors), you can bind one of your Console resources to a particular Director resource, and thus when you choose a particular Director, the appropriate Console configuration resource will be used. See the "Director" directive in the Console resource described below for more information.
Note, the Console resource is optional, but can be useful for restricted consoles as noted above.

configuration directive name	type of data	default value	remark
Description	= string		
Director	= string		
Heartbeat Interval	= time	0	
History File	= directory		
History Length	= positive-integer	100	
Name	**= name**		**required**
Password	**= Md5password**		**required**
Rc File	= directory		
TLS Allowed CN	= string-list		
TLS Authenticate	= yes|no		
TLS CA Certificate Dir	= directory		
TLS CA Certificate File	= directory		
TLS Certificate	= directory		
TLS Certificate Revocation List	= directory		
TLS Cipher List	= string		
TLS Enable	= yes|no		
TLS Key	= directory		
TLS Require	= yes|no		
TLS Verify Peer	= yes|no	yes	

Description = <string>

Director = <string>
If this directive is specified, this Console resource will be used by bconsole when that particular director is selected when first starting bconsole. I.e. it binds a particular console resource with its name and password to a particular director.

Heartbeat Interval = <time> (default: 0)
This directive is optional and if specified will cause the Console to set a keepalive interval (heartbeat) in seconds on each of the sockets to communicate with the Director. It is implemented only on systems (Linux, ...) that provide the **setsockopt** TCP_KEEPIDLE function. If the value is set to 0 (zero), no change is made to the socket.

History File = <directory>
If this directive is specified and the console is compiled with readline support, it will use the given filename as history file. If not specified, the history file will be named `~/.bconsole_history`

History Length = <positive-integer> (default: 100)
If this directive is specified the history file will be truncated after **HistoryLength** entries.

Name = <name> (required)
The name of this resource.

The Console name used to allow a restricted console to change its IP address using the SetIP command. The SetIP command must also be defined in the Director's conf CommandACL list.

Password = <Md5password> (required)
If this password is supplied, then the password specified in the Director resource of you Console conf will be ignored. See below for more details.

Rc File = <directory>

TLS Allowed CN = <string-list>

TLS Authenticate = <yes|no>

TLS CA Certificate Dir = <directory>

TLS CA Certificate File = <directory>

TLS Certificate = <directory>

TLS Certificate Revocation List = <directory>

TLS Cipher List = <string>

TLS Enable = <yes|no>
Bareos can be configured to encrypt all its network traffic. See chapter TLS Configuration Directives to see how the Bareos Director (and the other components) have to be configured to use TLS.

TLS Key = <directory>

TLS Require = <yes|no>

TLS Verify Peer = <yes|no> (default: yes)

The following configuration files were supplied by Phil Stracchino. For example, if we define the following in the user's bconsole.conf file (or perhaps the bwx-console.conf file):

```
Director {
   Name = MyDirector
   DIRport = 9101
   Address = myserver
   Password = "XXXXXXXXXX"    # no, really.  this is not obfuscation.
}


Console {
   Name = restricted-user
   Password = "UntrustedUser"
}
```

Where the Password in the Director section is deliberately incorrect, and the Console resource is given a name, in this case **restricted-user**. Then in the Director's bareos-dir.conf file (not directly accessible by the user), we define:

```
Console {
  Name = restricted-user
  Password = "UntrustedUser"
  JobACL = "Restricted Client Save"
  ClientACL = restricted-client
  StorageACL = main-storage
  ScheduleACL = *all*
  PoolACL = *all*
  FileSetACL = "Restricted Client's FileSet"
  CatalogACL = DefaultCatalog
  CommandACL = run
}
```

the user logging into the Director from his Console will get logged in as **restricted-user**, and he will only be able to see or access a Job with the name **Restricted Client Save** a Client with the name **restricted-client**, a Storage device **main-storage**, any Schedule or Pool, a FileSet named **Restricted Client's FileSet**, a Catalog named **DefaultCatalog**, and the only command he can use in the Console is the **run** command. In other words, this user is rather limited in what he can see and do with Bareos.
The following is an example of a bconsole.conf file that can access several Directors and has different Consoles depending on the director:

```
Director {
   Name = MyDirector
   DIRport = 9101
   Address = myserver
   Password = "XXXXXXXXXX"    # no, really.  this is not obfuscation.
}
```

```
Director {
   Name = SecondDirector
   DIRport = 9101
   Address = secondserver
   Password = "XXXXXXXXXX"    # no, really.  this is not obfuscation.
}

Console {
   Name = restricted-user
   Password = "UntrustedUser"
   Director = MyDirector
}

Console {
   Name = restricted-user
   Password = "A different UntrustedUser"
   Director = SecondDirector
}
```

The second Director referenced at "secondserver" might look like the following:

```
Console {
  Name = restricted-user
  Password = "A different UntrustedUser"
  JobACL = "Restricted Client Save"
  ClientACL = restricted-client
  StorageACL = second-storage
  ScheduleACL = *all*
  PoolACL = *all*
  FileSetACL = "Restricted Client's FileSet"
  CatalogACL = RestrictedCatalog
  CommandACL = run, restore
  WhereACL = "/"
}
```

13.3 Console Commands

For more details on running the console and its commands, please see the Bareos Console chapter of this manual.

13.4 Example Console Configuration File

An example Console configuration file might be the following:

```
#
# Bareos Console Configuration File
#
Director {
  Name = HeadMan
  address = "my_machine.my_domain.com"
  Password = Console_password
}
```

Chapter 14

Monitor Configuration

The Monitor configuration file is a stripped down version of the Director configuration file, mixed with a Console configuration file. It simply contains the information necessary to contact Directors, Clients, and Storage daemons you want to monitor.
For a general discussion of configuration file and resources including the data types recognized by **Bareos**, please see the Configuration chapter of this manual.
The following Monitor Resource definition must be defined:

- Monitor – to define the Monitor's name used to connect to all the daemons and the password used to connect to the Directors. Note, you must not define more than one Monitor resource in the Monitor configuration file.
- At least one Client, Storage or Director resource, to define the daemons to monitor.

14.1 Monitor Resource

The Monitor resource defines the attributes of the Monitor running on the network. The parameters you define here must be configured as a Director resource in Clients and Storages configuration files, and as a Console resource in Directors configuration files.

configuration directive name	type of data	default value	remark
Description	= string		
Dir Connect Timeout	= time	10	
FD Connect Timeout	= time	10	
Name	**= name**		**required**
Password	**= Md5password**		**required**
Refresh Interval	= time	60	
Require SSL	= yes|no	no	
SD Connect Timeout	= time	10	

Description = <string>

Dir Connect Timeout = <time> (default: 10)

FD Connect Timeout = <time> (default: 10)

Name = <name> (required)
Specifies the Director name used to connect to Client and Storage, and the Console name used to

connect to Director. This record is required.

Password = <Md5password> (required)
Where the password is needed for Directors to accept the Console connection. This password must be identical to the **Password** specified in the **Console** resource of the Director's configuration file. This record is required if you wish to monitor Directors.

Refresh Interval = <time> (default: 60)
Specifies the time to wait between status requests to each daemon. It can't be set to less than 1 second or more than 10 minutes.

Require SSL = <yes|no> (default: no)

SD Connect Timeout = <time> (default: 10)

14.2 Director Resource

The Director resource defines the attributes of the Directors that are monitored by this Monitor.
As you are not permitted to define a Password in this resource, to avoid obtaining full Director privileges, you must create a Console resource in the Director's configuration file, using the Console Name and Password defined in the Monitor resource. To avoid security problems, you should configure this Console resource to allow access to no other daemons, and permit the use of only two commands: **status** and **.status** (see below for an example).
You may have multiple Director resource specifications in a single Monitor configuration file.

configuration directive name	type of data	default value	remark
Address	**= string**		**required**
Description	= string		
Dir Port	= positive-integer	9101	
Enable SSL	= yes|no	no	
Name	**= name**		**required**

Address = <string> (required)
Where the address is a host name, a fully qualified domain name, or a network address used to connect to the Director. This record is required.

Description = <string>

Dir Port = <positive-integer> (default: 9101)
Specifies the port to use to connect to the Director. This port must be identical to the **DIRport** specified in the **Director** resource of the Director Configuration file.

Enable SSL = <yes|no> (default: no)

Name = <name> (required)
The Director name used to identify the Director in the list of monitored daemons. It is not required

to be the same as the one defined in the Director's configuration file. This record is required.

14.3 Client Resource

The Client resource defines the attributes of the Clients that are monitored by this Monitor.
You must create a Director resource in the Client's configuration file, using the Director Name defined in the Monitor resource. To avoid security problems, you should set the **Monitor** directive to **Yes** in this Director resource.
You may have multiple Director resource specifications in a single Monitor configuration file.

configuration directive name	type of data	default value	remark
Address	**= string**		**required**
Description	= string		
Enable SSL	= yes|no	no	
FD Port	= positive-integer	9102	
Name	**= name**		**required**
Password	= `Md5password`		**required**

Address = <string> (required)
Where the address is a host name, a fully qualified domain name, or a network address in dotted quad notation for a Bareos File daemon. This record is required.

Description = <string>

Enable SSL = <yes|no> (default: no)

FD Port = <positive-integer> (default: 9102)
Where the port is a port number at which the Bareos File daemon can be contacted.

Name = <name> (required)
The Client name used to identify the Director in the list of monitored daemons. It is not required to be the same as the one defined in the Client's configuration file. This record is required.

Password = <`Md5password`> (required)
This is the password to be used when establishing a connection with the File services, so the Client configuration file on the machine to be backed up must have the same password defined for this Director. This record is required.

14.4 Storage Resource

The Storage resource defines the attributes of the Storages that are monitored by this Monitor.
You must create a Director resource in the Storage's configuration file, using the Director Name defined in the Monitor resource. To avoid security problems, you should set the **Monitor** directive to **Yes** in this Director resource.
You may have multiple Director resource specifications in a single Monitor configuration file.

configuration directive name	type of data	default value	remark

Address	**= string**		**required**
Description	= string		
Enable SSL	= yes|no	no	
Name	**= name**		**required**
Password	**= Md5password**		**required**
SD Address	= string		
SD Password	= Md5password		
SD Port	= positive-integer	9103	

Address = <string> (required)
Where the address is a host name, a fully qualified domain name, or a network address in dotted quad notation for a Bareos Storage daemon. This record is required.

Description = <string>

Enable SSL = <yes|no> (default: no)

Name = <name> (required)
The Storage name used to identify the Director in the list of monitored daemons. It is not required to be the same as the one defined in the Storage's configuration file. This record is required.

Password = <Md5password> (required)
This is the password to be used when establishing a connection with the Storage services. This same password also must appear in the Director resource of the Storage daemon's configuration file. This record is required.

SD Address = <string>

SD Password = <Md5password>

SD Port = <positive-integer> (default: 9103)
Where port is the port to use to contact the storage daemon for information and to start jobs. This same port number must appear in the Storage resource of the Storage daemon's configuration file.

14.5 Tray Monitor

Tray Monitor Security

There is no security problem in relaxing the permissions on tray-monitor.conf as long as FD, SD and DIR are configured properly, so the passwords contained in this file only gives access to the status of the daemons. It could be a security problem if you consider the status information as potentially dangerous (most people consider this as not being dangerous).
Concerning Director's configuration:
In tray-monitor.conf, the password in the Monitor resource must point to a restricted console in bareos-dir.conf (see the documentation). So, if you use this password with bconsole, you'll only have access to the status of the director (commands status and .status). It could be a security problem if there is a bug in the ACL code of the director.

Concerning File and Storage Daemons' configuration:
In tray-monitor.conf, the Name in the Monitor resource must point to a Director resource in bareos-fd/sd.conf, with the Monitor directive set to **Yes** (see the documentation). It could be a security problem if there is a bug in the code which check if a command is valid for a Monitor (this is very unlikely as the code is pretty simple).

Example Tray Monitor configuration

An example Tray Monitor configuration file might be the following:

```
#
# Bareos Tray Monitor Configuration File
#
Monitor {
  Name = rufus-mon        # password for Directors
  Password = "GN0uRo7PTUmlMbqrJ2Gr1p0fk0HQJTxwnFyE4WSST3MWZseR"
  RefreshInterval = 10 seconds
}

Client {
  Name = rufus-fd
  Address = rufus
  FDPort = 9102           # password for FileDaemon
  Password = "FYpq4yyI1y562EMS35bA0J0QC0M2L3t5cZObxT3XQxgxppTn"
}
Storage {
  Name = rufus-sd
  Address = rufus
  SDPort = 9103           # password for StorageDaemon
  Password = "9usxgc307dMbe7jbD16v0PXlhD64UVasIDD0DH2WAujcDsc6"
}
Director {
  Name = rufus-dir
  DIRport = 9101
  address = rufus
}
```

Configuration 14.1: Example tray-monitor.conf

Example File daemon's Director record

```
#
# Restricted Director, used by tray-monitor to get the
#   status of the file daemon
#
Director {
  Name = rufus-mon
  Password = "FYpq4yyI1y562EMS35bA0J0QC0M2L3t5cZObxT3XQxgxppTn"
  Monitor = yes
}
```

Configuration 14.2: Example Monitor resource

A full example can be found at Example Client Configuration File.

Example Storage daemon's Director record

```
#
# Restricted Director, used by tray-monitor to get the
#   status of the storage daemon
#
Director {
  Name = rufus-mon
  Password = "9usxgc307dMbe7jbD16v0PXlhD64UVasIDD0DH2WAujcDsc6"
  Monitor = yes
}
```

Configuration 14.3: Example Monitor resource

A full example can be found at Example Storage Daemon Configuration File.

Example Director's Console record

```
#
# Restricted console used by tray-monitor to get the status of the director
#
Console {
  Name = Monitor
  Password = "GNOuRo7PTUmlMbqrJ2Gr1p0fk0HQJTxwnFyE4WSST3MWZseR"
  CommandACL = status, .status
}
```

Configuration 14.4: Example Monitor resource

A full example can be found at Example Director Configuration File.

Part III

Tasks and Concepts

Chapter 15

Bareos Console

The **Bareos Console** (`bconsole`) is a program that allows the user or the System Administrator, to interact with the Bareos Director daemon while the daemon is running.
The current Bareos Console comes as a shell interface (TTY style). It permit the administrator or authorized users to interact with Bareos. You can determine the status of a particular job, examine the contents of the Catalog as well as perform certain tape manipulations with the Console program.
Since the Console program interacts with the Director through the network, your Console and Director programs do not necessarily need to run on the same machine.
In fact, a certain minimal knowledge of the Console program is needed in order for Bareos to be able to write on more than one tape, because when Bareos requests a new tape, it waits until the user, via the Console program, indicates that the new tape is mounted.

15.1 Console Configuration

When the Console starts, it reads a standard Bareos configuration file named **bconsole.conf** unless you specify the **-c** command line option (see below). This file allows default configuration of the Console, and at the current time, the only Resource Record defined is the Director resource, which gives the Console the name and address of the Director. For more information on configuration of the Console program, please see the Console Configuration chapter of this document.

15.2 Running the Console Program

The console program can be run with the following options:

```
root@linux:~# bconsole -?
Usage: bconsole [-s] [-c config_file] [-d debug_level]
       -D <dir>    select a Director
       -l          list Directors defined
       -c <file>   set configuration file to file
       -d <nn>     set debug level to <nn>
       -dt         print timestamp in debug output
       -n          no conio
       -s          no signals
       -u <nn>     set command execution timeout to <nn> seconds
       -t          test - read configuration and exit
       -?          print this message.
```

Command 1: bconsole command line options

After launching the Console program (bconsole), it will prompt you for the next command with an asterisk (*). Generally, for all commands, you can simply enter the command name and the Console program will prompt you for the necessary arguments. Alternatively, in most cases, you may enter the command followed by arguments. The general format is:

```
 <command> <keyword1>[=<argument1>] <keyword2>[=<argument2>] ...
```

where **command** is one of the commands listed below; **keyword** is one of the keywords listed below (usually followed by an argument); and **argument** is the value. The command may be abbreviated to the shortest unique form. If two commands have the same starting letters, the one that will be selected is the one that

appears first in the **help** listing. If you want the second command, simply spell out the full command. None of the keywords following the command may be abbreviated.
For example:

```
list files jobid=23
```

will list all files saved for JobId 23. Or:

```
show pools
```

will display all the Pool resource records.
The maximum command line length is limited to 511 characters, so if you are scripting the console, you may need to take some care to limit the line length.

15.2.1 Exit the Console Program

Normally, you simply enter **quit** or **exit** and the Console program will terminate. However, it waits until the Director acknowledges the command. If the Director is already doing a lengthy command (e.g. prune), it may take some time. If you want to immediately terminate the Console program, enter the **.quit** command. There is currently no way to interrupt a Console command once issued (i.e. Ctrl-C does not work). However, if you are at a prompt that is asking you to select one of several possibilities and you would like to abort the command, you can enter a period (**.**), and in most cases, you will either be returned to the main command prompt or if appropriate the previous prompt (in the case of nested prompts). In a few places such as where it is asking for a Volume name, the period will be taken to be the Volume name. In that case, you will most likely be able to cancel at the next prompt.

15.2.2 Running the Console from a Shell Script

You can automate many Console tasks by running the console program from a shell script. For example, if you have created a file containing the following commands:

```
bconsole -c ./bconsole.conf <<END_OF_DATA
unmount storage=DDS-4
quit
END_OF_DATA
```

when that file is executed, it will unmount the current DDS-4 storage device. You might want to run this command during a Job by using the **RunBeforeJob** or **RunAfterJob** records.
It is also possible to run the Console program from file input where the file contains the commands as follows:

```
bconsole -c ./bconsole.conf <filename
```

where the file named **filename** contains any set of console commands.
As a real example, the following script is part of the Bareos regression tests. It labels a volume (a disk volume), runs a backup, then does a restore of the files saved.

```
bconsole <<END_OF_DATA
@output /dev/null
messages
@output /tmp/log1.out
label volume=TestVolume001
run job=Client1 yes
wait
messages
@#
@# now do a restore
@#
@output /tmp/log2.out
restore current all
yes
wait
messages
@output
quit
END_OF_DATA
```

The output from the backup is directed to /tmp/log1.out and the output from the restore is directed to /tmp/log2.out. To ensure that the backup and restore ran correctly, the output files are checked with:

```
grep "^ *Termination: *Backup OK" /tmp/log1.out
backupstat=$?
grep "^ *Termination: *Restore OK" /tmp/log2.out
restorestat=$?
```

15.3 Console Keywords

Unless otherwise specified, each of the following keywords takes an argument, which is specified after the keyword following an equal sign. For example:

```
jobid=536
```

all Permitted on the status and show commands to specify all components or resources respectively.

allfrompool Permitted on the update command to specify that all Volumes in the pool (specified on the command line) should be updated.

allfrompools Permitted on the update command to specify that all Volumes in all pools should be updated.

before Used in the restore command.

bootstrap Used in the restore command.

catalog Allowed in the use command to specify the catalog name to be used.

catalogs Used in the show command. Takes no arguments.

client | fd

clients Used in the show, list, and llist commands. Takes no arguments.

counters Used in the show command. Takes no arguments.

current Used in the restore command. Takes no argument.

days Used to define the number of days the `list nextvol` command should consider when looking for jobs to be run. The days keyword can also be used on the `status dir` command so that it will display jobs scheduled for the number of days you want. It can also be used on the `rerun` command, where it will automatically select all failed jobids in the last number of days for rerunning.

devices Used in the show command. Takes no arguments.

director | dir

directors Used in the show command. Takes no arguments.

directory Used in the restore command. Its argument specifies the directory to be restored.

enabled This keyword can appear on the `update volume` as well as the `update slots` commands, and can allows one of the following arguments: yes, true, no, false, archived, 0, 1, 2. Where 0 corresponds to no or false, 1 corresponds to yes or true, and 2 corresponds to archived. Archived volumes will not be used, nor will the Media record in the catalog be pruned. Volumes that are not enabled, will not be used for backup or restore.

done Used in the restore command. Takes no argument.

file Used in the restore command.

files Used in the list and llist commands. Takes no arguments.

fileset

filesets Used in the show command. Takes no arguments.

help Used in the show command. Takes no arguments.

hours Used on the `rerun` command to select all failed jobids in the last number of hours for rerunning.

jobs Used in the show, list and llist commands. Takes no arguments.

jobmedia Used in the list and llist commands. Takes no arguments.

jobtotals Used in the list and llist commands. Takes no arguments.

jobid The JobId is the numeric jobid that is printed in the Job Report output. It is the index of the database record for the given job. While it is unique for all the existing Job records in the catalog database, the same JobId can be reused once a Job is removed from the catalog. Probably you will refer specific Jobs that ran using their numeric JobId.

JobId can be used on the `rerun` command to select all jobs failed after and including the given jobid for rerunning.

job | jobname The Job or Jobname keyword refers to the name you specified in the Job resource, and hence it refers to any number of Jobs that ran. It is typically useful if you want to list all jobs of a particular name.

level

listing Permitted on the estimate command. Takes no argument.

limit

messages Used in the show command. Takes no arguments.

media Used in the list and llist commands. Takes no arguments.

nextvolume | nextvol Used in the list and llist commands. Takes no arguments.

on Takes no keyword.

off Takes no keyword.

pool

pools Used in the show, list, and llist commands. Takes no arguments.

select Used in the restore command. Takes no argument.

limit Used in the setbandwidth command. Takes integer in KB/s unit.

schedules Used in the show command. Takes no arguments.

storage | store | sd

storages Used in the show command. Takes no arguments.

ujobid The ujobid is a unique job identification that is printed in the Job Report output. At the current time, it consists of the Job name (from the Name directive for the job) appended with the date and time the job was run. This keyword is useful if you want to completely identify the Job instance run.

volume

volumes Used in the list and llist commands. Takes no arguments.

where Used in the restore command.

yes Used in the restore command. Takes no argument.

15.4 Console Commands

The following commands are currently implemented:

add This command is used to add Volumes to an existing Pool. That is, it creates the Volume name in the catalog and inserts into the Pool in the catalog, but does not attempt to access the physical Volume. Once added, Bareos expects that Volume to exist and to be labeled. This command is not normally used since Bareos will automatically do the equivalent when Volumes are labeled. However, there may be times when you have removed a Volume from the catalog and want to later add it back.

The full form of this command is:

```
add [pool=<pool-name> storage=<storage> jobid=<JobId>
```

bconsole 15.1: add

Normally, the **label** command is used rather than this command because the **label** command labels the physical media (tape, disk, DVD, ...) and does the equivalent of the **add** command. The **add** command affects only the Catalog and not the physical media (data on Volumes). The physical media must exist and be labeled before use (usually with the **label** command). This command can, however, be useful if you wish to add a number of Volumes to the Pool that will be physically labeled at a later time. It can also be useful if you are importing a tape from another site. Please see the **label** command below for the list of legal characters in a Volume name.

autodisplay This command accepts **on** or **off** as an argument, and turns auto-display of messages on or off respectively. The default for the console program is **off**, which means that you will be notified when there are console messages pending, but they will not automatically be displayed.

When autodisplay is turned off, you must explicitly retrieve the messages with the **messages** command. When autodisplay is turned on, the messages will be displayed on the console as they are received.

automount This command accepts **on** or **off** as the argument, and turns auto-mounting of the Volume after a **label** command on or off respectively. The default is **on**. If **automount** is turned off, you must explicitly **mount** tape Volumes after a label command to use it.

cancel This command is used to cancel a job and accepts **jobid=nnn** or **job=xxx** as an argument where nnn is replaced by the JobId and xxx is replaced by the job name. If you do not specify a keyword, the Console program will prompt you with the names of all the active jobs allowing you to choose one.

The full form of this command is:

```
cancel [jobid=<number> job=<job-name> ujobid=<unique-jobid>]
```

bconsole 15.2: cancel

Once a Job is marked to be cancelled, it may take a bit of time (generally within a minute but up to two hours) before the Job actually terminates, depending on what operations it is doing. Don't be surprised that you receive a Job not found message. That just means that one of the three daemons had already canceled the job. Messages numbered in the 1000's are from the Director, 2000's are from the File daemon and 3000's from the Storage daemon.

It is possible to cancel multiple jobs at once. Therefore, the following extra options are available for the job-selection:

- all jobs
- all jobs with a created state
- all jobs with a blocked state
- all jobs with a waiting state
- all jobs with a running state

Usage:

```
cancel all
cancel all state=<created|blocked|waiting|running>
```

bconsole 15.3: cancel all

Sometimes the Director already removed the job from its running queue, but the storage daemon still thinks it is doing a backup (or another job) - so you cannot cancel the job from within a console anymore. Therefore it is possible to cancel a job by JobId on the storage daemon. It might be helpful to execute a `status storage` on the Storage Daemon to make sure what job you want to cancel.

Usage:

```
cancel storage=<Storage Daemon> Jobid=<JobId>
```

bconsole 15.4: cancel on Storage Daemon

This way you can also remove a job that blocks any other jobs from running without the need to restart the whole storage daemon.

create This command is not normally used as the Pool records are automatically created by the Director when it starts based on what it finds in the conf file. If needed, this command can be used, to create a Pool record in the database using the Pool resource record defined in the Director's configuration file. So in a sense, this command simply transfers the information from the Pool resource in the configuration file into the Catalog. Normally this command is done automatically for you when the Director starts providing the Pool is referenced within a Job resource. If you use this command on an existing Pool, it will automatically update the Catalog to have the same information as the Pool resource. After creating a Pool, you will most likely use the **label** command to label one or more volumes and add their names to the Media database.

The full form of this command is:

```
create [pool=<pool-name>]
```

bconsole 15.5: create

When starting a Job, if Bareos determines that there is no Pool record in the database, but there is a Pool resource of the appropriate name, it will create it for you. If you want the Pool record to appear in the database immediately, simply use this command to force it to be created.

delete The delete command is used to delete a Volume, Pool or Job record from the Catalog as well as all associated catalog Volume records that were created. This command operates only on the Catalog database and has no effect on the actual data written to a Volume. This command can be dangerous and we strongly recommend that you do not use it unless you know what you are doing.

If the keyword **Volume** appears on the command line, the named Volume will be deleted from the catalog, if the keyword **Pool** appears on the command line, a Pool will be deleted, and if the keyword **Job** appears on the command line, a Job and all its associated records (File and JobMedia) will be deleted from the catalog.

The full form of this command is:

```
delete pool=<pool-name>
delete volume=<volume-name> pool=<pool-name>
delete JobId=<job-id> JobId=<job-id2> ...
delete Job JobId=n,m,o-r,t ...
```

bconsole 15.6: delete

The first form deletes a Pool record from the catalog database. The second form deletes a Volume record from the specified pool in the catalog database. The third form deletes the specified Job record from the catalog database. The last form deletes JobId records for JobIds n, m, o, p, q, r, and t. Where each one of the n,m,... is, of course, a number. That is a "delete jobid" accepts lists and ranges of jobids.

disable This command permits you to disable a Job for automatic scheduling. The job may have been previously enabled with the Job resource **Enabled** directive or using the console **enable** command. The next time the Director is restarted or the conf file is reloaded, the Enable/Disable state will be set to the value in the Job resource (default enabled) as defined in the bareos-dir.conf file.

The full form of this command is:

```
disable job=<job-name>
```

bconsole 15.7: disable

enable This command permits you to enable a Job for automatic scheduling. The job may have been previously disabled with the Job resource **Enabled** directive or using the console **disable** command. The next time the Director is restarted or the conf file is reloaded, the Enable/Disable state will be set to the value in the Job resource (default enabled) as defined in the bareos-dir.conf file.

The full form of this command is:

```
enable job=<job-name>
```

bconsole 15.8: enable

estimate Using this command, you can get an idea how many files will be backed up, or if you are unsure about your Include statements in your FileSet, you can test them without doing an actual backup. The default is to assume a Full backup. However, you can override this by specifying a **level=Incremental** or **level=Differential** on the command line. A Job name must be specified or you will be prompted for one, and optionally a Client and FileSet may be specified on the command line. It then contacts the client which computes the number of files and bytes that would be backed up. Please note that this is an estimate calculated from the number of blocks in the file rather than by reading the actual bytes. As such, the estimated backup size will generally be larger than an actual backup.

The `estimate` command can use the accurate code to detect changes and give a better estimation. You can set the accurate behavior on command line using `accurate=yes/no` or use the Job setting as default value.

Optionally you may specify the keyword **listing** in which case, all the files to be backed up will be listed. Note, it could take quite some time to display them if the backup is large. The full form is:

The full form of this command is:

```
estimate job=<job-name> listing client=<client-name> accurate=<yes|no> ↙
    ↪ fileset=<fileset-name> level=<level-name>
```

bconsole 15.9: estimate

Specification of the **job** is sufficient, but you can also override the client, fileset, accurate and/or level by specifying them on the estimate command line.

As an example, you might do:

```
@output /tmp/listing
estimate job=NightlySave listing level=Incremental
@output
```

bconsole 15.10: estimate: redirected output

which will do a full listing of all files to be backed up for the Job **NightlySave** during an Incremental save and put it in the file **/tmp/listing**. Note, the byte estimate provided by this command is based on the file size contained in the directory item. This can give wildly incorrect estimates of the actual storage used if there are sparse files on your systems. Sparse files are often found on 64 bit systems for certain system files. The size that is returned is the size Bareos will backup if the sparse option is not specified in the FileSet. There is currently no way to get an estimate of the real file size that would be found should the sparse option be enabled.

exit This command terminates the console program.

export The export command is used to export tapes from an autochanger. Most Automatic Tapechangers offer special slots for importing new tape cartridges or exporting written tape cartridges. This can happen without having to set the device offline.

The full form of this command is:

```
export storage=<storage-name> srcslots=<slot-selection> ↙
    ↪ [dstslots=<slot-selection> volume=<volume-name> scan]
```

bconsole 15.11: export

The export command does exactly the opposite of the import command. You can specify which slots should be transferred to import/export slots. The most useful application of the export command is the possibility to automatically transfer the volumes of a certain backup into the import/export slots for external storage.

To be able to to this, the export command also accepts a list of volume names to be exported.

Example:

```
export volume=A00020L4|A00007L4|A00005L4
```

bconsole 15.12: export volume

Instead of exporting volumes by names you can also select a number of slots via the srcslots keyword and export those to the slots you specify in dstslots. The export command will check if the slots have content (e.g. otherwise there is not much to export) and if there are enough export slots and if those are really import/export slots.

Example:

```
export srcslots=1-2 dstslots=37-38
```

bconsole 15.13: export slots

To automatically export the Volumes used by a certain backup job, you can use the following RunScript in that job:

```
RunScript {
    Console = "export storage=TandbergT40 volume=%V"
    RunsWhen = After
    RunsOnClient = no
}
```

bconsole 15.14: automatic export

To send an e-mail notification via the Messages resource regarding export tapes you can use the Variable %V substitution in the Messages resource, which is implemented in Bareos 13.2. However, it does also work in earlier releases inside the job resources. So in versions prior to Bareos 13.2 the following workaround can be used:

```
RunAfterJob = "/bin/bash -c \"/bin/echo Remove Tape %V | \
/usr/sbin/bsmtp -h localhost -f root@localhost -s 'Remove Tape %V' ↙
    ↪ root@localhost \""
```

bconsole 15.15: e-mail notification via messages resource regarding export tapes

gui Invoke the non-interactive gui mode. This command is only used when `bconsole` is commanded by an external program.

help This command displays the list of commands available.

import The import command is used to import tapes into an autochanger. Most Automatic Tapechangers offer special slots for importing new tape cartridges or exporting written tape cartridges. This can happen without having to set the device offline.

The full form of this command is:

```
import storage=<storage-name> [srcslots=<slot-selection> ↙
    ↪ dstslots=<slot-selection> volume=<volume-name> scan]
```

bconsole 15.16: import

To import new tapes into the autochanger, you only have to load the new tapes into the import/export slots and call import from the cmdline.

The import command will automatically transfer the new tapes into free slots of the autochanger. The slots are filled in order of the slot numbers. To import all tapes, there have to be enough free slots to load all tapes.

Example with a Library with 36 Slots and 3 Import/Export Slots:

```
*import storage=TandbergT40
Connecting to Storage daemon TandbergT40 at bareos:9103 ...
3306 Issuing autochanger "slots" command.
Device "Drive-1" has 39 slots.
Connecting to Storage daemon TandbergT40 at bareos:9103 ...
3306 Issuing autochanger "listall" command.
Connecting to Storage daemon TandbergT40 at bareos:9103 ...
3306 Issuing autochanger transfer command.
3308 Successfully transfered volume from slot 37 to 20.
Connecting to Storage daemon TandbergT40 at bareos:9103 ...
3306 Issuing autochanger transfer command.
```

```
3308 Successfully transfered volume from slot 38 to 21.
Connecting to Storage daemon TandbergT40 at bareos:9103 ...
3306 Issuing autochanger transfer command.
3308 Successfully transfered volume from slot 39 to 25.
```

bconsole 15.17: import example

You can also import certain slots when you don't have enough free slots in your autochanger to put all the import/export slots in.

Example with a Library with 36 Slots and 3 Import/Export Slots importing one slot:

```
*import storage=TandbergT40 srcslots=37 dstslots=20
Connecting to Storage daemon TandbergT40 at bareos:9103 ...
3306 Issuing autochanger "slots" command.
Device "Drive-1" has 39 slots.
Connecting to Storage daemon TandbergT40 at bareos:9103 ...
3306 Issuing autochanger "listall" command.
Connecting to Storage daemon TandbergT40 at bareos:9103 ...
3306 Issuing autochanger transfer command.
3308 Successfully transfered volume from slot 37 to 20.
```

bconsole 15.18: import example

label This command is used to label physical volumes. The full form of this command is:

```
label storage=<storage-name> volume=<volume-name> slot=<slot>
```

bconsole 15.19: label

If you leave out any part, you will be prompted for it. The media type is automatically taken from the Storage resource definition that you supply. Once the necessary information is obtained, the Console program contacts the specified Storage daemon and requests that the Volume be labeled. If the Volume labeling is successful, the Console program will create a Volume record in the appropriate Pool.

The Volume name is restricted to letters, numbers, and the special characters hyphen (**-**), underscore (_), colon (**:**), and period (**.**). All other characters including a space are invalid. This restriction is to ensure good readability of Volume names to reduce operator errors.

Please note, when labeling a blank tape, Bareos will get **read I/O error** when it attempts to ensure that the tape is not already labeled. If you wish to avoid getting these messages, please write an EOF mark on your tape before attempting to label it:

```
mt rewind
mt weof
```

The label command can fail for a number of reasons:

1. The Volume name you specify is already in the Volume database.
2. The Storage daemon has a tape or other Volume already mounted on the device, in which case you must **unmount** the device, insert a blank tape, then do the **label** command.
3. The Volume in the device is already a Bareos labeled Volume. (Bareos will never relabel a Bareos labeled Volume unless it is recycled and you use the **relabel** command).
4. There is no Volume in the drive.

There are two ways to relabel a volume that already has a Bareos label. The brute force method is to write an end of file mark on the tape using the system **mt** program, something like the following:

```
mt -f /dev/st0 rewind
mt -f /dev/st0 weof
```

For a disk volume, you would manually delete the Volume.

Then you use the **label** command to add a new label. However, this could leave traces of the old volume in the catalog.

The preferable method to relabel a Volume is to first **purge** the volume, either automatically, or explicitly with the **purge** command, then use the **relabel** command described below.

If your autochanger has barcode labels, you can label all the Volumes in your autochanger one after another by using the **label barcodes** command. For each tape in the changer containing a barcode, Bareos will mount the tape and then label it with the same name as the barcode. An appropriate Media record will also be created in the catalog. Any barcode that begins with the same characters as specified on the "CleaningPrefix=xxx" (default is "CLN") directive in the Director's Pool resource, will be treated as a cleaning tape, and will not be labeled. However, an entry for the cleaning tape will be created in the catalog. For example with:

```
Pool {
    Name ...
    Cleaning Prefix = "CLN"
}
```

Configuration 15.20: Cleaning Tape

Any slot containing a barcode of CLNxxxx will be treated as a cleaning tape and will not be mounted. Note, the full form of the command is:

```
label storage=xxx pool=yyy slots=1-5,10 barcodes
```

bconsole 15.21: label

list The list command lists the requested contents of the Catalog. The various fields of each record are listed on a single line. The various forms of the list command are:

```
list jobs
list jobid=<id>           (list jobid id)
list ujobid=<unique job name> (list job with unique name)
list job=<job-name>   (list all jobs with "job-name")
list jobname=<job-name>  (same as above)
    In the above, you can add "limit=nn" to limit the output to nn jobs.
list joblog jobid=<id> (list job output if recorded in the catalog)
list jobmedia
list jobmedia jobid=<id>
list jobmedia job=<job-name>
list files jobid=<id>
list files job=<job-name>
list pools
list clients
list jobtotals
list volumes
list volumes jobid=<id>
list volumes pool=<pool-name>
list volumes job=<job-name>
list volume=<volume-name>
list nextvolume job=<job-name>
list nextvol job=<job-name>
list nextvol job=<job-name> days=nnn
```

bconsole 15.22: list

What most of the above commands do should be more or less obvious. In general if you do not specify all the command line arguments, the command will prompt you for what is needed.

The **list nextvol** command will print the Volume name to be used by the specified job. You should be aware that exactly what Volume will be used depends on a lot of factors including the time and what a prior job will do. It may fill a tape that is not full when you issue this command. As a consequence, this command will give you a good estimate of what Volume will be used but not a definitive answer. In addition, this command may have certain side effect because it runs through the same algorithm as a job, which means it may automatically purge or recycle a Volume. By default, the job specified must run within the next two days or no volume will be found. You can, however, use the **days=nnn** specification to specify up to 50 days. For example, if on Friday, you want to see what Volume will be needed on Monday, for job MyJob, you would use **list nextvol job=MyJob days=3**.

If you wish to add specialized commands that list the contents of the catalog, you can do so by adding them to the **query.sql** file. However, this takes some knowledge of programming SQL. Please see the **query** command below for additional information. See below for listing the full contents of a catalog record with the **llist** command.

As an example, the command **list pools** might produce the following output:

```
*list pools
+------+---------+----------+----------+----------+-------------+
| PoId | Name    | NumVols  | MaxVols  | PoolType | LabelFormat |
+------+---------+----------+----------+----------+-------------+
|    1 | Default |        0 |        0 | Backup   | *           |
|    2 | Recycle |        0 |        8 | Backup   | File        |
+------+---------+----------+----------+----------+-------------+
```

bconsole 15.23: list pools

As mentioned above, the **list** command lists what is in the database. Some things are put into the database immediately when Bareos starts up, but in general, most things are put in only when they are first used, which is the case for a Client as with Job records, etc.

Bareos should create a client record in the database the first time you run a job for that client. Doing a **status** will not cause a database record to be created. The client database record will be created whether or not the job fails, but it must at least start. When the Client is actually contacted, additional info from the client will be added to the client record (a "uname -a" output).

If you want to see what Client resources you have available in your conf file, you use the Console command **show clients**.

llist The llist or "long list" command takes all the same arguments that the list command described above does. The difference is that the llist command list the full contents of each database record selected. It does so by listing the various fields of the record vertically, with one field per line. It is possible to produce a very large number of output lines with this command.

If instead of the **list pools** as in the example above, you enter **llist pools** you might get the following output:

```
*llist pools
          PoolId: 1
            Name: Default
         NumVols: 0
         MaxVols: 0
         UseOnce: 0
      UseCatalog: 1
 AcceptAnyVolume: 1
    VolRetention: 1,296,000
  VolUseDuration: 86,400
      MaxVolJobs: 0
     MaxVolBytes: 0
       AutoPrune: 0
         Recycle: 1
        PoolType: Backup
     LabelFormat: *

          PoolId: 2
            Name: Recycle
         NumVols: 0
         MaxVols: 8
         UseOnce: 0
      UseCatalog: 1
 AcceptAnyVolume: 1
    VolRetention: 3,600
  VolUseDuration: 3,600
      MaxVolJobs: 1
     MaxVolBytes: 0
       AutoPrune: 0
         Recycle: 1
        PoolType: Backup
```

```
      LabelFormat: File
```

bconsole 15.24: llist pools

messages This command causes any pending console messages to be immediately displayed.

memory Print current memory usage.

mount The mount command is used to get Bareos to read a volume on a physical device. It is a way to tell Bareos that you have mounted a tape and that Bareos should examine the tape. This command is normally used only after there was no Volume in a drive and Bareos requests you to mount a new Volume or when you have specifically unmounted a Volume with the **unmount** console command, which causes Bareos to close the drive. If you have an autoloader, the mount command will not cause Bareos to operate the autoloader unless you specify a **slot** and possibly a **drive**. The various forms of the mount command are:

```
mount  storage=<storage-name> [slot=<num>] [
       drive=<num> ]
mount [jobid=<id> | job=<job-name>]
```

bconsole 15.25: mount

If you have specified **Automatic Mount = yes** in the Storage daemon's Device resource, under most circumstances, Bareos will automatically access the Volume unless you have explicitly `unmount` ed it in the Console program.

move The move command allows to move volumes between slots in an autochanger without having to leave the bconsole.

To move a volume from slot 32 to slots 33, use:

```
*move storage=TandbergT40 srcslots=32 dstslots=33
Connecting to Storage daemon TandbergT40 at bareos:9103 ...
3306 Issuing autochanger "slots" command.
Device "Drive-1" has 39 slots.
Connecting to Storage daemon TandbergT40 at bareos:9103 ...
3306 Issuing autochanger "listall" command.
Connecting to Storage daemon TandbergT40 at bareos:9103 ...
3306 Issuing autochanger transfer command.
3308 Successfully transfered volume from slot 32 to 33.
```

bconsole 15.26: move

prune The Prune command allows you to safely remove expired database records from Jobs, Volumes and Statistics. This command works only on the Catalog database and does not affect data written to Volumes. In all cases, the Prune command applies a retention period to the specified records. You can Prune expired File entries from Job records; you can Prune expired Job records from the database, and you can Prune both expired Job and File records from specified Volumes.

```
prune files|jobs|volume|stats client=<client-name> volume=<volume-name>
```

bconsole 15.27: prune

For a Volume to be pruned, the **VolStatus** must be Full, Used, or Append, otherwise the pruning will not take place.

purge The Purge command will delete associated Catalog database records from Jobs and Volumes without considering the retention period. **Purge** works only on the Catalog database and does not affect data written to Volumes. This command can be dangerous because you can delete catalog records associated with current backups of files, and we recommend that you do not use it unless you know what you are doing. The permitted forms of **purge** are:

```
purge files jobid=<jobid>|job=<job-name> | client=<client-name>
purge jobs client=<client-name> (of all jobs)
purge volume|volume=<vol-name> (of all jobs)
```

bconsole 15.28: purge

For the **purge** command to work on Volume Catalog database records the **VolStatus** must be Append, Full, Used, or Error.

The actual data written to the Volume will be unaffected by this command unless you are using the `ActionOnPurge=Truncate` option on those Media.

To ask Bareos to truncate your `Purged` volumes, you need to use the following command in interactive mode or in a RunScript:

```
*purge volume action=truncate storage=File allpools
# or by default, action=all
*purge volume action storage=File pool=Default
```

bconsole 15.29: purge example

This is possible to specify the volume name, the media type, the pool, the storage, etc... (see `help purge`) Be sure that your storage device is idle when you decide to run this command.

resolve In the configuration files, Addresses can (and normally should) be specified as DNS names. As the different components of Bareos will establish network connections to other Bareos components, it is important that DNS name resolution works on involved components and delivers the same results. The `resolve` command can be used to test DNS resolution of a given hostname on director, storage daemonm or client.

```
*resolve www.bareos.com
bareos-dir resolves www.bareos.com to host[ipv4:84.44.166.242]

*resolve client=client1-fd www.bareos.com
client1-fd resolves www.bareos.com to host[ipv4:84.44.166.242]

*resolve storage=File www.bareos.com
bareos-sd resolves www.bareos.com to host[ipv4:84.44.166.242]
```

bconsole 15.30: resolve example

query This command reads a predefined SQL query from the query file (the name and location of the query file is defined with the QueryFile resource record in the Director's configuration file). You are prompted to select a query from the file, and possibly enter one or more parameters, then the command is submitted to the Catalog database SQL engine.

quit This command terminates the console program. The console program sends the **quit** request to the Director and waits for acknowledgment. If the Director is busy doing a previous command for you that has not terminated, it may take some time. You may quit immediately by issuing the **.quit** command (i.e. quit preceded by a period).

relabel This command is used to label physical volumes.

The full form of this command is:

```
relabel storage=<storage-name> oldvolume=<old-volume-name> ↙
    ↪ volume=<newvolume-name>}
```

bconsole 15.31: relabel

If you leave out any part, you will be prompted for it. In order for the Volume (old-volume-name) to be relabeled, it must be in the catalog, and the volume status must be marked **Purged** or **Recycle**. This happens automatically as a result of applying retention periods, or you may explicitly purge the volume using the **purge** command.

Once the volume is physically relabeled, the old data previously written on the Volume is lost and cannot be recovered.

release This command is used to cause the Storage daemon to release (and rewind) the current tape in the drive, and to re-read the Volume label the next time the tape is used.

```
release storage=<storage-name>
```

bconsole 15.32: release

After a release command, the device is still kept open by Bareos (unless Always Open $^{\text{Sd}}_{\text{Device}}$=No) so it cannot be used by another program. However, with some tape drives, the operator can remove the current tape and to insert a different one, and when the next Job starts, Bareos will know to re-read the tape label to find out what tape is mounted. If you want to be able to use the drive with another program (e.g. `mt`), you must use the `unmount` command to cause Bareos to completely release (close) the device.

reload The reload command causes the Director to re-read its configuration file and apply the new values. The new values will take effect immediately for all new jobs. However, if you change schedules, be aware that the scheduler pre-schedules jobs up to two hours in advance, so any changes that are to take place during the next two hours may be delayed. Jobs that have already been scheduled to run (i.e. surpassed their requested start time) will continue with the old values. New jobs will use the new values. Each time you issue a reload command while jobs are running, the prior config values will queued until all jobs that were running before issuing the reload terminate, at which time the old config values will be released from memory. The Directory permits keeping up to ten prior set of configurations before it will refuse a reload command. Once at least one old set of config values has been released it will again accept new reload commands.

While it is possible to reload the Director's configuration on the fly, even while jobs are executing, this is a complex operation and not without side effects. Accordingly, if you have to reload the Director's configuration while Bareos is running, it is advisable to restart the Director at the next convenient opportunity.

rerun The rerun command allows you to re-run a Job with exactly the same setting as the original Job. In Bareos, the job configuration is often altered by job overrides. These overrides alter the configuration of the job just for one job run. If because of any reason, a job with overrides fails, it is not easy to restart a new job that is exactly configured as the job that failed. The whole job configuration is automatically set to the defaults and it is hard to configure everything like it was.

By using the rerun command, it is much easier to rerun a job exactly as it was configured. You only have to specify the JobId of the failed job.

```
rerun jobid=<jobid> since_jobid=<jobid> days=<nr_days> hours=<nr_hours> yes
```

bconsole 15.33: rerun

You can select the jobid(s) to rerun by using one of the selection criteria. Using jobid= will automatically select all jobs failed after and including the given jobid for rerunning. By using days= or hours=, you can select all failed jobids in the last number of days or number of hours respectively for rerunning.

restore The restore command allows you to select one or more Jobs (JobIds) to be restored using various methods. Once the JobIds are selected, the File records for those Jobs are placed in an internal Bareos directory tree, and the restore enters a file selection mode that allows you to interactively walk up and down the file tree selecting individual files to be restored. This mode is somewhat similar to the standard Unix **restore** program's interactive file selection mode.

```
restore storage=<storage-name> client=<backup-client-name>
  where=<path> pool=<pool-name> fileset=<fileset-name>
  restoreclient=<restore-client-name>
  restorejob=<job-name>
  select current all done
```

bconsole 15.34: restore

Where **current**, if specified, tells the restore command to automatically select a restore to the most current backup. If not specified, you will be prompted. The **all** specification tells the restore command to restore all files. If it is not specified, you will be prompted for the files to restore. For details of the **restore** command, please see the Restore Chapter of this manual.

The client keyword initially specifies the client from which the backup was made and the client to which the restore will be make. However, if the restoreclient keyword is specified, then the restore is written to that client.

The restore job rarely needs to be specified, as bareos installations commonly only have a single restore job configured. However, for certain cases, such as a varying list of RunScript specifications, multiple restore jobs may be configured. The restorejob argument allows the selection of one of these jobs.

For more details, see the Restore chapter.

run This command allows you to schedule jobs to be run immediately.

The full form of the command is:

```
run job=<job-name> client=<client-name>
  fileset=<FileSet-name>  level=<level-keyword>
  storage=<storage-name>  where=<directory-prefix>
  when=<universal-time-specification> spooldata=yes|no yes
```

bconsole 15.35: run

Any information that is needed but not specified will be listed for selection, and before starting the job, you will be prompted to accept, reject, or modify the parameters of the job to be run, unless you have specified **yes**, in which case the job will be immediately sent to the scheduler.

If you wish to start a job at a later time, you can do so by setting the When time. Use the **mod** option and select **When** (no. 6). Then enter the desired start time in YYYY-MM-DD HH:MM:SS format.

The spooldata argument of the run command cannot be modified through the menu and is only accessible by setting its value on the intial command line. If no spooldata flag is set, the job, storage or schedule flag is used.

setbandwidth This command (Version >= 12.4.1) is used to limit the bandwidth of a running job or a client.

```
setbandwidth limit=<nb> [jobid=<id> | client=<cli>]
```

bconsole 15.36: setbandwidth

setdebug This command is used to set the debug level in each daemon. The form of this command is:

```
setdebug level=nnn [trace=0/1 client=<client-name> | dir | director | ↙
    ↪ storage=<storage-name> | all]
```

bconsole 15.37: setdebug

Each of the daemons normally has debug compiled into the program, but disabled. There are two ways to enable the debug output.

One is to add the **-d nnn** option on the command line when starting the daemon. The **nnn** is the debug level, and generally anything between 50 and 200 is reasonable. The higher the number, the more output is produced. The output is written to standard output.

The second way of getting debug output is to dynamically turn it on using the Console using the `setdebug level=nnn` command. If none of the options are given, the command will prompt you. You can selectively turn on/off debugging in any or all the daemons (i.e. it is not necessary to specify all the components of the above command).

If trace=1 is set, then tracing will be enabled, and the daemon will be placed in trace mode, which means that all debug output as set by the debug level will be directed to the file `bareos.trace` in the current directory of the daemon. Normally, tracing is needed only for Windows clients where the debug output cannot be written to a terminal or redirected to a file. When tracing, each debug output message is appended to the trace file. You must explicitly delete the file when you are done.

setip Sets new client address – if authorized.

A console is authorized to use the **SetIP** command only if it has a Console resource definition in both the Director and the Console. In addition, if the console name, provided on the **Name =** directive, must be the same as a Client name, the user of that console is permitted to use the **SetIP** command to change the Address directive in the Director's client resource to the IP address of the Console. This permits portables or other machines using DHCP (non-fixed IP addresses) to "notify" the Director of their current IP address.

show The show command will list the Director's resource records as defined in the Director's configuration file (normally **bareos-dir.conf**). This command is used mainly for debugging purposes by developers. The following keywords are accepted on the show command line: catalogs, clients, counters, devices, directors, filesets, jobs, messages, pools, schedules, storages, all, help. Please don't confuse this command with the **list**, which displays the contents of the catalog.

sqlquery The sqlquery command puts the Console program into SQL query mode where each line you enter is concatenated to the previous line until a semicolon (;) is seen. The semicolon terminates the command, which is then passed directly to the SQL database engine. When the output from the SQL engine is displayed, the formation of a new SQL command begins. To terminate SQL query mode and return to the Console command prompt, you enter a period (.) in column 1.

Using this command, you can query the SQL catalog database directly. Note you should really know what you are doing otherwise you could damage the catalog database. See the **query** command below for simpler and safer way of entering SQL queries.

Depending on what database engine you are using (MySQL, PostgreSQL or SQLite), you will have somewhat different SQL commands available. For more detailed information, please refer to the MySQL, PostgreSQL or SQLite documentation.

status This command will display the status of all components. For the director, it will display the next jobs that are scheduled during the next 24 hours as well as the status of currently running jobs. For the Storage Daemon, you will have drive status or autochanger content. The File Daemon will give you information about current jobs like average speed or file accounting. The full form of this command is:

```
status [all | dir=<dir-name> | director | scheduler | ↙
   ↪ schedule=<schedule-name> |
        client=<client-name> | storage=<storage-name> slots | subscriptions]
```

bconsole 15.38: status

If you do a **status dir**, the console will list any currently running jobs, a summary of all jobs scheduled to be run in the next 24 hours, and a listing of the last ten terminated jobs with their statuses. The scheduled jobs summary will include the Volume name to be used. You should be aware of two things: 1. to obtain the volume name, the code goes through the same code that will be used when the job runs, but it does not do pruning nor recycling of Volumes; 2. The Volume listed is at best a guess. The Volume actually used may be different because of the time difference (more durations may expire when the job runs) and another job could completely fill the Volume requiring a new one.

In the Running Jobs listing, you may find the following types of information:

```
2507 Catalog MatouVerify.2004-03-13_05.05.02 is waiting execution
5349 Full    CatalogBackup.2004-03-13_01.10.00 is waiting for higher
             priority jobs to finish
5348 Differe Minou.2004-03-13_01.05.09 is waiting on max Storage jobs
5343 Full    Rufus.2004-03-13_01.05.04 is running
```

Looking at the above listing from bottom to top, obviously JobId 5343 (Rufus) is running. JobId 5348 (Minou) is waiting for JobId 5343 to finish because it is using the Storage resource, hence the "waiting on max Storage jobs". JobId 5349 has a lower priority than all the other jobs so it is waiting for higher priority jobs to finish, and finally, JobId 2507 (MatouVerify) is waiting because only one job can run at a time, hence it is simply "waiting execution"

If you do a **status dir**, it will by default list the first occurrence of all jobs that are scheduled today and tomorrow. If you wish to see the jobs that are scheduled in the next three days (e.g. on Friday you want to see the first occurrence of what tapes are scheduled to be used on Friday, the weekend, and Monday), you can add the **days=3** option. Note, a **days=0** shows the first occurrence of jobs scheduled today only. If you have multiple run statements, the first occurrence of each run statement for the job will be displayed for the period specified.

If your job seems to be blocked, you can get a general idea of the problem by doing a **status dir**, but you can most often get a much more specific indication of the problem by doing a **status storage=xxx**. For example, on an idle test system, when I do **status storage=File**, I get:

```
*status storage=File
Connecting to Storage daemon File at 192.168.68.112:8103

rufus-sd Version: 1.39.6 (24 March 2006) i686-pc-linux-gnu redhat (Stentz)
Daemon started 26-Mar-06 11:06, 0 Jobs run since started.

Running Jobs:
No Jobs running.
====
```

```
Jobs waiting to reserve a drive:
====

Terminated Jobs:
 JobId  Level    Files          Bytes Status   Finished        Name
===================================================================
    59  Full         234      4,417,599 OK       15-Jan-06 11:54 usersave
====

Device status:
Autochanger "DDS-4-changer" with devices:
   "DDS-4" (/dev/nst0)
Device "DDS-4" (/dev/nst0) is mounted with Volume="TestVolume002"
Pool="*unknown*"
    Slot 2 is loaded in drive 0.
    Total Bytes Read=0 Blocks Read=0 Bytes/block=0
    Positioned at File=0 Block=0

Device "File" (/tmp) is not open.
====

In Use Volume status:
====
```

bconsole 15.39: status storage

Now, what this tells me is that no jobs are running and that none of the devices are in use. Now, if I **unmount** the autochanger, which will not be used in this example, and then start a Job that uses the File device, the job will block. When I re-issue the status storage command, I get for the Device status:

```
*status storage=File
...
Device status:
Autochanger "DDS-4-changer" with devices:
   "DDS-4" (/dev/nst0)
Device "DDS-4" (/dev/nst0) is not open.
    Device is BLOCKED. User unmounted.
    Drive 0 is not loaded.

Device "File" (/tmp) is not open.
    Device is BLOCKED waiting for media.
====
...
```

bconsole 15.40: status storage

Now, here it should be clear that if a job were running that wanted to use the Autochanger (with two devices), it would block because the user unmounted the device. The real problem for the Job I started using the "File" device is that the device is blocked waiting for media – that is Bareos needs you to label a Volume.

The command `status scheduler` (Version >= 12.4.4) can be used to check when a certain schedule will trigger. This gives more information than `status director` .

Called without parameters, `status scheduler` shows a preview for all schedules for the next 14 days. It first shows a list of the known schedules and the jobs that will be triggered by these jobs, and next, a table with date (including weekday), schedule name and applied overrides is displayed:

```
*status scheduler
Scheduler Jobs:

Schedule               Jobs Triggered
=============================================================

WeeklyCycle
                       BackupClient1
```

```
WeeklyCycleAfterBackup
                        BackupCatalog

====

Scheduler Preview for 14 days:

Date                    Schedule                Overrides
=============================================================
Di 04-Jun-2013 21:00    WeeklyCycle             Level=Incremental
Di 04-Jun-2013 21:10    WeeklyCycleAfterBackup  Level=Full
Mi 05-Jun-2013 21:00    WeeklyCycle             Level=Incremental
Mi 05-Jun-2013 21:10    WeeklyCycleAfterBackup  Level=Full
Do 06-Jun-2013 21:00    WeeklyCycle             Level=Incremental
Do 06-Jun-2013 21:10    WeeklyCycleAfterBackup  Level=Full
Fr 07-Jun-2013 21:00    WeeklyCycle             Level=Incremental
Fr 07-Jun-2013 21:10    WeeklyCycleAfterBackup  Level=Full
Sa 08-Jun-2013 21:00    WeeklyCycle             Level=Differential
Mo 10-Jun-2013 21:00    WeeklyCycle             Level=Incremental
Mo 10-Jun-2013 21:10    WeeklyCycleAfterBackup  Level=Full
Di 11-Jun-2013 21:00    WeeklyCycle             Level=Incremental
Di 11-Jun-2013 21:10    WeeklyCycleAfterBackup  Level=Full
Mi 12-Jun-2013 21:00    WeeklyCycle             Level=Incremental
Mi 12-Jun-2013 21:10    WeeklyCycleAfterBackup  Level=Full
Do 13-Jun-2013 21:00    WeeklyCycle             Level=Incremental
Do 13-Jun-2013 21:10    WeeklyCycleAfterBackup  Level=Full
Fr 14-Jun-2013 21:00    WeeklyCycle             Level=Incremental
Fr 14-Jun-2013 21:10    WeeklyCycleAfterBackup  Level=Full
Sa 15-Jun-2013 21:00    WeeklyCycle             Level=Differential
Mo 17-Jun-2013 21:00    WeeklyCycle             Level=Incremental
Mo 17-Jun-2013 21:10    WeeklyCycleAfterBackup  Level=Full
====
```

bconsole 15.41: status scheduler

`status scheduler` accepts the following parameters:

client=clientname shows only the schedules that affect the given client.

job=jobname shows only the schedules that affect the given job.

schedule=schedulename shows only the given schedule.

days=number of days shows only the number of days in the scheduler preview. Positive numbers show the future, negative numbers show the past. days can be combined with the other selection criteria. days= can be combined with the other selection criteria.

In case you are running a maintained version of Bareos, the command `status subscriptions` (Version >= 12.4.4) can help you to keep the overview over the subscriptions that are used.

To enable this functionality, just add the configuration directive subscriptions to the director configuration in the director resource:
The number of subscribed clients can be set in the director resource, for example:

```
Director {
   ...
   Subscriptions = 50
}
```

Configuration 15.42: enable subscription check

Using the console command `status subscriptions` , the status of the subscriptions can be checked any time interactively:

```
*status subscriptions
Ok: available subscriptions: 8 (42/50) (used/total)
```

bconsole 15.43: status subscriptions

Also, the number of subscriptions is checked after every job. If the number of clients is bigger than the configured limit, a Job warning is created a message like this:

```
JobId 7: Warning: Subscriptions exceeded: (used/total) (51/50)
```

bconsole 15.44: subscriptions warning

Please note: Nothing else than the warning is issued, no enforcement on backup, restore or any other operation will happen.
Setting the value for **Subscriptions** to 0 disables this functionality:

```
Director {
   ...
   Subscriptions = 0
}
```

Configuration 15.45: disable subscription check

Not configuring the directive at all also disables it, as the default value for the Subscriptions directive is zero.

time The time command shows the current date, time and weekday.

trace Turn on/off trace to file.

umount Alias for `unmount` .

unmount This command causes the indicated Bareos Storage daemon to unmount the specified device. The forms of the command are the same as the mount command:

```
unmount storage=<storage-name> [drive=<num>]
unmount [jobid=<id> | job=<job-name>]
```

bconsole 15.46: unmount

Once you unmount a storage device, Bareos will no longer be able to use it until you issue a mount command for that device. If Bareos needs to access that device, it will block and issue mount requests periodically to the operator.

If the device you are unmounting is an autochanger, it will unload the drive you have specified on the command line. If no drive is specified, it will assume drive 1.

In most cases, it is preferable to use the `release` instead.

update This command will update the catalog for either a specific Pool record, a Volume record, or the Slots in an autochanger with barcode capability. In the case of updating a Pool record, the new information will be automatically taken from the corresponding Director's configuration resource record. It can be used to increase the maximum number of volumes permitted or to set a maximum number of volumes. The following main keywords may be specified:

```
media, volume, pool, slots, stats
```

In the case of updating a Volume, you will be prompted for which value you wish to change. The following Volume parameters may be changed:

```
Volume Status
Volume Retention Period
Volume Use Duration
Maximum Volume Jobs
Maximum Volume Files
Maximum Volume Bytes
Recycle Flag
Recycle Pool
Slot
InChanger Flag
Pool
Volume Files
Volume from Pool
All Volumes from Pool
All Volumes from all Pools
```

For slots **update slots**, Bareos will obtain a list of slots and their barcodes from the Storage daemon, and for each barcode found, it will automatically update the slot in the catalog Media record to correspond to the new value. This is very useful if you have moved cassettes in the magazine, or if you have removed the magazine and inserted a different one. As the slot of each Volume is updated, the InChanger flag for that Volume will also be set, and any other Volumes in the Pool that were last mounted on the same Storage device will have their InChanger flag turned off. This permits Bareos to know what magazine (tape holder) is currently in the autochanger.

If you do not have barcodes, you can accomplish the same thing by using the **update slots scan** command. The **scan** keyword tells Bareos to physically mount each tape and to read its VolumeName.

For Pool **update pool**, Bareos will move the Volume record from its existing pool to the pool specified.

For **Volume from Pool**, **All Volumes from Pool** and **All Volumes from all Pools**, the following values are updated from the Pool record: Recycle, RecyclePool, VolRetention, VolUseDuration, MaxVolJobs, MaxVolFiles, and MaxVolBytes.

The full form of the update command with all command line arguments is:

```
update volume=<volume-name> pool=<poolname>
  slots volstatus=<volume-status> VolRetention=<volume-retention>
  VolUse=<volume-use-period> MaxVolJobs=nnn MaxVolBytes=nnn Recycle=yes|no
  slot=nnn enabled=n recyclepool=<pool-name>
```

bconsole 15.47: update

use This command allows you to specify which Catalog database to use. Normally, you will be using only one database so this will be done automatically. In the case that you are using more than one database, you can use this command to switch from one to another.

```
use [catalog=<catalog>]
```

bconsole 15.48: use

var This command takes a string or quoted string and does variable expansion on it the same way variable expansion is done on the **LabelFormat** string. Thus, for the most part, you can test your LabelFormat strings. The difference between the **var** command and the actual LabelFormat process is that during the var command, no job is running so "dummy" values are used in place of Job specific variables. Generally, however, you will get a good idea of what is going to happen in the real case.

version The command prints the Director's version.

wait The wait command causes the Director to pause until there are no jobs running. This command is useful in a batch situation such as regression testing where you wish to start a job and wait until that job completes before continuing. This command now has the following options:

```
wait [jobid=<jobid>] [jobuid=<unique id>] [job=<job name>]
```

bconsole 15.49: wait

If specified with a specific JobId, ... the wait command will wait for that particular job to terminate before continuing.

15.4.1 Special dot (.) Commands

There is a list of commands that are prefixed with a period (.). These commands are intended to be used either by batch programs or graphical user interface front-ends. They are not normally used by interactive users. For details, see Bareos Developer Guide (dot-commands) .

15.4.2 Special At (@) Commands

Normally, all commands entered to the Console program are immediately forwarded to the Director, which may be on another machine, to be executed. However, there is a small list of **at** commands, all beginning with an at character (@), that will not be sent to the Director, but rather interpreted by the Console program directly. Note, these commands are implemented only in the TTY console program and not in the Bat Console. These commands are:

@input <filename> Read and execute the commands contained in the file specified.

@output <filename> w/a Send all following output to the filename specified either overwriting the file (w) or appending to the file (a). To redirect the output to the terminal, simply enter **@output** without a filename specification. WARNING: be careful not to overwrite a valid file. A typical example during a regression test might be:

```
@output /dev/null
commands ...
@output
```

@tee <filename> w/a Send all subsequent output to both the specified file and the terminal. It is turned off by specifying **@tee** or **@output** without a filename.

@sleep <seconds> Sleep the specified number of seconds.

@time Print the current time and date.

@version Print the console's version.

@quit quit

@exit quit

@# anything Comment

@help Get the list of every special @ commands.

@separator <char> When using bconsole with readline, you can set the command separator to one of those characters to write commands who require multiple input on one line, or to put multiple commands on a single line.

```
!$%&'()*+,-/:;<>?[]^`{|}~
```

Note, if you use a semicolon (;) as a separator character, which is common, you will not be able to use the **sql** command, which requires each command to be terminated by a semicolon.

15.5 Adding Volumes to a Pool

TODO: move to another chapter
If you have used the **label** command to label a Volume, it will be automatically added to the Pool, and you will not need to add any media to the pool.
Alternatively, you may choose to add a number of Volumes to the pool without labeling them. At a later time when the Volume is requested by **Bareos** you will need to label it.
Before adding a volume, you must know the following information:

1. The name of the Pool (normally "Default")
2. The Media Type as specified in the Storage Resource in the Director's configuration file (e.g. "DLT8000")
3. The number and names of the Volumes you wish to create.

For example, to add media to a Pool, you would issue the following commands to the console program:

```
*add
Enter name of Pool to add Volumes to: Default
Enter the Media Type: DLT8000
Enter number of Media volumes to create. Max=1000: 10
Enter base volume name: Save
Enter the starting number: 1
10 Volumes created in pool Default
*
```

To see what you have added, enter:

```
*list media pool=Default
+-------+----------+---------+---------+-------+------------------+
| MedId | VolumeNa | MediaTyp| VolStat | Bytes | LastWritten      |
+-------+----------+---------+---------+-------+------------------+
|    11 | Save0001 | DLT8000 | Append  |     0 | 0000-00-00 00:00 |
|    12 | Save0002 | DLT8000 | Append  |     0 | 0000-00-00 00:00 |
|    13 | Save0003 | DLT8000 | Append  |     0 | 0000-00-00 00:00 |
|    14 | Save0004 | DLT8000 | Append  |     0 | 0000-00-00 00:00 |
|    15 | Save0005 | DLT8000 | Append  |     0 | 0000-00-00 00:00 |
|    16 | Save0006 | DLT8000 | Append  |     0 | 0000-00-00 00:00 |
|    17 | Save0007 | DLT8000 | Append  |     0 | 0000-00-00 00:00 |
|    18 | Save0008 | DLT8000 | Append  |     0 | 0000-00-00 00:00 |
|    19 | Save0009 | DLT8000 | Append  |     0 | 0000-00-00 00:00 |
|    20 | Save0010 | DLT8000 | Append  |     0 | 0000-00-00 00:00 |
+-------+----------+---------+---------+-------+------------------+
*
```

Notice that the console program automatically appended a number to the base Volume name that you specify (Save in this case). If you don't want it to append a number, you can simply answer 0 (zero) to the question "Enter number of Media volumes to create. Max=1000:", and in this case, it will create a single Volume with the exact name you specify.

Chapter 16

The Restore Command

16.1 General

Below, we will discuss restoring files with the Console **restore** command, which is the recommended way of doing restoring files. It is not possible to restore files by automatically starting a job as you do with Backup, Verify, ... jobs. However, in addition to the console restore command, there is a standalone program named **bextract**, which also permits restoring files. For more information on this program, please see the Bareos Utility Programs chapter of this manual. We don't particularly recommend the **bextract** program because it lacks many of the features of the normal Bareos restore, such as the ability to restore Win32 files to Unix systems, and the ability to restore access control lists (ACL). As a consequence, we recommend, wherever possible to use Bareos itself for restores as described below.
You may also want to look at the **bls** program in the same chapter, which allows you to list the contents of your Volumes. Finally, if you have an old Volume that is no longer in the catalog, you can restore the catalog entries using the program named **bscan**, documented in the same Bareos Utility Programs chapter.
In general, to restore a file or a set of files, you must run a **restore** job. That is a job with **Type = Restore**. As a consequence, you will need a predefined **restore** job in your **bareos-dir.conf** (Director's config) file. The exact parameters (Client, FileSet, ...) that you define are not important as you can either modify them manually before running the job or if you use the **restore** command, explained below, Bareos will automatically set them for you. In fact, you can no longer simply run a restore job. You must use the restore command.
Since Bareos is a network backup program, you must be aware that when you restore files, it is up to you to ensure that you or Bareos have selected the correct Client and the correct hard disk location for restoring those files. **Bareos** will quite willingly backup client A, and restore it by sending the files to a different directory on client B. Normally, you will want to avoid this, but assuming the operating systems are not too different in their file structures, this should work perfectly well, if so desired. By default, Bareos will restore data to the same Client that was backed up, and those data will be restored not to the original places but to **/tmp/bareos-restores**. This is configured in the default restore command resource in bareos-dir.conf. You may modify any of these defaults when the restore command prompts you to run the job by selecting the **mod** option.

16.2 The Restore Command

Since Bareos maintains a catalog of your files and on which Volumes (disk or tape), they are stored, it can do most of the bookkeeping work, allowing you simply to specify what kind of restore you want (current, before a particular date), and what files to restore. Bareos will then do the rest.
This is accomplished using the **restore** command in the Console. First you select the kind of restore you want, then the JobIds are selected, the File records for those Jobs are placed in an internal Bareos directory tree, and the restore enters a file selection mode that allows you to interactively walk up and down the file tree selecting individual files to be restored. This mode is somewhat similar to the standard Unix **restore** program's interactive file selection mode.
If a Job's file records have been pruned from the catalog, the **restore** command will be unable to find any files to restore. Bareos will ask if you want to restore all of them or if you want to use a regular expression to restore only a selection while reading media. See FileRegex option and below for more details on this.
Within the Console program, after entering the **restore** command, you are presented with the following selection prompt:

```
* restore
First you select one or more JobIds that contain files
to be restored. You will be presented several methods
of specifying the JobIds. Then you will be allowed to
select which files from those JobIds are to be restored.

To select the JobIds, you have the following choices:
     1: List last 20 Jobs run
     2: List Jobs where a given File is saved
     3: Enter list of comma separated JobIds to select
     4: Enter SQL list command
     5: Select the most recent backup for a client
     6: Select backup for a client before a specified time
     7: Enter a list of files to restore
     8: Enter a list of files to restore before a specified time
     9: Find the JobIds of the most recent backup for a client
    10: Find the JobIds for a backup for a client before a specified time
    11: Enter a list of directories to restore for found JobIds
    12: Select full restore to a specified Job date
    13: Cancel
Select item:  (1-13):
```

bconsole 16.1: restore

There are a lot of options, and as a point of reference, most people will want to select item 5 (the most recent backup for a client). The details of the above options are:

- Item 1 will list the last 20 jobs run. If you find the Job you want, you can then select item 3 and enter its JobId(s).

- Item 2 will list all the Jobs where a specified file is saved. If you find the Job you want, you can then select item 3 and enter the JobId.

- Item 3 allows you the enter a list of comma separated JobIds whose files will be put into the directory tree. You may then select which files from those JobIds to restore. Normally, you would use this option if you have a particular version of a file that you want to restore and you know its JobId. The most common options (5 and 6) will not select a job that did not terminate normally, so if you know a file is backed up by a Job that failed (possibly because of a system crash), you can access it through this option by specifying the JobId.

- Item 4 allows you to enter any arbitrary SQL command. This is probably the most primitive way of finding the desired JobIds, but at the same time, the most flexible. Once you have found the JobId(s), you can select item 3 and enter them.

- Item 5 will automatically select the most recent Full backup and all subsequent incremental and differential backups for a specified Client. These are the Jobs and Files which, if reloaded, will restore your system to the most current saved state. It automatically enters the JobIds found into the directory tree in an optimal way such that only the most recent copy of any particular file found in the set of Jobs will be restored. This is probably the most convenient of all the above options to use if you wish to restore a selected Client to its most recent state.

  There are two important things to note. First, this automatic selection will never select a job that failed (terminated with an error status). If you have such a job and want to recover one or more files from it, you will need to explicitly enter the JobId in item 3, then choose the files to restore.

  If some of the Jobs that are needed to do the restore have had their File records pruned, the restore will be incomplete. Bareos currently does not correctly detect this condition. You can however, check for this by looking carefully at the list of Jobs that Bareos selects and prints. If you find Jobs with the JobFiles column set to zero, when files should have been backed up, then you should expect problems.

  If all the File records have been pruned, Bareos will realize that there are no file records in any of the JobIds chosen and will inform you. It will then propose doing a full restore (non-selective) of those JobIds. This is possible because Bareos still knows where the beginning of the Job data is on the Volumes, even if it does not know where particular files are located or what their names are.

- Item 6 allows you to specify a date and time, after which Bareos will automatically select the most recent Full backup and all subsequent incremental and differential backups that started before the specified date and time.
- Item 7 allows you to specify one or more filenames (complete path required) to be restored. Each filename is entered one at a time or if you prefix a filename with the less-than symbol (<) Bareos will read that file and assume it is a list of filenames to be restored. If you prefix the filename with a question mark (?), then the filename will be interpreted as an SQL table name, and Bareos will include the rows of that table in the list to be restored. The table must contain the JobId in the first column and the FileIndex in the second column. This table feature is intended for external programs that want to build their own list of files to be restored. The filename entry mode is terminated by entering a blank line.
- Item 8 allows you to specify a date and time before entering the filenames. See Item 7 above for more details.
- Item 9 allows you find the JobIds of the most recent backup for a client. This is much like option 5 (it uses the same code), but those JobIds are retained internally as if you had entered them manually. You may then select item 11 (see below) to restore one or more directories.
- Item 10 is the same as item 9, except that it allows you to enter a before date (as with item 6). These JobIds will then be retained internally.
- Item 11 allows you to enter a list of JobIds from which you can select directories to be restored. The list of JobIds can have been previously created by using either item 9 or 10 on the menu. You may then enter a full path to a directory name or a filename preceded by a less than sign (<). The filename should contain a list of directories to be restored. All files in those directories will be restored, but if the directory contains subdirectories, nothing will be restored in the subdirectory unless you explicitly enter its name.
- Item 12 is a full restore to a specified job date.
- Item 13 allows you to cancel the restore command.

As an example, suppose that we select item 5 (restore to most recent state). If you have not specified a client=xxx on the command line, it it will then ask for the desired Client, which on my system, will print all the Clients found in the database as follows:

```
Select item:  (1-13): 5
Defined clients:
     1: Rufus
     2: Matou
     3: Polymatou
     4: Minimatou
     5: Minou
     6: MatouVerify
     7: PmatouVerify
     8: RufusVerify
     9: Watchdog
Select Client (File daemon) resource (1-9): 1
```

bconsole 16.2: restore: select client

The listed clients are only examples, yours will look differently. If you have only one Client, it will be automatically selected. In this example, I enter 1 for **Rufus** to select the Client. Then Bareos needs to know what FileSet is to be restored, so it prompts with:

```
The defined FileSet resources are:
     1: Full Set
     2: Other Files
Select FileSet resource (1-2):
```

If you have only one FileSet defined for the Client, it will be selected automatically. I choose item 1, which is my full backup. Normally, you will only have a single FileSet for each Job, and if your machines are similar (all Linux) you may only have one FileSet for all your Clients.
At this point, Bareos has all the information it needs to find the most recent set of backups. It will then query the database, which may take a bit of time, and it will come up with something like the following. Note, some of the columns are truncated here for presentation:

```
+-------+------+----------+-------------+-------------+------+-------+------------+
| JobId | Levl | JobFiles | StartTime   | VolumeName  | File | SesId |VolSesTime  |
+-------+------+----------+-------------+-------------+------+-------+------------+
| 1,792 | F    |  128,374 | 08-03 01:58 | DLT-19Jul02 |   67 |    18 | 1028042998 |
| 1,792 | F    |  128,374 | 08-03 01:58 | DLT-04Aug02 |    0 |    18 | 1028042998 |
| 1,797 | I    |      254 | 08-04 13:53 | DLT-04Aug02 |    5 |    23 | 1028042998 |
| 1,798 | I    |       15 | 08-05 01:05 | DLT-04Aug02 |    6 |    24 | 1028042998 |
+-------+------+----------+-------------+-------------+------+-------+------------+
You have selected the following JobId: 1792,1792,1797
Building directory tree for JobId 1792 ...
Building directory tree for JobId 1797 ...
Building directory tree for JobId 1798 ...
cwd is: /
$
```

Depending on the number of **JobFiles** for each JobId, the "`Building directory tree ...`" can take a bit of time. If you notice ath all the JobFiles are zero, your Files have probably been pruned and you will not be able to select any individual files – it will be restore everything or nothing.
In our example, Bareos found four Jobs that comprise the most recent backup of the specified Client and FileSet. Two of the Jobs have the same JobId because that Job wrote on two different Volumes. The third Job was an incremental backup to the previous Full backup, and it only saved 254 Files compared to 128,374 for the Full backup. The fourth Job was also an incremental backup that saved 15 files.
Next Bareos entered those Jobs into the directory tree, with no files marked to be restored as a default, tells you how many files are in the tree, and tells you that the current working directory (**cwd**) is /. Finally, Bareos prompts with the dollar sign ($) to indicate that you may enter commands to move around the directory tree and to select files.
If you want all the files to automatically be marked when the directory tree is built, you could have entered the command **restore all**, or at the $ prompt, you can simply enter **mark ***.
Instead of choosing item 5 on the first menu (Select the most recent backup for a client), if we had chosen item 3 (Enter list of JobIds to select) and we had entered the JobIds **1792,1797,1798** we would have arrived at the same point.
One point to note, if you are manually entering JobIds, is that you must enter them in the order they were run (generally in increasing JobId order). If you enter them out of order and the same file was saved in two or more of the Jobs, you may end up with an old version of that file (i.e. not the most recent).
Directly entering the JobIds can also permit you to recover data from a Job that wrote files to tape but that terminated with an error status.
While in file selection mode, you can enter **help** or a question mark (?) to produce a summary of the available commands:

```
 Command    Description
  =======    ===========
  cd         change current directory
  count      count marked files in and below the cd
  dir        long list current directory, wildcards allowed
  done       leave file selection mode
  estimate   estimate restore size
  exit       same as done command
  find       find files, wildcards allowed
  help       print help
  ls         list current directory, wildcards allowed
  lsmark     list the marked files in and below the cd
  mark       mark dir/file to be restored recursively in dirs
  markdir    mark directory name to be restored (no files)
  pwd        print current working directory
  unmark     unmark dir/file to be restored recursively in dir
  unmarkdir  unmark directory name only no recursion
  quit       quit and do not do restore
  ?          print help
```

As a default no files have been selected for restore (unless you added **all** to the command line. If you want to restore everything, at this point, you should enter **mark ***, and then **done** and Bareos will write the bootstrap records to a file and request your approval to start a restore job.
If you do not enter the above mentioned **mark *** command, you will start with an empty state. Now you can simply start looking at the tree and **mark** particular files or directories you want restored. It is easy to make a mistake in specifying a file to mark or unmark, and Bareos's error handling is not perfect, so please check your work by using the **ls** or **dir** commands to see what files are actually selected. Any selected file has its name preceded by an asterisk.
To check what is marked or not marked, enter the **count** command, which displays:

```
128401 total files. 128401 marked to be restored.
```

Each of the above commands will be described in more detail in the next section. We continue with the above example, having accepted to restore all files as Bareos set by default. On entering the **done** command, Bareos prints:

```
Run Restore job
JobName:         RestoreFiles
Bootstrap:       /var/lib/bareos/client1.restore.3.bsr
Where:           /tmp/bareos-restores
Replace:         Always
FileSet:         Full Set
Backup Client:   client1
Restore Client:  client1
Format:          Native
Storage:         File
When:            2013-06-28 13:30:08
Catalog:         MyCatalog
Priority:        10
Plugin Options:  *None*
OK to run? (yes/mod/no):
```

Please examine each of the items very carefully to make sure that they are correct. In particular, look at **Where**, which tells you where in the directory structure the files will be restored, and **Client**, which tells you which client will receive the files. Note that by default the Client which will receive the files is the Client that was backed up. These items will not always be completed with the correct values depending on which of the restore options you chose. You can change any of these default items by entering **mod** and responding to the prompts.
The above assumes that you have defined a **Restore** Job resource in your Director's configuration file. Normally, you will only need one Restore Job resource definition because by its nature, restoring is a manual operation, and using the Console interface, you will be able to modify the Restore Job to do what you want. An example Restore Job resource definition is given below.
Returning to the above example, you should verify that the Client name is correct before running the Job. However, you may want to modify some of the parameters of the restore job. For example, in addition to checking the Client it is wise to check that the Storage device chosen by Bareos is indeed correct. Although the **FileSet** is shown, it will be ignored in restore. The restore will choose the files to be restored either by reading the **Bootstrap** file, or if not specified, it will restore all files associated with the specified backup **JobId** (i.e. the JobId of the Job that originally backed up the files).
Finally before running the job, please note that the default location for restoring files is **not** their original locations, but rather the directory **/tmp/bareos-restores**. You can change this default by modifying your **bareos-dir.conf** file, or you can modify it using the **mod** option. If you want to restore the files to their original location, you must have **Where** set to nothing or to the root, i.e. /.
If you now enter **yes**, Bareos will run the restore Job.

16.3 Selecting Files by Filename

If you have a small number of files to restore, and you know the filenames, you can either put the list of filenames in a file to be read by Bareos, or you can enter the names one at a time. The filenames must include the full path and filename. No wild cards are used.
To enter the files, after the **restore**, you select item number 7 from the prompt list:

```
* restore
First you select one or more JobIds that contain files
to be restored. You will be presented several methods
of specifying the JobIds. Then you will be allowed to
select which files from those JobIds are to be restored.

To select the JobIds, you have the following choices:
     1: List last 20 Jobs run
     2: List Jobs where a given File is saved
     3: Enter list of comma separated JobIds to select
     4: Enter SQL list command
     5: Select the most recent backup for a client
     6: Select backup for a client before a specified time
```

```
     7: Enter a list of files to restore
     8: Enter a list of files to restore before a specified time
     9: Find the JobIds of the most recent backup for a client
    10: Find the JobIds for a backup for a client before a specified time
    11: Enter a list of directories to restore for found JobIds
    12: Select full restore to a specified Job date
    13: Cancel
Select item:  (1-13): 7
```

bconsole 16.3: restore list of files

which then prompts you for the client name:

```
Defined Clients:
     1: client1
     2: Tibs
     3: Rufus
Select the Client (1-3): 3
```

Of course, your client list will be different, and if you have only one client, it will be automatically selected. And finally, Bareos requests you to enter a filename:

```
Enter filename:
```

At this point, you can enter the full path and filename

```
Enter filename: /etc/resolv.conf
Enter filename:
```

as you can see, it took the filename. If Bareos cannot find a copy of the file, it prints the following:

```
Enter filename: junk filename
No database record found for: junk filename
Enter filename:
```

If you want Bareos to read the filenames from a file, you simply precede the filename with a less-than symbol (<).
It is possible to automate the selection by file by putting your list of files in say **/tmp/file-list**, then using the following command:

```
restore client=client1 file=</tmp/file-list
```

If in modifying the parameters for the Run Restore job, you find that Bareos asks you to enter a Job number, this is because you have not yet specified either a Job number or a Bootstrap file. Simply entering zero will allow you to continue and to select another option to be modified.

16.4 Replace Options

When restoring, you have the option to specify a Replace option. This directive determines the action to be taken when restoring a file or directory that already exists. This directive can be set by selecting the **mod** option. You will be given a list of parameters to choose from. Full details on this option can be found in the Job Resource section of the Director documentation.

16.5 Command Line Arguments

If all the above sounds complicated, you will probably agree that it really isn't after trying it a few times. It is possible to do everything that was shown above, with the exception of selecting the FileSet, by using command line arguments with a single command by entering:

```
restore client=Rufus select current all done yes
```

The **client=Rufus** specification will automatically select Rufus as the client, the **current** tells Bareos that you want to restore the system to the most current state possible, and the **yes** suppresses the final **yes/mod/no** prompt and simply runs the restore.
The full list of possible command line arguments are:

- **all** – select all Files to be restored.
- **select** – use the tree selection method.
- **done** – do not prompt the user in tree mode.
- **copies** – instead of using the actual backup jobs for restoring use the copies which were made of these backup Jobs. This could mean that on restore the client will contact a remote storage daemon if the data is copied to a remote storage daemon as part of your copy Job scheme.
- **current** – automatically select the most current set of backups for the specified client.
- **client=xxxx** – initially specifies the client from which the backup was made and the client to which the restore will be make. See also "restoreclient" keyword.
- **restoreclient=xxxx** – if the keyword is specified, then the restore is written to that client.
- **jobid=nnn** – specify a JobId or comma separated list of JobIds to be restored.
- **before=YYYY-MM-DD HH:MM:SS** – specify a date and time to which the system should be restored. Only Jobs started before the specified date/time will be selected, and as is the case for **current** Bareos will automatically find the most recent prior Full save and all Differential and Incremental saves run before the date you specify. Note, this command is not too user friendly in that you must specify the date/time exactly as shown.
- **file=filename** – specify a filename to be restored. You must specify the full path and filename. Prefixing the entry with a less-than sign (<) will cause Bareos to assume that the filename is on your system and contains a list of files to be restored. Bareos will thus read the list from that file. Multiple file=xxx specifications may be specified on the command line.
- **jobid=nnn** – specify a JobId to be restored.
- **pool=pool-name** – specify a Pool name to be used for selection of Volumes when specifying options 5 and 6 (restore current system, and restore current system before given date). This permits you to have several Pools, possibly one offsite, and to select the Pool to be used for restoring.
- **where=/tmp/bareos-restore** – restore files in **where** directory.
- **yes** – automatically run the restore without prompting for modifications (most useful in batch scripts).
- **strip_prefix=/prod** – remove a part of the filename when restoring.
- **add_prefix=/test** – add a prefix to all files when restoring (like where) (can't be used with **where=**).
- **add_suffix=.old** – add a suffix to all your files.
- **regexwhere=!a.pdf!a.bkp.pdf!** – do complex filename manipulation like with sed unix command. Will overwrite other filename manipulation. For details, see the regexwhere section.
- **restorejob=jobname** – Pre-chooses a restore job. Bareos can be configured with multiple restore jobs ("Type = Restore" in the job definition). This allows the specification of different restore properties, including a set of RunScripts. When more than one job of this type is configured, during restore, Bareos will ask for a user selection interactively, or use the given restorejob.

16.6 Using File Relocation

Introduction

The **where=** option is simple, but not very powerful. With file relocation, Bareos can restore a file to the same directory, but with a different name, or in an other directory without recreating the full path.
You can also do filename and path manipulations, such as adding a suffix to all your files, renaming files or directories, etc. Theses options will overwrite **where=** option.
For example, many users use OS snapshot features so that file `/home/eric/mbox` will be backed up from the directory `/.snap/home/eric/mbox`, which can complicate restores. If you use **where=/tmp**, the file will be restored to `/tmp/.snap/home/eric/mbox` and you will have to move the file to `/home/eric/mbox.bkp` by hand.

However, case, you could use the **strip_prefix=/.snap** and **add_suffix=.bkp** options and Bareos will restore the file to its original location – that is `/home/eric/mbox`.
To use this feature, there are command line options as described in the restore section of this manual; you can modify your restore job before running it; or you can add options to your restore job in as described in Strip Prefix Dir Job and Add Prefix Dir Job.

```
Parameters to modify:
     1: Level
     2: Storage
    ...
    10: File Relocation
    ...
Select parameter to modify (1-12):


This will replace your current Where value
     1: Strip prefix
     2: Add prefix
     3: Add file suffix
     4: Enter a regexp
     5: Test filename manipulation
     6: Use this ?
Select parameter to modify (1-6):
```

RegexWhere Format

The format is very close to that used by sed or Perl (`s/replace this/by that/`) operator. A valid regexwhere expression has three fields :

- a search expression (with optional submatch)
- a replacement expression (with optionnal back references $1 to $9)
- a set of search options (only case-insensitive "i" at this time)

Each field is delimited by a separator specified by the user as the first character of the expression. The separator can be one of the following:

`<separator-keyword> = / ! ; % : , ~ # = &`

You can use several expressions separated by a commas.

Examples

Orignal filename	New filename	RegexWhere	Comments
`c:/system.ini`	`c:/system.old.ini`	`/.ini$/.old.ini/`	$ matches end of name
`/prod/u01/pdata/`	`/rect/u01/rdata`	`/prod/rect/,/pdata/rdata/`	uses two regexp
`/prod/u01/pdata/`	`/rect/u01/rdata`	`!/prod/!/rect/!,/pdata/rdata/`	use `!` as separator
`C:/WINNT`	`d:/WINNT`	`/c:/d:/i`	case insensitive pattern match

16.7 Restoring Directory Attributes

Depending how you do the restore, you may or may not get the directory entries back to their original state. Here are a few of the problems you can encounter, and for same machine restores, how to avoid them.

- You backed up on one machine and are restoring to another that is either a different OS or doesn't have the same users/groups defined. Bareos does the best it can in these situations. Note, Bareos has saved the user/groups in numeric form, which means on a different machine, they may map to different user/group names.
- You are restoring into a directory that is already created and has file creation restrictions. Bareos tries to reset everything but without walking up the full chain of directories and modifying them all during the restore, which Bareos does and will not do, getting permissions back correctly in this situation depends to a large extent on your OS.

- You are doing a recursive restore of a directory tree. In this case Bareos will restore a file before restoring the file's parent directory entry. In the process of restoring the file Bareos will create the parent directory with open permissions and ownership of the file being restored. Then when Bareos tries to restore the parent directory Bareos sees that it already exists (Similar to the previous situation). If you had set the Restore job's "Replace" property to "never" then Bareos will not change the directory's permissions and ownerships to match what it backed up, you should also notice that the actual number of files restored is less then the expected number. If you had set the Restore job's "Replace" property to "always" then Bareos will change the Directory's ownership and permissions to match what it backed up, also the actual number of files restored should be equal to the expected number.

- You selected one or more files in a directory, but did not select the directory entry to be restored. In that case, if the directory is not on disk Bareos simply creates the directory with some default attributes which may not be the same as the original. If you do not select a directory and all its contents to be restored, you can still select items within the directory to be restored by individually marking those files, but in that case, you should individually use the "markdir" command to select all higher level directory entries (one at a time) to be restored if you want the directory entries properly restored.

16.8 Restoring on Windows

If you are restoring on Windows systems, Bareos will restore the files with the original ownerships and permissions as would be expected. This is also true if you are restoring those files to an alternate directory (using the Where option in restore). However, if the alternate directory does not already exist, the Bareos File daemon (Client) will try to create it. In some cases, it may not create the directories, and if it does since the File daemon runs under the SYSTEM account, the directory will be created with SYSTEM ownership and permissions. In this case, you may have problems accessing the newly restored files.
To avoid this problem, you should create any alternate directory before doing the restore. Bareos will not change the ownership and permissions of the directory if it is already created as long as it is not one of the directories being restored (i.e. written to tape).
The default restore location is **/tmp/bareos-restores/** and if you are restoring from drive **E:**, the default will be **/tmp/bareos-restores/e/**, so you should ensure that this directory exists before doing the restore, or use the **mod** option to select a different **where** directory that does exist.
Some users have experienced problems restoring files that participate in the Active Directory. They also report that changing the userid under which Bareos (bareos-fd.exe) runs, from SYSTEM to a Domain Admin userid, resolves the problem.

16.9 Restore Errors

There are a number of reasons why there may be restore errors or warning messages. Some of the more common ones are:

file count mismatch This can occur for the following reasons:

- You requested Bareos not to overwrite existing or newer files.
- A Bareos miscount of files/directories. This is an on-going problem due to the complications of directories, soft/hard link, and such. Simply check that all the files you wanted were actually restored.

file size error When Bareos restores files, it checks that the size of the restored file is the same as the file status data it saved when starting the backup of the file. If the sizes do not agree, Bareos will print an error message. This size mismatch most often occurs because the file was being written as Bareos backed up the file. In this case, the size that Bareos restored will be greater than the status size. This often happens with log files.

If the restored size is smaller, then you should be concerned about a possible tape error and check the Bareos output as well as your system logs.

16.10 Example Restore Job Resource

```
Job {
```

```
  Name = "RestoreFiles"
  Type = Restore
  Client = Any-client
  FileSet = "Any-FileSet"
  Storage = Any-storage
  Where = /tmp/bareos-restores
  Messages = Standard
  Pool = Default
}
```

If **Where** is not specified, the default location for restoring files will be their original locations.

16.11 File Selection Commands

After you have selected the Jobs to be restored and Bareos has created the in-memory directory tree, you will enter file selection mode as indicated by the dollar sign (**$**) prompt. While in this mode, you may use the commands listed above. The basic idea is to move up and down the in memory directory structure with the **cd** command much as you normally do on the system. Once you are in a directory, you may select the files that you want restored. As a default no files are marked to be restored. If you wish to start with all files, simply enter: **cd /** and **mark ***. Otherwise proceed to select the files you wish to restore by marking them with the **mark** command. The available commands are:

cd The **cd** command changes the current directory to the argument specified. It operates much like the Unix **cd** command. Wildcard specifications are not permitted.

Note, on Windows systems, the various drives (c:, d:, ...) are treated like a directory within the file tree while in the file selection mode. As a consequence, you must do a **cd c:** or possibly in some cases a **cd C:** (note upper case) to get down to the first directory.

dir The **dir** command is similar to the **ls** command, except that it prints it in long format (all details). This command can be a bit slower than the **ls** command because it must access the catalog database for the detailed information for each file.

estimate The **estimate** command prints a summary of the total files in the tree, how many are marked to be restored, and an estimate of the number of bytes to be restored. This can be useful if you are short on disk space on the machine where the files will be restored.

find The **find** command accepts one or more arguments and displays all files in the tree that match that argument. The argument may have wildcards. It is somewhat similar to the Unix command **find / -name arg**.

ls The **ls** command produces a listing of all the files contained in the current directory much like the Unix **ls** command. You may specify an argument containing wildcards, in which case only those files will be listed.

Any file that is marked to be restored will have its name preceded by an asterisk (*****). Directory names will be terminated with a forward slash (/) to distinguish them from filenames.

lsmark The **lsmark** command is the same as the **ls** except that it will print only those files marked for extraction. The other distinction is that it will recursively descend into any directory selected.

mark The **mark** command allows you to mark files to be restored. It takes a single argument which is the filename or directory name in the current directory to be marked for extraction. The argument may be a wildcard specification, in which case all files that match in the current directory are marked to be restored. If the argument matches a directory rather than a file, then the directory and all the files contained in that directory (recursively) are marked to be restored. Any marked file will have its name preceded with an asterisk (*****) in the output produced by the **ls** or **dir** commands. Note, supplying a full path on the mark command does not work as expected to select a file or directory in the current directory. Also, the **mark** command works on the current and lower directories but does not touch higher level directories.

After executing the **mark** command, it will print a brief summary:

```
No files marked.
```

If no files were marked, or:

```
nn files marked.
```

if some files are marked.

unmark The **unmark** is identical to the **mark** command, except that it unmarks the specified file or files so that they will not be restored. Note: the **unmark** command works from the current directory, so it does not unmark any files at a higher level. First do a **cd /** before the **unmark *** command if you want to unmark everything.

pwd The **pwd** command prints the current working directory. It accepts no arguments.

count The **count** command prints the total files in the directory tree and the number of files marked to be restored.

done This command terminates file selection mode.

exit This command terminates file selection mode (the same as done).

quit This command terminates the file selection and does not run the restore job.

help This command prints a summary of the commands available.

? This command is the same as the **help** command.

If your filename contains some weird caracters, you can use `?`, `*` or \\. For example, if your filename contains a \, you can use \\\\.

```
* mark weird_file\\\\with-backslash
```

Chapter 17

Volume Management

This chapter presents most all the features needed to do Volume management. Most of the concepts apply equally well to both tape and disk Volumes. However, the chapter was originally written to explain backing up to disk, so you will see it is slanted in that direction, but all the directives presented here apply equally well whether your volume is disk or tape.
If you have a lot of hard disk storage or you absolutely must have your backups run within a small time window, you may want to direct Bareos to backup to disk Volumes rather than tape Volumes. This chapter is intended to give you some of the options that are available to you so that you can manage either disk or tape volumes.

17.1 Key Concepts and Resource Records

Getting Bareos to write to disk rather than tape in the simplest case is rather easy. In the Storage daemon's configuration file, you simply define an **Archive Device** to be a directory. The default directory to store backups on disk is `/var/lib/bareos/storage`:

```
Device {
  Name = FileBackup
  Media Type = File
  Archive Device = /var/lib/bareos/storage
  Random Access = Yes;
  AutomaticMount = yes;
  RemovableMedia = no;
  AlwaysOpen = no;
}
```

Assuming you have the appropriate **Storage** resource in your Director's configuration file that references the above Device resource,

```
Storage {
  Name = FileStorage
  Address = ...
  Password = ...
  Device = FileBackup
  Media Type = File
}
```

Bareos will then write the archive to the file **/var/lib/bareos/storage/<volume-name>** where <volume-name> is the volume name of a Volume defined in the Pool. For example, if you have labeled a Volume named **Vol001**, Bareos will write to the file **/var/lib/bareos/storage/Vol001**. Although you can later move the archive file to another directory, you should not rename it or it will become unreadable by Bareos. This is because each archive has the filename as part of the internal label, and the internal label must agree with the system filename before Bareos will use it.
Although this is quite simple, there are a number of problems. The first is that unless you specify otherwise, Bareos will always write to the same volume until you run out of disk space. This problem is addressed below.
In addition, if you want to use concurrent jobs that write to several different volumes at the same time, you will need to understand a number of other details. An example of such a configuration is given at the end of this chapter under Concurrent Disk Jobs.

17.1.1 Pool Options to Limit the Volume Usage

Some of the options you have, all of which are specified in the Pool record, are:

- To write each Volume only once (i.e. one Job per Volume or file in this case), use:
  UseVolumeOnce = yes.
- To write nnn Jobs to each Volume, use:
  Maximum Volume Jobs = nnn.
- To limit the maximum size of each Volume, use:
  Maximum Volume Bytes = mmmm.
  Note, if you use disk volumes you should probably limit the Volume size to some reasonable value such as say 5GB. This is because during a restore, Bareos is currently unable to seek to the proper place

in a disk volume to restore a file, which means that it must read all records up to where the restore begins. If your Volumes are 50GB, reading half or more of the volume could take quite a bit of time. Also, if you ever have a partial hard disk failure, you are more likely to be able to recover more data if they are in smaller Volumes.

- To limit the use time (i.e. write the Volume for a maximum of five days), use:

  Volume Use Duration = ttt.

Note that although you probably would not want to limit the number of bytes on a tape as you would on a disk Volume, the other options can be very useful in limiting the time Bareos will use a particular Volume (be it tape or disk). For example, the above directives can allow you to ensure that you rotate through a set of daily Volumes if you wish.
As mentioned above, each of those directives is specified in the Pool or Pools that you use for your Volumes. In the case of **Maximum Volume Job**, **Maximum Volume Bytes**, and **Volume Use Duration**, you can actually specify the desired value on a Volume by Volume basis. The value specified in the Pool record becomes the default when labeling new Volumes. Once a Volume has been created, it gets its own copy of the Pool defaults, and subsequently changing the Pool will have no effect on existing Volumes. You can either manually change the Volume values, or refresh them from the Pool defaults using the **update volume** command in the Console. As an example of the use of one of the above, suppose your Pool resource contains:

```
Pool {
  Name = File
  Pool Type = Backup
  Volume Use Duration = 23h
}
```

then if you run a backup once a day (every 24 hours), Bareos will use a new Volume for each backup, because each Volume it writes can only be used for 23 hours after the first write. Note, setting the use duration to 23 hours is not a very good solution for tapes unless you have someone on-site during the weekends, because Bareos will want a new Volume and no one will be present to mount it, so no weekend backups will be done until Monday morning.

17.1.2 Automatic Volume Labeling

Use of the above records brings up another problem – that of labeling your Volumes. For automated disk backup, you can either manually label each of your Volumes, or you can have Bareos automatically label new Volumes when they are needed.
Please note that automatic Volume labeling can also be used with tapes, but it is not nearly so practical since the tapes must be pre-mounted. This requires some user interaction. Automatic labeling from templates does NOT work with autochangers since Bareos will not access unknown slots. There are several methods of labeling all volumes in an autochanger magazine. For more information on this, please see the Autochanger chapter of this manual.
Automatic Volume labeling is enabled by making a change to both the Pool resource (Director) and to the Device resource (Storage daemon) shown above. In the case of the Pool resource, you must provide Bareos with a label format that it will use to create new names. In the simplest form, the label format is simply the Volume name, to which Bareos will append a four digit number. This number starts at 0001 and is incremented for each Volume the catalog contains. Thus if you modify your Pool resource to be:

```
Pool {
  Name = File
  Pool Type = Backup
  Volume Use Duration = 23h
  LabelFormat = "Vol"
}
```

Bareos will create Volume names Vol0001, Vol0002, and so on when new Volumes are needed. Much more complex and elaborate labels can be created using variable expansion defined in the Variable Expansion chapter of this manual.
The second change that is necessary to make automatic labeling work is to give the Storage daemon permission to automatically label Volumes. Do so by adding **LabelMedia = yes** to the Device resource as follows:

```
Device {
  Name = File
```

```
  Media Type = File
  Archive Device = /home/bareos/backups
  Random Access = Yes;
  AutomaticMount = yes;
  RemovableMedia = no;
  AlwaysOpen = no;
  LabelMedia = yes
}
```

You can find more details of the **Label Format** Pool record in Label Format $^{\text{Dir}}_{\text{Pool}}$ description of the Pool resource records.

17.1.3 Restricting the Number of Volumes and Recycling

Automatic labeling discussed above brings up the problem of Volume management. With the above scheme, a new Volume will be created every day. If you have not specified Retention periods, your Catalog will continue to fill keeping track of all the files Bareos has backed up, and this procedure will create one new archive file (Volume) every day.
The tools Bareos gives you to help automatically manage these problems are the following:

1. Catalog file record retention periods, the File Retention $^{\text{Dir}}_{\text{Client}}$ record in the Client resource.
2. Catalog job record retention periods, the Job Retention $^{\text{Dir}}_{\text{Client}}$ record in the Client resource.
3. The Auto Prune $^{\text{Dir}}_{\text{Client}}$ = yes record in the Client resource to permit application of the above two retention periods.
4. The Volume Retention $^{\text{Dir}}_{\text{Pool}}$ record in the Pool resource.
5. The Auto Prune $^{\text{Dir}}_{\text{Pool}}$ = yes record in the Pool resource to permit application of the Volume retention period.
6. The Recycle $^{\text{Dir}}_{\text{Pool}}$ = yes record in the Pool resource to permit automatic recycling of Volumes whose Volume retention period has expired.
7. The Recycle Oldest Volume $^{\text{Dir}}_{\text{Pool}}$ = yes record in the Pool resource tells Bareos to Prune the oldest volume in the Pool, and if all files were pruned to recycle this volume and use it.
8. The Recycle Current Volume $^{\text{Dir}}_{\text{Pool}}$ = yes record in the Pool resource tells Bareos to Prune the currently mounted volume in the Pool, and if all files were pruned to recycle this volume and use it.
9. The Purge Oldest Volume $^{\text{Dir}}_{\text{Pool}}$ = yes record in the Pool resource permits a forced recycling of the oldest Volume when a new one is needed.
   Please note! *This record ignores retention periods! We highly recommend not to use this record, but instead use Recycle Oldest Volume* $^{\text{Dir}}_{\text{Pool}}$.
10. The Maximum Volumes $^{\text{Dir}}_{\text{Pool}}$ = nnn record in the Pool resource to limit the number of Volumes that can be created.

The first three records (File Retention, Job Retention, and AutoPrune) determine the amount of time that Job and File records will remain in your Catalog, and they are discussed in detail in the Automatic Volume Recycling chapter of this manual.
Volume Retention, AutoPrune, and Recycle determine how long Bareos will keep your Volumes before reusing them, and they are also discussed in detail in the Automatic Volume Recycling chapter of this manual.
The Maximum Volumes record can also be used in conjunction with the Volume Retention period to limit the total number of archive Volumes (files) that Bareos will create. By setting an appropriate Volume Retention period, a Volume will be purged just before it is needed and thus Bareos can cycle through a fixed set of Volumes. Cycling through a fixed set of Volumes can also be done by setting **Recycle Oldest Volume = yes** or **Recycle Current Volume = yes**. In this case, when Bareos needs a new Volume, it will prune the specified volume.

17.2 Concurrent Disk Jobs

Above, we discussed how you could have a single device named **FileBackup** that writes to volumes in **/home/bareos/backups**. You can, in fact, run multiple concurrent jobs using the Storage definition given with this example, and all the jobs will simultaneously write into the Volume that is being written.
Now suppose you want to use multiple Pools, which means multiple Volumes, or suppose you want each client to have its own Volume and perhaps its own directory such as **/home/bareos/client1** and **/home-/bareos/client2** ... With the single Storage and Device definition above, neither of these two is possible. Why? Because Bareos disk storage follows the same rules as tape devices. Only one Volume can be mounted on any Device at any time. If you want to simultaneously write multiple Volumes, you will need multiple Device resources in your bareos-sd.conf file, and thus multiple Storage resources in your bareos-dir.conf.
OK, so now you should understand that you need multiple Device definitions in the case of different directories or different Pools, but you also need to know that the catalog data that Bareos keeps contains only the Media Type and not the specific storage device. This permits a tape for example to be re-read on any compatible tape drive. The compatibility being determined by the Media Type. The same applies to disk storage. Since a volume that is written by a Device in say directory **/home/bareos/backups** cannot be read by a Device with an Archive Device definition of **/home/bareos/client1**, you will not be able to restore all your files if you give both those devices **Media Type = File**. During the restore, Bareos will simply choose the first available device, which may not be the correct one. If this is confusing, just remember that the Directory has only the Media Type and the Volume name. It does not know the **Archive Device** (or the full path) that is specified in the Storage daemon. Thus you must explicitly tie your Volumes to the correct Device by using the Media Type.
The example shown below shows a case where there are two clients, each using its own Pool and storing their Volumes in different directories.

17.2.1 An Example

The following example is not very practical, but can be used to demonstrate the proof of concept in a relatively short period of time. The example consists of a two clients that are backed up to a set of 12 archive files (Volumes) for each client into different directories on the Storage machine. Each Volume is used (written) only once, and there are four Full saves done every hour (so the whole thing cycles around after three hours).
What is key here is that each physical device on the Storage daemon has a different Media Type. This allows the Director to choose the correct device for restores ...
The Director's configuration file is as follows:

```
Director {
  Name = my-dir
  QueryFile = "~/bareos/bin/query.sql"
  PidDirectory = "~/bareos/working"
  WorkingDirectory = "~/bareos/working"
  Password = dir_password
}
Schedule {
  Name = "FourPerHour"
  Run = Level=Full hourly at 0:05
  Run = Level=Full hourly at 0:20
  Run = Level=Full hourly at 0:35
  Run = Level=Full hourly at 0:50
}
Job {
  Name = "RecycleExample"
  Type = Backup
  Level = Full
  Client = Rufus
  FileSet= "Example FileSet"
  Messages = Standard
  Storage = FileStorage
  Pool = Recycle
  Schedule = FourPerHour
}

Job {
  Name = "RecycleExample2"
  Type = Backup
  Level = Full
  Client = Roxie
```

```
  FileSet= "Example FileSet"
  Messages = Standard
  Storage = FileStorage1
  Pool = Recycle1
  Schedule = FourPerHour
}

FileSet {
  Name = "Example FileSet"
  Include {
    Options {
      compression=GZIP
      signature=SHA1
    }
    File = /home/user/bareos/bin
  }
}

Client {
  Name = Rufus
  Address = rufus
  Catalog = BackupDB
  Password = client_password
}

Client {
  Name = Roxie
  Address = roxie
  Catalog = BackupDB
  Password = client1_password
}

Storage {
  Name = FileStorage
  Address = rufus
  Password = local_storage_password
  Device = RecycleDir
  Media Type = File
}

Storage {
  Name = FileStorage1
  Address = rufus
  Password = local_storage_password
  Device = RecycleDir1
  Media Type = File1
}

Catalog {
  Name = BackupDB
  dbname = bareos; user = bareos; password = ""
}
Messages {
  Name = Standard
  ...
}
Pool {
  Name = Recycle
  Use Volume Once = yes
  Pool Type = Backup
  LabelFormat = "Recycle-"
  AutoPrune = yes
  VolumeRetention = 2h
  Maximum Volumes = 12
  Recycle = yes
}

Pool {
  Name = Recycle1
  Use Volume Once = yes
  Pool Type = Backup
  LabelFormat = "Recycle1-"
  AutoPrune = yes
  VolumeRetention = 2h
  Maximum Volumes = 12
  Recycle = yes
```

```
}
```

and the Storage daemon's configuration file is:

```
Storage {
  Name = my-sd
  WorkingDirectory = "~/bareos/working"
  Pid Directory = "~/bareos/working"
  MaximumConcurrentJobs = 10
}
Director {
  Name = my-dir
  Password = local_storage_password
}
Device {
  Name = RecycleDir
  Media Type = File
  Archive Device = /home/bareos/backups
  LabelMedia = yes;
  Random Access = Yes;
  AutomaticMount = yes;
  RemovableMedia = no;
  AlwaysOpen = no;
}

Device {
  Name = RecycleDir1
  Media Type = File1
  Archive Device = /home/bareos/backups1
  LabelMedia = yes;
  Random Access = Yes;
  AutomaticMount = yes;
  RemovableMedia = no;
  AlwaysOpen = no;
}

Messages {
  Name = Standard
  director = my-dir = all
}
```

With a little bit of work, you can change the above example into a weekly or monthly cycle (take care about the amount of archive disk space used).

17.3 Backing up to Multiple Disks

Bareos can, of course, use multiple disks, but in general, each disk must be a separate Device specification in the Storage daemon's conf file, and you must then select what clients to backup to each disk. You will also want to give each Device specification a different Media Type so that during a restore, Bareos will be able to find the appropriate drive.
The situation is a bit more complicated if you want to treat two different physical disk drives (or partitions) logically as a single drive, which Bareos does not directly support. However, it is possible to back up your data to multiple disks as if they were a single drive by linking the Volumes from the first disk to the second disk.
For example, assume that you have two disks named **/disk1** and **/disk2**. If you then create a standard Storage daemon Device resource for backing up to the first disk, it will look like the following:

```
Device {
  Name = client1
  Media Type = File
  Archive Device = /disk1
  LabelMedia = yes;
  Random Access = Yes;
  AutomaticMount = yes;
  RemovableMedia = no;
  AlwaysOpen = no;
}
```

Since there is no way to get the above Device resource to reference both **/disk1** and **/disk2** we do it by pre-creating Volumes on /disk2 with the following:

```
ln -s /disk2/Disk2-vol001 /disk1/Disk2-vol001
ln -s /disk2/Disk2-vol002 /disk1/Disk2-vol002
ln -s /disk2/Disk2-vol003 /disk1/Disk2-vol003
...
```

At this point, you can label the Volumes as Volume **Disk2-vol001**, **Disk2-vol002**, ... and Bareos will use them as if they were on /disk1 but actually write the data to /disk2. The only minor inconvenience with this method is that you must explicitly name the disks and cannot use automatic labeling unless you arrange to have the labels exactly match the links you have created.
An important thing to know is that Bareos treats disks like tape drives as much as it can. This means that you can only have a single Volume mounted at one time on a disk as defined in your Device resource in the Storage daemon's conf file. You can have multiple concurrent jobs running that all write to the one Volume that is being used, but if you want to have multiple concurrent jobs that are writing to separate disks drives (or partitions), you will need to define separate Device resources for each one, exactly as you would do for two different tape drives. There is one fundamental difference, however. The Volumes that you create on the two drives cannot be easily exchanged as they can for a tape drive, because they are physically resident (already mounted in a sense) on the particular drive. As a consequence, you will probably want to give them different Media Types so that Bareos can distinguish what Device resource to use during a restore. An example would be the following:

```
Device {
  Name = Disk1
  Media Type = File1
  Archive Device = /disk1
  LabelMedia = yes;
  Random Access = Yes;
  AutomaticMount = yes;
  RemovableMedia = no;
  AlwaysOpen = no;
}

Device {
  Name = Disk2
  Media Type = File2
  Archive Device = /disk2
  LabelMedia = yes;
  Random Access = Yes;
  AutomaticMount = yes;
  RemovableMedia = no;
  AlwaysOpen = no;
}
```

With the above device definitions, you can run two concurrent jobs each writing at the same time, one to **/disk1** and the other to **/disk2**. The fact that you have given them different Media Types will allow Bareos to quickly choose the correct Storage resource in the Director when doing a restore.

17.4 Considerations for Multiple Clients

If we take the above example and add a second Client, here are a few considerations:

- Although the second client can write to the same set of Volumes, you will probably want to write to a different set.
- You can write to a different set of Volumes by defining a second Pool, which has a different name and a different **LabelFormat**.
- If you wish the Volumes for the second client to go into a different directory (perhaps even on a different filesystem to spread the load), you would do so by defining a second Device resource in the Storage daemon. The **Name** must be different, and the **Archive Device** could be different. To ensure that Volumes are never mixed from one pool to another, you might also define a different MediaType (e.g. **File1**).

In this example, we have two clients, each with a different Pool and a different number of archive files retained. They also write to different directories with different Volume labeling.
The Director's configuration file is as follows:

```
Director {
  Name = my-dir
  QueryFile = "~/bareos/bin/query.sql"
  PidDirectory = "~/bareos/working"
  WorkingDirectory = "~/bareos/working"
  Password = dir_password
}
# Basic weekly schedule
Schedule {
  Name = "WeeklySchedule"
  Run = Level=Full fri at 1:30
  Run = Level=Incremental sat-thu at 1:30
}
FileSet {
  Name = "Example FileSet"
  Include {
    Options {
      compression=GZIP
      signature=SHA1
    }
    File = /home/user/bareos/bin
  }
}
Job {
  Name = "Backup-client1"
  Type = Backup
  Level = Full
  Client = client1
  FileSet= "Example FileSet"
  Messages = Standard
  Storage = File1
  Pool = client1
  Schedule = "WeeklySchedule"
}
Job {
  Name = "Backup-client2"
  Type = Backup
  Level = Full
  Client = client2
  FileSet= "Example FileSet"
  Messages = Standard
  Storage = File2
  Pool = client2
  Schedule = "WeeklySchedule"
}
Client {
  Name = client1
  Address = client1
  Catalog = BackupDB
  Password = client1_password
  File Retention = 7d
}
Client {
  Name = client2
  Address = client2
  Catalog = BackupDB
  Password = client2_password
}
# Two Storage definitions with different Media Types
#  permits different directories
Storage {
  Name = File1
  Address = rufus
  Password = local_storage_password
  Device = client1
  Media Type = File1
}
Storage {
  Name = File2
  Address = rufus
  Password = local_storage_password
  Device = client2
  Media Type = File2
}
Catalog {
  Name = BackupDB
```

```
  dbname = bareos; user = bareos; password = ""
}
Messages {
  Name = Standard
  ...
}
# Two pools permits different cycling periods and Volume names
# Cycle through 15 Volumes (two weeks)
Pool {
  Name = client1
  Use Volume Once = yes
  Pool Type = Backup
  LabelFormat = "Client1-"
  AutoPrune = yes
  VolumeRetention = 13d
  Maximum Volumes = 15
  Recycle = yes
}
# Cycle through 8 Volumes (1 week)
Pool {
  Name = client2
  Use Volume Once = yes
  Pool Type = Backup
  LabelFormat = "Client2-"
  AutoPrune = yes
  VolumeRetention = 6d
  Maximum Volumes = 8
  Recycle = yes
}
```

and the Storage daemon's configuration file is:

```
Storage {
  Name = my-sd
  WorkingDirectory = "~/bareos/working"
  Pid Directory = "~/bareos/working"
  MaximumConcurrentJobs = 10
}
Director {
  Name = my-dir
  Password = local_storage_password
}
# Archive directory for Client1
Device {
  Name = client1
  Media Type = File1
  Archive Device = /home/bareos/client1
  LabelMedia = yes;
  Random Access = Yes;
  AutomaticMount = yes;
  RemovableMedia = no;
  AlwaysOpen = no;
}
# Archive directory for Client2
Device {
  Name = client2
  Media Type = File2
  Archive Device = /home/bareos/client2
  LabelMedia = yes;
  Random Access = Yes;
  AutomaticMount = yes;
  RemovableMedia = no;
  AlwaysOpen = no;
}
Messages {
  Name = Standard
  director = my-dir = all
}
```

17.5 Automatic Volume Recycling

By default, once Bareos starts writing a Volume, it can append to the volume, but it will not overwrite the existing data thus destroying it. However when Bareos **recycles** a Volume, the Volume becomes available for being reused, and Bareos can at some later time overwrite the previous contents of that Volume. Thus all previous data will be lost. If the Volume is a tape, the tape will be rewritten from the beginning. If the Volume is a disk file, the file will be truncated before being rewritten.
You may not want Bareos to automatically recycle (reuse) tapes. This would require a large number of tapes though, and in such a case, it is possible to manually recycle tapes. For more on manual recycling, see the section entitled Manually Recycling Volumes below in this chapter.
Most people prefer to have a Pool of tapes that are used for daily backups and recycled once a week, another Pool of tapes that are used for Full backups once a week and recycled monthly, and finally a Pool of tapes that are used once a month and recycled after a year or two. With a scheme like this, the number of tapes in your pool or pools remains constant.
By properly defining your Volume Pools with appropriate Retention periods, Bareos can manage the recycling (such as defined above) automatically.
Automatic recycling of Volumes is controlled by four records in the **Pool** resource definition in the Director's configuration file. These four records are:

- AutoPrune = yes
- VolumeRetention = <time>
- Recycle = yes
- RecyclePool = <APool>

The above three directives are all you need assuming that you fill each of your Volumes then wait the Volume Retention period before reusing them. If you want Bareos to stop using a Volume and recycle it before it is full, you will need to use one or more additional directives such as:

- Use Volume Once = yes
- Volume Use Duration = ttt
- Maximum Volume Jobs = nnn
- Maximum Volume Bytes = mmm

Please see below and the Basic Volume Management chapter of this manual for more complete examples.
Automatic recycling of Volumes is performed by Bareos only when it wants a new Volume and no appendable Volumes are available in the Pool. It will then search the Pool for any Volumes with the **Recycle** flag set and the Volume Status is **Purged**. At that point, it will choose the oldest purged volume and recycle it.
If there are no volumes with Status **Purged**, then the recycling occurs in two steps: The first is that the Catalog for a Volume must be pruned of all Jobs (i.e. Purged). Files contained on that Volume, and the second step is the actual recycling of the Volume. Only Volumes marked **Full** or **Used** will be considerd for pruning. The Volume will be purged if the VolumeRetention period has expired. When a Volume is marked as Purged, it means that no Catalog records reference that Volume, and the Volume can be recycled. Until recycling actually occurs, the Volume data remains intact. If no Volumes can be found for recycling for any of the reasons stated above, Bareos will request operator intervention (i.e. it will ask you to label a new volume).
A key point mentioned above, that can be a source of frustration, is that Bareos will only recycle purged Volumes if there is no other appendable Volume available, otherwise, it will always write to an appendable Volume before recycling even if there are Volume marked as Purged. This preserves your data as long as possible. So, if you wish to "force" Bareos to use a purged Volume, you must first ensure that no other Volume in the Pool is marked **Append**. If necessary, you can manually set a volume to **Full**. The reason for this is that Bareos wants to preserve the data on your old tapes (even though purged from the catalog) as long as absolutely possible before overwriting it. There are also a number of directives such as **Volume Use Duration** that will automatically mark a volume as **Used** and thus no longer appendable.

17.5.1 Automatic Pruning

As Bareos writes files to tape, it keeps a list of files, jobs, and volumes in a database called the catalog. Among other things, the database helps Bareos to decide which files to back up in an incremental or differential backup, and helps you locate files on past backups when you want to restore something. However, the catalog will grow larger and larger as time goes on, and eventually it can become unacceptably large.
Bareos's process for removing entries from the catalog is called Pruning. The default is Automatic Pruning, which means that once an entry reaches a certain age (e.g. 30 days old) it is removed from the catalog. Note that Job records that are required for current restore won't be removed automatically, and File records are needed for VirtualFull and Accurate backups. Once a job has been pruned, you can still restore it from the backup tape, but one additional step is required: scanning the volume with bscan. The alternative to Automatic Pruning is Manual Pruning, in which you explicitly tell Bareos to erase the catalog entries for a volume. You'd usually do this when you want to reuse a Bareos volume, because there's no point in keeping a list of files that USED TO BE on a tape. Or, if the catalog is starting to get too big, you could prune the oldest jobs to save space. Manual pruning is done with the prune command in the console.

17.5.2 Pruning Directives

There are three pruning durations. All apply to catalog database records and not to the actual data in a Volume. The pruning (or retention) durations are for: Volumes (Media records), Jobs (Job records), and Files (File records). The durations inter-depend a bit because if Bareos prunes a Volume, it automatically removes all the Job records, and all the File records. Also when a Job record is pruned, all the File records for that Job are also pruned (deleted) from the catalog.
Having the File records in the database means that you can examine all the files backed up for a particular Job. They take the most space in the catalog (probably 90-95% of the total). When the File records are pruned, the Job records can remain, and you can still examine what Jobs ran, but not the details of the Files backed up. In addition, without the File records, you cannot use the Console restore command to restore the files.
When a Job record is pruned, the Volume (Media record) for that Job can still remain in the database, and if you do a "list volumes", you will see the volume information, but the Job records (and its File records) will no longer be available.
In each case, pruning removes information about where older files are, but it also prevents the catalog from growing to be too large. You choose the retention periods in function of how many files you are backing up and the time periods you want to keep those records online, and the size of the database. You can always re-insert the records (with 98% of the original data) by using "bscan" to scan in a whole Volume or any part of the volume that you want.
By setting **AutoPrune** to **yes** you will permit **Bareos** to automatically prune all Volumes in the Pool when a Job needs another Volume. Volume pruning means removing records from the catalog. It does not shrink the size of the Volume or affect the Volume data until the Volume gets overwritten. When a Job requests another volume and there are no Volumes with Volume Status **Append** available, Bareos will begin volume pruning. This means that all Jobs that are older than the **VolumeRetention** period will be pruned from every Volume that has Volume Status **Full** or **Used** and has Recycle set to **yes**. Pruning consists of deleting the corresponding Job, File, and JobMedia records from the catalog database. No change to the physical data on the Volume occurs during the pruning process. When all files are pruned from a Volume (i.e. no records in the catalog), the Volume will be marked as **Purged** implying that no Jobs remain on the volume. The Pool records that control the pruning are described below.

AutoPrune = <yes—no> If AutoPrune is set to **yes** (default), Bareos will automatically apply the Volume retention period when running a Job and it needs a new Volume but no appendable volumes are available. At that point, Bareos will prune all Volumes that can be pruned (i.e. AutoPrune set) in an attempt to find a usable volume. If during the autoprune, all files are pruned from the Volume, it will be marked with VolStatus **Purged**. The default is **yes**. Note, that although the File and Job records may be pruned from the catalog, a Volume will be marked Purged (and hence ready for recycling) if the Volume status is Append, Full, Used, or Error. If the Volume has another status, such as Archive, Read-Only, Disabled, Busy, or Cleaning, the Volume status will not be changed to Purged.

Volume Retention = <time-period-specification> The Volume Retention record defines the length of time that Bareos will guarantee that the Volume is not reused counting from the time the last job stored on the Volume terminated. A key point is that this time period is not even considered as long at the Volume remains appendable. The Volume Retention period count down begins only when the Append status has been changed to some othe status (Full, Used, Purged, ...).

When this time period expires, and if **AutoPrune** is set to **yes**, and a new Volume is needed, but no appendable Volume is available, Bareos will prune (remove) Job records that are older than the specified Volume Retention period.

The Volume Retention period takes precedence over any Job Retention period you have specified in the Client resource. It should also be noted, that the Volume Retention period is obtained by reading the Catalog Database Media record rather than the Pool resource record. This means that if you change the VolumeRetention in the Pool resource record, you must ensure that the corresponding change is made in the catalog by using the **update pool** command. Doing so will insure that any new Volumes will be created with the changed Volume Retention period. Any existing Volumes will have their own copy of the Volume Retention period that can only be changed on a Volume by Volume basis using the **update volume** command.

When all file catalog entries are removed from the volume, its VolStatus is set to **Purged**. The files remain physically on the Volume until the volume is overwritten.

Retention periods are specified in seconds, minutes, hours, days, weeks, months, quarters, or years on the record. See the Configuration chapter of this manual for additional details of time specification.

The default is 1 year.

Recycle = <yes—no> This statement tells Bareos whether or not the particular Volume can be recycled (i.e. rewritten). If Recycle is set to **no** (the default), then even if Bareos prunes all the Jobs on the volume and it is marked **Purged**, it will not consider the tape for recycling. If Recycle is set to **yes** and all Jobs have been pruned, the volume status will be set to **Purged** and the volume may then be reused when another volume is needed. If the volume is reused, it is relabeled with the same Volume Name, however all previous data will be lost.

It is also possible to "force" pruning of all Volumes in the Pool associated with a Job by adding **Prune Files = yes** to the Job resource.

17.5.3 Recycling Algorithm

After all Volumes of a Pool have been pruned (as mentioned above, this happens when a Job needs a new Volume and no appendable Volumes are available), Bareos will look for the oldest Volume that is Purged (all Jobs and Files expired), and if the **Recycle** flag is on (Recycle=yes) for that Volume, Bareos will relabel it and write new data on it.
As mentioned above, there are two key points for getting a Volume to be recycled. First, the Volume must no longer be marked Append (there are a number of directives to automatically make this change), and second since the last write on the Volume, one or more of the Retention periods must have expired so that there are no more catalog backup job records that reference that Volume. Once both those conditions are satisfied, the volume can be marked Purged and hence recycled.
The full algorithm that Bareos uses when it needs a new Volume is:
The algorithm described below assumes that AutoPrune is enabled, that Recycling is turned on, and that you have defined appropriate Retention periods, or used the defaults for all these items.

- If the request is for an Autochanger device, look only for Volumes in the Autochanger (i.e. with InChanger set and that have the correct Storage device).
- Search the Pool for a Volume with VolStatus=Append (if there is more than one, the Volume with the oldest date last written is chosen. If two have the same date then the one with the lowest MediaId is chosen).
- Search the Pool for a Volume with VolStatus=Recycle and the InChanger flag is set true (if there is more than one, the Volume with the oldest date last written is chosen. If two have the same date then the one with the lowest MediaId is chosen).
- Try recycling any purged Volumes.
- Prune volumes applying Volume retention period (Volumes with VolStatus Full, Used, or Append are pruned). Note, even if all the File and Job records are pruned from a Volume, the Volume will not be marked Purged until the Volume retention period expires.
- Search the Pool for a Volume with VolStatus=Purged

- If a Pool named "Scratch" exists, search for a Volume and if found move it to the current Pool for the Job and use it. Note, when the Scratch Volume is moved into the current Pool, the basic Pool defaults are applied as if it is a newly labeled Volume (equivalent to an **update volume from pool** command).
- If we were looking for Volumes in the Autochanger, go back to step 2 above, but this time, look for any Volume whether or not it is in the Autochanger.
- Attempt to create a new Volume if automatic labeling enabled If Python is enabled, a Python NewVolume event is generated before the Label Format directve is used. If the maximum number of Volumes specified for the pool is reached, a new Volume will not be created.
- Prune the oldest Volume if RecycleOldestVolume=yes (the Volume with the oldest LastWritten date and VolStatus equal to Full, Recycle, Purged, Used, or Append is chosen). This record ensures that all retention periods are properly respected.
- Purge the oldest Volume if PurgeOldestVolume=yes (the Volume with the oldest LastWritten date and VolStatus equal to Full, Recycle, Purged, Used, or Append is chosen). We strongly recommend against the use of **PurgeOldestVolume** as it can quite easily lead to loss of current backup data.
- Give up and ask operator.

The above occurs when Bareos has finished writing a Volume or when no Volume is present in the drive.
On the other hand, if you have inserted a different Volume after the last job, and Bareos recognizes the Volume as valid, it will request authorization from the Director to use this Volume. In this case, if you have set **Recycle Current Volume = yes** and the Volume is marked as Used or Full, Bareos will prune the volume and if all jobs were removed during the pruning (respecting the retention periods), the Volume will be recycled and used.
The recycling algorithm in this case is:

- If the VolStatus is **Append** or **Recycle** is set, the volume will be used.
- If **Recycle Current Volume** is set and the volume is marked **Full** or **Used**, Bareos will prune the volume (applying the retention period). If all Jobs are pruned from the volume, it will be recycled.

This permits users to manually change the Volume every day and load tapes in an order different from what is in the catalog, and if the volume does not contain a current copy of your backup data, it will be used.
A few points from Alan Brown to keep in mind:

1. If a pool doesn't have maximum volumes defined then Bareos will prefer to demand new volumes over forcibly purging older volumes.
2. If volumes become free through pruning and the Volume retention period has expired, then they get marked as "purged" and are immediately available for recycling - these will be used in preference to creating new volumes.
3. If the Job, File, and Volume retention periods are different, then it's common to see a tape with no files or jobs listed in the database, but which is still not marked as "purged".

17.5.4 Recycle Status

Each Volume inherits the Recycle status (yes or no) from the Pool resource record when the Media record is created (normally when the Volume is labeled). This Recycle status is stored in the Media record of the Catalog. Using the Console program, you may subsequently change the Recycle status for each Volume. For example in the following output from **list volumes**:

```
+----------+-------+--------+---------+------------+--------+-----+
| VolumeNa | Media | VolSta | VolByte | LastWritte | VolRet | Rec |
+----------+-------+--------+---------+------------+--------+-----+
| File0001 | File  | Full   | 4190055 | 2002-05-25 | 14400  | 1   |
| File0002 | File  | Full   | 1896460 | 2002-05-26 | 14400  | 1   |
| File0003 | File  | Full   | 1896460 | 2002-05-26 | 14400  | 1   |
| File0004 | File  | Full   | 1896460 | 2002-05-26 | 14400  | 1   |
| File0005 | File  | Full   | 1896460 | 2002-05-26 | 14400  | 1   |
| File0006 | File  | Full   | 1896460 | 2002-05-26 | 14400  | 1   |
| File0007 | File  | Purged | 1896466 | 2002-05-26 | 14400  | 1   |
+----------+-------+--------+---------+------------+--------+-----+
```

all the volumes are marked as recyclable, and the last Volume, **File0007** has been purged, so it may be immediately recycled. The other volumes are all marked recyclable and when their Volume Retention period (14400 seconds or four hours) expires, they will be eligible for pruning, and possibly recycling. Even though Volume **File0007** has been purged, all the data on the Volume is still recoverable. A purged Volume simply means that there are no entries in the Catalog. Even if the Volume Status is changed to **Recycle**, the data on the Volume will be recoverable. The data is lost only when the Volume is re-labeled and re-written.
To modify Volume **File0001** so that it cannot be recycled, you use the **update volume pool=File** command in the console program, or simply **update** and Bareos will prompt you for the information.

```
+----------+------+-------+---------+-------------+-------+-----+
| VolumeNa | Media| VolSta| VolByte | LastWritten | VolRet| Rec |
+----------+------+-------+---------+-------------+-------+-----+
| File0001 | File | Full  | 4190055 | 2002-05-25  | 14400 | 0   |
| File0002 | File | Full  | 1897236 | 2002-05-26  | 14400 | 1   |
| File0003 | File | Full  | 1896460 | 2002-05-26  | 14400 | 1   |
| File0004 | File | Full  | 1896460 | 2002-05-26  | 14400 | 1   |
| File0005 | File | Full  | 1896460 | 2002-05-26  | 14400 | 1   |
| File0006 | File | Full  | 1896460 | 2002-05-26  | 14400 | 1   |
| File0007 | File | Purged| 1896466 | 2002-05-26  | 14400 | 1   |
+----------+------+-------+---------+-------------+-------+-----+
```

In this case, **File0001** will never be automatically recycled. The same effect can be achieved by setting the Volume Status to Read-Only.
As you have noted, the Volume Status (VolStatus) column in the catalog database contains the current status of the Volume, which is normally maintained automatically by Bareos. To give you an idea of some of the values it can take during the life cycle of a Volume, here is a picture created by Arno Lehmann:

```
A typical volume life cycle is like this:

               because job count or size limit exceeded
      Append  ----------------------------------------->  Used
        ^                                                   |
        | First Job writes to        Retention time passed  |
        | the volume                   and recycling takes  |
        |                                             place  |
        |                                                    v
      Recycled <------------------------------------- Purged
                    Volume is selected for reuse
```

17.5.5 Making Bareos Use a Single Tape

Most people will want Bareos to fill a tape and when it is full, a new tape will be mounted, and so on. However, as an extreme example, it is possible for Bareos to write on a single tape, and every night to rewrite it. To get this to work, you must do two things: first, set the VolumeRetention to less than your save period (one day), and the second item is to make Bareos mark the tape as full after using it once. This is done using **UseVolumeOnce = yes**. If this latter record is not used and the tape is not full after the first time it is written, Bareos will simply append to the tape and eventually request another volume. Using the tape only once, forces the tape to be marked **Full** after each use, and the next time **Bareos** runs, it will recycle the tape.
An example Pool resource that does this is:

```
Pool {
  Name = DDS-4
  Use Volume Once = yes
  Pool Type = Backup
  AutoPrune = yes
  VolumeRetention = 12h # expire after 12 hours
  Recycle = yes
}
```

17.5.6 Daily, Weekly, Monthly Tape Usage Example

This example is meant to show you how one could define a fixed set of volumes that Bareos will rotate through on a regular schedule. There are an infinite number of such schemes, all of which have various advantages and disadvantages.
We start with the following assumptions:

- A single tape has more than enough capacity to do a full save.
- There are ten tapes that are used on a daily basis for incremental backups. They are prelabeled Daily1 ... Daily10.
- There are four tapes that are used on a weekly basis for full backups. They are labeled Week1 ... Week4.
- There are 12 tapes that are used on a monthly basis for full backups. They are numbered Month1 ... Month12
- A full backup is done every Saturday evening (tape inserted Friday evening before leaving work).
- No backups are done over the weekend (this is easy to change).
- The first Friday of each month, a Monthly tape is used for the Full backup.
- Incremental backups are done Monday - Friday (actually Tue-Fri mornings).

We start the system by doing a Full save to one of the weekly volumes or one of the monthly volumes. The next morning, we remove the tape and insert a Daily tape. Friday evening, we remove the Daily tape and insert the next tape in the Weekly series. Monday, we remove the Weekly tape and re-insert the Daily tape. On the first Friday of the next month, we insert the next Monthly tape in the series rather than a Weekly tape, then continue. When a Daily tape finally fills up, **Bareos** will request the next one in the series, and the next day when you notice the email message, you will mount it and **Bareos** will finish the unfinished incremental backup.
What does this give? Well, at any point, you will have the last complete Full save plus several Incremental saves. For any given file you want to recover (or your whole system), you will have a copy of that file every day for at least the last 14 days. For older versions, you will have at least three and probably four Friday full saves of that file, and going back further, you will have a copy of that file made on the beginning of the month for at least a year.
So you have copies of any file (or your whole system) for at least a year, but as you go back in time, the time between copies increases from daily to weekly to monthly.
What would the Bareos configuration look like to implement such a scheme?

```
Schedule {
  Name = "NightlySave"
  Run = Level=Full Pool=Monthly 1st sat at 03:05
  Run = Level=Full Pool=Weekly 2nd-5th sat at 03:05
  Run = Level=Incremental Pool=Daily tue-fri at 03:05
}
Job {
  Name = "NightlySave"
  Type = Backup
  Level = Full
  Client = LocalMachine
  FileSet = "File Set"
  Messages = Standard
  Storage = DDS-4
  Pool = Daily
  Schedule = "NightlySave"
}
# Definition of file storage device
Storage {
  Name = DDS-4
  Address = localhost
  SDPort = 9103
  Password = XXXXXXXXXXXX
  Device = FileStorage
  Media Type = 8mm
}
FileSet {
  Name = "File Set"
  Include {
    Options {
      signature=MD5
    }
    File = ffffffffffffffff
  }
  Exclude  { File=*.o }
```

```
}
Pool {
  Name = Daily
  Pool Type = Backup
  AutoPrune = yes
  VolumeRetention = 10d   # recycle in 10 days
  Maximum Volumes = 10
  Recycle = yes
}
Pool {
  Name = Weekly
  Use Volume Once = yes
  Pool Type = Backup
  AutoPrune = yes
  VolumeRetention = 30d  # recycle in 30 days (default)
  Recycle = yes
}
Pool {
  Name = Monthly
  Use Volume Once = yes
  Pool Type = Backup
  AutoPrune = yes
  VolumeRetention = 365d  # recycle in 1 year
  Recycle = yes
}
```

17.5.7 Automatic Pruning and Recycling Example

Perhaps the best way to understand the various resource records that come into play during automatic pruning and recycling is to run a Job that goes through the whole cycle. If you add the following resources to your Director's configuration file:

```
Schedule {
  Name = "30 minute cycle"
  Run = Level=Full Pool=File Messages=Standard Storage=File
        hourly at 0:05
  Run = Level=Full Pool=File Messages=Standard Storage=File
        hourly at 0:35
}
Job {
  Name = "Filetest"
  Type = Backup
  Level = Full
  Client=XXXXXXXXXX
  FileSet="Test Files"
  Messages = Standard
  Storage = File
  Pool = File
  Schedule = "30 minute cycle"
}
# Definition of file storage device
Storage {
  Name = File
  Address = XXXXXXXXXX
  SDPort = 9103
  Password = XXXXXXXXXXXX
  Device = FileStorage
  Media Type = File
}
FileSet {
  Name = "File Set"
  Include {
    Options {
      signature=MD5
    }
    File = fffffffffffffff
  }
  Exclude  { File=*.o }
}
Pool {
  Name = File
  Use Volume Once = yes
  Pool Type = Backup
  LabelFormat = "File"
```

```
  AutoPrune = yes
  VolumeRetention = 4h
  Maximum Volumes = 12
  Recycle = yes
}
```

Where you will need to replace the **ffffffff**'s by the appropriate files to be saved for your configuration. For the FileSet Include, choose a directory that has one or two megabytes maximum since there will probably be approximately eight copies of the directory that **Bareos** will cycle through.
In addition, you will need to add the following to your Storage daemon's configuration file:

```
Device {
  Name = FileStorage
  Media Type = File
  Archive Device = /tmp
  LabelMedia = yes;
  Random Access = Yes;
  AutomaticMount = yes;
  RemovableMedia = no;
  AlwaysOpen = no;
}
```

With the above resources, Bareos will start a Job every half hour that saves a copy of the directory you chose to /tmp/File0001 ... /tmp/File0012. After 4 hours, Bareos will start recycling the backup Volumes (/tmp/File0001 ...). You should see this happening in the output produced. Bareos will automatically create the Volumes (Files) the first time it uses them.
To turn it off, either delete all the resources you've added, or simply comment out the **Schedule** record in the **Job** resource.

17.5.8 Manually Recycling Volumes

Although automatic recycling of Volumes is implemented (see the Automatic Volume Recycling chapter of this manual), you may want to manually force reuse (recycling) of a Volume.
Assuming that you want to keep the Volume name, but you simply want to write new data on the tape, the steps to take are:

- Use the **update volume** command in the Console to ensure that the **Recycle** field is set to **1**
- Use the **purge jobs volume** command in the Console to mark the Volume as **Purged**. Check by using **list volumes**.

Once the Volume is marked Purged, it will be recycled the next time a Volume is needed.
If you wish to reuse the tape by giving it a new name, follow the following steps:

- Use the `purge jobs volume` command in the Console to mark the Volume as **Purged**. Check by using `list volumes` .
- Use the Console `relabel` command to relabel the Volume.

Please note that the relabel command applies only to tape Volumes.
For Bareos versions prior to 1.30 or to manually relabel the Volume, use the instructions below:

- Use the **delete volume** command in the Console to delete the Volume from the Catalog.
- If a different tape is mounted, use the **unmount** command, remove the tape, and insert the tape to be renamed.
- Write an EOF mark in the tape using the following commands:

  ```
  mt -f /dev/nst0 rewind
  mt -f /dev/nst0 weof
  ```

  where you replace **/dev/nst0** with the appropriate device name on your system.
- Use the `label` command to write a new label to the tape and to enter it in the catalog.

Please be aware that the **delete** command can be dangerous. Once it is done, to recover the File records, you must either restore your database as it was before the **delete** command, or use the **bscan** utility program to scan the tape and recreate the database entries.

Chapter 18

Automated Disk Backup

If you manage five or ten machines and have a nice tape backup, you don't need Pools, and you may wonder what they are good for. In this chapter, you will see that Pools can help you optimize disk storage space. The same techniques can be applied to a shop that has multiple tape drives, or that wants to mount various different Volumes to meet their needs.

The rest of this chapter will give an example involving backup to disk Volumes, but most of the information applies equally well to tape Volumes.

Given is a scenario, where the size of a full backup is about 15GB.

It is required, that backup data is available for six months. Old files should be available on a daily basis for a week, a weekly basis for a month, then monthly for six months. In addition, offsite capability is not needed. The daily changes amount to about 300MB on the average, or about 2GB per week.

As a consequence, the total volume of data they need to keep to meet their needs is about 100GB (15GB x 6 + 2GB x 5 + 0.3 x 7) = 102.1GB.

The chosen solution was to use a 120GB hard disk – far less than 1/10th the price of a tape drive and the cassettes to handle the same amount of data, and to have the backup software write to disk files.

The rest of this chapter will explain how to setup Bareos so that it would automatically manage a set of disk files with the minimum sysadmin intervention.

18.1 Overall Design

Getting Bareos to write to disk rather than tape in the simplest case is rather easy.

One needs to consider about what happens if we have only a single large Bareos Volume defined on our hard disk. Everything works fine until the Volume fills, then Bareos will ask you to mount a new Volume. This same problem applies to the use of tape Volumes if your tape fills. Being a hard disk and the only one you have, this will be a bit of a problem. It should be obvious that it is better to use a number of smaller Volumes and arrange for Bareos to automatically recycle them so that the disk storage space can be reused.

As mentioned, the solution is to have multiple Volumes, or files on the disk. To do so, we need to limit the use and thus the size of a single Volume, by time, by number of jobs, or by size. Any of these would work, but we chose to limit the use of a single Volume by putting a single job in each Volume with the exception of Volumes containing Incremental backup where there will be 6 jobs (a week's worth of data) per volume. The details of this will be discussed shortly. This is a single client backup, so if you have multiple clients you will need to multiply those numbers by the number of clients, or use a different system for switching volumes, such as limiting the volume size.

TODO: This chapter will get rewritten. Instead of limiting a Volume to one job, we will utilize `Max Use Duration = 24 hours`. *This prevents problems when adding more clients, because otherwise each job has to run seperat.*

The next problem to resolve is recycling of Volumes. As you noted from above, the requirements are to be able to restore monthly for 6 months, weekly for a month, and daily for a week. So to simplify things, why not do a Full save once a month, a Differential save once a week, and Incremental saves daily. Now since each of these different kinds of saves needs to remain valid for differing periods, the simplest way to do this (and possibly the only) is to have a separate Pool for each backup type.

The decision was to use three Pools: one for Full saves, one for Differential saves, and one for Incremental saves, and each would have a different number of volumes and a different Retention period to accomplish the requirements.

18.1.1 Full Pool

Putting a single Full backup on each Volume, will require six Full save Volumes, and a retention period of six months. The Pool needed to do that is:

```
Pool {
  Name = Full-Pool
  Pool Type = Backup
  Recycle = yes
  AutoPrune = yes
  Volume Retention = 6 months
  Maximum Volume Jobs = 1
  Label Format = Full-
  Maximum Volumes = 9
}
```

Configuration 18.1: Full-Pool

Since these are disk Volumes, no space is lost by having separate Volumes for each backup (done once a month in this case). The items to note are the retention period of six months (i.e. they are recycled after six months), that there is one job per volume (Maximum Volume Jobs = 1), the volumes will be labeled Full-0001, ... Full-0006 automatically. One could have labeled these manually from the start, but why not use the features of Bareos.
Six months after the first volume is used, it will be subject to pruning and thus recycling, so with a maximum of 9 volumes, there should always be 3 volumes available (note, they may all be marked used, but they will be marked purged and recycled as needed).
If you have two clients, you would want to set **Maximum Volume Jobs** to 2 instead of one, or set a limit on the size of the Volumes, and possibly increase the maximum number of Volumes.

18.1.2 Differential Pool

For the Differential backup Pool, we choose a retention period of a bit longer than a month and ensure that there is at least one Volume for each of the maximum of five weeks in a month. So the following works:

```
Pool {
  Name = Diff-Pool
  Pool Type = Backup
  Recycle = yes
  AutoPrune = yes
  Volume Retention = 40 days
  Maximum Volume Jobs = 1
  Label Format = Diff-
  Maximum Volumes = 10
}
```

Configuration 18.2: Differential Pool

As you can see, the Differential Pool can grow to a maximum of 9 volumes, and the Volumes are retained 40 days and thereafter they can be recycled. Finally there is one job per volume. This, of course, could be tightened up a lot, but the expense here is a few GB which is not too serious.
If a new volume is used every week, after 40 days, one will have used 7 volumes, and there should then always be 3 volumes that can be purged and recycled.
See the discussion above concering the Full pool for how to handle multiple clients.

18.1.3 Incremental Pool

Finally, here is the resource for the Incremental Pool:

```
Pool {
  Name = Inc-Pool
  Pool Type = Backup
  Recycle = yes
  AutoPrune = yes
  Volume Retention = 20 days
  Maximum Volume Jobs = 6
  Label Format = Inc-
  Maximum Volumes = 7
}
```

Configuration 18.3: Incremental Pool

We keep the data for 20 days rather than just a week as the needs require. To reduce the proliferation of volume names, we keep a week's worth of data (6 incremental backups) in each Volume. In practice, the retention period should be set to just a bit more than a week and keep only two or three volumes instead of five. Again, the lost is very little and as the system reaches the full steady state, we can adjust these values so that the total disk usage doesn't exceed the disk capacity.
If you have two clients, the simplest thing to do is to increase the maximum volume jobs from 6 to 12. As mentioned above, it is also possible limit the size of the volumes. However, in that case, you will need to have a better idea of the volume or add sufficient volumes to the pool so that you will be assured that in the next cycle (after 20 days) there is at least one volume that is pruned and can be recycled.

18.2 Configuration Files

The following example shows you the actual files used, with only a few minor modifications to simplify things.
The Director's configuration file is as follows:

```
Director {          # define myself
  Name = bareos-dir
  QueryFile = "/usr/lib/bareos/scripts/query.sql"
  Maximum Concurrent Jobs = 1
  Password = "*** CHANGE ME ***"
  Messages = Standard
}

JobDefs {
  Name = "DefaultJob"
  Type = Backup
  Level = Incremental
  Client = bareos-fd
  FileSet = "Full Set"
  Schedule = "WeeklyCycle"
  Storage = File
  Messages = Standard
  Pool = Inc-Pool
  Full Backup Pool = Full-Pool
  Incremental Backup Pool = Inc-Pool
  Differential Backup Pool = Diff-Pool
  Priority = 10
  Write Bootstrap = "/var/lib/bareos/%c.bsr"
}

Job {
  Name = client
  Client = client-fd
  JobDefs = "DefaultJob"
  FileSet = "Full Set"
}

# Backup the catalog database (after the nightly save)
Job {
  Name = "BackupCatalog"
  Client = client-fd
  JobDefs = "DefaultJob"
  Level = Full
  FileSet="Catalog"
  Schedule = "WeeklyCycleAfterBackup"
  # This creates an ASCII copy of the catalog
  # Arguments to make_catalog_backup.pl are:
  #  make_catalog_backup.pl <catalog-name>
  RunBeforeJob = "/usr/lib/bareos/scripts/make_catalog_backup.pl MyCatalog"
  # This deletes the copy of the catalog
  RunAfterJob  = "/usr/lib/bareos/scripts/delete_catalog_backup"
  # This sends the bootstrap via mail for disaster recovery.
  # Should be sent to another system, please change recipient accordingly
  Write Bootstrap = "|/usr/sbin/bsmtp -h localhost -f \"\(Bareos\) \" -s \"Bootstrap for Job %j\"  ↙
     ↪ root@localhost"
  Priority = 11                   # run after main backup
}

# Standard Restore template, to be changed by Console program
Job {
  Name = "RestoreFiles"
```

```
  Type = Restore
  Client = client-fd
  FileSet="Full Set"
  Storage = File
  Messages = Standard
  Pool = Default
  Where = /tmp/bareos-restores
}

# List of files to be backed up
FileSet {
  Name = "Full Set"
  Include = {
    Options {
      signature=SHA1;
      compression=GZIP9
    }
    File = /
    File = /usr
    File = /home
    File = /boot
    File = /var
    File = /opt
  }
  Exclude = {
    File = /proc
    File = /tmp
    File = /.journal
    File = /.fsck
    ...
  }
}

Schedule {
  Name = "WeeklyCycle"
  Run = Level=Full 1st sun at 2:05
  Run = Level=Differential 2nd-5th sun at 2:05
  Run = Level=Incremental mon-sat at 2:05
}

# This schedule does the catalog. It starts after the WeeklyCycle
Schedule {
  Name = "WeeklyCycleAfterBackup"
  Run = Level=Full sun-sat at 2:10
}

# This is the backup of the catalog
FileSet {
  Name = "Catalog"
  Include {
    Options {
      signature = MD5
    }
    File = "/var/lib/bareos/bareos.sql" # database dump
    File = "/etc/bareos"                # configuration
  }
}

Client {
  Name = client-fd
  Address = client
  FDPort = 9102
  Password = " *** CHANGE ME ***"
  AutoPrune = yes      # Prune expired Jobs/Files
  Job Retention = 6 months
  File Retention = 60 days
}

Storage {
  Name = File
  Address = localhost
  Password = " *** CHANGE ME ***"
  Device = FileStorage
  Media Type = File
}
```

```
Catalog {
  Name = MyCatalog
  dbname = bareos; user = bareos; password = ""
}

Pool {
  Name = Full-Pool
  Pool Type = Backup
  Recycle = yes           # automatically recycle Volumes
  AutoPrune = yes         # Prune expired volumes
  Volume Retention = 6 months
  Maximum Volume Jobs = 1
  Label Format = Full-
  Maximum Volumes = 9
}

Pool {
  Name = Inc-Pool
  Pool Type = Backup
  Recycle = yes           # automatically recycle Volumes
  AutoPrune = yes         # Prune expired volumes
  Volume Retention = 20 days
  Maximum Volume Jobs = 6
  Label Format = Inc-
  Maximum Volumes = 7
}

Pool {
  Name = Diff-Pool
  Pool Type = Backup
  Recycle = yes
  AutoPrune = yes
  Volume Retention = 40 days
  Maximum Volume Jobs = 1
  Label Format = Diff-
  Maximum Volumes = 10
}

Messages {
  Name = Standard
  mailcommand = "bsmtp -h mail.domain.com -f \"\(Bareos\) %r\"
      -s \"Bareos: %t %e of %c %l\" %r"
  operatorcommand = "bsmtp -h mail.domain.com -f \"\(Bareos\) %r\"
      -s \"Bareos: Intervention needed for %j\" %r"
  mail = root@domain.com = all, !skipped
  operator = root@domain.com = mount
  console = all, !skipped, !saved
  append = "/home/bareos/bin/log" = all, !skipped
}
```

Configuration 18.4: bareos-dir.conf

and the Storage daemon's configuration file is:

```
Storage {               # definition of myself
  Name = bareos-sd
}

Director {
  Name = bareos-dir
  Password = " *** CHANGE ME ***"
}

Device {
  Name = FileStorage
  Media Type = File
  Archive Device = /var/lib/bareos/storage
  LabelMedia = yes;    # lets Bareos label unlabeled media
  Random Access = yes;
  AutomaticMount = yes;   # when device opened, read it
  RemovableMedia = no;
  AlwaysOpen = no;
}

Messages {
  Name = Standard
```

```
  director = bareos-dir = all
}
```

Configuration 18.5: bareos-sd.conf

Chapter 19

Autochanger Support

Bareos provides autochanger support for reading and writing tapes. In order to work with an autochanger, Bareos requires a number of things, each of which is explained in more detail after this list:

- The package `bareos-storage-tape` must be installed.
- A script that actually controls the autochanger according to commands sent by Bareos. Bareos contains the script `mtx-changer`, that utilize the command `mtx`. It's config file is normally located at `/etc/bareos/mtx-changer.conf`
- That each Volume (tape) to be used must be defined in the Catalog and have a Slot number assigned to it so that Bareos knows where the Volume is in the autochanger. This is generally done with the **label** command, but can also done after the tape is labeled using the **update slots** command. See below for more details. You must pre-label the tapes manually before using them.
- Modifications to your Storage daemon's Device configuration resource to identify that the device is a changer, as well as a few other parameters.
- You should also modify your Storage resource definition in the Director's configuration file so that you are automatically prompted for the Slot when labeling a Volume.
- You need to ensure that your Storage daemon has access permissions to both the tape drive and the control device. On Linux, the system user `bareos` is added to the groups `disk` and `tape`, so that it should have the permission to access the library.
- You need to have **Autochanger = yes** in your Storage resource in your `bareos-dir.conf` file so that you will be prompted for the slot number when you label Volumes.

Bareos uses its own `mtx-changer` script to interface with a program that actually does the tape changing. Thus in principle, **mtx-changer** can be adapted to function with any autochanger program, or you can call any other script or program. The current version of **mtx-changer** works with the `mtx` program. FreeBSD users might need to adapt this script to use `chio`. For more details, refer to the Testing Autochanger chapter. Bareos also supports autochangers with barcode readers. This support includes two Console commands: `label barcodes` and `update slots`. For more details on these commands, see the chapter about Barcode Support.
Current Bareos autochanger support does not include cleaning, stackers, or silos. Stackers and silos are not supported because Bareos expects to be able to access the Slots randomly. However, if you are very careful to setup Bareos to access the Volumes in the autochanger sequentially, you may be able to make Bareos work with stackers (gravity feed and such).
In principle, if **mtx** will operate your changer correctly, then it is just a question of adapting the **mtx-changer** script (or selecting one already adapted) for proper interfacing.
If you are having troubles, please use the **auto** command in the **btape** program to test the functioning of your autochanger with Bareos. Please remember, that on most distributions, the Storage daemon runs as user `bareos` and not as `root`. You will need to ensure that the Storage daemon has sufficient permissions to access the autochanger.
Some users have reported that the the Storage daemon blocks under certain circumstances in trying to mount a volume on a drive that has a different volume loaded. As best we can determine, this is simply a matter of waiting a bit. The drive was previously in use writing a Volume, and sometimes the drive will remain BLOCKED for a good deal of time (up to 7 minutes on a slow drive) waiting for the cassette to rewind and to unload before the drive can be used with a different Volume.

19.1 Knowing What SCSI Devices You Have

19.1.1 Linux

Under Linux, you can

```
cat /proc/scsi/scsi
```

to see what SCSI devices you have available. You can also:

```
cat /proc/scsi/sg/device_hdr /proc/scsi/sg/devices
```

to find out how to specify their control address (**/dev/sg0** for the first, **/dev/sg1** for the second, ...) on the **Changer Device =** Bareos directive.
You can also use the excellent **lsscsi** tool.

```
$ lsscsi -g
 [1:0:2:0]    tape    SEAGATE  ULTRIUM06242-XXX 1619  /dev/st0  /dev/sg9
 [1:0:14:0]   mediumx STK      L180             0315  /dev/sch0 /dev/sg10
 [2:0:3:0]    tape    HP       Ultrium 3-SCSI   G24S  /dev/st1  /dev/sg11
 [3:0:0:0]    enclosu HP       A6255A           HP04  -         /dev/sg3
 [3:0:1:0]    disk    HP 36.4G ST336753FC       HP00  /dev/sdd  /dev/sg4
```

19.1.2 FreeBSD

Under FreeBSD, use the following command to list the SCSI devices as well as the **/dev/passn** that you will use on the Bareos **Changer Device =** directive:

```
camcontrol devlist
```

Please check that your Storage daemon has permission to access this device.
The following tip for FreeBSD users comes from Danny Butroyd: on reboot Bareos will NOT have permission to control the device /dev/pass0 (assuming this is your changer device). To get around this just edit the /etc/devfs.conf file and add the following to the bottom:

```
own     pass0   root:bareos
perm    pass0   0666
own     nsa0.0  root:bareos
perm    nsa0.0    0666
```

This gives the bareos group permission to write to the nsa0.0 device too just to be on the safe side. To bring these changes into effect just run:-
/etc/rc.d/devfs restart
Basically this will stop you having to manually change permissions on these devices to make Bareos work when operating the AutoChanger after a reboot.

19.2 Slots

To properly address autochangers, Bareos must know which Volume is in each **slot** of the autochanger. Slots are where the changer cartridges reside when not loaded into the drive. Bareos numbers these slots from one to the number of cartridges contained in the autochanger.
Bareos will not automatically use a Volume in your autochanger unless it is labeled and the slot number is stored in the catalog and the Volume is marked as InChanger. This is because it must know where each volume is to be able to load the volume. For each Volume in your changer, you will, using the Console program, assign a slot. This information is kept in **Bareos's** catalog database along with the other data for the volume. If no slot is given, or the slot is set to zero, Bareos will not attempt to use the autochanger even if all the necessary configuration records are present. When doing a **mount** command on an autochanger, you must specify which slot you want mounted. If the drive is loaded with a tape from another slot, it will unload it and load the correct tape, but normally, no tape will be loaded because an **unmount** command causes Bareos to unload the tape in the drive.
You can check if the Slot number and InChanger flag are set by doing a:

```
list Volumes
```

in the Console program.

19.3 Multiple Devices

Some autochangers have more than one read/write device (drive). The Autochanger resource permits you to group Device resources, where each device represents a drive. The Director may still reference the Devices (drives) directly, but doing so, bypasses the proper functioning of the drives together. Instead, the Director (in the Storage resource) should reference the Autochanger resource name. Doing so permits the Storage daemon to ensure that only one drive uses the mtx-changer script at a time, and also that two drives don't reference the same Volume.
Multi-drive requires the use of the **Drive Index** directive in the Device resource of the Storage daemon's configuration file. Drive numbers or the Device Index are numbered beginning at zero, which is the default. To use the second Drive in an autochanger, you need to define a second Device resource and set the Drive Index to 1 for that device. In general, the second device will have the same **Changer Device** (control channel) as the first drive, but a different **Archive Device**.
As a default, Bareos jobs will prefer to write to a Volume that is already mounted. If you have a multiple drive autochanger and you want Bareos to write to more than one Volume in the same Pool at the same time, you will need to set Prefer Mounted Volumes $^{\text{Dir}}_{\text{Job}}$ in the Directors Job resource to **no**. This will cause the Storage daemon to maximize the use of drives.

19.4 Device Configuration Records

Configuration of autochangers within Bareos is done in the Device resource of the Storage daemon. Four records: **Autochanger**, **Changer Device**, **Changer Command**, and **Maximum Changer Wait** control how Bareos uses the autochanger.
These four records, permitted in **Device** resources, are described in detail below. Note, however, that the **Changer Device** and the **Changer Command** directives are not needed in the Device resource if they are present in the **Autochanger** resource.

Autochanger = <yes | no> (default: no)
The **Autochanger** record specifies if the current device belongs to an autochanger resource.

Changer Device = <device-name> In addition to the Archive Device name, you must specify a **Changer Device** name. This is because most autochangers are controlled through a different device than is used for reading and writing the cartridges. For example, on Linux, one normally uses the generic SCSI interface for controlling the autochanger, but the standard SCSI interface for reading and writing the tapes. On Linux, for the **Archive Device = /dev/nst0**, you would typically have **Changer Device = /dev/sg0**. Note, some of the more advanced autochangers will locate the changer device on **/dev/sg1**. Such devices typically have several drives and a large number of tapes.

On FreeBSD systems, the changer device will typically be on **/dev/pass0** through **/dev/passN**.

On Solaris, the changer device will typically be some file under **/dev/rdsk**.

Please ensure that your Storage daemon has permission to access this device.

Changer Command = <command> This record is used to specify the external program to call and what arguments to pass to it. The command is assumed to be a standard program or shell script that can be executed by the operating system. This command is invoked each time that Bareos wishes to manipulate the autochanger. The following substitutions are made in the **command** before it is sent to the operating system for execution:

```
%% = %
%a = archive device name
%c = changer device name
%d = changer drive index base 0
%f = Client's name
%j = Job name
%o = command  (loaded, load, or unload)
%s = Slot base 0
%S = Slot base 1
%v = Volume name
```

An actual example for using **mtx** with the **mtx-changer** script (part of the Bareos distribution) is:

```
Changer Command = "/usr/lib/bareos/scripts/mtx-changer %c %o %S %a %d"
```

Details of the three commands currently used by Bareos (loaded, load, unload) as well as the output expected by Bareos are given in the Bareos Autochanger Interface section.

Maximum Changer Wait = <time> This record is used to define the maximum amount of time that Bareos will wait for an autoloader to respond to a command (e.g. load). The default is set to 120 seconds. If you have a slow autoloader you may want to set it longer.

If the autoloader program fails to respond in this time, it will be killed and Bareos will request operator intervention.

Drive Index = <number> This record allows you to tell Bareos to use the second or subsequent drive in an autochanger with multiple drives. Since the drives are numbered from zero, the second drive is defined by

```
Device Index = 1
```

To use the second drive, you need a second Device resource definition in the Bareos configuration file. See the Multiple Drive section above in this chapter for more information.

In addition, for proper functioning of the Autochanger, you must define an Autochanger resource.

19.5 An Example Configuration File

The following two resources implement an autochanger:

```
Autochanger {
  Name = Autochanger
  Device = DDS-4
  Changer Command = "/usr/lib/bareos/scripts/mtx-changer %c %o %S %a %d"
  Changer Device = /dev/sg0
}

Device {
  Name = DDS-4
  Media Type = DDS-4
  Archive Device = /dev/nst0    # Normal archive device
  Autochanger = yes
  LabelMedia = no;
  AutomaticMount = yes;
  AlwaysOpen = yes;
}
```

where you will adapt the **Archive Device**, the **Changer Device**, and the path to the **Changer Command** to correspond to the values used on your system.

19.6 A Multi-drive Example Configuration File

The following resources implement a multi-drive autochanger:

```
Autochanger {
  Name = Autochanger
  Device = Drive-0
  Device = Drive-1
  Changer Command = "/usr/lib/bareos/scripts/mtx-changer %c %o %S %a %d"
  Changer Device = /dev/sg0
}

Device {
  Name = Drive-0
  Drive Index = 0
  Media Type = DDS-4
  Archive Device = /dev/nst0    # Normal archive device
  Autochanger = yes
  LabelMedia = no;
  AutomaticMount = yes;
  AlwaysOpen = yes;
}
```

```
Device {
  Name = Drive-1
  Drive Index = 1
  Media Type = DDS-4
  Archive Device = /dev/nst1    # Normal archive device
  Autochanger = yes
  LabelMedia = no;
  AutomaticMount = yes;
  AlwaysOpen = yes;
}
```

where you will adapt the **Archive Device** and the **Changer Device** to correspond to the values used on your system.

19.7 Specifying Slots When Labeling

If you add an **Autochanger = yes** record to the Storage resource in your Director's configuration file, the Bareos Console will automatically prompt you for the slot number when the Volume is in the changer when you **add** or **label** tapes for that Storage device. If your **mtx-changer** script is properly installed, Bareos will automatically load the correct tape during the label command.
You must also set **Autochanger = yes** in the Storage daemon's Device resource as we have described above in order for the autochanger to be used. Please see the Auto Changer $^{\text{Dir}}_{\text{Storage}}$ in the Director's chapter and the Autochanger $^{\text{Sd}}_{\text{Device}}$ in the Storage daemon chapter for more details on these records.
Thus all stages of dealing with tapes can be totally automated. It is also possible to set or change the Slot using the **update** command in the Console and selecting **Volume Parameters** to update.
Even though all the above configuration statements are specified and correct, Bareos will attempt to access the autochanger only if a **slot** is non-zero in the catalog Volume record (with the Volume name).
If your autochanger has barcode labels, you can label all the Volumes in your autochanger one after another by using the **label barcodes** command. For each tape in the changer containing a barcode, Bareos will mount the tape and then label it with the same name as the barcode. An appropriate Media record will also be created in the catalog. Any barcode that begins with the same characters as specified on the "CleaningPrefix=xxx" command, will be treated as a cleaning tape, and will not be labeled. For example with:

```
Pool {
  Name ...
  Cleaning Prefix = "CLN"
}
```

Any slot containing a barcode of CLNxxxx will be treated as a cleaning tape and will not be mounted.

19.8 Changing Cartridges

If you wish to insert or remove cartridges in your autochanger or you manually run the **mtx** program, you must first tell Bareos to release the autochanger by doing:

```
unmount
(change cartridges and/or run mtx)
mount
```

If you do not do the unmount before making such a change, Bareos will become completely confused about what is in the autochanger and may stop function because it expects to have exclusive use of the autochanger while it has the drive mounted.

19.9 Dealing with Multiple Magazines

If you have several magazines or if you insert or remove cartridges from a magazine, you should notify Bareos of this. By doing so, Bareos will as a preference, use Volumes that it knows to be in the autochanger before accessing Volumes that are not in the autochanger. This prevents unneeded operator intervention.
If your autochanger has barcodes (machine readable tape labels), the task of informing Bareos is simple. Every time, you change a magazine, or add or remove a cartridge from the magazine, simply use following commands in the Console program:

```
unmount
(remove magazine)
(insert new magazine)
update slots
mount
```

This will cause Bareos to request the autochanger to return the current Volume names in the magazine. This will be done without actually accessing or reading the Volumes because the barcode reader does this during inventory when the autochanger is first turned on. Bareos will ensure that any Volumes that are currently marked as being in the magazine are marked as no longer in the magazine, and the new list of Volumes will be marked as being in the magazine. In addition, the Slot numbers of the Volumes will be corrected in Bareos's catalog if they are incorrect (added or moved).
If you do not have a barcode reader on your autochanger, you have several alternatives.

1. You can manually set the Slot and InChanger flag using the **update volume** command in the Console (quite painful).
2. You can issue a

   ```
   update slots scan
   ```

   command that will cause Bareos to read the label on each of the cartridges in the magazine in turn and update the information (Slot, InChanger flag) in the catalog. This is quite effective but does take time to load each cartridge into the drive in turn and read the Volume label.

19.10 Update Slots Command

If you change only one cartridge in the magazine, you may not want to scan all Volumes, so the **update slots** command (as well as the **update slots scan** command) has the additional form:

```
update slots=n1,n2,n3-n4, ...
```

where the keyword **scan** can be appended or not. The n1,n2, ... represent Slot numbers to be updated and the form n3-n4 represents a range of Slot numbers to be updated (e.g. 4-7 will update Slots 4,5,6, and 7). This form is particularly useful if you want to do a scan (time expensive) and restrict the update to one or two slots.
For example, the command:

```
update slots=1,6 scan
```

will cause Bareos to load the Volume in Slot 1, read its Volume label and update the Catalog. It will do the same for the Volume in Slot 6. The command:

```
update slots=1-3,6
```

will read the barcoded Volume names for slots 1,2,3 and 6 and make the appropriate updates in the Catalog. If you don't have a barcode reader the above command will not find any Volume names so will do nothing.

19.11 Using the Autochanger

Let's assume that you have properly defined the necessary Storage daemon Device records, and you have added the **Autochanger = yes** record to the Storage resource in your Director's configuration file.
Now you fill your autochanger with say six blank tapes.
What do you do to make Bareos access those tapes?
One strategy is to prelabel each of the tapes. Do so by starting Bareos, then with the Console program, enter the **label** command:

```
./bconsole
Connecting to Director rufus:8101
1000 OK: rufus-dir Version: 1.26 (4 October 2002)
*label
```

it will then print something like:

```
Using default Catalog name=BackupDB DB=bareos
The defined Storage resources are:
     1: Autochanger
     2: File
Select Storage resource (1-2): 1
```

I select the autochanger (1), and it prints:

```
Enter new Volume name: TestVolume1
Enter slot (0 for none): 1
```

where I entered **TestVolume1** for the tape name, and slot **1** for the slot. It then asks:

```
Defined Pools:
     1: Default
     2: File
Select the Pool (1-2): 1
```

I select the Default pool. This will be automatically done if you only have a single pool, then Bareos will proceed to unload any loaded volume, load the volume in slot 1 and label it. In this example, nothing was in the drive, so it printed:

```
Connecting to Storage daemon Autochanger at localhost:9103 ...
Sending label command ...
3903 Issuing autochanger "load slot 1" command.
3000 OK label. Volume=TestVolume1 Device=/dev/nst0
Media record for Volume=TestVolume1 successfully created.
Requesting mount Autochanger ...
3001 Device /dev/nst0 is mounted with Volume TestVolume1
You have messages.
*
```

You may then proceed to label the other volumes. The messages will change slightly because Bareos will unload the volume (just labeled TestVolume1) before loading the next volume to be labeled.
Once all your Volumes are labeled, Bareos will automatically load them as they are needed.
To "see" how you have labeled your Volumes, simply enter the **list volumes** command from the Console program, which should print something like the following:

```
*{\bf list volumes}
Using default Catalog name=BackupDB DB=bareos
Defined Pools:
     1: Default
     2: File
Select the Pool (1-2): 1
+-------+----------+--------+---------+-------+--------+----------+-------+------+
| MedId | VolName  | MedTyp | VolStat | Bites | LstWrt | VolReten | Recyc | Slot |
+-------+----------+--------+---------+-------+--------+----------+-------+------+
| 1     | TestVol1 | DDS-4  | Append  | 0     | 0      | 30672000 | 0     | 1    |
| 2     | TestVol2 | DDS-4  | Append  | 0     | 0      | 30672000 | 0     | 2    |
| 3     | TestVol3 | DDS-4  | Append  | 0     | 0      | 30672000 | 0     | 3    |
| ...                                                                          |
+-------+----------+--------+---------+-------+--------+----------+-------+------+
```

19.12 Barcode Support

Bareos provides barcode support with two Console commands, **label barcodes** and **update slots**.
The **label barcodes** will cause Bareos to read the barcodes of all the cassettes that are currently installed in the magazine (cassette holder) using the **mtx-changer list** command. Each cassette is mounted in turn and labeled with the same Volume name as the barcode.
The **update slots** command will first obtain the list of cassettes and their barcodes from **mtx-changer**. Then it will find each volume in turn in the catalog database corresponding to the barcodes and set its Slot to correspond to the value just read. If the Volume is not in the catalog, then nothing will be done. This command is useful for synchronizing Bareos with the current magazine in case you have changed magazines or in case you have moved cassettes from one slot to another. If the autochanger is empty, nothing will be done.
The **Cleaning Prefix** statement can be used in the Pool resource to define a Volume name prefix, which if it matches that of the Volume (barcode) will cause that Volume to be marked with a VolStatus of **Cleaning**. This will prevent Bareos from attempting to write on the Volume.

19.13 Use bconsole to display Autochanger content

The **status slots storage=xxx** command displays autochanger content.

```
 Slot |  Volume Name    |  Status  |      Type         |    Pool        |  Loaded |
------+-----------------+----------+-------------------+----------------+---------|
    1 |           00001 |   Append |  DiskChangerMedia |        Default |    0    |
    2 |           00002 |   Append |  DiskChangerMedia |        Default |    0    |
    3*|           00003 |   Append |  DiskChangerMedia |        Scratch |    0    |
    4 |                 |          |                   |                |    0    |
```

If you see a * near the slot number, you have to run **update slots** command to synchronize autochanger content with your catalog.

19.14 Bareos Autochanger Interface

Bareos calls the autochanger script that you specify on the **Changer Command** statement. Normally this script will be the **mtx-changer** script that we provide, but it can in fact be any program. The only requirement for the script is that it must understand the commands that Bareos uses, which are **loaded**, **load**, **unload**, **list**, and **slots**. In addition, each of those commands must return the information in the precise format as specified below:

```
- Currently the changer commands used are:
    loaded -- returns number of the slot that is loaded, base 1,
              in the drive or 0 if the drive is empty.
    load   -- loads a specified slot (note, some autochangers
              require a 30 second pause after this command) into
              the drive.
    unload -- unloads the device (returns cassette to its slot).
    list   -- returns one line for each cassette in the autochanger
              in the format <slot>:<barcode>. Where
              the {\bf slot} is the non-zero integer representing
              the slot number, and {\bf barcode} is the barcode
              associated with the cassette if it exists and if you
              autoloader supports barcodes. Otherwise the barcode
              field is blank.
    slots  -- returns total number of slots in the autochanger.
```

Bareos checks the exit status of the program called, and if it is zero, the data is accepted. If the exit status is non-zero, Bareos will print an error message and request the tape be manually mounted on the drive.

19.15 Tapespeed and blocksizes

The Bareos Whitepaper Tape Speed Tuning shows that the two parameters **Maximum File Size** and **Maximum Block Size** of the device have significant influence on the tape speed.
While it is no problem to change the Maximum File Size $^{\text{Sd}}_{\text{Device}}$ parameter, unfortunately it is not possible to change the Maximum Block Size $^{\text{Sd}}_{\text{Device}}$ parameter, because the previously written tapes would become unreadable in the new setup. It would require that the Maximum Block Size $^{\text{Sd}}_{\text{Device}}$ parameter is switched back to the old value to be able to read the old volumes, but of course then the new volumes would be unreadable.
Why is that the case?
The problem is that Bareos writes the label block (header) in the same block size that is configured in the Maximum Block Size $^{\text{Sd}}_{\text{Device}}$ parameter in the device. Per default, this value is 63k, so usually a tape written by Bareos looks like this:

```
|------------------
|label block  (63k)|
|------------------
|data block  1(63k)|
|data block  2(63k)|
|...               |
|data block  n(63k)|
--------------------
```

Setting the maximum block size to e.g. 512k, would lead to the following:

```
|------------------
|label block (512k)|
|------------------
|data block 1(512k)|
|data block 2(512k)|
|...               |
|data block n(512k)|
--------------------
```

As you can see, every block is written with the maximum block size, also the label block.
The problem that arises here is that reading a block header with a wrong block size causes a read error which is interpreted as an non-existent label by Bareos.
This is a potential source of data loss, because in normal operation, Bareos refuses to relabel an already labeled volume to be sure to not overwrite data that is still needed. If Bareos cannot read the volume label, this security mechanism does not work and you might label tapes already labeled accidentally.
To solve this problem, the block size handling was changed in Bareos Version >= 14.2.0 in the following way:

- The tape label block is always written in the standard 63k (64512) block size.
- The following blocks are then written in the block size configured in the **Maximum Block Size** directive.
- To be able to change the block size in an existing environment, it is now possible to set the Maximum Block Size $^{\text{Dir}}_{\text{Pool}}$ and Minimum Block Size $^{\text{Dir}}_{\text{Pool}}$ in the pool resource. This setting is automatically promoted to each medium in that pool as usual (i.e. when a medium is labeled for that pool or if a volume is transferred to that pool from the scratch pool). When a volume is mounted, the volume's block size is used to write and read the data blocks that follow the header block.

The following picture shows the result:

```
|--------------------------------|
|label block (label block size)  |
|--------------------------------|
|data block 1(maximum block size)|
|data block 2(maximum block size)|
|...                             |
|data block n(maximum block size)|
---------------------------------|
```

We have a label block with a certain size (63k per default to be compatible to old installations), and the following data blocks are written with another blocksize.
This approach has the following advantages:

- If nothing is configured, existing installations keep on working without problems.
- If you want to switch an existing installation that uses the default block size and move to a new (usually bigger) block size, you can do that easily by creating a new pool, where Maximum Block Size $^{\text{Dir}}_{\text{Pool}}$ is set to the new value that you wish to use in the future:

```
Pool {
   Name = LTO-4-1M
      Pool Type = Backup
      Recycle = yes                       # Bareos can automatically recycle Volumes
      AutoPrune = yes                     # Prune expired volumes
      Volume Retention = 1 Month          # How long should the Full Backups be kept? (#06)
      Maximum Block Size = 1048576
      Recycle Pool = Scratch
}
```

Configuration 19.1: Pool Ressource: setting Maximum Block Size

Now configure your backups that they will write into the newly defined pool in the future, and your backups will be written with the new block size.
Your existing tapes can be automatically transferred to the new pool when they expire via the Scratch Pool mechanism. When a tape in your old pool expires, it is transferred to the scratch pool if you set **Recycle**

Pool = Scratch. When your new pool needs a new volume, it will get it from the scratch pool and apply the new pool's properties to that tape which also include Maximum Block Size $^{\text{Dir}}_{\text{Pool}}$ and Minimum Block Size $^{\text{Dir}}_{\text{Pool}}$.
This way you can smoothly switch your tapes to a new block size while you can still restore the data on your old tapes at any time.

Possible Problems

There is only one case where the new block handling will cause problems, and this is if you have used bigger block sizes already in your setup. As we now defined the label block to always be 63k, all labels will not be readable.
To also solve this problem, the directive Label Block Size $^{\text{Sd}}_{\text{Device}}$ can be used to define a different label block size. That way, everything should work smoothly as all label blocks will be readable again.

How can I find out which block size was used when the tape was written?

At least on Linux, you can see if Bareos tries to read the blocks with the wrong block size. In that case, you get a kernel message like the following in your system's messages:

```
[542132.410170] st1: Failed to read 1048576 byte block with 64512 byte transfer.
```

Here, the block was written with 1M block size but we only read 64k.

Direct access to Volumes with with non-default block sizes

`bls` and `bextract` can directly access Bareos volumes without catalog database. This means that these programs don't have information about the used block size.
To be able to read a volume written with an arbitrary block size, you need to set the Label Block Size $^{\text{Sd}}_{\text{Device}}$ (to be able to to read the label block) and the Maximum Block Size $^{\text{Sd}}_{\text{Device}}$ (to be able to read the data blocks) setting in the device definition used by those tools to be able to open the medium.
Example using `bls` with a tape that was written with another blocksize than the `DEFAULT_BLOCK_SIZE` (63k), but with the default label block size of 63k:

```
root@linux:~# bls FC-Drive-1 -V A00007L4
bls: butil.c:289-0 Using device: "FC-Drive-1" for reading.
25-Feb 12:47 bls JobId 0: No slot defined in catalog (slot=0) for Volume "A00007L4" on "FC-Drive-1"  ↙
    ↪ (/dev/tape/by-id/scsi-350011d00018a5f03-nst).
25-Feb 12:47 bls JobId 0: Cartridge change or "update slots" may be required.
25-Feb 12:47 bls JobId 0: Ready to read from volume "A00007L4" on device "FC-Drive-1"  ↙
    ↪ (/dev/tape/by-id/scsi-350011d00018a5f03-nst).
25-Feb 12:47 bls JobId 0: Error: block.c:1004 Read error on fd=3 at file:blk 0:1 on device "FC-Drive-1"  ↙
    ↪ (/dev/tape/by-id/scsi-350011d00018a5f03-nst). ERR=Cannot allocate memory.
 Bareos status: file=0 block=1
 Device status: ONLINE IM_REP_EN file=0 block=2
0 files found.
```

Commands 19.2: bls with non-default block size

As can be seen, `bls` manages to read the label block as it knows what volume is mounted (Ready to read from volume `A00007L4`), but fails to read the data blocks.

```
root@linux:~# dmesg
[...]
st2: Failed to read 131072 byte block with 64512 byte transfer.
[...]
```

Commands 19.3: dmesg

This shows that the block size for the data blocks that we need is 131072.
Now we have to set this block size in the `bareos-sd.conf`, device resource as Maximum Block Size $^{\text{Sd}}_{\text{Device}}$:

```
Device {
  Name = FC-Drive-1
  Drive Index = 0
  Media Type = LTO-4
  Archive Device = /dev/tape/by-id/scsi-350011d00018a5f03-nst
  AutomaticMount = yes
  AlwaysOpen = yes
  RemovableMedia = yes
  RandomAccess = no
```

```
  AutoChanger = yes
  Maximum Block Size = 131072
}
```

Configuration 19.4: Storage Device Resource: setting Maximum Block Size

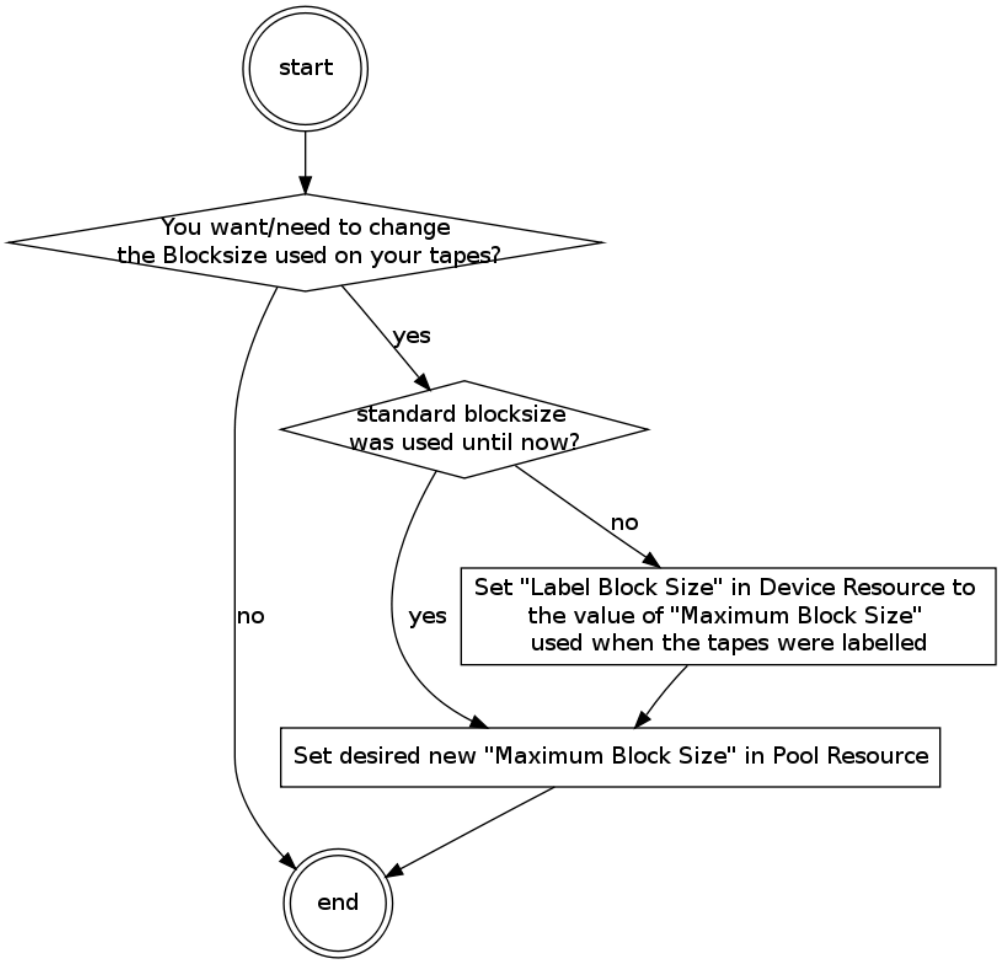
Now we can call bls again, and everything works as expected:

```
root@linux:~# bls FC-Drive-1 -V A00007L4
bls: butil.c:289-0 Using device: "FC-Drive-1" for reading.
25-Feb 12:49 bls JobId 0: No slot defined in catalog (slot=0) for Volume "A00007L4" on "FC-Drive-1"  ↙
    ↪ (/dev/tape/by-id/scsi-350011d00018a5f03-nst).
25-Feb 12:49 bls JobId 0: Cartridge change or "update slots" may be required.
25-Feb 12:49 bls JobId 0: Ready to read from volume "A00007L4" on device "FC-Drive-1"  ↙
    ↪ (/dev/tape/by-id/scsi-350011d00018a5f03-nst).
bls JobId 203: [...]
```

Commands 19.5: bls with non-default block size

How to configure the block sizes in your environment

The following chart shows how to set the directives for **maximum block size** and **label block size** depending on how your current setup is:



Chapter 20

Using Tape Drives without Autochanger

Although Recycling and Backing Up to Disk Volume have been discussed in previous chapters, this chapter is meant to give you an overall view of possible backup strategies and to explain their advantages and disadvantages.

20.1 Simple One Tape Backup

Probably the simplest strategy is to back everything up to a single tape and insert a new (or recycled) tape when it fills and Bareos requests a new one.

20.1.1 Advantages

- The operator intervenes only when a tape change is needed (e.g. once a month).
- There is little chance of operator error because the tape is not changed daily.
- A minimum number of tapes will be needed for a full restore. Typically the best case will be one tape and worst two.
- You can easily arrange for the Full backup to occur a different night of the month for each system, thus load balancing and shortening the backup time.

20.1.2 Disadvantages

- If your site burns down, you will lose your current backups
- After a tape fills and you have put in a blank tape, the backup will continue, and this will generally happen during working hours.

20.1.3 Practical Details

This system is very simple. When the tape fills and Bareos requests a new tape, you **unmount** the tape from the Console program, insert a new tape and **label** it. In most cases after the label, Bareos will automatically mount the tape and resume the backup. Otherwise, you simply **mount** the tape.
Using this strategy, one typically does a Full backup once a week followed by daily Incremental backups. To minimize the amount of data written to the tape, one can do a Full backup once a month on the first Sunday of the month, a Differential backup on the 2nd-5th Sunday of the month, and incremental backups the rest of the week.

20.2 Manually Changing Tapes

If you use the strategy presented above, Bareos will ask you to change the tape, and you will **unmount** it and then remount it when you have inserted the new tape.
If you do not wish to interact with Bareos to change each tape, there are several ways to get Bareos to release the tape:

- In your Storage daemon's Device resource, set **AlwaysOpen = no**. In this case, Bareos will release the tape after every job. If you run several jobs, the tape will be rewound and repositioned to the end at the beginning of every job. This is not very efficient, but does let you change the tape whenever you want.
- Use a **RunAfterJob** statement to run a script after your last job. This could also be an **Admin** job that runs after all your backup jobs. The script could be something like:

```
#!/bin/sh
bconsole <<END_OF_DATA
release storage=your-storage-name
END_OF_DATA
```

  In this example, you would have **AlwaysOpen=yes**, but the **release** command would tell Bareos to rewind the tape and on the next job assume the tape has changed. This strategy may not work on some systems, or on autochangers because Bareos will still keep the drive open.
- The final strategy is similar to the previous case except that you would use the unmount command to force Bareos to release the drive. Then you would eject the tape, and remount it as follows:

```
#!/bin/sh
bconsole <<END_OF_DATA
unmount storage=your-storage-name
END_OF_DATA

# the following is a shell command
mt eject

bconsole <<END_OF_DATA
mount storage=your-storage-name
END_OF_DATA
```

20.3 Daily Tape Rotation

This scheme is quite different from the one mentioned above in that a Full backup is done to a different tape every day of the week. Generally, the backup will cycle continuously through five or six tapes each week. Variations are to use a different tape each Friday, and possibly at the beginning of the month. Thus if backups are done Monday through Friday only, you need only five tapes, and by having two Friday tapes, you need a total of six tapes. Many sites run this way, or using modifications of it based on two week cycles or longer.

20.3.1 Advantages

- All the data is stored on a single tape, so recoveries are simple and faster.
- Assuming the previous day's tape is taken offsite each day, a maximum of one days data will be lost if the site burns down.

20.3.2 Disadvantages

- The tape must be changed every day requiring a lot of operator intervention.
- More errors will occur because of human mistakes.
- If the wrong tape is inadvertently mounted, the Backup for that day will not occur exposing the system to data loss.
- There is much more movement of the tape each day (rewinds) leading to shorter tape drive life time.
- Initial setup of Bareos to run in this mode is more complicated than the Single tape system described above.
- Depending on the number of systems you have and their data capacity, it may not be possible to do a Full backup every night for time reasons or reasons of tape capacity.

20.3.3 Practical Details

The simplest way to "force" Bareos to use a different tape each day is to define a different Pool for each day of the the week a backup is done. In addition, you will need to specify appropriate Job and File retention periods so that Bareos will relabel and overwrite the tape each week rather than appending to it. Nic Bellamy has supplied an actual working model of this which we include here.

What is important is to create a different Pool for each day of the week, and on the **run** statement in the Schedule, to specify which Pool is to be used. He has one Schedule that accomplishes this, and a second Schedule that does the same thing for the Catalog backup run each day after the main backup (Priorities were not available when this script was written). In addition, he uses a **Max Start Delay** of 22 hours so that if the wrong tape is premounted by the operator, the job will be automatically canceled, and the backup cycle will re-synchronize the next day. He has named his Friday Pool **WeeklyPool** because in that Pool, he wishes to have several tapes to be able to restore to a time older than one week.

And finally, in his Storage daemon's Device resource, he has **Automatic Mount = yes** and **Always Open = No**. This is necessary for the tape ejection to work in his **end_of_backup.sh** script below.

For example, his bareos-dir.conf file looks like the following:

```
# /etc/bareos/bareos-dir.conf
#
# Bareos Director Configuration file
#
Director {
  Name = ServerName
  DIRport = 9101
  QueryFile = "/etc/bareos/query.sql"
  Maximum Concurrent Jobs = 1
  Password = "console-pass"
  Messages = Standard
}
#
# Define the main nightly save backup job
#
Job {
  Name = "NightlySave"
  Type = Backup
  Client = ServerName
  FileSet = "Full Set"
  Schedule = "WeeklyCycle"
  Storage = Tape
  Messages = Standard
  Pool = Default
  Write Bootstrap = "/var/lib/bareos/NightlySave.bsr"
  Max Start Delay = 22h
}
# Backup the catalog database (after the nightly save)
Job {
  Name = "BackupCatalog"
  Type = Backup
  Client = ServerName
  FileSet = "Catalog"
  Schedule = "WeeklyCycleAfterBackup"
  Storage = Tape
  Messages = Standard
  Pool = Default
  # This creates an ASCII copy of the catalog
  # WARNING!!! Passing the password via the command line is insecure.
  # see comments in make_catalog_backup for details.
  RunBeforeJob = "/usr/lib/bareos/make_catalog_backup -u bareos"
  # This deletes the copy of the catalog, and ejects the tape
  RunAfterJob  = "/etc/bareos/end_of_backup.sh"
  Write Bootstrap = "/var/lib/bareos/BackupCatalog.bsr"
  Max Start Delay = 22h
}
# Standard Restore template, changed by Console program
Job {
  Name = "RestoreFiles"
  Type = Restore
  Client = ServerName
  FileSet = "Full Set"
  Storage = Tape
  Messages = Standard
```

```
  Pool = Default
  Where = /tmp/bareos-restores
}
# List of files to be backed up
FileSet {
  Name = "Full Set"
  Include = signature=MD5 {
    /
    /data
  }
  Exclude = { /proc /tmp /.journal }
}
#
# When to do the backups
#
Schedule {
  Name = "WeeklyCycle"
  Run = Level=Full Pool=MondayPool Monday at 8:00pm
  Run = Level=Full Pool=TuesdayPool Tuesday at 8:00pm
  Run = Level=Full Pool=WednesdayPool Wednesday at 8:00pm
  Run = Level=Full Pool=ThursdayPool Thursday at 8:00pm
  Run = Level=Full Pool=WeeklyPool Friday at 8:00pm
}
# This does the catalog. It starts after the WeeklyCycle
Schedule {
  Name = "WeeklyCycleAfterBackup"
  Run = Level=Full Pool=MondayPool Monday at 8:15pm
  Run = Level=Full Pool=TuesdayPool Tuesday at 8:15pm
  Run = Level=Full Pool=WednesdayPool Wednesday at 8:15pm
  Run = Level=Full Pool=ThursdayPool Thursday at 8:15pm
  Run = Level=Full Pool=WeeklyPool Friday at 8:15pm
}
# This is the backup of the catalog
FileSet {
  Name = "Catalog"
  Include = signature=MD5 {
     /var/lib/bareos/bareos.sql
  }
}
# Client (File Services) to backup
Client {
  Name = ServerName
  Address = dionysus
  FDPort = 9102
  Password = "client-pass"
  File Retention = 30d
  Job Retention = 30d
  AutoPrune = yes
}
# Definition of file storage device
Storage {
  Name = Tape
  Address = dionysus
  SDPort = 9103
  Password = "storage-pass"
  Device = Tandberg
  Media Type = MLR1
}
# Generic catalog service
Catalog {
  Name = MyCatalog
  dbname = bareos; user = bareos; password = ""
}
# Reasonable message delivery -- send almost all to email address
#  and to the console
Messages {
  Name = Standard
  mailcommand = "/usr/sbin/bsmtp -h localhost -f \"\(Bareos\) %r\" -s \"Bareos: %t %e of %c %l\" %r"
  operatorcommand = "/usr/sbin/bsmtp -h localhost -f \"\(Bareos\) %r\" -s \"Bareos: Intervention needed for %j\" %r"
  mail = root@localhost = all, !skipped
  operator = root@localhost = mount
  console = all, !skipped, !saved
  append = "/var/lib/bareos/log" = all, !skipped
}

# Pool definitions
```

```
#
# Default Pool for jobs, but will hold no actual volumes
Pool {
  Name = Default
  Pool Type = Backup
}
Pool {
  Name = MondayPool
  Pool Type = Backup
  Recycle = yes
  AutoPrune = yes
  Volume Retention = 6d
  Maximum Volume Jobs = 2
}
Pool {
  Name = TuesdayPool
  Pool Type = Backup
  Recycle = yes
  AutoPrune = yes
  Volume Retention = 6d
  Maximum Volume Jobs = 2
}
Pool {
  Name = WednesdayPool
  Pool Type = Backup
  Recycle = yes
  AutoPrune = yes
  Volume Retention = 6d
  Maximum Volume Jobs = 2
}
Pool {
  Name = ThursdayPool
  Pool Type = Backup
  Recycle = yes
  AutoPrune = yes
  Volume Retention = 6d
  Maximum Volume Jobs = 2
}
Pool {
  Name = WeeklyPool
  Pool Type = Backup
  Recycle = yes
  AutoPrune = yes
  Volume Retention = 12d
  Maximum Volume Jobs = 2
}
# EOF
```

In order to get Bareos to release the tape after the nightly backup, this setup uses a **RunAfterJob** script that deletes the database dump and then rewinds and ejects the tape. The following is a copy of **end_of_backup.sh**

```
#! /bin/sh
/usr/lib/bareos/delete_catalog_backup
mt rewind
mt eject
exit 0
```

Finally, if you list his Volumes, you get something like the following:

```
*list media
Using default Catalog name=MyCatalog DB=bareos
Pool: WeeklyPool
+-----+-----------+-------+--------+-----------+-----------------+-------+------+
| MeId| VolumeName| MedTyp| VolStat| VolBytes  | LastWritten     | VolRet| Recyc|
+-----+-----------+-------+--------+-----------+-----------------+-------+------+
| 5   | Friday_1  | MLR1  | Used   | 2157171998| 2003-07-11 20:20| 103680| 1    |
| 6   | Friday_2  | MLR1  | Append | 0         | 0               | 103680| 1    |
+-----+-----------+-------+--------+-----------+-----------------+-------+------+
Pool: MondayPool
+-----+-----------+-------+--------+-----------+-----------------+-------+------+
| MeId| VolumeName| MedTyp| VolStat| VolBytes  | LastWritten     | VolRet| Recyc|
+-----+-----------+-------+--------+-----------+-----------------+-------+------+
| 2   | Monday    | MLR1  | Used   | 2260942092| 2003-07-14 20:20| 518400| 1    |
+-----+-----------+-------+--------+-----------+-----------------+-------+------+
```

```
Pool: TuesdayPool
+-----+-----------+-------+--------+-----------+-----------------+-------+------+
| MeId| VolumeName| MedTyp| VolStat| VolBytes  | LastWritten     | VolRet| Recyc|
+-----+-----------+-------+--------+-----------+-----------------+-------+------+
| 3   | Tuesday   | MLR1  | Used   | 2268180300| 2003-07-15 20:20| 518400| 1    |
+-----+-----------+-------+--------+-----------+-----------------+-------+------+
Pool: WednesdayPool
+-----+-----------+-------+--------+-----------+-----------------+-------+------+
| MeId| VolumeName| MedTyp| VolStat| VolBytes  | LastWritten     | VolRet| Recyc|
+-----+-----------+-------+--------+-----------+-----------------+-------+------+
| 4   | Wednesday | MLR1  | Used   | 2138871127| 2003-07-09 20:2 | 518400| 1    |
+-----+-----------+-------+--------+-----------+-----------------+-------+------+
Pool: ThursdayPool
+-----+-----------+-------+--------+-----------+-----------------+-------+------+
| MeId| VolumeName| MedTyp| VolStat| VolBytes  | LastWritten     | VolRet| Recyc|
+-----+-----------+-------+--------+-----------+-----------------+-------+------+
| 1   | Thursday  | MLR1  | Used   | 2146276461| 2003-07-10 20:50| 518400| 1    |
+-----+-----------+-------+--------+-----------+-----------------+-------+------+
Pool: Default
No results to list.
```

Chapter 21

Data Spooling

Bareos allows you to specify that you want the Storage daemon to initially write your data to disk and then subsequently to tape. This serves several important purposes.

- It takes a long time for data to come in from the File daemon during an Incremental backup. If it is directly written to tape, the tape will start and stop or shoe-shine as it is often called causing tape wear. By first writing the data to disk, then writing it to tape, the tape can be kept in continual motion.
- While the spooled data is being written to the tape, the despooling process has exclusive use of the tape. This means that you can spool multiple simultaneous jobs to disk, then have them very efficiently despooled one at a time without having the data blocks from several jobs intermingled, thus substantially improving the time needed to restore files. While despooling, all jobs spooling continue running.
- Writing to a tape can be slow. By first spooling your data to disk, you can often reduce the time the File daemon is running on a system, thus reducing downtime, and/or interference with users. Of course, if your spool device is not large enough to hold all the data from your File daemon, you may actually slow down the overall backup.

Data spooling is exactly that "spooling". It is not a way to first write a "backup" to a disk file and then to a tape. When the backup has only been spooled to disk, it is not complete yet and cannot be restored until it is written to tape.
Bareos also supports writing a backup to disk then later migrating or moving it to a tape (or any other medium). For details on this, please see the Migration and Copy chapter of this manual for more details.
The remainder of this chapter explains the various directives that you can use in the spooling process.

21.1 Data Spooling Directives

The following directives can be used to control data spooling.

- Turn data spooling on/off at the Job level: Spool Data $^{\text{Dir}}_{\text{Job}}$ = yes|no
- This setting can be overwritten in a Schedule Run $^{\text{Dir}}_{\text{Schedule}}$ directive: `SpoolData=yes|no`
- To override the Job specification in a bconsole session using the `run` command: `SpoolData=yes|no`

  Please note that this does not refer to a configuration statement, but to an argument for the run command.
- To limit the the maximum spool file size for a particular job: Spool Size $^{\text{Dir}}_{\text{Job}}$
- To limit the maximum total size of the spooled data for a particular device: Maximum Spool Size $^{\text{Sd}}_{\text{Device}}$
- To limit the maximum total size of the spooled data for a particular device for a single job: Maximum Job Spool Size $^{\text{Sd}}_{\text{Device}}$
- To specify the spool directory for a particular device: Spool Directory $^{\text{Sd}}_{\text{Device}}$

21.1.1 Additional Notes

- Please note! *Exclude your the spool directory from any backup, otherwise, your job will write enormous amounts of data to the Volume, and most probably terminate in error. This is because in attempting to backup the spool file, the backup data will be written a second time to the spool file, and so on ad infinitum.*
- Another advice is to always specify the Maximum Spool Size $^{\text{Sd}}_{\text{Device}}$ so that your disk doesn't completely fill up. In principle, data spooling will properly detect a full disk, and despool data allowing the job to continue. However, attribute spooling is not so kind to the user. If the disk on which attributes are being spooled fills, the job will be canceled. In addition, if your working directory is on the same partition as the spool directory, then Bareos jobs will fail possibly in bizarre ways when the spool fills.
- When data spooling is enabled, Bareos automatically turns on attribute spooling. In other words, it also spools the catalog entries to disk. This is done so that in case the job fails, there will be no catalog entries pointing to non-existent tape backups.
- Attribute despooling occurs near the end of a job. The Storage daemon accumulates file attributes during the backup and sends them to the Director at the end of the job. The Director then inserts the file attributes into the catalog. During this insertion, the tape drive may be inactive. When the file attribute insertion is completed, the job terminates.
- Attribute spool files are always placed in the working directory of the Storage daemon.
- When Bareos begins despooling data spooled to disk, it takes exclusive use of the tape. This has the major advantage that in running multiple simultaneous jobs at the same time, the blocks of several jobs will not be intermingled.
- It is probably best to provide as large a spool file as possible to avoid repeatedly spooling/despooling. Also, while a job is despooling to tape, the File daemon must wait (i.e. spooling stops for the job while it is despooling).
- If you are running multiple simultaneous jobs, Bareos will continue spooling other jobs while one is despooling to tape, provided there is sufficient spool file space.

Chapter 22

Migration and Copy

The term Migration, as used in the context of Bareos, means moving data from one Volume to another. In particular it refers to a Job (similar to a backup job) that reads data that was previously backed up to a Volume and writes it to another Volume. As part of this process, the File catalog records associated with the first backup job are purged. In other words, Migration moves Bareos Job data from one Volume to another by reading the Job data from the Volume it is stored on, writing it to a different Volume in a different Pool, and then purging the database records for the first Job.
The Copy process is essentially identical to the Migration feature with the exception that the Job that is copied is left unchanged. This essentially creates two identical copies of the same backup. However, the copy is treated as a copy rather than a backup job, and hence is not directly available for restore. If Bareos finds a copy when a job record is purged (deleted) from the catalog, it will promote the copy as *real* backup and will make it available for automatic restore.
Copy and Migration jobs do not involve the File daemon.
Jobs can be selected for migration based on a number of criteria such as:

- a single previous Job
- a Volume
- a Client
- a regular expression matching a Job, Volume, or Client name
- the time a Job has been on a Volume
- high and low water marks (usage or occupation) of a Pool
- Volume size

The details of these selection criteria will be defined below.
To run a Migration job, you must first define a Job resource very similar to a Backup Job but with Type $^{\text{Dir}}_{\text{Job}}$ = Migrate instead of Type $^{\text{Dir}}_{\text{Job}}$ = Backup. One of the key points to remember is that the Pool that is specified for the migration job is the only pool from which jobs will be migrated, with one exception noted below. In addition, the Pool to which the selected Job or Jobs will be migrated is defined by the Next Pool $^{\text{Dir}}_{\text{Pool}}$ = ... in the Pool resource specified for the Migration Job.
Bareos permits Pools to contain Volumes of different Media Types. However, when doing migration, this is a very undesirable condition. For migration to work properly, you should use Pools containing only Volumes of the same Media Type for all migration jobs.
A migration job can be started manually or from a Schedule, like a backup job. It searches for existing backup Jobs that match the parameters specified in the migration Job resource, primarily a Selection Type $^{\text{Dir}}_{\text{Job}}$. If no match was found, the Migration job terminates without further action. Otherwise, for each Job found this way, the Migration Job will run a new Job which copies the Job data to a new Volume in the Migration Pool.
Normally three jobs are involved during a migration:

- The Migration control Job which starts the migration child Jobs.
- The previous Backup Job (already run). The File records of this Job are purged when the Migration job terminates successfully. The data remain on the Volume until it is recycled.

- A new Migration Backup Job that moves the data from the previous Backup job to the new Volume. If you subsequently do a restore, the data will be read from this Job.

If the Migration control Job finds more than one existing Job to migrate, it creates one migration job for each of them. This may result in a large number of Jobs. Please note that Migration doesn't scale too well if you migrate data off of a large Volume because each job must read the same Volume, hence the jobs will have to run consecutively rather than simultaneously.

22.1 Important Migration Considerations

- Each Pool into which you migrate Jobs or Volumes **must** contain Volumes of only one Media Type $^{\text{Dir}}_{\text{Storage}}$.
- Migration takes place on a JobId by JobId basis. That is each JobId is migrated in its entirety and independently of other JobIds. Once the Job is migrated, it will be on the new medium in the new Pool, but for the most part, aside from having a new JobId, it will appear with all the same characteristics of the original job (start, end time, ...). The column RealEndTime in the catalog Job table will contain the time and date that the Migration terminated, and by comparing it with the EndTime column you can tell whether or not the job was migrated. Also, the Job table contains a PriorJobId column which is set to the original JobId for migration jobs. For non-migration jobs this column is zero.
- After a Job has been migrated, the File records are purged from the original Job. Moreover, the Type of the original Job is changed from "B" (backup) to "M" (migrated), and another Type "B" job record is added which refers to the new location of the data. Since the original Job record stays in the bareos catalog, it is still possible to restore from the old media by specifying the original JobId for the restore. However, no file selection is possible in this case, so one can only restore **all** files this way.
- A Job will be migrated only if all Volumes on which the job is stored are marked Full, Used, or Error. In particular, Volumes marked Append will not be considered for migration which rules out the possibility that new files are appended to a migrated Volume. This policy also prevents deadlock situations, like attempting to read and write the same Volume from two jobs at the same time.
- Migration works only if the Job resource of the original Job is still defined in the current director configuration. Otherwise you'll get a fatal error.
- Setting the Migration High Bytes watermark is not sufficient for migration to take place. In addition, you must define and schedule a migration job which looks for jobs that can be migrated.
- To figure out which jobs are going to be migrated by a given configuration, choose a debug level of 100 or more. This activates information about the migration selection process.
- Bareos currently does only minimal Storage conflict resolution, so you must take care to ensure that you don't try to read and write to the same device or Bareos may block waiting to reserve a drive that it will never find. In general, ensure that all your migration pools contain only one Media Type $^{\text{Dir}}_{\text{Storage}}$, and that you always migrate to pools with different Media Types.
- The Next Pool $^{\text{Dir}}_{\text{Pool}}$ = ... directive must be defined in the Pool referenced in the Migration Job to define the Pool into which the data will be migrated.
- Migration has only be tested carefully for the "Job" and "Volume" selection types. All other selection types (time, occupancy, smallest, oldest, ...) are experimental features.

22.2 Configure Copy or Migration Jobs

The following directives can be used to define a Copy or Migration job:

Job Resource

- Type $^{\text{Dir}}_{\text{Job}}$ = Migrate|Copy
- Selection Type $^{\text{Dir}}_{\text{Job}}$
- Selection Pattern $^{\text{Dir}}_{\text{Job}}$

- Pool Dir Job
  For Selection Type Dir Job other than SQLQuery, this defines what Pool will be examined for finding JobIds to migrate
- Purge Migration Job Dir Job

Pool Resource

- Next Pool Dir Pool
  to what pool Jobs will be migrated
- Migration Time Dir Pool
  if Selection Type Dir Job = PoolTime
- Migration High Bytes Dir Pool
  if Selection Type Dir Job = PoolOccupancy
- Migration Low Bytes Dir Pool
  optional if Selection Type Dir Job = PoolOccupancy is used
- Storage Dir Pool
  if Copy/Migration involves multiple Storage Daemon, see Multiple Storage Daemons

22.2.1 Example Migration Jobs

Assume a simple configuration with a single backup job as described below.

```
# Define the backup Job
Job {
  Name = "NightlySave"
  Type = Backup
  Level = Incremental                 # default
  Client=rufus-fd
  FileSet="Full Set"
  Schedule = "WeeklyCycle"
  Messages = Standard
  Pool = Default
}

# Default pool definition
Pool {
  Name = Default
  Pool Type = Backup
  AutoPrune = yes
  Recycle = yes
  Next Pool = Tape
  Storage = File
  LabelFormat = "File"
}

# Tape pool definition
Pool {
  Name = Tape
  Pool Type = Backup
  AutoPrune = yes
  Recycle = yes
  Storage = DLTDrive
}

# Definition of File storage device
Storage {
  Name = File
  Address = rufus
  Password = "secret"
  Device = "File"          # same as Device in Storage daemon
  Media Type = File        # same as MediaType in Storage daemon
}

# Definition of DLT tape storage device
Storage {
  Name = DLTDrive
  Address = rufus
```

```
  Password = "secret"
  Device = "HP DLT 80"      # same as Device in Storage daemon
  Media Type = DLT8000      # same as MediaType in Storage daemon
}
```

Configuration 22.1: Backup Job

Note that the backup job writes to the `Default` pool, which corresponds to `File` storage. There is no Storage Dir Pool directive in the Job resource while the two `Pool` resources contain different Storage Dir Pool directives. Moreover, the `Default` pool contains a Next Pool Dir Pool directive that refers to the `Tape` pool.
In order to migrate jobs from the `Default` pool to the `Tape` pool we add the following Job resource:

```
Job {
  Name = "migrate-volume"
  Type = Migrate
  Messages = Standard
  Pool = Default
  Selection Type = Volume
  Selection Pattern = "."
}
```

Configuration 22.2: migrate all volumes of a pool

The Selection Type Dir Job and Selection Pattern Dir Job directives instruct Bareos to select all volumes of the given pool (`Default`) whose volume names match the given regular expression (*"."*), i.e., all volumes. Hence those jobs which were backed up to any volume in the `Default` pool will be migrated. Because of the Next Pool Dir Pool directive of the `Default` pool resource, the jobs will be migrated to tape storage.
Another way to accomplish the same is the following Job resource:

```
Job {
  Name = "migrate"
  Type = Migrate
  Messages = Standard
  Pool = Default
  Selection Type = Job
  Selection Pattern = ".*Save"
}
```

Configuration 22.3: migrate all jobs named *Save

This migrates all jobs ending with *Save* from the `Default` pool to the `Tape` pool, i.e., from File storage to Tape storage.

Multiple Storage Daemons

Beginning from Bareos Version >= 13.2.0 , Migration and Copy jobs are also possible from one Storage daemon to another Storage Daemon.
Please note:

- the director must have two different storage resources configured (e.g. storage1 and storage2)
- each storage needs an own device and an individual pool (e.g. pool1, pool2)
- each pool is linked to its own storage via the storage directive in the pool resource
- to configure the migration from pool1 to pool2, the Next Pool Dir Pool directive of pool1 has to point to pool2
- the copy job itself has to be of type copy/migrate (exactly as already known in copy- and migration jobs)

Example:

```
#bareos-dir.conf

# Fake fileset for copy jobs
Fileset {
  Name = None
  Include {
    Options {
      signature = MD5
    }
```

```
  }
}

# Fake client for copy jobs
Client {
  Name = None
  Address = localhost
  Password = "NoNe"
  Catalog = MyCatalog
}

# Source storage for migration
Storage {
   Name = storage1
   Address = sd1.example.com
   Password = "secret1"
   Device = File1
   Media Type = File
}

# Target storage for migration
Storage {
   Name = storage2
   Address = sd2.example.com
   Password = "secret2"
   Device = File2
   Media Type = File2   # Has to be different than in storage1
}

Pool {
   Name = pool1
   Storage = storage1
   Next Pool = pool2    # This points to the target storage
}

Pool {
   Name = pool2
   Storage = storage2
}

Job {
   Name = CopyToRemote
   Type = Copy
   Messages = Standard
   Selection Type = PoolUncopiedJobs
   Spool Data = Yes
   Pool = pool1
}
```

Configuration 22.4: bareos-dir.conf: Copy Job between different Storage Daemons

Chapter 23

File Deduplication using Base Jobs

A base job is sort of like a Full save except that you will want the FileSet to contain only files that are unlikely to change in the future (i.e. a snapshot of most of your system after installing it). After the base job has been run, when you are doing a Full save, you specify one or more Base jobs to be used. All files that have been backed up in the Base job/jobs but not modified will then be excluded from the backup. During a restore, the Base jobs will be automatically pulled in where necessary.
Imagine having 100 nearly identical Windows or Linux machine containing the OS and user files. Now for the OS part, a Base job will be backed up once, and rather than making 100 copies of the OS, there will be only one. If one or more of the systems have some files updated, no problem, they will be automatically backuped.
A new Job directive **Base=JobX,JobY,...** permits to specify the list of files that will be used during Full backup as base.

```
Job {
   Name = BackupLinux
   Level= Base
   ...
}

Job {
   Name = BackupZog4
   Base = BackupZog4, BackupLinux
   Accurate = yes
   ...
}
```

In this example, the job `BackupZog4` will use the most recent version of all files contained in `BackupZog4` and `BackupLinux` jobs. Base jobs should have run with **Level=Base** to be used.
By default, Bareos will compare permissions bits, user and group fields, modification time, size and the checksum of the file to choose between the current backup and the BaseJob file list. You can change this behavior with the `BaseJob` FileSet option. This option works like the **Verify**, that is described in the FileSet chapter.

```
FileSet {
  Name = Full
  Include = {
    Options {
       BaseJob  = pmugcs5
       Accurate = mcs
       Verify   = pin5
    }
    File = /
  }
}
```

Please note! *The current implementation doesn't permit to scan volume with* `bscan`*. The result wouldn't permit to restore files easily.*

Chapter 24

Plugins

The functionality of Bareos can be extended by plugins. They do exists plugins for the different daemons (Director, Storage- and File-Daemon).
To use plugins, they must be enabled in the configuration (**Plugin Directory** and **Plugin Names**).

24.1 File Daemon Plugins

File Daemon plugins are configured by the **Plugin** directive of a File Set.
Please note! *Currently the plugin command is being stored as part of the backup. The restore command in your directive should be flexible enough if things might change in future, otherwise you could run into trouble.*

24.1.1 bpipe Plugin

The bpipe plugin is a generic pipe program, that simply transmits the data from a specified program to Bareos for backup, and from Bareos to a specified program for restore. The purpose of the plugin is to provide an interface to any system program for backup and restore. That allows you, for example, to do database backups without a local dump. By using different command lines to bpipe, you can backup any kind of data (ASCII or binary) depending on the program called.
On Linux, the Bareos bpipe plugin is part of the `bareos-filedaemon` package and is therefore installed on any system running the filedaemon.
The bpipe plugin is so simple and flexible, you may call it the "Swiss Army Knife" of the current existing plugins for Bareos.
The bpipe plugin is specified in the Include section of your Job's FileSet resource in your `bareos-dir.conf`.

```
FileSet {
  Name = "MyFileSet"
  Include {
    Options {
      signature = MD5
      compression = gzip
    }
    Plugin = "bpipe:file=<filepath>:reader=<readprogram>:writer=<writeprogram>
  }
}
```

Configuration 24.1: bpipe fileset

The syntax and semantics of the Plugin directive require the first part of the string up to the colon to be the name of the plugin. Everything after the first colon is ignored by the File daemon but is passed to the plugin. Thus the plugin writer may define the meaning of the rest of the string as he wishes. The full syntax of the plugin directive as interpreted by the bpipe plugin is:

```
Plugin = "<plugin>:file=<filepath>:reader=<readprogram>:writer=<writeprogram>"
```

Configuration 24.2: bpipe directive

plugin is the name of the plugin with the trailing -fd.so stripped off, so in this case, we would put bpipe in the field.

filepath specifies the namespace, which for bpipe is the pseudo path and filename under which the backup will be saved. This pseudo path and filename will be seen by the user in the restore file tree. For example, if the value is */MySQL/mydump.sql*, the data backed up by the plugin will be put under that "pseudo" path and filename. You must be careful to choose a naming convention that is unique to avoid a conflict with a path and filename that actually exists on your system.

readprogram for the bpipe plugin specifies the "reader" program that is called by the plugin during backup to read the data. bpipe will call this program by doing a popen on it.

writeprogram for the bpipe plugin specifies the "writer" program that is called by the plugin during restore to write the data back to the filesystem.

Please note that the two items above describing the "reader" and "writer", these programs are "executed" by Bareos, which means there is no shell inerpretation of any command line arguments you might use. If you want to use shell characters (redirection of input or output, ...), then we recommend that you put your command or commands in a shell script and execute the script. In addition if you backup a file with reader program, when running the writer program during the restore, Bareos will not automatically create the path to the file. Either the path must exist, or you must explicitly do so with your command or in a shell script. See the examples about Backup of a PostgreSQL Database and Backup of a MySQL Database.

24.1.2 PGSQL Plugin

See chapter Backup of a PostgreSQL Databases by using the PGSQL-Plugin.

24.1.3 MSSQL Plugin

See chapter Backup of MSSQL Databases with Bareos Plugin.

24.1.4 LDAP Plugin

This plugin is intended to backup (and restore) the contents of a LDAP server. It uses normal LDAP operation for this. The package `bareos-filedaemon-ldap-python-plugin` (Version >= 15.2.0) contains an example configuration file, that must be adapted to your envirnoment.

24.1.5 Cephfs Plugin

Opposite to the Rados Backend that is used to store data on a CEPH Object Store, this plugin is intended to backup a CEPH Object Store via the Cephfs interface to other media. The package `bareos-filedaemon-ceph-plugin` (Version >= 15.2.0) contains an example configuration file, that must be adapted to your envirnoment.

24.1.6 Rados Plugin

Opposite to the Rados Backend that is used to store data on a CEPH Object Store, this plugin is intended to backup a CEPH Object Store via the Rados interface to other media. The package `bareos-filedaemon-ceph-plugin` (Version >= 15.2.0) contains an example configuration file, that must be adapted to your envirnoment.

24.1.7 GlusterFS Plugin

Opposite to the GFAPI Backend that is used to store data on a Gluster system, this plugin is intended to backup data from a Gluster system to other media. The package `bareos-filedaemon-glusterfs-plugin` (Version >= 15.2.0) contains an example configuration file, that must be adapted to your envirnoment.

24.1.8 python-fd Plugin

The **python-fd** plugin behaves similar to the python-dir Plugin. Base plugins and an example get installed via the package bareos-filedaemon-python-plugin. Configuration is done in the FileSet Resource on the director.
We basically distinguish between command-plugin and option-plugins.

Command Plugins

Command plugins are used to replace or extend the FileSet definition in the File Section. If you have a command-plugin, you can use it like in this example:

```
FileSet {
  Name = "mysql"
  Include {
    Options {
      Signature = MD5 # calculate md5 checksum per file
    }
    File = "/etc"
    Plugin = "python:module_path=/usr/lib/bareos/plugins:module_name=bareos-fd-mysql"
  }
}
```

Configuration 24.3: bareos-dir.conf: Python FD command plugins

This example uses the MySQL plugin to backup MySQL dumps in addition to `/etc`.

Option Plugins

Option plugins are activated in the Options resource of a FileSet definition.
Example:

```
FileSet {
  Name = "option"
  Include {
    Options {
      Signature = MD5 # calculate md5 checksum per file
      Plugin = "python:module_path=/usr/lib/bareos/plugins:module_name=bareos-fd-file-interact"
    }
    File = "/etc"
    File = "/usr/lib/bareos/plugins"
  }
}
```

Configuration 24.4: bareos-dir.conf: Python FD option plugins

This plugin bareos-fd-file-interact from https://github.com/bareos/bareos-contrib/tree/master/fd-plugins/options-plugin-sample has a method that is called before and after each file that goes into the backup, it can be used as a template for whatever plugin wants to interact with files before or after backup.

24.1.9 VMware Plugin

The VMware® Plugin can be used for agentless backups of virtual machines running on VMware vSphere®. It makes use of CBT (Changed Block Tracking) to do space efficient full and incremental backups, see below for mandatory requirements.
It is included in Bareos since Version >= 15.2.0 .

Status

The Plugin can do full, differential and incremental backup and restore of VM disks.
Current limitations amongst others are:

Normal VM disks can not be excluded from the backup. It is not yet possible to exclude normal (dependent) VM disks from backups. However, independent disks are excluded implicitly because they are not affected by snapshots which are required for CBT based backup.

VM configuration is not backed up. The VM configuration is not yet (bareos-15.2.2) backed up, so that it is not yet possible to recreate a completely deleted VM.

Restore can only be done to the same VM or to local VMDK files. Until Bareos Version 15.2.2, the restore has only be possible to the same existing VM with existing virtual disks. Since Version >= 15.2.3 it is also possible to restore to local VMDK files, see below for more details.

Requirements

As the Plugin is based on the VMware vSphere® Storage APIs for Data Protection, which requires at least a VMware vSphere® Essentials License. It does not work with standalone unlicensed VMware® ESXi™.

Installation

Install the package `bareos-vmware-plugin` including its requirments by using an appropriate package management tool (eg. `yum`, `zypper`, `apt`)
The FAQ may have additional useful information.

Configuration

First add a user account in vCenter that has full privileges by assigning the account to an administrator role or by adding the account to a group that is assigned to an administrator role. While any user account with full privileges could be used, it is better practice to create a separate user account, so that the actions by this account logged in vSphere are clearly distinguishable. In the future a more detailed set of required role privilges may be defined.
When using the vCenter appliance with embedded SSO, a user account usually has the structure `<username>@vsphere.local`, it may be different when using Active Directory as SSO in vCenter. For the examples here, we will use `bakadm@vsphere.local` with the password `Bak.Adm-1234`.
For more details regarding users and permissions in vSphere see

- http://pubs.vmware.com/vsphere-55/topic/com.vmware.vsphere.security.doc/GUID-72BFF98C-C530-4C50-BF31-B5779D2A4BBB.html and
- http://pubs.vmware.com/vsphere-55/topic/com.vmware.vsphere.security.doc/GUID-5372F580-5C23-4E9C-8A4E-EF1B4DD9033E.html

Make sure to add or enable the following settings in `/etc/bareos/bareos-fd.conf`:

```
...
FileDaemon {
...
  Plugin Directory = /usr/lib/bareos/plugins
  Plugin Names = python
...
}
```

Configuration 24.5: bareos-fd.conf: Plugin Settings

Note: Depending on Platform, the Plugin Directory may also be `/usr/lib64/bareos/plugins`
To define the backup of a VM in Bareos, a job definition and a fileset resource must be added to the Bareos director confguration. In vCenter, VMs are usually organized in datacenters and folders. The following example shows how to configure the backup of the VM named *websrv1* in the datacenter *mydc1* folder *webservers* on the vCenter server `vcenter.example.org`:

```
Job {
  Name = "vm-websrv1"
  JobDefs = "DefaultJob"
  FileSet = "vm-websrv1_fileset"
}

FileSet {
  Name = "vm-websrv1_fileset"

  Include {
    Options {
         signature = MD5
         Compression = GZIP
    }
    Plugin = "python:module_path=/usr/lib64/bareos/plugins/vmware_plugin:module_name=bareos-fd-vmware:dc= ↙
     ↪ mydc1:folder=/webservers:vmname=websrv1:vcserver=vcenter.example.org:vcuser=bakadm@vsphere.local: ↙
     ↪ vcpass=Bak.Adm-1234"
  }
}
```

Configuration 24.6: bareos-dir.conf: VMware Plugin Job and FileSet definition

For VMs defined in the root-folder, `folder=/` must be specified in the Plugin definition.

Backup

Before running the first backup, CBT (Changed Block Tracking) must be enabled for the VMs to be backed up.
As of http://kb.vmware.com/kb/2075984 manually enabling CBT is currently not working properly. The API however works properly. To enable CBT use the Script `vmware_cbt_tool.py`, it is packaged in the bareos-vmware-plugin package:

```
# vmware_cbt_tool.py --help
usage: vmware_cbt_tool.py [-h] -s HOST [-o PORT] -u USER [-p PASSWORD] -d
                          DATACENTER -f FOLDER -v VMNAME [--enablecbt]
                          [--disablecbt] [--resetcbt] [--info]

Process args for enabling/disabling/resetting CBT

optional arguments:
  -h, --help            show this help message and exit
  -s HOST, --host HOST  Remote host to connect to
  -o PORT, --port PORT  Port to connect on
  -u USER, --user USER  User name to use when connecting to host
  -p PASSWORD, --password PASSWORD
                        Password to use when connecting to host
  -d DATACENTER, --datacenter DATACENTER
                        DataCenter Name
  -f FOLDER, --folder FOLDER
                        Folder Name
  -v VMNAME, --vmname VMNAME
                        Names of the Virtual Machines
  --enablecbt           Enable CBT
  --disablecbt          Disable CBT
  --resetcbt            Reset CBT (disable, then enable)
  --info                Show information (CBT supported and enabled or
                        disabled)
```

Commands 24.7: usage of vmware_cbt_tool.py

For the above configuration example, the command to enable CBT would be

```
# vmware_cbt_tool.py -s vcenter.example.org -u bakadm@vsphere.local -p Bak.Adm-1234 -d mydc1 -f ↙
    ↪ /webservers -v websrv1 --enablecbt
```

Commands 24.8: Example using vmware_cbt_tool.py

Note: CBT does not work if the virtual hardware version is 6 or earlier.
After enabling CBT, Backup Jobs can be run or scheduled as usual, for example in `bconsole`:
`run job=vm-websrv1 level=Full`

Restore

For restore, the VM must be powered off and no snapshot must exist. In `bconsole` use the restore menu 5, select the correct FileSet and enter `mark *`, then `done`. After restore has finished, the VM can be powered on.

Restore to local VMDK File

Since Version >= 15.2.3 it is possible to restore to local VMDK files. That means, instead of directly restoring a disk that belongs to the VM, the restore creates VMDK disk image files on the filesystem of the system that runs the Bareos File Daemon. As the VM that the backup was taken from is not affected by this, it can remain switched on while restoring to local VMDK. Such a restored VMDK file can then be uploaded to a VMware vSphere® datastore or accessed by tools like guestfish to extract single files.
For restoring to local VMDK, the plugin option *localvmdk=yes* must be passed. The following example shows how to perform such a restore using `bconsole`:

```
*restore
Automatically selected Catalog: MyCatalog
Using Catalog "MyCatalog"

First you select one or more JobIds that contain files
to be restored. You will be presented several methods
of specifying the JobIds. Then you will be allowed to
select which files from those JobIds are to be restored.
```

```
To select the JobIds, you have the following choices:
     1: List last 20 Jobs run
     ...
     5: Select the most recent backup for a client
     ...
    13: Cancel
Select item:  (1-13): 5
Automatically selected Client: vmw5-bareos-centos6-64-devel-fd
The defined FileSet resources are:
     1: Catalog
     ...
     5: PyTestSetVmware-test02
     6: PyTestSetVmware-test03
     ...
Select FileSet resource (1-10): 5
+-------+-------+----------+--------------+---------------------+------------------+
| jobid | level | jobfiles | jobbytes     | starttime           | volumename       |
+-------+-------+----------+--------------+---------------------+------------------+
|   625 | F     |        4 | 4,733,002,754 | 2016-02-18 10:32:03 | Full-0067        |
...
You have selected the following JobIds: 625,626,631,632,635

Building directory tree for JobId(s) 625,626,631,632,635 ...
10 files inserted into the tree.

You are now entering file selection mode where you add (mark) and
remove (unmark) files to be restored. No files are initially added, unless
you used the "all" keyword on the command line.
Enter "done" to leave this mode.

cwd is: /
$ mark *
10 files marked.
$ done
Bootstrap records written to /var/lib/bareos/vmw5-bareos-centos6-64-devel-dir.restore.1.bsr

The job will require the following
   Volume(s)                 Storage(s)                SD Device(s)
===========================================================================

    Full-0001                 File                      FileStorage
    ...
    Incremental-0078          File                      FileStorage

Volumes marked with "*" are online.

10 files selected to be restored.

Using Catalog "MyCatalog"
Run Restore job
JobName:         RestoreFiles
Bootstrap:       /var/lib/bareos/vmw5-bareos-centos6-64-devel-dir.restore.1.bsr
Where:           /tmp/bareos-restores
Replace:         Always
FileSet:         Linux All
Backup Client:   vmw5-bareos-centos6-64-devel-fd
Restore Client:  vmw5-bareos-centos6-64-devel-fd
Format:          Native
Storage:         File
When:            2016-02-25 15:06:48
Catalog:         MyCatalog
Priority:        10
Plugin Options:  *None*
OK to run? (yes/mod/no): mod
Parameters to modify:
     1: Level
     ...
    14: Plugin Options
Select parameter to modify (1-14): 14
Please enter Plugin Options string: python:localvmdk=yes
Run Restore job
JobName:         RestoreFiles
Bootstrap:       /var/lib/bareos/vmw5-bareos-centos6-64-devel-dir.restore.1.bsr
Where:           /tmp/bareos-restores
Replace:         Always
```

```
FileSet:          Linux All
Backup Client:    vmw5-bareos-centos6-64-devel-fd
Restore Client:   vmw5-bareos-centos6-64-devel-fd
Format:           Native
Storage:          File
When:             2016-02-25 15:06:48
Catalog:          MyCatalog
Priority:         10
Plugin Options:   python: module_path=/usr/lib64/bareos/plugins/vmware_plugin:  ↙
     ↪ module_name=bareos-fd-vmware: dc=dass5:folder=/: vmname=stephand-test02:  ↙
     ↪ vcserver=virtualcenter5.dass-it:vcuser=bakadm@vsphere.local: vcpass=Bak.Adm-1234: localvmdk=yes
OK to run? (yes/mod/no): yes
Job queued. JobId=639
```

Commands 24.9: Example restore to local VMDK

Note: Since Bareos Version >= 15.2.3 it is sufficient to add Python plugin options, e.g. by *python:localvmdk=yes*
Before, all Python plugin must be repeated and the additional be added, like: `python:module_path=/usr/lib64/bareos/plugins/vmware_plugin:module_name=bareos-fd-vmware:dc=dass5:folder=/:vmname=stephand-test02:vcserver=virtualcenter5.dass-it:vcuser=bakadm@vsphere.local:vcpass=Bak.Adm-1234:localvmdk=yes`
After the restore process has finished, the restored VMDK files can be found under `/tmp/bareos-restores/`:

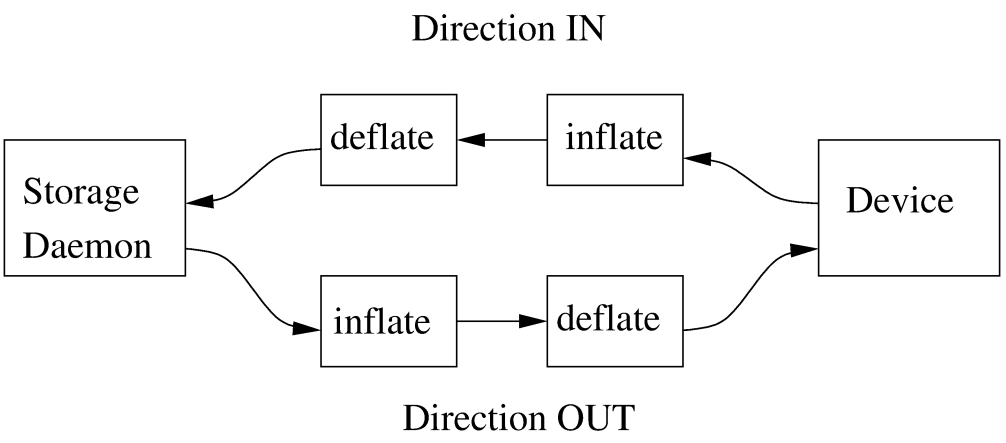
```
# ls -laR /tmp/bareos-restores
/tmp/bareos-restores:
total 28
drwxr-x--x.  3 root root  4096 Feb 25 15:47 .
drwxrwxrwt. 17 root root 20480 Feb 25 15:44 ..
drwxr-xr-x.  2 root root  4096 Feb 25 15:19 [ESX5-PS100] stephand-test02

/tmp/bareos-restores/[ESX5-PS100] stephand-test02:
total 7898292
drwxr-xr-x. 2 root root       4096 Feb 25 15:19 .
drwxr-x--x. 3 root root       4096 Feb 25 15:47 ..
-rw-------. 1 root root 2075197440 Feb 25 15:19 stephand-test02_1.vmdk
-rw-------. 1 root root 6012731392 Feb 25 15:19 stephand-test02.vmdk
```

Commands 24.10: Example result of restore to local VMDK

24.2 Storage Daemon Plugins

24.2.1 autoxflate-sd

This plugin is part of the `bareos-storage` package.
The autoxflate-sd plugin can inflate (decompress) and deflate (compress) the data being written to or read from a device. It can also do both.



Therefore the autoxflate plugin inserts a inflate and a deflate function block into the stream going to the device (called OUT) and coming from the device (called IN).
Each stream passes first the inflate function block, then the deflate function block.
The inflate blocks are controlled by the setting of the Auto Inflate $^{\text{Sd}}_{\text{Device}}$ directive.

The deflate blocks are controlled by the setting of the Auto Deflate Sd Device, Auto Deflate Algorithm Sd Device and Auto Deflate Level Sd Device directives.
The inflate blocks, if enabled, will uncompress data if it is compressed using the algorithm that was used during compression.
The deflate blocks, if enabled, will compress uncompressed data with the algorithm and level configured in the according directives.
The series connection of the inflate and deflate function blocks makes the plugin very flexible.
Szenarios where this plugin can be used are for example:

- client computers with weak cpus can do backups without compression and let the sd do the compression when writing to disk
- compressed backups can be recompressed to a different compression format (e.g. gzip → lzo) using migration jobs
- client backups can be compressed with compression algorithms that the client itself does not support

Multi-core cpus will be utilized when using parallel jobs as the compression is done in each jobs' thread.
When the autoxflate plugin is configured, it will write some status information into the joblog.

```
autodeflation: compressor on device FileStorage is FZ4H
```

Messages 24.11: used compression algorithm

```
autoxflate-sd.c: FileStorage OUT:[SD->inflate=yes->deflate=yes->DEV] IN:[DEV->inflate=yes->deflate=yes->SD]
```

Messages 24.12: configured inflation and deflation blocks

```
autoxflate-sd.c: deflate ratio: 50.59%
```

Messages 24.13: overall deflation/inflation ratio

Additional Auto XFlate On Replication Sd Storage can be configured at the Storage resource.

24.2.2 scsicrypto-sd

This plugin is part of the `bareos-storage-tape` package.

General

LTO Hardware Encryption Modern tape-drives, for example LTO (from LTO4 onwards) support hardware encryption. There are several ways of using encryption with these drives. The following three types of key management are available for encrypting drives. The transmission of the keys to the volumes is accomplished by either of the three:

- A backup application that supports Application Managed Encryption (AME)
- A tape library that supports Library Managed Encryption (LME)
- A Key Management Appliance (KMA)

We added support for Application Managed Encryption (AME) scheme, where on labeling a crypto key is generated for a volume and when the volume is mounted, the crypto key is loaded. When finally the volume is unmounted, the key is cleared from the memory of the Tape Drive using the SCSI SPOUT command set. If you have implemented Library Managed Encryption (LME) or a Key Management Appliance (KMA), there is no need to have support from Bareos on loading and clearing the encryption keys, as either the Library knows the per volume encryption keys itself, or it will ask the KMA for the encryption key when it needs it. For big installations you might consider using a KMA, but the Application Managed Encryption implemented in Bareos should also scale rather well and have a low overhead as the keys are only loaded and cleared when needed.

The scsicrypto-sd plugin The `scsicrypto-sd` hooks into the `unload`, `label read`, `label write` and `label verified` events for loading and clearing the key. It checks whether it it needs to clear the drive by either using an internal state (if it loaded a key before) or by checking the state of a special option that first issues an encrytion status query. If there is a connection to the director and the volume information is not available, it will ask the director for the data on the currently loaded volume. If no connection is available, a cache will be used which should contain the most recently mounted volumes. If an encryption key is available, it will be loaded into the drive's memory.

Changes in the director The director has been extended with additional code for handling hardware data encryption. The extra keyword **encrypt** on the label of a volume will force the director to generate a new semi-random passphrase for the volume, which will be stored in the database as part of the media information.
A passphrase is always stored in the database base64-encoded. When a so called **Key Encryption Key** is set in the config of the director, the passphrase is first wrapped using RFC3394 key wrapping and then base64-encoded. By using key wrapping, the keys in the database are safe against people sniffing the info, as the data is still encrypted using the Key Encryption Key (which in essence is just an extra passphrase of the same length as the volume passphrases used).
When the storage daemon needs to mount the volume, it will ask the director for the volume information and that protocol is extended with the exchange of the base64-wrapped encryption key (passphrase). The storage daemon provides an extra config option in which it records the Key Encryption Key of the particular director, and as such can unwrap the key sent into the original passphrase.
As can be seen from the above info we don't allow the user to enter a passphrase, but generate a semi-random passphrase using the openssl random functions (if available) and convert that into a readable ASCII stream of letters, numbers and most other characters, apart from the quotes and space etc. This will produce much stronger passphrases than when requesting the info from a user. As we store this information in the database, the user never has to enter these passphrases.
The volume label is written in unencrypted form to the volume, so we can always recognize a Bareos volume. When the key is loaded onto the drive, we set the decryption mode to mixed, so we can read both unencrypted and encrypted data from the volume. When no key or the wrong key has been loaded, the drive will give an IO error when trying to read the volume. For disaster recovery you can store the Key Encryption Key and the content of the wrapped encryption keys somewhere safe and the bscrypto tool together with the scsicrypto-sd plugin can be used to get access to your volumes, in case you ever lose your complete environment.
If you don't want to use the scsicrypto-sd plugin when doing DR and you are only reading one volume, you can also set the crypto key using the bscrypto tool. Because we use the mixed decryption mode, in which you can read both encrypted and unencrypted data from a volume, you can set the right encryption key before reading the volume label.
If you need to read more than one volume, you better use the scsicrypto-sd plugin with tools like bscan/bextract, as the plugin will then auto-load the correct encryption key when it loads the volume, similiarly to what the storage daemon does when performing backups and restores.
The volume label is unencrypted, so a volume can also be recognized by a non-encrypted installation, but it won't be able to read the actual data from it. Using an encrypted volume label doesn't add much security (there is no security-related info in the volume label anyhow) and it makes it harder to recognize either a labeled volume with encrypted data or an unlabeled new volume (both would return an IO-error on read of the label.)

Configuration

SCSI crypto setup The initial setup of SCSI crypto looks something like this:

- Generate a Key Encryption Key e.g.

```
bscrypto -g -
```

For details see bscrypto.

Security Setup Some security levels need to be increased for the storage daemon to be able to use the low level SCSI interface for setting and getting the encryption status on a tape device.
The following additional security is needed for the following operating systems:

Linux (SG_IO ioctl interface): The user running the storage daemon needs the following additional capabilities:

- `CAP_SYS_RAWIO` (see capabilities(7))
  - On older kernels you might need `CAP_SYS_ADMIN`. Try `CAP_SYS_RAWIO` first and if that doesn't work try `CAP_SYS_ADMIN`
- If you are running the storage daemon as another user than root (which has the `CAP_SYS_RAWIO` capability), you need to add it to the current set of capabilities.

- If you are using systemd, you could add this additional capability to the CapabilityBoundingSet parameter.
  - For systemd add the following to the bareos-sd.service: `Capabilities=cap_sys_rawio+ep`

You can also set up the extra capability on `bscrypto` and `bareos-sd` by running the following commands:

```
setcap cap_sys_rawio=ep bscrypto
setcap cap_sys_rawio=ep bareos-sd
```

Check the setting with

```
getcap -v bscrypto
getcap -v bareos-sd
```

`getcap` and `setcap` are part of libcap-progs.
If `bareos-sd` does not have the appropriate capabilities, all other tape operations may still work correctly, but you will get "Unable to perform SG_IO ioctl" errors.

Solaris (USCSI ioctl interface): The user running the storage daemon needs the following additional privileges:

- `PRIV_SYS_DEVICES` (see privileges(5))

If you are running the storage daemon as another user than root (which has the `PRIV_SYS_DEVICES` privilege), you need to add it to the current set of privileges. This can be set up by setting this either as a project for the user, or as a set of extra privileges in the SMF definition starting the storage daemon. The SMF setup is the cleanest one.
For SMF make sure you have something like this in the instance block:

```
<method_context working_directory=":default"> <method_credential user="bareos" group="bareos" privileges=" ↙
    ↪ basic,sys_devices"/> </method_context>
```

Changes in bareos-sd.conf

- Set the Key Encryption Key
  - Key Encryption Key $^{\text{Sd}}_{\text{Director}}$ = *passphrase*
- Enable the loading of storage daemon plugins
  - Plugin Directory $^{\text{Sd}}_{\text{Storage}}$ = `path_to_sd_plugins`
- Enable the SCSI encryption option
  - Drive Crypto Enabled $^{\text{Sd}}_{\text{Device}}$ = yes
- Enable this, if you want the plugin to probe the encryption status of the drive when it needs to clear a pending key
  - Query Crypto Status $^{\text{Sd}}_{\text{Device}}$ = yes

Changes in bareos-dir.conf

- Set the Key Encryption Key
  - Key Encryption Key $^{\text{Dir}}_{\text{Director}}$ = *passphrase*

Testing

Restart the Storage Daemon and the Director. After this you can label new volumes with the encrypt option, e.g.

```
label slots=1-5 barcodes encrypt
```

Disaster Recovery

For Disaster Recovery (DR) you need the following information:

- Actual bareos-sd.conf with config options enabled as described above, including, among others, a definition of a director with the Key Encryption Key used for creating the encryption keys of the volumes.
- The actual keys used for the encryption of the volumes.

This data needs to be availabe as a so called crypto cache file which is used by the plugin when no connection to the director can be made to do a lookup (most likely on DR).
Most of the times the needed information, e.g. the bootstrap info, is available on recently written volumes and most of the time the encryption cache will contain the most recent data, so a recent copy of the `bareos-sd.<portnr>.cryptoc` file in the working directory is enough most of the time. You can also save the info from database in a safe place and use bscrypto to populate this info (VolumeName →EncryptKey) into the crypto cache file used by `bextract` and `bscan`. You can use `bscrypto` with the following flags to create a new or update an existing crypto cache file e.g.:

```
bscrypto -p /var/lib/bareos/bareos-sd.<portnr>.cryptoc
```

- A valid BSR file containing the location of the last safe of the database makes recovery much easier. Adding a post script to the database save job could collect the needed info and make sure its stored somewhere safe.
- Recover the database in the normal way e.g. for postgresql:

```
bextract -D <director_name> -c bareos-sd.conf -V <volname> \ /dev/nst0 /tmp -b bootstrap.bsr
/usr/lib64/bareos/create_bareos_database
/usr/lib64/bareos/grant_bareos_privileges
psql bareos < /tmp/var/lib/bareos/bareos.sql
```

Or something similar (change paths to follow where you installed the software or where the package put it).
Note: As described at the beginning of this chapter, there are different types of key management, AME, LME and KMA. If the Library is set up for LME or KMA, it probably won't allow our AME setup and the scsi-crypto plugin will fail to set/clear the encryption key. To be able to use AME you need to "Modify Encryption Method" and set it to something like "Application Managed". If you decide to use LME or KMA you don't have to bother with the whole setup of AME which may for big libraries be easier, although the overhead of using AME even for very big libraries should be minimal.

24.2.3 scsitapealert-sd

This plugin is part of the `bareos-storage-tape` package.

24.2.4 python-sd Plugin

The **python-sd** plugin behaves similar to the python-dir Plugin.

24.3 Director Plugins

24.3.1 python-dir Plugin

The **python-dir** plugin is intended to extend the functionality of the Bareos Director by Python code. A working example is included.

- install the `bareos-director-python-plugin` package
- change to the Bareos plugin directory (`/usr/lib/bareos/plugins/` or `/usr/lib64/bareos/plugins/`)
- copy `bareos-dir.py.template` to `bareos-dir.py`
- activate the plugin in the Bareos Director configuration
- restart the Bareos Director
- change `bareos-dir.py` as required
- restart the Bareos Director

Loading plugins

Since Version >= 14.4.0 multiple Python plugins can be loaded and plugin names can be arbitrary. Before this, the Python plugin always loads the file `bareos-dir.py`.
The director plugins are configured in the Job-Resource (or JobDefs resource). To load a Python plugin you need

module_path= pointing to your plugin directory (needs to be enabled in the Director resource, too

module_name= Your plugin (without the suffix .py)

instance= default is '0', you can leave this, as long as you only have 1 Director Python plugin. If you have more than 1, start with instance=0 and increment the instance for each plugin.

- You can add plugin specific option key-value pairs, each pair separated by ':' key=value

Example:

```
Director {
  # ...
  # Plugin directory
  Plugin Directory = /usr/lib64/bareos/plugins
  # Load the python plugin
  Plugin Names = "python"
}

JobDefs {
  Name = "DefaultJob"
  Type = Backup
  # ...
  # Load the class based plugin with testoption=testparam
  Dir Plugin Options = "python:instance=0:module_path=/usr/lib64/bareos/plugins:module_name=bareos-dir- ↙
    ↪ class-plugins:testoption=testparam
  # ...
}
```

Configuration 24.14: bareos-dir.conf: Python Plugins

Write your own Python Plugin

Some plugin examples are available on https://github.com/bareos/bareos-contrib. The class-based approach lets you easily reuse stuff already defined in the baseclass BareosDirPluginBaseclass, which ships with the `bareos-director-python-plugin` package. The examples contain the plugin bareos-dir-nsca-sender, that submits the results and performance data of a backup job directly to Icinga or Nagios using the NSCA protocol.

Chapter 25

The Windows Version of Bareos

The Windows version of Bareos is a native Win32 port, but there are very few source code changes to the Unix code, which means that the Windows version is for the most part running code that has long proved stable on Unix systems. Chapter Operating Systems show, what Windows versions are supported.

The Bareos component that is most often used in Windows is the File daemon or Client program. As a consequence, when we speak of the Windows version of Bareos below, we are mostly referring to the File daemon (client).

Once installed Bareos normally runs as a system service. This means that it is immediately started by the operating system when the system is booted, and runs in the background even if there is no user logged into the system.

25.1 Windows Installation

Normally, you will install the Windows version of Bareos from the binaries. The winbareos binary packages are provided under http://download.bareos.org/bareos/release/latest/windows. Additionally, there are OPSI packages available under http://download.bareos.org/bareos/release/latest/windows/opsi.

This install is standard Windows .exe that runs an install wizard using the NSIS Free Software installer, so if you have already installed Windows software, it should be very familiar to you. Providing you do not already have Bareos installed, the installer installs the binaries and dlls in `C:\Program Files\Bareos` and the configuration files in `C:\ProgramData \Bareos` (for Windows XP and older: `C:\Documents and Settings\All Users\Application Data\Bareos`).

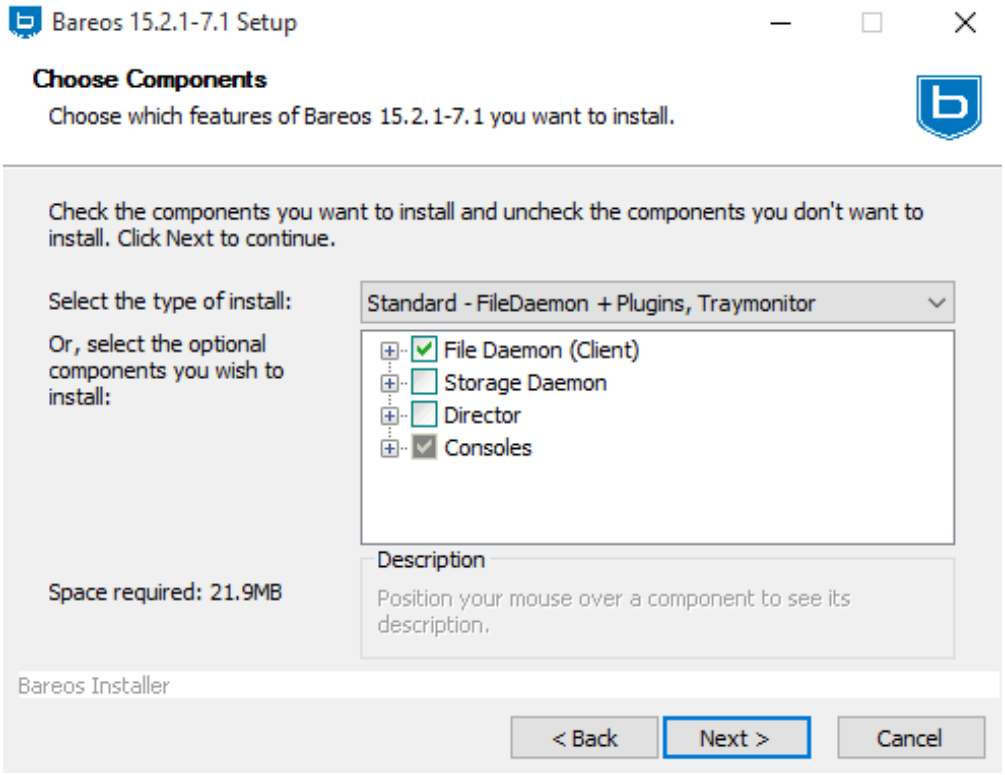
In addition, the **Start>All Programs>Bareos** menu item will be created during the installation, and on that menu, you will find items for editing the configuration files, displaying the document, and starting `BAT` or `bconsole`.

25.1.1 Graphical Installation

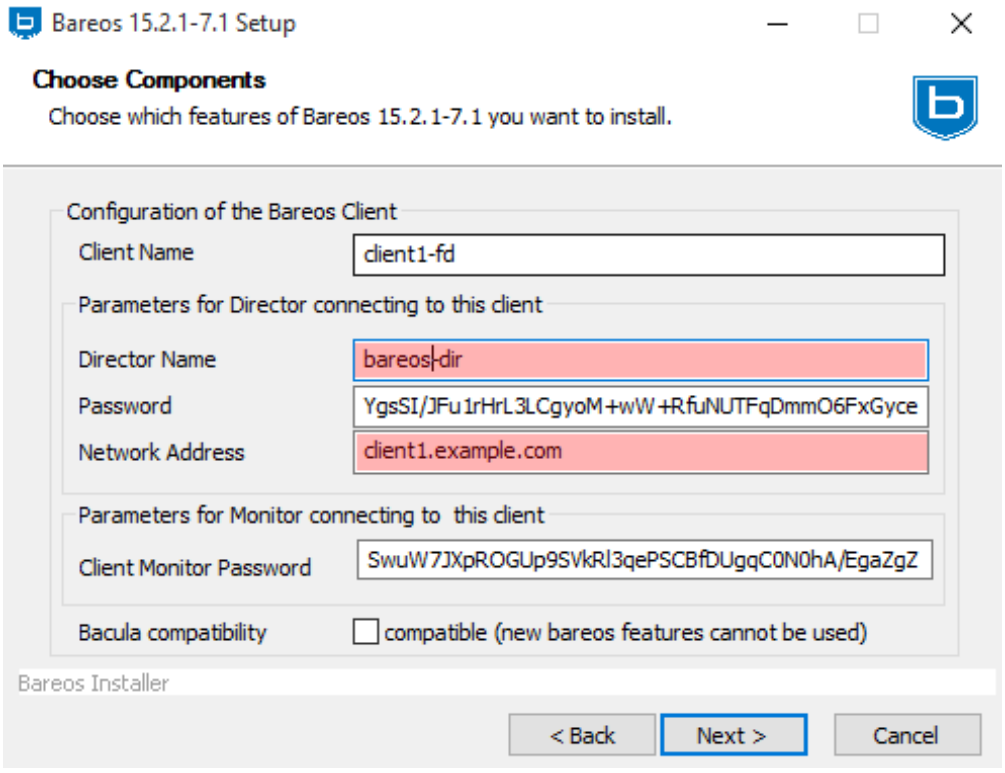
Here are the important steps.

- You must be logged in as an Administrator to the local machine to do a correct installation, if not, please do so before continuing.

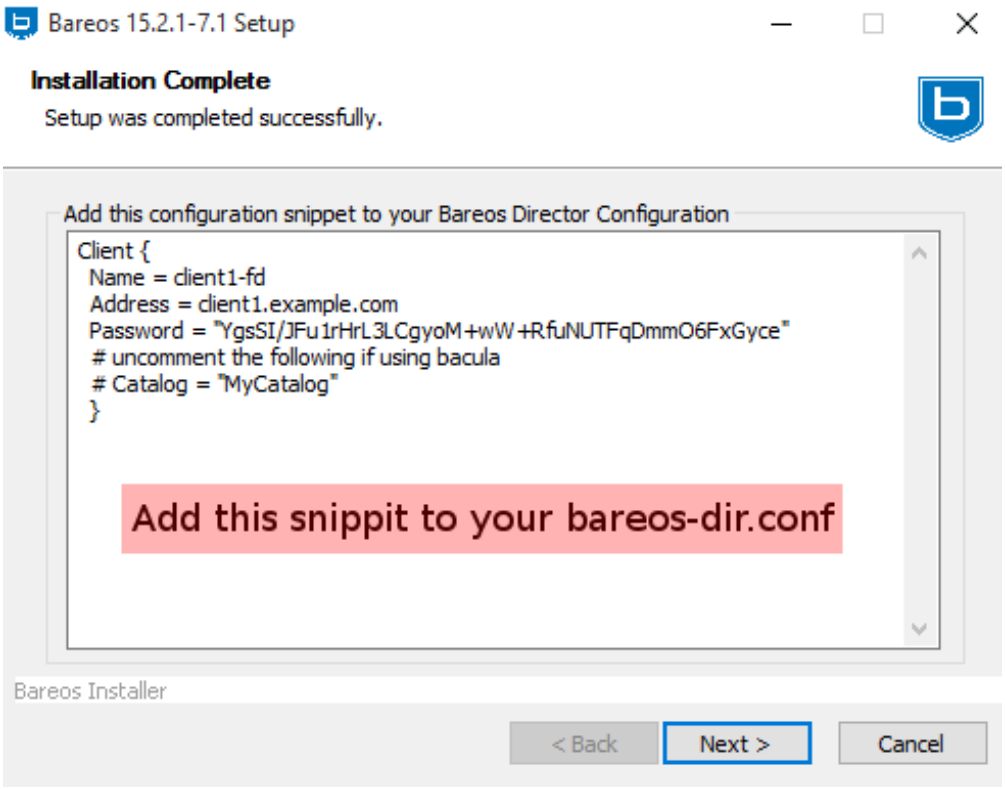
- For a standard installation you may only select the "Tray-Monitor" and the "Open Firewall for Client" as additional optional components.



- You need to fill in the name of your bareos director in the client configuration dialogue and the FQDN or ip address of your client.



- Add the client resource to your Bareos Director Configuration and a job resource for the client as it is also described in the default bareos-dir.conf



25.1.2 Command Line (Silent) Installation

Silent installation is possible since Version >= 12.4.4 . All inputs that are given during interactive install can now directly be configured on the commandline, so that an automatic silent install is possible.

Commandline Switches

/? shows the list of available parameters.

/S sets the installer to silent. The Installation is done without user interaction. This switch is also available for the uninstaller.

/CLIENTADDRESS network address of the client

/CLIENTNAME sets the name of the client resource

/CLIENTMONITORPASSWORD sets the password for monitor access

/CLIENTPASSWORD sets the password to access the client

/DBADMINUSER=user sets the database admin user, default=postgres. Version >= 14.2.1

/DBADMINPASSWORD=password sets the database admin password, default=*none*. Version >= 14.2.1

/DIRECTORADDRESS sets network address of the director for bconsole or bat access

/DIRECTORNAME sets the name of the director to access the client and of the director to accessed by bconsole and bat

/DIRECTORPASSWORD set the password to access the director

/SILENTKEEPCONFIG keep configuration files on silent uninstall and use exinsting config files during silent install. Version >= 12.4.4

/INSTALLDIRECTOR install the Bareos Director (and bconsole). Version >= 14.2.1

/INSTALLSTORAGE install the Bareos Storage Daemon. Version >= 14.2.1

/WRITELOGS makes also non-debug installer write a log file. Version >= 14.2.1

/D=`C:\specify \installation \directory` (Important: It has to be the last option!)

By setting the Installation Parameters via commandline and using the silent installer, you can install the bareos client without having to do any configuration after the installation e.g. as follows:

```
c:\winbareos.exe /S /CLIENTNAME=hostname-fd /CLIENTPASSWORD="verysecretpassword" /DIRECTORNAME=bareos-dir
```

DBADMINUSER and DBADMINPASSWORD are used to create the bareos databases. If login is not possible silent installer will abort

25.1.3 Installing multiple Windows filedaemon services

It is possible to run multiple Bareos File Daemon instances on Windows. To achieve this, you need to create a service for each instance, and a configuration file that at least has a individual fd port for each instance.
To create two bareos-fd services, you can call the following service create calls on the commandline on windows as administrator:

```
sc create bareosfd2 binpath="\"C:\Program Files\Bareos\bareos-fd.exe\" /service  -c ↙
    ↪ \"C:\ProgramData\Bareos\bareos-fd2.conf\""  depend= "tcpip/afd"
sc create bareosfd3 binpath="\"C:\Program Files\Bareos\bareos-fd.exe\" /service  -c ↙
    ↪ \"C:\ProgramData\Bareos\bareos-fd3.conf\""  depend= "tcpip/afd"
```

This will create two Bareos File Daemon services, one with the name bareosfd2 and the second with the name bareosfd3.
The configuration files for the two services are `bareos-fd.conf` and `bareos-fd2.conf`, and need to have different network settings.
The services can be started by calling

```
sc start bareosfd2
```

and

```
sc start bareosfd3
```

25.2 Dealing with Windows Problems

If you are not using the portable option, and you have Enable VSS $^{\text{Dir}}_{\text{FileSet}}$ (Volume Shadow Copy) enabled in the Bareos Director and you experience problems with Bareos not being able to open files, it is most likely that you are running an antivirus program that blocks Bareos from doing certain operations. In this case, disable the antivirus program and try another backup. If it succeeds, either get a different (better) antivirus program or use something like Client Run Before Job $^{\text{Dir}}_{\text{Job}}$/Client Run Before Job $^{\text{Dir}}_{\text{Job}}$ to turn off the antivirus program while the backup is running.
If turning off anti-virus software does not resolve your VSS problems, you might have to turn on VSS debugging. The following link describes how to do this: http://support.microsoft.com/kb/887013/en-us.
In Microsoft Windows Small Business Server 2003 the VSS Writer for Exchange is turned off by default. To turn it on, please see the following link: http://support.microsoft.com/default.aspx?scid=kb;EN-US;Q838183
The most likely source of problems is authentication when the Director attempts to connect to the File daemon that you installed. This can occur if the names and the passwords defined in the File daemon's configuration file `bareos-fd.conf` file on the Windows machine do not match with the names and the passwords in the Director's configuration file `bareos-dir.conf` located on your Unix/Linux server.
More specifically, the password found in the `Client` resource in the Director's configuration file must be the same as the password in the `Director` resource of the Bareos File Daemon configuration file. In addition, the name of the `Director` resource in the Bareos File Daemon configuration file must be the same as the name in the Director resource of the Director's configuration file.
It is a bit hard to explain in words, but if you understand that a Director normally has multiple Clients and a Client (or File daemon) may permit access by multiple Directors, you can see that the names and the passwords on both sides must match for proper authentication.
To get proper debug output of the daemons running on windows, please do the following: (The following example shows how to to it with the Bareos File Daemon).
Use `regedit` and open the registry in

```
Computer\HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\services\Bareos-fd
```

and set the **ImagePath** setting from

```
"C:\Program Files\Bareos\bareos-fd.exe" /service  -c "C:\ProgramData\Bareos\bareos-fd.conf"
```

to

```
"C:\Program Files\Bareos\bareos-fd.exe" /service -d200  -c "C:\ProgramData\Bareos\bareos-fd.conf"
```

After restarting the service, you will find a file called `C:\bareos -fd.trace` which will contain the debug output created by the daemon.
The same can be done for the Director (replace bareos-fd by bareos-dir) and for the Storage Daemon (replace bareos-fd by bareos-sd).

25.3 Windows Compatibility Considerations

25.3.1 Exclusively Opened Filed

If you are not using the Volume Shadow Copy Service (VSS) option and if any applications are running during the backup and they have files opened exclusively, Bareos will not be able to backup those files, so be sure you close your applications (or tell your users to close their applications) before the backup. Fortunately, most Microsoft applications do not open files exclusively so that they can be backed up. However, you will need to experiment. In any case, if Bareos cannot open the file, it will print an error message, so you will always know which files were not backed up. If Volume Shadow Copy Service is enabled, Bareos is able to backing up any file.

25.3.2 Registry

During backup, Bareos doesn't know about the system registry, so you will either need to write it out to an ASCII file using `regedit /e` or use a program specifically designed to make a copy or backup the registry.

25.3.3 Windows Reparse Points

Version >= 12.4.5
Besides normal files and directories, Windows filesystems also support special files, called "Reparse Points". Bareos can handle the following types of Reparse points:

- Symbolic links to directories
- Symbolic links to files
- Junction Points
- Volume Mount Points

The Volume Mount Points are a special case of a Junction Point. To make things easier, in the following when talking about Junction Points, we mean only the Junction Points that are not Volume Mount Points. The Symbolic Links and the Junction Points are comparable to Symbolic Links in Unix/Linux. They are files that point to another location in the filesystem.
Symbolic Links and Junction Points can be created with the Windows commandline command `mklink`.
When doing a directory listing in the commandline (cmd) in Windows, it shows the filetypes JUNCTION, SYMLINK or SYMLINKD and the target between the square brackets:

```
C:\linktest>dir
 Volume in drive C has no label.
 Volume Serial Number is C8A3-971F

 Directory of C:\linktest

08/07/2014  03:05 PM    <DIR>          .
08/07/2014  03:05 PM    <DIR>          ..
08/07/2014  02:59 PM    <SYMLINKD>     dirlink [C:\Program Files\Bareos]
08/07/2014  03:02 PM    <SYMLINK>      filelink [C:\Program Files\Bareos\bareos-dir.exe]
08/07/2014  03:00 PM    <JUNCTION>     junction [C:\Program Files\Bareos]
08/07/2014  03:05 PM    <JUNCTION>     volumemountpoint [\??\Volume{e960247d-09a1-11e3-93ec-005056add71d}\]
               1 File(s)              0 bytes
               5 Dir(s)  90,315,137,024 bytes free
```

Commands 25.1: special files

Symbolic Links. Directory Symbolic Links, and Junctions that are not a Volume MountPoint are treated by Bareos as symbolic links and are backed up and restored as they are, so the object is restored and points to where it pointed when it was backed up.
Volume Mount Points are different. They allow to mount a harddisk partition as a subfolder of a drive instead of a driveletter.
When backing up a Volume Mount Point, it is backed up as directory.
If **OneFS** is set to yes (default), the Volume Mount Point (VMP) is backed up as directory but the content of the VMP will not be backed up. Also, the Joblog will contain a message like this:

```
C:/linktest/vmp is a different filesystem. Will not descend from C:/linktest into it.
```

Messages 25.2: Warning on Volume Moint Point and OneFS

This is the normal behavior of the **OneFS** option.
If OneFS is set to no, the filedaemon will change into the VMP as if it was a normal directory and will backup all files found inside of the VMP.

VMPs and VSS Snapshots

As Virtual Mount Points mounts another Volume into the current filesystem, it is desired that if the content of the VMP will be backed up during the backup (`onefs = no`), we also want to have this volume snapshotted via VSS.
To achieve this, we now automatically check every volume added to the VSS snapshotset if it contains VMPs, and add the volumes mounted by those VMPs to the vss snapshotset recursively.
Volumes can be mounted nested and multiple times, but can only be added to the snapshotset once. This is the reason why the number of vmps can be greater than the number of volumes added for the volume mount points.
The Job Log will show how many VMPs were found like this:

```
Volume Mount Points found: 7, added to snapshotset: 5
```

Messages 25.3: Volume Mount Points are added automatically to VSS snapshots (if onefs

Accordingly, if OneFS is set to yes, we do not need to handle Volume Mount Points this way. If OneFS is set to yes (default), the joblog will contain the following information:

```
VolumeMountpoints are not processed as onefs = yes.
```

Messages 25.4: Volume Mount Points are ignored on VSS snapshots (if onefs

25.3.4 Hard Links

Windows also supports hard links, even so they are seldom used. These are treated as normal files and will be restored as individual files (which will not be hardlinks again)

25.3.5 FilesNotToBackup Registry Key

Version >= 14.2.0
Windows supports a special Registry Key that specifies the names of the files and directories that backup applications should not backup or restore.
The full path to this registry key is `HKEY_LOCAL_MACHINE\SYSTEM \CurrentControlSet \Control \ BackupRestore \FilesNotToBackup`
Bareos automatically converts these entries to wildcards which will be automatically excluded from backup.
The backup log shows a short information about the creation of the exludes like this:

```
Created 28 wildcard excludes from FilesNotToBackup Registry key
```

Messages 25.5: Excludes according to the FilesNotToBackup registry key

More details can be found if the filedaemon is run in debug mode inside of the `bareos-fd.trace` logfile. Each entry and the resulting wildcard are logged.

```
client-win-fd: win32.c:465-0 (1) "WER" :
client-win-fd: win32.c:482-0         "C:\ProgramData\Microsoft\Windows\WER\* /s"
client-win-fd: win32.c:527-0     ->  "C:/ProgramData/Microsoft/Windows/WER/*"
client-win-fd: win32.c:465-0 (2) "Kernel Dumps" :
client-win-fd: win32.c:482-0         "C:\Windows\Minidump\* /s"
```

```
client-win-fd: win32.c:527-0     ->  "C:/Windows/Minidump/*"
client-win-fd: win32.c:482-0         "C:\Windows\memory.dmp"
client-win-fd: win32.c:527-0     ->  "C:/Windows/memory.dmp"
client-win-fd: win32.c:465-0 (3) "Power Management" :
client-win-fd: win32.c:482-0         "\hiberfil.sys"
client-win-fd: win32.c:527-0     ->  "[A-Z]:/hiberfil.sys"
client-win-fd: win32.c:465-0 (4) "MS Distributed Transaction Coordinator" :
client-win-fd: win32.c:482-0         "C:\Windows\system32\MSDtc\MSDTC.LOG"
client-win-fd: win32.c:527-0     ->  "C:/Windows/system32/MSDtc/MSDTC.LOG"
client-win-fd: win32.c:482-0         "C:\Windows\system32\MSDtc\trace\dtctrace.log"
client-win-fd: win32.c:527-0     ->  "C:/Windows/system32/MSDtc/trace/dtctrace.log"
```

Messages 25.6: translation between registry key FilesNotToBackup and Bareos Exclude FileSet

It is possible to disable this functionality by setting the FileSet option **AutoExclude** to no.
The JobLog will then show the following informational line:

```
Fileset has autoexclude disabled, ignoring FilesNotToBackup Registry key
```

Messages 25.7: AutoExclude disabled

For more details about the Windows registry key see http://msdn.microsoft.com/en-us/library/windows/desktop/bb891959%28v=vs.85%29.aspx#filesnottobackup.

25.3.6 Windows dedup support

Version >= 12.4.5
Windows 2012 has dedup support which needs handling.

25.3.7 Store all file attributes

Version >= 12.4.5
Windows has gathered quite some special specific file flags over the years but not all are saved during backup so some are never restored by the restore process. The most important ones are the ARCHIVE flag which is "misused" by some programs for storing some special information. Others that are known not to be stored are the COMPRESSED flag which means that a restored file looses it and will be restored as an uncompressed file.

25.3.8 Support for Windows EFS filesystems

Version >= 12.4.5
Windows has support for a so called EFS filesystem. This is an encrypted filesystem, to be able to backup the data and to restore it we need to use a special API. With this API you in essence export the data on backup and import it on restore. This way you never have access to the unencrypted data but just import and export the encrypted data. This is the cleanest way of handling encryption by just seeing the data as some opaque data and not try to do anything special with it.

25.4 Volume Shadow Copy Service (VSS)

VSS is available since Windows XP. From the perspective of a backup-solution for Windows, this is an extremely important step. VSS allows Bareos to backup open files and even to interact with applications like RDBMS to produce consistent file copies. VSS aware applications are called VSS Writers, they register with the OS so that when Bareos wants to do a Snapshot, the OS will notify the register Writer programs, which may then create a consistent state in their application, which will be backed up. Examples for these writers are "MSDE" (Microsoft database engine), "Event Log Writer", "Registry Writer" plus 3rd party-writers. If you have a non-vss aware application a shadow copy is still generated and the open files can be backed up, but there is no guarantee that the file is consistent.
Bareos produces a message from each of the registered writer programs when it is doing a VSS backup so you know which ones are correctly backed up.
Technically Bareos creates a shadow copy as soon as the backup process starts. It does then backup all files from the shadow copy and destroys the shadow copy after the backup process. Please have in mind, that VSS creates a snapshot and thus backs up the system at the state it had when starting the backup. It will disregard file changes which occur during the backup process.
VSS can be turned on by placing an

```
Enable VSS = yes
```

in your FileSet resource.
The VSS aware File daemon has the letters VSS on the signon line that it produces when contacted by the console. For example:

```
Tibs-fd Version: 1.37.32 (22 July 2005) VSS Windows XP MVS NT 5.1.2600
```

the VSS is shown in the line above. This only means that the File daemon is capable of doing VSS not that VSS is turned on for a particular backup. There are two ways of telling if VSS is actually turned on during a backup. The first is to look at the status output for a job, e.g.:

```
Running Jobs:
JobId 1 Job NightlySave.2005-07-23_13.25.45 is running.
    VSS Backup Job started: 23-Jul-05 13:25
    Files=70,113 Bytes=3,987,180,650 Bytes/sec=3,244,247
    Files Examined=75,021
    Processing file: c:/Documents and Settings/user/My Documents/My Pictures/Misc1/Sans titre - 39.pdd
    SDReadSeqNo=5 fd=352
```

Here, you see under Running Jobs that JobId 1 is "VSS Backup Job started ..." This means that VSS is enabled for that job. If VSS is not enabled, it will simply show "Backup Job started ..." without the letters VSS.
The second way to know that the job was backed up with VSS is to look at the Job Report, which will look something like the following:

```
23-Jul 13:25 rufus-dir: Start Backup JobId 1, Job=NightlySave.2005-07-23_13.25.45
23-Jul 13:26 rufus-sd: Wrote label to prelabeled Volume "TestVolume001" on device "DDS-4" (/dev/nst0)
23-Jul 13:26 rufus-sd: Spooling data ...
23-Jul 13:26 Tibs: Generate VSS snapshots. Driver="VSS WinXP", Drive(s)="C"
23-Jul 13:26 Tibs: VSS Writer: "MSDEWriter", State: 1 (VSS_WS_STABLE)
23-Jul 13:26 Tibs: VSS Writer: "Microsoft Writer (Bootable State)", State: 1 (VSS_WS_STABLE)
23-Jul 13:26 Tibs: VSS Writer: "WMI Writer", State: 1 (VSS_WS_STABLE)
23-Jul 13:26 Tibs: VSS Writer: "Microsoft Writer (Service State)", State: 1 (VSS_WS_STABLE)
```

In the above Job Report listing, you see that the VSS snapshot was generated for drive C (if other drives are backed up, they will be listed on the `Drive(s)="C"` line. You also see the reports from each of the writer program. Here they all report VSS_WS_STABLE, which means that you will get a consistent snapshot of the data handled by that writer.

25.4.1 VSS Problems

If you are experiencing problems such as VSS hanging on MSDE, first try running **vssadmin** to check for problems, then try running **ntbackup** which also uses VSS to see if it has similar problems. If so, you know that the problem is in your Windows machine and not with Bareos.
The FD hang problems were reported with **MSDEwriter** when:

- a local firewall locked local access to the MSDE TCP port (MSDEwriter seems to use TCP/IP and not Named Pipes).
- msdtcs was installed to run under "localsystem": try running msdtcs under networking account (instead of local system) (com+ seems to work better with this configuration).

25.5 Windows Firewalls

The Windows buildin Firewall is enabled since Windows version WinXP SP2. The Bareos installer opens the required network ports for Bareos. However, if you are using another Firewall, you might need to manually open the Bareos network port 9102/TCP.

25.5.1 Network TCP Port

If you want to see if the File daemon has properly opened the port and is listening, you can enter the following command in a shell window:

```
netstat -an | findstr 910[123]
```

25.6 Windows Restore Problems

Please see the Restore Chapter of this manual for problems that you might encounter doing a restore.

25.7 Windows Backup Problems

If during a Backup, you get the message: **ERR=Access is denied** and you are using the portable option, you should try both adding both the non-portable (backup API) and the Volume Shadow Copy options to your Director's conf file.
In the Options resource:

```
portable = no
```

In the FileSet resource:

```
enablevss = yes
```

In general, specifying these two options should allow you to backup any file on a Windows system. However, in some cases, if users have allowed to have full control of their folders, even system programs such a Bareos can be locked out. In this case, you must identify which folders or files are creating the problem and do the following:

1. Grant ownership of the file/folder to the Administrators group, with the option to replace the owner on all child objects.

2. Grant full control permissions to the Administrators group, and change the user's group to only have Modify permission to the file/folder and all child objects.

Thanks to Georger Araujo for the above information.

25.8 Windows Ownership and Permissions Problems

If you restore files backed up from Windows to an alternate directory, Bareos may need to create some higher level directories that were not saved (or restored). In this case, the File daemon will create them under the SYSTEM account because that is the account that Bareos runs under as a service and with full access permission. However, there may be cases where you have problems accessing those files even if you run as administrator. In principle, Microsoft supplies you with the way to cease the ownership of those files and thus change the permissions. However, a much better solution to working with and changing Win32 permissions is the program **SetACL**, which can be found at http://setacl.sourceforge.net/.
If you have not installed Bareos while running as Administrator and if Bareos is not running as a Process with the userid (User Name) SYSTEM, then it is very unlikely that it will have sufficient permission to access all your files.
Some users have experienced problems restoring files that participate in the Active Directory. They also report that changing the userid under which Bareos (bareos-fd.exe) runs, from SYSTEM to a Domain Admin userid, resolves the problem.

25.9 Fixing the Windows Boot Record

An effective way to restore a Windows backup is to install Windows on a different hard drive and restore the backup. Then run the recovery CD and run

```
diskpart
   select disk 0
   select part 1
   active
   exit

bootrec /rebuldbcd
bootrec /fixboot
bootrec /fixmbr
```

25.10 File Daemon: Windows Specific Command Line Options

These options are not normally seen or used by the user, and are documented here only for information purposes. At the current time, to change the default options, you must either manually run **Bareos** or you must manually edit the system registry and modify the appropriate entries.
In order to avoid option clashes between the options necessary for **Bareos** to run on Windows and the standard Bareos options, all Windows specific options are signaled with a forward slash character (/), while as usual, the standard Bareos options are signaled with a minus (-), or a minus minus (--). All the standard Bareos options can be used on the Windows version. In addition, the following Windows only options are implemented:

/service Start Bareos as a service

/run Run the Bareos application

/install Install Bareos as a service in the system registry

/remove Uninstall Bareos from the system registry

/about Show the Bareos about dialogue box

/status Show the Bareos status dialogue box

/events Show the Bareos events dialogue box (not yet implemented)

/kill Stop any running **Bareos**

/help Show the Bareos help dialogue box

It is important to note that under normal circumstances the user should never need to use these options as they are normally handled by the system automatically once Bareos is installed. However, you may note these options in some of the .bat files that have been created for your use.

Chapter 26

Network setup

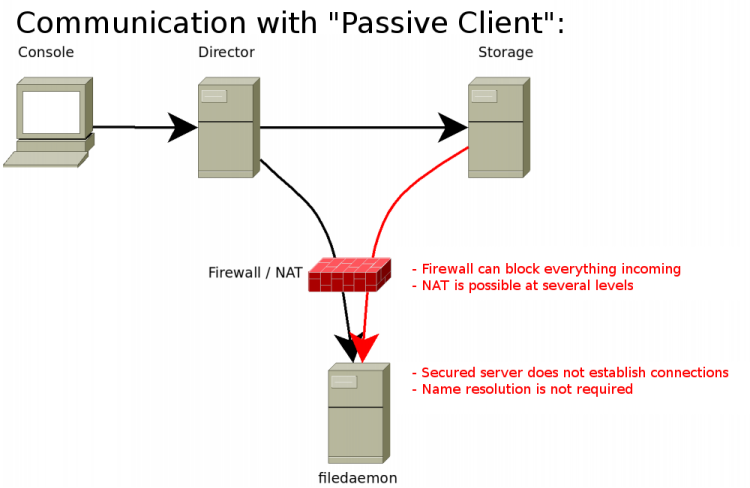
26.1 Passive Clients

The normal way of initializing the data channel (the channel where the backup data itself is transported) is done by the Bareos File Daemon (client) that connects to the Bareos Storage Daemon.
In many setups, this can cause problems, as this means that:

- The client must be able to resolve the name of the Bareos Storage Daemon (often not true, you have to do tricks with the hosts file)
- The client must be allowed to create a new connection.
- The client must be able to connect to the Bareos Storage Daemon over the network (often difficult over NAT or Firewall)

By using Passive Client, the initialization of the datachannel is reversed, so that the storage daemon connects to the Bareos File Daemon. This solves almost every problem created by firewalls, NAT-gateways and resolving issues, as

- The Bareos Storage Daemon initiates the connection, and thus can pass through the same or similar firewall rules that the director already has to access the Bareos File Daemon.
- The client never initiates any connection, thus can be completely firewalled.
- The client never needs any name resolution and is totally independent from any resolving issues.



26.1.1 Usage

To use this new feature, just configure Passive $^{\text{Dir}}_{\text{Client}}$=yes in the client definition of the Bareos Director:

```
Client {
   Name = client1-fd
   Password = "secretpassword"
   Passive = yes
```

```
   [...]
}
```

Configuration 26.1: Enable passive mode in bareos-dir.conf

Also, prior to bareos version 15, you need to set Compatible $^{\text{Fd}}_{\text{Client}}$=no in the `bareos-fd.conf` configuration file. Since Bareos Version 15, the compatible option is set to no per default and does not need to be specified anymore.

```
Director {
  Name = bareos-dir
  Password = "secretpassword"
}

Client {
   Name = client1-fd
   [...]
   Compatible = no
}
```

Configuration 26.2: Disable compatible mode for the Bareos File Daemon in bareos-fd.conf

Chapter 27

Transport Encryption

Bareos TLS (Transport Layer Security) is built-in network encryption code to provide secure network transport similar to that offered by **stunnel** or **ssh**. The data written to Volumes by the Storage daemon is not encrypted by this code. For data encryption, please see the Data Encryption Chapter of this manual.
The Bareos encryption implementations were written by Landon Fuller.
Supported features of this code include:

- Client/Server TLS Requirement Negotiation
- TLSv1 Connections with Server and Client Certificate Validation
- Forward Secrecy Support via Diffie-Hellman Ephemeral Keying

This document will refer to both "server" and "client" contexts. These terms refer to the accepting and initiating peer, respectively.
Diffie-Hellman anonymous ciphers are not supported by this code. The use of DH anonymous ciphers increases the code complexity and places explicit trust upon the two-way CRAM-MD5 implementation. CRAM-MD5 is subject to known plaintext attacks, and it should be considered considerably less secure than PKI certificate-based authentication.

27.1 TLS Configuration Directives

Additional configuration directives have been added to all the daemons (Director, File daemon, and Storage daemon) as well as the various different Console programs. These new directives are defined as follows:

TLS Enable = <yes|no> (default: no)
Enable TLS support. If TLS is not enabled, none of the other TLS directives have any effect. In other words, even if you set **TLS Require = yes** you need to have TLS enabled or TLS will not be used.

TLS Require = <yes|no> (default: no)
Require TLS connections. This directive is ignored unless **TLS Enable** is set to **yes**. If TLS is not required, and TLS is enabled, then Bareos will connect with other daemons either with or without TLS depending on what the other daemon requests. If TLS is enabled and TLS is required, then Bareos will refuse any connection that does not use TLS.

TLS Certificate = <filename>
The full path and filename of a PEM encoded TLS certificate. It can be used as either a client or server certificate. PEM stands for Privacy Enhanced Mail, but in this context refers to how the certificates are encoded. It is used because PEM files are base64 encoded and hence ASCII text based rather than binary. They may also contain encrypted information.

TLS Key = <filename>
The full path and filename of a PEM encoded TLS private key. It must correspond to the TLS certificate.

TLS Verify Peer = <yes|no>
Verify peer certificate. Instructs server to request and verify the client's x509 certificate. Any client certificate signed by a known-CA will be accepted unless the TLS Allowed CN configuration directive

is used, in which case the client certificate must correspond to the Allowed Common Name specified. This directive is valid only for a server and not in a client context.

You can set `TLS Verify Peer = No` in the

- bconsole.conf
- bat.conf and
- bareos-fd.conf

configuration files when using TLS.

```
# relaxed tls configuration
# has security implications, attention
TLS Verify Peer = No
```

Configuration 27.1: Relaxed TLS Configuration

TLS Allowed CN = <stringlist>
Common name attribute of allowed peer certificates. If this directive is specified, all server certificates will be verified against this list. This can be used to ensure that only the CA-approved Director may connect. This directive may be specified more than once.

TLS CA Certificate File = <filename>
The full path and filename specifying a PEM encoded TLS CA certificate(s). Multiple certificates are permitted in the file. One of *TLS CA Certificate File* or *TLS CA Certificate Dir* are required in a server context if *TLS Verify Peer* (see above) is also specified, and are always required in a client context.

TLS CA Certificate Dir = <directory>
Full path to TLS CA certificate directory. In the current implementation, certificates must be stored PEM encoded with OpenSSL-compatible hashes, which is the subject name's hash and an extension of **.0**. One of *TLS CA Certificate File* or *TLS CA Certificate Dir* are required in a server context if *TLS Verify Peer* is also specified, and are always required in a client context.

TLS DH File = <filename>
Path to PEM encoded Diffie-Hellman parameter file. If this directive is specified, DH key exchange will be used for the ephemeral keying, allowing for forward secrecy of communications. DH key exchange adds an additional level of security because the key used for encryption/decryption by the server and the client is computed on each end and thus is never passed over the network if Diffie-Hellman key exchange is used. Even if DH key exchange is not used, the encryption/decryption key is always passed encrypted. This directive is only valid within a server context.

To generate the parameter file, you may use openssl:

```
openssl dhparam -out dh1024.pem -5 1024
```

27.2 Creating a Self-signed Certificate

You may create a self-signed certificate for use with the Bareos TLS that will permit you to make it function, but will not allow certificate validation. The .pem file containing both the certificate and the key valid for ten years can be made with the following:

```
openssl req -new -x509 -nodes -out bareos.pem -keyout bareos.pem -days 3650
```

The above script will ask you a number of questions. You may simply answer each of them by entering a return, or if you wish you may enter your own data.
Note, however, that self-signed certificates will only work for the outgoing end of connections. For example, in the case of the Director making a connection to a File Daemon, the File Daemon may be configured to allow self-signed certificates, but the certificate used by the Director must be signed by a certificate that is explicitly trusted on the File Daemon end.
This is necessary to prevent "man in the middle" attacks from tools such as ettercap. Essentially, if the Director does not verify that it is talking to a trusted remote endpoint, it can be tricked into talking to a malicious 3rd party who is relaying and capturing all traffic by presenting its own certificates to the Director

and File Daemons. The only way to prevent this is by using trusted certificates, so that the man in the middle is incapable of spoofing the connection using his own.
To get a trusted certificate (CA or Certificate Authority signed certificate), you will either need to purchase certificates signed by a commercial CA or become a CA yourself, and thus you can sign all your own certificates.
The program TinyCA has a very nice Graphical User Interface that allows you to easily setup and maintain your own CA. TinyCA can be found at http://tinyca.sm-zone.net/.

27.3 Example TLS Configuration Files

An example of the TLS portions of the configuration files are listed below:
bareos-dir.conf

```
Director {                            # define myself
  Name = backup1-dir
  ...
  TLS Enable = yes
  TLS Require = yes
  TLS Verify Peer = yes
  TLS Allowed CN = "bareos@backup1.example.com"
  TLS Allowed CN = "administrator@example.com"
  TLS CA Certificate File = /usr/local/etc/ssl/ca.pem
  # This is a server certificate, used for incoming
  # console connections.
  TLS Certificate = /usr/local/etc/ssl/backup1/cert.pem
  TLS Key = /usr/local/etc/ssl/backup1/key.pem
}

Storage {
  Name = File
  Address = backup1.example.com
  ...
  TLS Require = yes
  TLS CA Certificate File = /usr/local/etc/ssl/ca.pem
  # This is a client certificate, used by the director to
  # connect to the storage daemon
  TLS Certificate = /usr/local/etc/ssl/bareos@backup1/cert.pem
  TLS Key = /usr/local/etc/ssl/bareos@backup1/key.pem
}

Client {
  Name = backup1-fd
  Address = server1.example.com
  ...

  TLS Enable = yes
  TLS Require = yes
  TLS CA Certificate File = /usr/local/etc/ssl/ca.pem
}
```

bareos-fd.conf

```
Director {
  Name = backup1-dir
  ...
  TLS Enable = yes
  TLS Require = yes
  TLS Verify Peer = yes
  # Allow only the Director to connect
  TLS Allowed CN = "bareos@backup1.example.com"
  TLS CA Certificate File = /usr/local/etc/ssl/ca.pem
  # This is a server certificate. It is used by connecting
  # directors to verify the authenticity of this file daemon
  TLS Certificate = /usr/local/etc/ssl/server1/cert.pem
  TLS Key = /usr/local/etc/ssl/server1/key.pem
}

FileDaemon {
  Name = backup1-fd
  ...
  # you need these TLS entries so the SD and FD can
  # communicate
```

```
    TLS Enable = yes
    TLS Require = yes

    TLS CA Certificate File = /usr/local/etc/ssl/ca.pem
    TLS Certificate = /usr/local/etc/ssl/server1/cert.pem
    TLS Key = /usr/local/etc/ssl/server1/key.pem
}
```

bareos-sd.conf

```
  Storage {                             # definition of myself
    Name = backup1-sd
    ...
    # These TLS configuration options are used for incoming
    # file daemon connections. Director TLS settings are handled
    # below.
    TLS Enable = yes
    TLS Require = yes
    # Peer certificate is not required/requested -- peer validity
    # is verified by the storage connection cookie provided to the
    # File Daemon by the director.
    TLS Verify Peer = no
    TLS CA Certificate File = /usr/local/etc/ssl/ca.pem
    # This is a server certificate. It is used by connecting
    # file daemons to verify the authenticity of this storage daemon
    TLS Certificate = /usr/local/etc/ssl/backup1/cert.pem
    TLS Key = /usr/local/etc/ssl/backup1/key.pem
  }

  #
  # List Directors who are permitted to contact Storage daemon
  #
  Director {
    Name = backup1-dir
    ...
    TLS Enable = yes
    TLS Require = yes
    # Require the connecting director to provide a certificate
    # with the matching CN.
    TLS Verify Peer = yes
    TLS Allowed CN = "bareos@backup1.example.com"
    TLS CA Certificate File = /usr/local/etc/ssl/ca.pem
    # This is a server certificate. It is used by the connecting
    # director to verify the authenticity of this storage daemon
    TLS Certificate = /usr/local/etc/ssl/backup1/cert.pem
    TLS Key = /usr/local/etc/ssl/backup1/key.pem
  }
```

Chapter 28

Data Encryption

Bareos permits file data encryption and signing within the File Daemon (or Client) prior to sending data to the Storage Daemon. Upon restoration, file signatures are validated and any mismatches are reported. At no time does the Director or the Storage Daemon have access to unencrypted file contents.
Please note! *These feature is only available, if Bareos is builed against OpenSSL.*
It is very important to specify what this implementation does NOT do:

- The implementation does not encrypt file metadata such as file path names, permissions, ownership and extended attributes. However, Mac OS X resource forks are encrypted.

Encryption and signing are implemented using RSA private keys coupled with self-signed x509 public certificates. This is also sometimes known as PKI or Public Key Infrastructure.
Each File Daemon should be given its own unique private/public key pair. In addition to this key pair, any number of "Master Keys" may be specified – these are key pairs that may be used to decrypt any backups should the File Daemon key be lost. Only the Master Key's public certificate should be made available to the File Daemon. Under no circumstances should the Master Private Key be shared or stored on the Client machine.
The Master Keys should be backed up to a secure location, such as a CD placed in a in a fire-proof safe or bank safety deposit box. The Master Keys should never be kept on the same machine as the Storage Daemon or Director if you are worried about an unauthorized party compromising either machine and accessing your encrypted backups.
While less critical than the Master Keys, File Daemon Keys are also a prime candidate for off-site backups; burn the key pair to a CD and send the CD home with the owner of the machine.
Please note! *If you lose your encryption keys, backups will be unrecoverable.* **always** *store a copy of your master keys in a secure, off-site location.*
The basic algorithm used for each backup session (Job) is:

1. The File daemon generates a session key.
2. The FD encrypts that session key via PKE for all recipients (the file daemon, any master keys).
3. The FD uses that session key to perform symmetric encryption on the data.

28.1 Encryption Technical Details

The implementation uses 128bit AES-CBC, with RSA encrypted symmetric session keys. The RSA key is user supplied. If you are running OpenSSL >= 0.9.8, the signed file hash uses SHA-256, otherwise SHA-1 is used.
End-user configuration settings for the algorithms are not currently exposed, only the algorithms listed above are used. However, the data written to Volume supports arbitrary symmetric, asymmetric, and digest algorithms for future extensibility, and the back-end implementation currently supports:

```
Symmetric Encryption:
    - 128, 192, and 256-bit AES-CBC
    - Blowfish-CBC

Asymmetric Encryption (used to encrypt symmetric session keys):
    - RSA
```

```
Digest Algorithms:
    - MD5
    - SHA1
    - SHA256
    - SHA512
```

The various algorithms are exposed via an entirely re-usable, OpenSSL-agnostic API (ie, it is possible to drop in a new encryption backend). The Volume format is DER-encoded ASN.1, modeled after the Cryptographic Message Syntax from RFC 3852. Unfortunately, using CMS directly was not possible, as at the time of coding a free software streaming DER decoder/encoder was not available.

28.2 Generating Private/Public Encryption Keys

Generate a Master Key Pair with:

```
openssl genrsa -out master.key 2048
openssl req -new -key master.key -x509 -out master.cert
```

Generate a File Daemon Key Pair for each FD:

```
openssl genrsa -out fd-example.key 2048
openssl req -new -key fd-example.key -x509 -out fd-example.cert
cat fd-example.key fd-example.cert >fd-example.pem
```

Note, there seems to be a lot of confusion around the file extensions given to these keys. For example, a .pem file can contain all the following: private keys (RSA and DSA), public keys (RSA and DSA) and (x509) certificates. It is the default format for OpenSSL. It stores data Base64 encoded DER format, surrounded by ASCII headers, so is suitable for text mode transfers between systems. A .pem file may contain any number of keys either public or private. We use it in cases where there is both a public and a private key.
Above we have used the .cert extension to refer to X509 certificate encoding that contains only a single public key.

28.3 Example Data Encryption Configurations (bareos-fd.conf)

```
FileDaemon {
   Name = client1-fd

   # encryption configuration
   PKI Signatures = Yes                          # Enable Data Signing
   PKI Encryption = Yes                          # Enable Data Encryption
   PKI Keypair    = "/etc/bareos/client1-fd.pem" # Public and Private Keys
   PKI Master Key = "/etc/bareos/master.cert"    # ONLY the Public Key
   PKI Cipher     = aes128                       # specify desired PKI Cipher here
}
```

28.4 Decrypting with a Master Key

It is preferable to retain a secure, non-encrypted copy of the client's own encryption keypair. However, should you lose the client's keypair, recovery with the master keypair is possible.
You must:

- Concatenate the master private and public key into a single keypair file, ie:

  ```
  cat master.key master.cert > master.keypair
  ```

- Set the PKI Keypair statement in your bareos configuration file:

  ```
  PKI Keypair = master.keypair
  ```

- Start the restore. The master keypair will be used to decrypt the file data.

Chapter 29

NDMP Backups with Bareos

NDMP

- is the abbreviation for Network Data Management Protocol.
- is a protocol that transports data between Network Attached Storages (NAS) and backup devices.
- is widely used by storage product vendors and OS vendors like NetApp, Isilon, EMC, Oracle.
- information are available at http://www.ndmp.org/.
- version is currently (2016) NDMP Version 4.
- uses TCP/IP and XDR (External Data Representation) for the communication.

The Bareos NDMP implementation is based on the NDMJOB NDMP reference implementation of Traakan, Inc., Los Altos, CA which has a BSD style license (2 clause one) with some enhancements.
An NDMP system consists of basically three elements:

Data Management Application or DMA does the administration of the backup in NDMP and commands the Primary and Secondary Storage Systems to do a backup or restore operation.

Primary Storage System or DATA AGENT is the Storage System that will be backed up, e.g. a NAS Server that is NDMP enabled.

Secondary Storage System or TAPE AGENT is the Storage System that the backup data will be stored on.

Bareos implements the "Data Management Application" inside of the Bareos Director, and a "Secondary Storage System" or TAPE AGENT in the Bareos Storage Daemon.
The TAPE AGENT in the Bareos Storage Daemon emulates a NDMP tape drive that has an infinite tape. The blocks being written to the NDMP tape are stored inside of a normal Bareos backup stream and then stored into the volumes managed by Bareos.
Therefore, there is always a pair of storage resource definitions:

- a conventional Bareos storage resource and
- a NDMP storage resource

These two are linked together and the data that is stored via NDMP into the NDMP storage resource is being really written into the paired conventional Bareos storage resource.
On restore, the data is read by the conventional resource, and then recovered as NDMP stream from the NDMP resource.

29.1 Example Setup for NDMP backup

This example starts from a clean default Bareos installation.

29.1.1 Enable NDMP on your storage appliance

The storage appliance needs to be configured to allow NDMP connections. Therefore usually the NDMP service needs to be enabled and configured with a username and password.

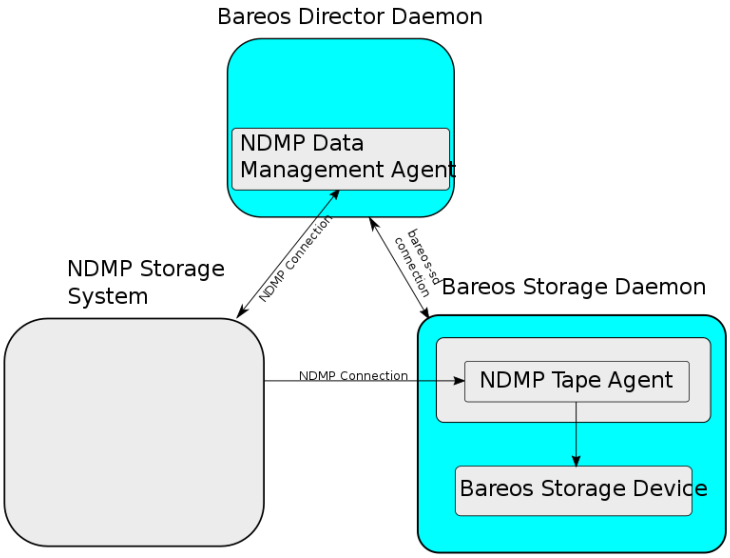


Figure 29.1: Relationship between Bareos and NDMP components

29.1.2 Bareos Director: Configure NDMP Client Resource

Add a Client resource to the Bareos Director configuration and configure it to access your NDMP storage system (Primary Storage System/DATA AGENT).

- Protocol $^{\text{Dir}}_{\text{Client}}$ must be either NDMPv2, NDMPv3 or NDMPv4.
- Port $^{\text{Dir}}_{\text{Client}}$ is set to the NDMP Port (usually 10000).
- Username $^{\text{Dir}}_{\text{Client}}$ and Password $^{\text{Dir}}_{\text{Client}}$ are used for the authentication against the NDMP Storage System.
- Auth Type $^{\text{Dir}}_{\text{Client}}$ is either Cleartext or MD5. NDMP supports both.

In our example we connect to a Isilon storage appliance emulator:

```
Client {
  Name = ndmp-client
  Address = 10.20.250.91  # IP/FQDN of the storage appliance
  Port = 10000            # Default port for NDMP
  Protocol = NDMPv4       # Need to specify protocol before password as protocol determines password ↙
    ↪ encoding used
  Auth Type = Clear       # Cleartext Authentication
  Username = "ndmpadmin"  # username of the NDMP user on the DATA AGENT e.g. storage box being backuped.
  Password = "test"       # password of the NDMP user on the DATA AGENT e.g. storage box being backuped.
}
```

Verify, that you can access your Primary Storage System via Bareos:

```
*status client=ndmp-client

Data Agent 10.20.250.91 NDMPv4
  Host info
    hostname    isilonsim-1
    os_type     Isilon OneFS
    os_vers     v7.1.1.5
    hostid      005056ad8483ba43cc55a711cd384506e3c1

  Server info
    vendor      Isilon
    product     Isilon NDMP
    revision    2.2
```

```
    auths       (2) NDMP4_AUTH_TEXT NDMP4_AUTH_MD5

  Connection types
    addr_types  (2) NDMP4_ADDR_TCP NDMP4_ADDR_LOCAL

  Backup type info of tar format
    attrs       0x7fe
    set         FILESYSTEM=/ifs
    set         FILES=
    set         EXCLUDE=
    set         PER_DIRECTORY_MATCHING=N
    set         HIST=f
    set         DIRECT=N
    set         LEVEL=0
    set         UPDATE=Y
    set         RECURSIVE=Y
    set         ENCODING=UTF-8
    set         ENFORCE_UNIQUE_NODE=N
    set         PATHNAME_SEPARATOR=/
    set         DMP_NAME=
    set         BASE_DATE=0
    set         NDMP_UNICODE_FH=N

  Backup type info of dump format
    attrs       0x7fe
    set         FILESYSTEM=/ifs
    set         FILES=
    set         EXCLUDE=
    set         PER_DIRECTORY_MATCHING=N
    set         HIST=f
    set         DIRECT=N
    set         LEVEL=0
    set         UPDATE=Y
    set         RECURSIVE=Y
    set         ENCODING=UTF-8
    set         ENFORCE_UNIQUE_NODE=N
    set         PATHNAME_SEPARATOR=/
    set         DMP_NAME=
    set         BASE_DATE=0
    set         NDMP_UNICODE_FH=N

  File system /ifs
    physdev     OneFS
    unsupported 0x0
    type        NFS
    status
    space       12182519808 total, 686768128 used, 11495751680 avail
    inodes      17664000 total, 16997501 used
    set         MNTOPTS=
    set         MNTTIME=00:00:00 00:00:00
```

bconsole 29.1: verify connection to NDMP Primary Storage System

This output shows that the access to the storage appliance was successful.

29.1.3 Bareos Storage Daemon: Configure NDMP

Enabling NDMP

To enable the NDMP TAPE AGENT inside of the Bareos Storage Daemon, set NDMP Enable $^{\text{Sd}}_{\text{Storage}}$=yes:

```
#
# Default SD config block: enable the NDMP protocol,
# otherwise it won't listen on port 10000.
#
Storage {
   Name = ....
```

```
   ...
   NDMP Enable = yes
}
```

Configuration 29.2: enable NDMP in Bareos Storage Daemon

Add a NDMP resource

Additionally, we need to define the access credentials for our NDMP TAPE AGENT (Secondary Storage) inside of this Storage Daemon.
These are configured by adding a NDMP resource to `bareos-sd.conf`:

```
#
# This resource gives the DMA in the Director access to the Bareos SD via the NDMP protocol.
# This option is used via the NDMP protocol to open the right TAPE AGENT connection to your
# Bareos SD via the NDMP protocol. The initialization of the SD is done via the native protocol
# and is handled via the PairedStorage keyword.
#
Ndmp {
  Name = bareos-dir-isilon
  Username = ndmpadmin
  Password = test
  AuthType = Clear
}
```

Username and Password can be anything, but they will have to match the settings in the Bareos Director NDMP Storage resource we configure next.
Now restart the Bareos Storage Daemon. If everything is correct, the Bareos Storage Daemon starts and listens now on the usual port (9103) and additionally on port 10000 (ndmp).

```
root@linux:~# netstat -lntp | grep bareos-sd
tcp        0      0 0.0.0.0:9103            0.0.0.0:*               LISTEN      10661/bareos-sd
tcp        0      0 0.0.0.0:10000           0.0.0.0:*               LISTEN      10661/bareos-sd
```

29.1.4 Bareos Director: Configure a Paired Storage

For NDMP Backups, we always need two storages that are paired together. The default configuration already has a Storage `File` defined:

```
Storage {
  Name = File
  Address = bareos
  Password = "pNZ3TvFAL/t+MyOIQo58p5B/oB79SFncdAmLXKHa9U59"
  Device = FileStorage
  Media Type = File
}
```

We now add a paired storage to the already existing `File` storage:

```
#
# Same storage daemon but via NDMP protocol.
# We link via the PairedStorage config option the Bareos SD
# instance definition to a NDMP TAPE AGENT.
#
Storage {
  Name = NDMPFile
  Address = bareos
  Port = 10000
  Protocol = NDMPv4
  Auth Type = Clear
  Username = ndmpadmin
  Password = "test"
  Device = FileStorage
  Media Type = File
  PairedStorage = File
}
```

The settings of Username and Password need to match the settings of the Bareos Storage Daemon's NDMP resource we added before. The address will be used by the storage appliance's NDMP Daemon to connect to the Bareos Storage Daemon via NDMP. Make sure that the Storage appliance can resolve the name or use an IP address.
Now save the director resource and restart the Bareos Director. Verify that the configuration is correct:

```
*status storage=NDMPFile
Connecting to Storage daemon File at bareos:9103

bareos-sd Version: 15.2.2 (16 November 2015) x86_64-redhat-linux-gnu redhat Red ↙
    ↪ Hat Enterprise Linux Server release 7.0 (Maipo)
Daemon started 14-Jan-16 10:10. Jobs: run=0, running=0.
 Heap: heap=135,168 smbytes=34,085 max_bytes=91,589 bufs=75 max_bufs=77
 Sizes: boffset_t=8 size_t=8 int32_t=4 int64_t=8 mode=0 bwlimit=0kB/s

Running Jobs:
No Jobs running.
====

Jobs waiting to reserve a drive:
====

Terminated Jobs:
====

Device status:

Device "FileStorage" (/var/lib/bareos/storage) is not open.
==
====

Used Volume status:
====

====

*
```

bconsole 29.3: verify connection to the Bareos Storage Daemon

The output looks the same, as if a `status storage=File` would have been called.

29.1.5 Bareos Director: Configure NDMP Fileset

To specify what files and directories from the storage appliance should be backed up, a Fileset needs to be specified. In our example, we decided to backup `/ifs/home` directory.
The specified directory needs to be a filesystem or a subdirectory of a filesystem which can be accessed by NDMP. Which filesystems are available is showed in the `status client` output of the NDMP client.
Additionally, NDMP can be configured via NDMP environment variables. These can be specified in the Options Block of the Fileset with the **Meta** keyword. Which variables are available is partly depending on the NDMP implementation of the Storage Appliance.

```
Fileset {
  Name = "NDMP Fileset"
  Include {
    Options {
        meta = "USE_TBB_IF_AVAILABLE=y"
        meta = "BUTYPE=DUMP"
        meta = "ENCODING=ISO_8859_1"
        meta = "RESTORE_HARDLINK_BY_TABLE=y"
        meta = "FH_REPORT_FULL_DIRENTS=y"
    }
    File = /ifs/home
  }
}
```

Configuration 29.4: NDMP Fileset

Use multiple **File** directives in Include $^{\text{Dir}}_{\text{FileSet}}$ to backup multiple directories.
Please note! *Some NDMP environment variables are set automatically by the DMA in the director and should NOT be set by the user. The following environment variables are currently set automatically:*

- *HIST*

- *TYPE*
- *DIRECT*
- *LEVEL*
- *UPDATE*
- *EXCLUDE*
- *INCLUDE*
- *FILESYSTEM*
- *PREFIX*

Please note! *Normally (Protocol $^{Dir}_{Client}$=Native) Filesets get handled by the Bareos File Daemon. When connecting directly to a NDMP Clients (Protocol $^{Dir}_{Client}$=NDMP*), no Bareos File Daemon is involved and therefore most Fileset options can't be used. Instead, parameters are handled via* ***Options →Meta*** *from Include $^{Dir}_{FileSet}$.*

29.1.6 Bareos Director: Configure NDMP Jobs

To do NDMP backups and restores, some special settings need to be configured. We define special Backup and Restore jobs for NDMP.

```
Job {
  Name          = "ndmp-backup-job"
  Type          = Backup
  Protocol      = NDMP
  Level         = Incremental
  Client        = ndmp-client
  Backup Format = dump
  FileSet       = "NDMP Fileset"
  Storage       = NDMPFile
  Pool          = Full
  Messages      = Standard
}
```

Configuration 29.5: NDMP backup job

```
Job {
  Name          = "ndmp-restore-job"
  Type          = Restore
  Protocol      = NDMP
  Client        = ndmp-client
  Backup Format = dump
  FileSet       = "NDMP Fileset"
  Storage       = NDMPFile
  Pool          = Full
  Messages      = Standard
  Where         = /
}
```

Configuration 29.6: NDMP restore job

- Backup Format $^{Dir}_{Job}$=dump is used in our example. Other Backup Formats have other advantages/disadvantages.

29.2 Run NDMP Backup

Now we are ready to do our first NDMP backup:

```
*run job=ndmp-backup-job
Using Catalog "MyCatalog"
Run Backup job
JobName:  ndmp-backup-job
Level:    Incremental
```

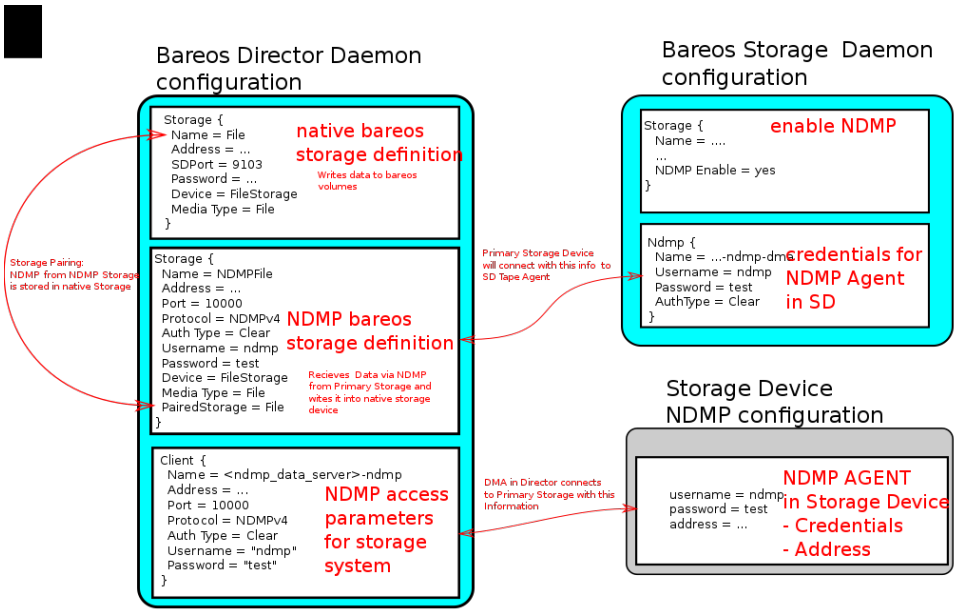


Figure 29.2: NDMP configuration overview

```
Client:    ndmp-client
Format:    dump
FileSet:   NDMP Fileset
Pool:      Full (From Job resource)
Storage:   NDMPFile (From Job resource)
When:      2016-01-14 10:48:04
Priority: 10
OK to run? (yes/mod/no): yes
Job queued. JobId=1
*wait jobid=1
JobId=1
JobStatus=OK (T)
*list joblog jobid=1
 2016-01-14 10:57:53 bareos-dir JobId 1: Start NDMP Backup JobId 1, ↙
    ↪ Job=NDMPJob.2016-01-14_10.57.51_04
 2016-01-14 10:57:53 bareos-dir JobId 1: Created new Volume "Full-0001" in catalog.
 2016-01-14 10:57:53 bareos-dir JobId 1: Using Device "FileStorage" to write.
 2016-01-14 10:57:53 bareos-dir JobId 1: Opening tape drive ↙
    ↪ LPDA-DEJC-ENJL-AHAI-JCBD-LICP-LKHL-IEDK@/ifs/home%0 read/write
 2016-01-14 10:57:53 bareos-sd JobId 1: Labeled new Volume "Full-0001" on device ↙
    ↪ "FileStorage" (/var/lib/bareos/storage).
 2016-01-14 10:57:53 bareos-sd JobId 1: Wrote label to prelabeled Volume ↙
    ↪ "Full-0001" on device "FileStorage" (/var/lib/bareos/storage)
 2016-01-14 10:57:53 bareos-dir JobId 1: Commanding tape drive to rewind
 2016-01-14 10:57:53 bareos-dir JobId 1: Waiting for operation to start
 2016-01-14 10:57:53 bareos-dir JobId 1: Async request NDMP4_LOG_MESSAGE
 2016-01-14 10:57:53 bareos-dir JobId 1: Operation started
 2016-01-14 10:57:53 bareos-dir JobId 1: Monitoring backup
 2016-01-14 10:57:53 bareos-dir JobId 1: LOG_MESSAGE: 'Filetransfer: Transferred ↙
    ↪ 5632 bytes in 0.087 seconds throughput of 63.133 KB/s'
 2016-01-14 10:57:53 bareos-dir JobId 1: LOG_MESSAGE: 'Filetransfer: Transferred ↙
    ↪ 5632 total bytes '
 2016-01-14 10:57:53 bareos-dir JobId 1: LOG_MESSAGE: 'CPU  user=0.016416  ↙
    ↪ sys=0.029437  ft=0.077296  cdb=0.000000'
 2016-01-14 10:57:53 bareos-dir JobId 1: LOG_MESSAGE: 'maxrss=14576  in=13  ↙
    ↪ out=22  vol=155  inv=72'
 2016-01-14 10:57:53 bareos-dir JobId 1: LOG_MESSAGE: '
```

```
       Objects (scanned/included):
       ---------------------------
       Regular Files:          (1/1)
       Sparse Files:           (0/0)
       Stub Files:             (0/0)
       Directories:            (2/2)
       ADS Entries:            (0/0)
       ADS Containers:         (0/0)
       Soft Links:             (0/0)
       Hard Links:             (0/0)
       Block Device:           (0/0)
       Char Device:            (0/0)
       FIFO:                   (0/0)
       Socket:                 (0/0)
       Whiteout:               (0/0)
       Unknown:                (0/0)'
2016-01-14 10:57:53 bareos-dir JobId 1: LOG_MESSAGE: '
       Dir Depth (count)
       -----------------------
       Total Dirs:             2
       Max Depth:              1

       File Size (count)
       -----------------------
       == 0                    0
       <= 8k                   1
       <= 64k                  0
       <= 1M                   0
       <= 20M                  0
       <= 100M                 0
       <= 1G                   0
        > 1G                   0
       ------------------------
       Total Files:            1
       Total Bytes:            643
       Max Size:               643
       Mean Size:              643'
2016-01-14 10:57:53 bareos-dir JobId 1: LOG_MESSAGE: '
       File History
       ------------------------
       Num FH_HIST_FILE messages:          0
       Num FH_HIST_DIR  messages:          6
       Num FH_HIST_NODE messages:          3'
2016-01-14 10:57:54 bareos-dir JobId 1: Async request NDMP4_NOTIFY_MOVER_HALTED
2016-01-14 10:57:54 bareos-dir JobId 1: DATA: bytes 2053KB MOVER: written ↙
  ↪ 2079KB record 33
2016-01-14 10:57:54 bareos-dir JobId 1: Operation done, cleaning up
2016-01-14 10:57:54 bareos-dir JobId 1: Waiting for operation to halt
2016-01-14 10:57:54 bareos-dir JobId 1: Commanding tape drive to NDMP9_MTIO_EOF ↙
  ↪ 2 times
2016-01-14 10:57:54 bareos-dir JobId 1: Commanding tape drive to rewind
2016-01-14 10:57:54 bareos-dir JobId 1: Closing tape drive ↙
  ↪ LPDA-DEJC-ENJL-AHAI-JCBD-LICP-LKHL-IEDK@/ifs/home%0
2016-01-14 10:57:54 bareos-dir JobId 1: Operation halted, stopping
2016-01-14 10:57:54 bareos-dir JobId 1: Operation ended OKAY
2016-01-14 10:57:54 bareos-sd JobId 1: Elapsed time=00:00:01, Transfer ↙
  ↪ rate=2.128 M Bytes/second
2016-01-14 10:57:54 bareos-dir JobId 1: Bareos bareos-dir 15.2.2 (16Nov15):
 Build OS:               x86_64-redhat-linux-gnu redhat Red Hat Enterprise Linux ↙
  ↪ Server release 7.0 (Maipo)
 JobId:                  1
 Job:                    ndmp-backup-job.2016-01-14_10.57.51_04
 Backup Level:           Full
 Client:                 "ndmp-client"
 FileSet:                "NDMP Fileset" 2016-01-14 10:57:51
```

```
 Pool:                  "Full" (From Job resource)
 Catalog:               "MyCatalog" (From Client resource)
 Storage:               "NDMPFile" (From Job resource)
 Scheduled time:        14-Jan-2016 10:57:51
 Start time:            14-Jan-2016 10:57:53
 End time:              14-Jan-2016 10:57:54
 Elapsed time:          1 sec
 Priority:              10
 NDMP Files Written:    3
 SD Files Written:      1
 NDMP Bytes Written:    2,102,784 (2.102 MB)
 SD Bytes Written:      2,128,987 (2.128 MB)
 Rate:                  2102.8 KB/s
 Volume name(s):        Full-0001
 Volume Session Id:     4
 Volume Session Time:   1452764858
 Last Volume Bytes:     2,131,177 (2.131 MB)
 Termination:           Backup OK
```

bconsole 29.7: run NDMP backup

We have successfully created our first NDMP backup.
Let us have a look what files are in our backup:

```
*list files jobid=1
 /@NDMP/ifs/home%0
 /ifs/home/
 /ifs/home/admin/
 /ifs/home/admin/.zshrc
```

bconsole 29.8: list the files of the backup job

The real backup data is stored in the file `/@NDMP/ifs/home%0` (we will refer to it as "NDMP main backup file" or "main backup file" later on). One NDMP main backup file is created for every directory specified in the used Fileset. The other files show the file history and are hardlinks to the backup file.

29.2.1 NDMP Backup Level

The trailing number in the main backup file (after the `%` character) indicates the NDMP backup level:

Level	Description
0	Full NDMP backup.
1	Differential or first Incremental backup.
2-9	second to ninth Incremental backup.

Differential Backups are supported. The NDMP backup level will be 1, visible as trailing number in the backup file (`/@NDMP/ifs/home%1`).

Incremental Backups are supported. The NDMP backup level will increment with each run, until a Full (0) or Differential (1) will be made. The maximum backup level will be 9. Additional Incremental backups will result in a failed job and the message:

```
2016-01-21 13:35:51 bareos-dir JobId 12: Fatal error: NDMP dump format doesn't support more than 8 ↙
    ↪ incrementals, please run a Differential or a Full Backup
```

29.3 Run NDMP Restore

Now that we have a NDMP backup, we of course also want to restore some data from the backup. If the backup we just did saved the Filehistory, we are able to select single files for restore. Otherwise, we will only be able to restore the whole backup.

29.3.1 Full Restore

Either select all files or the main backup file (`/@NDMP/ifs/home%0`). If file history is not included in the backup job, than only the main backup file is available.

29.3.2 Restore files to original path

```
*restore jobid=1
You have selected the following JobId: 1

Building directory tree for JobId(s) 1 ...
2 files inserted into the tree.

You are now entering file selection mode where you add (mark) and
remove (unmark) files to be restored. No files are initially added, unless
you used the "all" keyword on the command line.
Enter "done" to leave this mode.

cwd is: /
$ mark /ifs/home/admin/.zshrc
$ done
Bootstrap records written to /var/lib/bareos/bareos-dir.restore.1.bsr

The job will require the following
   Volume(s)                 Storage(s)                SD Device(s)
===========================================================================

    Full-0001                 File                      FileStorage

Volumes marked with "*" are online.


1 file selected to be restored.

The defined Restore Job resources are:
     1: RestoreFiles
     2: ndmp-restore-job
Select Restore Job (1-2): 2
Defined Clients:
     1: bareos-fd
     2: ndmp-client
Select the Client (1-2): 2
Run Restore job
JobName:         ndmp-backup-job
Bootstrap:       /var/lib/bareos/bareos-dir.restore.1.bsr
Where:           /
Replace:         Always
FileSet:         NDMP Fileset
Backup Client:   ndmp-client
Restore Client:  ndmp-client
Format:          dump
Storage:         File
When:            2016-01-14 11:04:46
Catalog:         MyCatalog
Priority:        10
Plugin Options:  *None*
OK to run? (yes/mod/no): yes
Job queued. JobId=2
*wait jobid=2
JobId=2
JobStatus=OK (T)
*list joblog jobid=2
14-Jan 11:04 bareos-dir JobId 2: Start Restore Job ↙
    ↪ ndmp-backup-job.2016-01-14_11.04.53_05
14-Jan 11:04 bareos-dir JobId 2: Using Device "FileStorage" to read.
14-Jan 11:04 bareos-dir JobId 2: Opening tape drive ↙
    ↪ KKAE-IMLO-NHJD-GOCO-GJCO-GEHB-BODL-ADNG@/ifs/home read-only
14-Jan 11:04 bareos-dir JobId 2: Commanding tape drive to rewind
14-Jan 11:04 bareos-dir JobId 2: Waiting for operation to start
```

```
14-Jan 11:04 bareos-sd JobId 2: Ready to read from volume "Full-0001" on device ↙
    ↪ "FileStorage" (/var/lib/bareos/storage).
14-Jan 11:04 bareos-sd JobId 2: Forward spacing Volume "Full-0001" to file:block ↙
    ↪ 0:194.
14-Jan 11:04 bareos-dir JobId 2: Async request NDMP4_LOG_MESSAGE
14-Jan 11:04 bareos-dir JobId 2: Operation started
14-Jan 11:04 bareos-dir JobId 2: Monitoring recover
14-Jan 11:04 bareos-dir JobId 2: DATA: bytes 0KB  MOVER: read 0KB record 0
14-Jan 11:04 bareos-dir JobId 2: LOG_MESSAGE: 'Filetransfer: Transferred 1048576 ↙
    ↪ bytes in 0.135 seconds throughput of 7557.139 KB/s'
14-Jan 11:04 bareos-dir JobId 2: OK: /admin/.zshrc
14-Jan 11:04 bareos-dir JobId 2: LOG_MESSAGE: '
        Objects:
        ------------------------------
        Regular Files:          (1)
        Stub Files:             (0)
        Directories:            (0)
        ADS Entries:            (0)
        Soft Links:             (0)
        Hard Links:             (0)
        Block Device:           (0)
        Char Device:            (0)
        FIFO:                   (0)
        Socket:                 (0)
        Unknown:                (0)'
14-Jan 11:04 bareos-dir JobId 2: LOG_MESSAGE: '
        File Size (count)
        ------------------------------
        == 0                    0
        <= 8k                   1
        <= 64k                  0
        <= 1M                   0
        <= 20M                  0
        <= 100M                 0
        <= 1G                   0
         > 1G                   0
        ------------------------------
        Total Files:            1
        Total Bytes:            643
        Max Size:               643
        Mean Size:              643'
14-Jan 11:04 bareos-dir JobId 2: Async request NDMP4_NOTIFY_MOVER_PAUSED
14-Jan 11:04 bareos-dir JobId 2: DATA: bytes 1024KB  MOVER: read 2079KB record 32
14-Jan 11:04 bareos-dir JobId 2: Mover paused, reason=NDMP9_MOVER_PAUSE_EOF
14-Jan 11:04 bareos-dir JobId 2: End of tapes
14-Jan 11:04 bareos-dir JobId 2: DATA: bytes 1024KB  MOVER: read 2079KB record 32
14-Jan 11:04 bareos-dir JobId 2: Operation done, cleaning up
14-Jan 11:04 bareos-dir JobId 2: Waiting for operation to halt
14-Jan 11:04 bareos-dir JobId 2: Commanding tape drive to rewind
14-Jan 11:04 bareos-dir JobId 2: Closing tape drive ↙
    ↪ KKAE-IMLO-NHJD-GOCO-GJCO-GEHB-BODL-ADNG@/ifs/home
14-Jan 11:04 bareos-dir JobId 2: Operation halted, stopping
14-Jan 11:04 bareos-dir JobId 2: Operation ended OKAY
14-Jan 11:04 bareos-dir JobId 2: LOG_FILE messages: 1 OK, 0 ERROR, total 1 of 1
14-Jan 11:04 bareos-dir JobId 2: Bareos bareos-dir 15.2.2 (16Nov15):
  Build OS:               x86_64-redhat-linux-gnu redhat Red Hat Enterprise Linux ↙
    ↪ Server release 7.0 (Maipo)
  JobId:                  2
  Job:                    ndmp-backup-job.2016-01-14_11.04.53_05
  Restore Client:         ndmp-client
  Start time:             14-Jan-2016 11:04:55
  End time:               14-Jan-2016 11:04:57
  Elapsed time:           2 secs
  Files Expected:         1
  Files Restored:         1
```

```
  Bytes Restored:          1,048,576
  Rate:                    524.3 KB/s
  SD termination status:   OK
  Termination:             Restore OK
```

29.3.3 Restore files to different path

The restore location is determined by the Where Dir Job setting of the restore job. In NDMP, this parameter works in a special manner, the prefix can be either “relative” to the filesystem or “absolute”. If a prefix is set in form of a directory (like `/bareos-restores`), it will be a relative prefix and will be added between the filesystem and the filename. This is needed to make sure that the data is restored in a different directory, but into the same filesystem. If the prefix is set with a leading caret (`^`), it will be an absolute prefix and will be put at the front of the restore path. This is needed if the restored data should be stored into a different filesystem.
Example:

original file name	where	restored file
`/ifs/home/admin/.zshrc`	`/bareos-restores`	`/ifs/home/bareos-restores/admin/.zshrc`
`/ifs/home/admin/.zshrc`	`^/ifs/data/bareos-restores`	`/ifs/data/bareos-restores/admin/.zshrc`

29.4 NDMP Copy Jobs

To be able to do copy jobs, we need to have a second storage resource where we can copy the data to. Depending on your requirements, this resource can be added to the existing Bareos Storage Daemon (e.g. `autochanger-0` for tape based backups) or to an additional Bareos Storage Daemon.
We set up an additional Bareos Storage Daemon on a host named `bareos-sd2.example.com` with the default `FileStorage` device.
When this is done, add a second storage resource `File2` to the `bareos-dir.conf`:

```
Storage {
  Name = File2
  Address = bareos-sd2.example.com
  Password = <secretpassword>
  Device = FileStorage
  Media Type = File
}
```

Configuration 29.9: Storage resource File2

Copy Jobs copy data from one pool to another (see Migration and Copy). So we need to define a pool where the copies will be written to:
Add a Pool that the copies will run to:

```
#
# Copy Destination Pool
#
Pool {
  Name = Copy
  Pool Type = Backup
  Recycle = yes                       # Bareos can automatically recycle Volumes
  AutoPrune = yes                     # Prune expired volumes
  Volume Retention = 365 days         # How long should the Full Backups be kept? (#06)
  Maximum Volume Bytes = 50G          # Limit Volume size to something reasonable
  Maximum Volumes = 100               # Limit number of Volumes in Pool
  Label Format = "Copy-"              # Volumes will be labeled "Full-<volume-id>"
  Storage = File2                     # Pool belongs to Storage File2
}
```

Configuration 29.10: Pool resource Copy

Then we need to define the just defined pool as the Next Pool Dir Pool of the pool that actually holds the data to be copied.
In our case this is the `Full` Pool:

```
#
# Full Pool definition
#
Pool {
  Name = Full
```

```
  [...]
  Next Pool = Copy   # <- this line needs to be added!
}
```

Configuration 29.11: add Next Pool setting

Finally, we need to define a Copy Job that will select the jobs that are in the `Full` pool and copy them over to the `Copy` pool reading the data via the `File` Storage and writing the data via the `File2` Storage:

```
Job {
   Name = NDMPCopy
   Type = Copy
   Messages = Standard
   Selection Type = PoolUncopiedJobs
   Pool = Full
   Storage = NDMPFile
}
```

Configuration 29.12: NDMP copy job

After restarting the director and storage daemon, we can run the Copy job:

```
*run job=NDMPCopy
Run Copy job
JobName:       NDMPCopy
Bootstrap:     *None*
Pool:          Full (From Job resource)
NextPool:      Copy (From unknown source)
Write Storage: File2 (From Storage from Run NextPool override)
JobId:         *None*
When:          2016-01-21 09:19:49
Catalog:       MyCatalog
Priority:      10
OK to run? (yes/mod/no): yes
Job queued. JobId=74
*wait jobid=74
JobId=74
JobStatus=OK (T)
*list joblog jobid=74
21-Jan 09:19 bareos-dir JobId 74: The following 1 JobId was chosen to be copied: 73
21-Jan 09:19 bareos-dir JobId 74: Automatically selected Catalog: MyCatalog
21-Jan 09:19 bareos-dir JobId 74: Using Catalog "MyCatalog"
21-Jan 09:19 bareos-dir JobId 75: Copying using JobId=73 ↙
    ↪ Job=NDMPJob.2016-01-21_09.18.50_49
21-Jan 09:19 bareos-dir JobId 75: Bootstrap records written to ↙
    ↪ /var/lib/bareos/bareos-dir.restore.20.bsr
21-Jan 09:19 bareos-dir JobId 74: Job queued. JobId=75
21-Jan 09:19 bareos-dir JobId 74: Copying JobId 75 started.
21-Jan 09:19 bareos-dir JobId 74: Bareos bareos-dir 15.2.2 (16Nov15):
  Build OS:               x86_64-redhat-linux-gnu redhat Red Hat Enterprise Linux ↙
    ↪ Server release 7.0 (Maipo)
  Current JobId:          74
  Current Job:            NDMPCopy.2016-01-21_09.19.50_50
  Catalog:                "MyCatalog" (From Default catalog)
  Start time:             21-Jan-2016 09:19:52
  End time:               21-Jan-2016 09:19:52
  Elapsed time:           0 secs
  Priority:               10
  Termination:            Copying -- OK

21-Jan 09:19 bareos-dir JobId 75: Start Copying JobId 75, ↙
    ↪ Job=NDMPCopy.2016-01-21_09.19.52_51
21-Jan 09:19 bareos-dir JobId 75: Using Device "FileStorage" to read.
21-Jan 09:19 bareos-dir JobId 76: Using Device "FileStorage2" to write.
21-Jan 09:19 bareos-sd JobId 75: Ready to read from volume "Full-0001" on device ↙
    ↪ "FileStorage" (/var/lib/bareos/storage).
21-Jan 09:19 bareos-sd JobId 76: Volume "Copy-0004" previously written, moving to ↙
    ↪ end of data.
```

```
21-Jan 09:19 bareos-sd JobId 76: Ready to append to end of Volume "Copy-0004" size=78177310
21-Jan 09:19 bareos-sd JobId 75: Forward spacing Volume "Full-0001" to file:block 0:78177310.
21-Jan 09:19 bareos-sd JobId 75: End of Volume at file 0 on device "FileStorage" (/var/lib/bareos/storage), Volume "Full-0001"
21-Jan 09:19 bareos-sd JobId 75: End of all volumes.
21-Jan 09:19 bareos-sd JobId 76: Elapsed time=00:00:01, Transfer rate=64.61 K Bytes/second
21-Jan 09:19 bareos-dir JobId 75: Bareos bareos-dir 15.2.2 (16Nov15):
  Build OS:               x86_64-redhat-linux-gnu redhat Red Hat Enterprise Linux Server release 7.0 (Maipo)
  Prev Backup JobId:      73
  Prev Backup Job:        NDMPJob.2016-01-21_09.18.50_49
  New Backup JobId:       76
  Current JobId:          75
  Current Job:            NDMPCopy.2016-01-21_09.19.52_51
  Backup Level:           Incremental
  Client:                 ndmp-client
  FileSet:                "NDMP Fileset"
  Read Pool:              "Full" (From Job resource)
  Read Storage:           "NDMPFile" (From Job resource)
  Write Pool:             "Copy" (From Job Pool's NextPool resource)
  Write Storage:          "File2" (From Storage from Pool's NextPool resource)
  Next Pool:              "Copy" (From Job Pool's NextPool resource)
  Catalog:                "MyCatalog" (From Default catalog)
  Start time:             21-Jan-2016 09:19:54
  End time:               21-Jan-2016 09:19:54
  Elapsed time:           0 secs
  Priority:               10
  SD Files Written:       1
  SD Bytes Written:       64,614 (64.61 KB)
  Rate:                   0.0 KB/s
  Volume name(s):         Copy-0004
  Volume Session Id:      43
  Volume Session Time:    1453307753
  Last Volume Bytes:      78,242,384 (78.24 MB)
  SD Errors:              0
  SD termination status:  OK
  Termination:            Copying OK
```

bconsole 29.13: run copy job

Now we successfully copied over the NDMP job.
Please note! *`list jobs` will only show the number of main backup files as JobFiles. However, with `list files jobid=...` all files are visible.*

29.4.1 Restore to NDMP Primary Storage System

Unfortunately, we are not able to restore the copied data to our NDMP storage. If we try we get this message:

```
21-Jan 09:21 bareos-dir JobId 77: Fatal error: Read storage File2 doesn't point to storage definition with paired storage option.
```

To be able to do NDMP operations from the storage that was used to store the copies, we need to define a NDMP storage that is paired with it. The definition is very similar to our `NDMPFile` Storage, as we want to restore the data to the same NDMP Storage system:

```
Storage {
  Name = NDMPFile2
  Address = bareos-sd2.example.com
  Port = 10000
  Protocol = NDMPv4
  Auth Type = Clear
  Username = ndmpadmin
  Password = "test"
  Device = FileStorage2
```

```
  Media Type = File
  PairedStorage = File2
}
```

Configuration 29.14: add paired Storage resource for File2

Also we have to configure NDMP on the Bareos Storage Daemon `bareos-sd2.example.com`. For this follow the instruction from Bareos Storage Daemon: Configure NDMP.
After this, a restore from `bareos-sd2.example.com` directly to the NDMP Primary Storage System is possible.

29.5 NDMP Debugging

To debug the NDMP backups, these settings can be adapted:

- NDMP Snooping Dir Director
- NDMP Log Level Dir Director
- NDMP Log Level Dir Client
- NDMP Snooping Sd Storage
- NDMP Log Level Sd Storage

This will create a lot of debugging output that will help to find the problem during NDMP backups.

29.6 Limitations

29.6.1 NDMP Job limitations when scanning in volumes

For NDMP jobs, all data is stored into a single big file. The file and directory information (File History in NDMP Terms) is stored as hardlinks to this big file.

File information are not available in the Bareos backup stream. As hardlink information is only stored in the Bareos database, but not int the backup stream itself, it is not possible to recover the file history information from the NDMP stream with `bscan`.
As storing the database dump for disaster recovery and storing the bootstrap file offsite is recommended anyway (see Steps to Take Before Disaster Strikes), this should be not a big problem in correctly setup environments.
For the same reason, the information about the number of files of a job (e.g. JobFiles with `list jobs` command) is limited to the number of NDMP backup files in copied jobs.

29.6.2 Single file restore on incremental backups

No single file restore on merged backups. Unfortunately, it is currently (bareos-15.2.2) not possible to restore a chain of Full and Incremental backups at once. The workaround for that problem is to restore the full backup and each incremental each in a single restore operation.

29.6.3 Restore always transfers the full main backup file to the Primary Storage System

On restore, the full main backup file (`@NDMP/...%.`) is always transfered back to the Primary Storage System, together with a description, want files to restore.
The reason for this is that the Primary Storage System handles the backup data by itself. Bareos will not modify the backup data it receives from the Primary Storage System.

29.7 Tested Environments

Bareos NDMP support have been tested against:

Vendor	Product	NDMP Subsystem	Bareos version	Features	Remarks
Isilon	Isilon OneFS v7.1.1.5	Isilon NDMP 2.2	bareos-15.2.2		
NetApp		Release 8.2.3 7-Mode	bareos-15.2.2		
Oracle/Sun	ZFS Storage Appliance, OS 8.3		bareos-15.2.2		

Chapter 30

Catalog Maintenance

30.1 Catalog Database

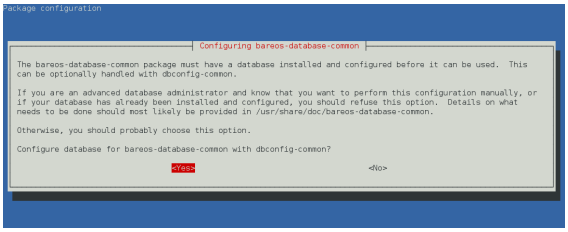
Bareos stores its catalog in a database. Different database backends are supported:

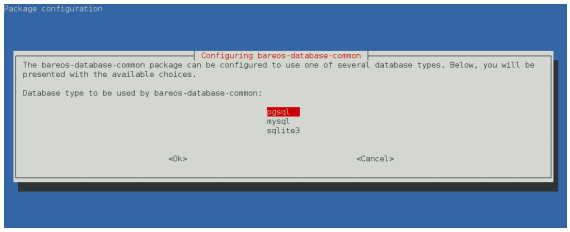
- PostgreSQL
- MySQL/MariaDB
- Sqlite (only for testing)

What database will be used, can be configured in `/etc/bareos/bareos-dir.conf`, see the Catalog Resource.
As MariaDB is a fork of MySQL, we use MySQL as synonym for MariaDB. We test our packages against the prefered MySQL fork that a distribution provides.
The database often runs on the same server as the Bareos Director. However, it is also possible to run it on a different system. This might require some more manual configuration.

30.1.1 dbconfig-common (Debian)

Since Bareos Version >= 14.2.0 the Debian (and Ubuntu) based packages support the `dbconfig-common` mechanism to create and update the Bareos database, according to the user choices.
The first choice is, if `dbconfig-common` should be used at all. If you decide against it, the database must be configured manually, see Manual Configuration.
If you decided to use `dbconfig-common` , the next question will only be asked, if more than one Bareos database backend (`bareos-database-*`) is installed. If this is the case, select the database backend you want to use.





Depending on the selected database backend, more questions about how to access the database will be asked. Often, the default values are suitable.
The `dbconfig-common` configuration (and credentials) is done by the `bareos-database-common` package. Settings are stored in the file `/etc/dbconfig-common/bareos-database-common.conf`.
The Bareos database backend will get automatically configured in `/etc/bareos/bareos-dir.conf`. A later reconfiguration might require manual adapt changes.
Please note! *When using the PostgreSQL backend and updating to Bareos < 14.2.3, it is necessary to manually grant database permissions (`grant_bareos_privileges`), normally by*

```
root@linux:~# su - postgres -c /usr/lib/bareos/scripts/grant_bareos_privileges
```

For details see chapter Manual Configuration.

30.1.2 Manual Configuration

Bareos comes with a number of scripts to prepare and update the databases. All these scripts are located in the Bareos script directory, normally at `/usr/lib/bareos/scripts/`.

Script	Stage	Description
`create_bareos_database`	installation	create Bareos database
`make_bareos_tables`	installation	create Bareos tables
`grant_bareos_privileges`	installation	grant database access privileges
`update_bareos_tables`	update	update the database schema
`drop_bareos_tables`	deinstallation	remove Bareos database tables
`drop_bareos_database`	deinstallation	create Bareos database
`make_catalog_backup.pl`	backup	backup the Bareos database, default on Linux
`make_catalog_backup`	backup	backup the Bareos database for systems without Perl
`delete_catalog_backup`	backup helper	remove the temporary Bareos database backup file

The database preparation scripts have following configuration options:

db_type

- command line parameter $1
- config file `/etc/bareos/bareos-dir.conf`: catalog.MyCatalog.dbdriver
- installed database backends
- fallback: postgresql

db_name

- environment variable `db_name`
- config file `/etc/bareos/bareos-dir.conf`: catalog.MyCatalog.dbname
- default: bareos

db_user

- environment variable `db_user`
- config file `/etc/bareos/bareos-dir.conf`: catalog.MyCatalog.dbuser
- default: bareos

db_password

- environment variable `db_password`
- config file `/etc/bareos/bareos-dir.conf`: catalog.MyCatalog.dbpassword
- default: *none*

Reading the settings from the configuration file `/etc/bareos/bareos-dir.conf`is of course only possible, if the current user have read access to this file. The normal PostgreSQL administrator user (`postgres`) don't have these permissions. So if you plan to use non-default database settings, you might add the user `postgres` to the group `bareos`.
The database preparation scripts need to have password-less administrator access to the database. Depending on the distribution you're using, this require additional configuration. See the following section about howto achieve this for the different database systems.
To view and test the currently configured settings, use following commands:

```
root@linux:~#  /usr/sbin/bareos-dbcheck -B -c /etc/bareos/bareos-dir.conf
catalog=MyCatalog
db_name=bareos
db_driver=mysql
db_user=bareos
db_password=YourPassword
db_address=
db_port=0
db_socket=
db_type=MySQL
working_dir=/var/lib/bareos
```

Commands 30.1: Show current database configuration

```
root@linux:~#  /usr/sbin/bareos-dir -t -f -d 500
[...]
bareos-dir: mysql.c:204-0 Error 1045 (28000): Access denied for user 'bareos'@'localhost' (using password: ↙
    ↪ YES)
bareos-dir: dird.c:1114-0 Could not open Catalog "MyCatalog", database "bareos".
bareos-dir: dird.c:1119-0 mysql.c:200 Unable to connect to MySQL server.
Database=bareos User=bareos
MySQL connect failed either server not running or your authorization is incorrect.
bareos-dir: mysql.c:239-0 closedb ref=0 connected=0 db=0
25-Apr 16:25 bareos-dir ERROR TERMINATION
Please correct configuration file: bareos-dir.conf
```

Commands 30.2: Test the database connection. Example: wrong password

PostgreSQL

On most distributions, PostgreSQL uses ident to allow access to the database system. The database administrator account is the Unix user `postgres`. Normally, this user can access the database without password, as the ident mechanism is used to identify the user.
If this works on your system can be verified by

```
su - postgres
psql
```

Commands 30.3: Access the local PostgreSQL database

If your database is configured to to require a password, this must be definied in the file `~/.pgpass` in the following syntax: `HOST:PORT:DATABASE:USER:PASSWORD`, e.g.

```
localhost:*:bareos:bareos:secret
```

Configuration 30.4: PostgreSQL access credentials

The permission of this file must be 0600 (`chmod 0600 ~/.pgpass`).
Again, verify that you have specified the correct settings by calling the `psql` command. If this connects you to the database, your credentials are good. Exit the PostgreSQL client and run the Bareos database preparation scripts:

```
su - postgres
/usr/lib/bareos/scripts/create_bareos_database
/usr/lib/bareos/scripts/make_bareos_tables
/usr/lib/bareos/scripts/grant_bareos_privileges
```

Commands 30.5: Setup Bareos catalog database

The encoding of the bareos database must be `SQL_ASCII`. The command `create_bareos_database` automatically creates the database with this encoding. This can be verified by the command `psql -l`, which shows information about existing databases:

```
root@linux:~# psql -l
        List of databases
   Name    |  Owner   | Encoding
-----------+----------+-----------
 bareos    | postgres | SQL_ASCII
 postgres  | postgres | UTF8
 template0 | postgres | UTF8
 template1 | postgres | UTF8
(4 rows)
```

Commands 30.6: List existing databases

The owner of the database may vary. The Bareos database maintance scripts don't change the default owner of the Bareos database, so it stays at the PostgreSQL administration user. The `grant_bareos_privileges` script grant the required permissions to the Bareos database user. In contrast, when installing (not updating) using dbconfig, the database owner will be identical with the Bareos database user.
By default, using PostgreSQL ident, a Unix user can access a database of the same name. Therefore the user `bareos` can access the database `bareos`.

```
root@linux:~# su - bareos -s /bin/sh
bareos@linux:~# psql
Welcome to psql 8.3.23, the PostgreSQL interactive terminal.

Type:  \copyright for distribution terms
```

```
       \h for help with SQL commands
       \? for help with psql commands
       \g or terminate with semicolon to execute query
       \q to quit

bareos=> \dt
                List of relations
 Schema |          Name          | Type  |  Owner
--------+------------------------+-------+----------
 public | basefiles              | table | postgres
 public | cdimages               | table | postgres
 public | client                 | table | postgres
 public | counters               | table | postgres
 public | device                 | table | postgres
 public | devicestats            | table | postgres
 public | file                   | table | postgres
 public | filename               | table | postgres
 public | fileset                | table | postgres
 public | job                    | table | postgres
 public | jobhisto               | table | postgres
 public | jobmedia               | table | postgres
 public | jobstats               | table | postgres
 public | location               | table | postgres
 public | locationlog            | table | postgres
 public | log                    | table | postgres
 public | media                  | table | postgres
 public | mediatype              | table | postgres
 public | ndmpjobenvironment     | table | postgres
 public | ndmplevelmap           | table | postgres
 public | path                   | table | postgres
 public | pathhierarchy          | table | postgres
 public | pathvisibility         | table | postgres
 public | pool                   | table | postgres
 public | quota                  | table | postgres
 public | restoreobject          | table | postgres
 public | status                 | table | postgres
 public | storage                | table | postgres
 public | unsavedfiles           | table | postgres
 public | version                | table | postgres
(30 rows)

bareos=> select * from Version;
 versionid
-----------
      2002
(1 row)

bareos=> \du
                                List of roles
   Role name   | Superuser | Create role | Create DB | Connections | Member of
---------------+-----------+-------------+-----------+-------------+-----------
 bareos        | no        | no          | no        | no limit    | {}
 postgres      | yes       | yes         | yes       | no limit    | {}
(2 rows)

bareos=> \dp
                Access privileges for database "bareos"
 Schema |              Name                |   Type   |  Access privileges
--------+----------------------------------+----------+-------------------------------------
 public | basefiles                        | table    | {root=arwdxt/root,bareos=arwdxt/root}
 public | basefiles_baseid_seq             | sequence | {root=rwU/root,bareos=rw/root}
...

bareos=>
```

Commands 30.7: Verify Bareos database on PostgreSQL as Unix user bareos

MySQL

MySQL user authentication is username, password and host-based. The database administrator is the user `root`.

On some distributions access to the MySQL database is allowed password-less as database user `root`, on other distributions, a password is required. On productive systems you normally want to have password

secured access.
The bareos database preparation scripts require password-less access to the database. To guarantee this, create a MySQL credentials file `~/.my.cnf` with the credentials of the database administrator:

```
[client]
host=localhost
user=root
password=YourPasswordForAccessingMysqlAsRoot
```

Configuration 30.8: MySQL credentials file /.my.cnf

Alternatively you can specifiy your database password by adding it to the file `/etc/my.cnf`.
Verify that you have specified the correct settings by calling the `mysql` command. If this connects you to the database, your credentials are good. Exit the MySQL client.
For the Bareos database connection, you should specify a database password. Otherwise the Bareos database user gets the permission to connect without password. This is not recommended. Choose a database password and add it into the Bareos Director configuration file `/etc/bareos/bareos-dir.conf`:

```
...
#
# Generic catalog service
#
Catalog {
  Name = MyCatalog
  # Uncomment the following lines if you want the dbi driver
  # dbdriver = "dbi:postgresql"; dbaddress = 127.0.0.1; dbport =
  dbdriver = "mysql"
  dbname = "bareos"
  dbuser = "bareos"
  dbpassword = "YourSecretPassword"
}
...
```

Configuration 30.9: Bareos catalog configuration

After this, run the Bareos database preparation scripts. For Bareos <= 13.2.2, the database password must be specified as environment variable `db_password`. From Version >= 13.2.3 the database password is read from `/etc/bareos/bareos-dir.conf`, if no environment variable is given.

```
export db_password=YourSecretPassword
/usr/lib/bareos/scripts/create_bareos_database
/usr/lib/bareos/scripts/make_bareos_tables
/usr/lib/bareos/scripts/grant_bareos_privileges
```

Commands 30.10: Setup Bareos catalog database

After this, you can use the `mysql` command to verify that your database setup is okay and works with your the Bareos database user. The result should look similar as this (here Bareos 13.2 is used on SLES11):

```
root@linux:~# mysql --user=bareos --password=YourSecretPassword bareos
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 162
Server version: 5.5.32 SUSE MySQL package

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> show tables;
+--------------------+
| Tables_in_bareos   |
+--------------------+
| BaseFiles          |
| CDImages           |
| Client             |
| Counters           |
| Device             |
| DeviceStats        |
| File               |
| FileSet            |
| Filename           |
```

```
| Job                |
| JobHisto           |
| JobMedia           |
| JobStats           |
| Location           |
| LocationLog        |
| Log                |
| Media              |
| MediaType          |
| NDMPJobEnvironment |
| NDMPLevelMap       |
| Path               |
| PathHierarchy      |
| PathVisibility     |
| Pool               |
| Quota              |
| RestoreObject      |
| Status             |
| Storage            |
| UnsavedFiles       |
| Version            |
+--------------------+
30 rows in set (0.00 sec)

mysql> select * from Version;
+-----------+
| VersionId |
+-----------+
|      2002 |
+-----------+
1 row in set (0.00 sec)

mysql> exit
Bye
```

Commands 30.11: Verify Bareos database on MySQL

Modify database credentials If you want to change the Bareos database credentials, do the following:

- stop the Bareos director
- modify the configuration file `/etc/bareos/bareos-dir.conf`
- rerun the grant script `grant_bareos_privileges` (or modify database user directly)
- start the Bareos director

Modify the configuration file `/etc/bareos/bareos-dir.conf`:

```
...
#
# Generic catalog service
#
Catalog {
  Name = MyCatalog
  # Uncomment the following lines if you want the dbi driver
  # dbdriver = "dbi:postgresql"; dbaddress = 127.0.0.1; dbport =
  dbdriver = "mysql"
  dbname = "bareos"
  dbuser = "bareos"
  dbpassword = "MyNewSecretPassword"
}
...
```

Configuration 30.12: Bareos catalog configuration: set new password

Rerun the Bareos grant script `grant_bareos_privileges` ...

```
export db_password=MyNewSecretPassword
/usr/lib/bareos/scripts/grant_bareos_privileges
```

Commands 30.13: Modify database privileges

... or modify the database users directly:

```
root@linux:~# mysql
mysql> SELECT user,host,password FROM mysql.user WHERE user='bareos';
+--------+-----------+-------------------------------------------+
| user   | host      | password                                  |
+--------+-----------+-------------------------------------------+
| bareos | 127.0.0.1 | *CD8C42695AC221807E2BA599FC392C650155C16C |
| bareos | localhost | *CD8C42695AC221807E2BA599FC392C650155C16C |
| bareos | ::1       | *CD8C42695AC221807E2BA599FC392C650155C16C |
+--------+-----------+-------------------------------------------+
3 rows in set (0.00 sec)

mysql> UPDATE mysql.user SET Password=PASSWORD('MyNewSecretPassword') where User='bareos';
Query OK, 3 rows affected (0.00 sec)
Rows matched: 3  Changed: 3  Warnings: 0

mysql> FLUSH PRIVILEGES;
Query OK, 0 rows affected (0.00 sec)

mysql> SELECT user,host,password FROM mysql.user WHERE user='bareos';
+--------+-----------+-------------------------------------------+
| user   | host      | password                                  |
+--------+-----------+-------------------------------------------+
| bareos | 127.0.0.1 | *2119D34B0C0F7452E952EE3A73A7CAA30C1B1852 |
| bareos | localhost | *2119D34B0C0F7452E952EE3A73A7CAA30C1B1852 |
| bareos | ::1       | *2119D34B0C0F7452E952EE3A73A7CAA30C1B1852 |
+--------+-----------+-------------------------------------------+
3 rows in set (0.00 sec)

mysql>
```

Commands 30.14: Show Bareos database users

Sqlite

There are different versions of Sqlite available. When we use the term Sqlite, we will always refer to Sqlite3. Sqlite is a file based database. Access via network connection is not supported. Because its setup is easy, it is a good database for testing. However please don't use it in a production environment.
Sqlite stores a database in a single file. Bareos creates this file at `/var/lib/bareos/bareos.db`.
Sqlite does not offer access permissions. The only permissions that do apply are the Unix file permissions. The database is accessable by following command:

```
root@linux:~# sqlite3 /var/lib/bareos/bareos.db
SQLite version 3.7.6.3
Enter ".help" for instructions
Enter SQL statements terminated with a ";"
sqlite> .tables
BaseFiles           Filename            Media               Pool
CDImages            Job                 MediaType           Quota
Client              JobHisto            NDMPJobEnvironment  RestoreObject
Counters            JobMedia            NDMPLevelMap        Status
Device              JobStats            NextId              Storage
DeviceStats         Location            Path                UnsavedFiles
File                LocationLog         PathHierarchy       Version
FileSet             Log                 PathVisibility
sqlite> select * from Version;
2002
sqlite>
```

Commands 30.15: Verify Bareos database on Sqlite3

30.2 Retention Periods

Without proper setup and maintenance, your Catalog may continue to grow indefinitely as you run Jobs and backup Files, and/or it may become very inefficient and slow. How fast the size of your Catalog grows depends on the number of Jobs you run and how many files they backup. By deleting records within the database, you can make space available for the new records that will be added during the next Job. By constantly deleting old expired records (dates older than the Retention period), your database size will remain constant.

Setting Retention Periods

Bareos uses three Retention periods: the **File Retention** period, the **Job Retention** period, and the **Volume Retention** period. Of these three, the File Retention period is by far the most important in determining how large your database will become.
The **File Retention** and the **Job Retention** are specified in each Client resource as is shown below. The **Volume Retention** period is specified in the Pool resource, and the details are given in the next chapter of this manual.

File Retention = <time-period-specification> The File Retention record defines the length of time that Bareos will keep File records in the Catalog database. When this time period expires, and if **AutoPrune** is set to **yes**, Bareos will prune (remove) File records that are older than the specified File Retention period. The pruning will occur at the end of a backup Job for the given Client. Note that the Client database record contains a copy of the File and Job retention periods, but Bareos uses the current values found in the Director's Client resource to do the pruning.

Since File records in the database account for probably 80 percent of the size of the database, you should carefully determine exactly what File Retention period you need. Once the File records have been removed from the database, you will no longer be able to restore individual files in a Job. However, as long as the Job record still exists, you will be able to restore all files in the job.

Retention periods are specified in seconds, but as a convenience, there are a number of modifiers that permit easy specification in terms of minutes, hours, days, weeks, months, quarters, or years on the record. See the Configuration chapter of this manual for additional details of modifier specification.

The default File retention period is 60 days.

Job Retention = <time-period-specification> The Job Retention record defines the length of time that **Bareos** will keep Job records in the Catalog database. When this time period expires, and if **AutoPrune** is set to **yes** Bareos will prune (remove) Job records that are older than the specified Job Retention period. Note, if a Job record is selected for pruning, all associated File and JobMedia records will also be pruned regardless of the File Retention period set. As a consequence, you normally will set the File retention period to be less than the Job retention period.

As mentioned above, once the File records are removed from the database, you will no longer be able to restore individual files from the Job. However, as long as the Job record remains in the database, you will be able to restore all the files backuped for the Job. As a consequence, it is generally a good idea to retain the Job records much longer than the File records.

The retention period is specified in seconds, but as a convenience, there are a number of modifiers that permit easy specification in terms of minutes, hours, days, weeks, months, quarters, or years. See the Configuration chapter of this manual for additional details of modifier specification.

The default Job Retention period is 180 days.

AutoPrune = <yes/no> If AutoPrune is set to **yes** (default), Bareos will automatically apply the File retention period and the Job retention period for the Client at the end of the Job. If you turn this off by setting it to **no**, your Catalog will grow each time you run a Job.

Job statistics

Bareos catalog contains lot of information about your IT infrastructure, how many files, their size, the number of video or music files etc. Using Bareos catalog during the day to get them permit to save resources on your servers.
In this chapter, you will find tips and information to measure Bareos efficiency and report statistics.
If you want to have statistics on your backups to provide some Service Level Agreement indicators, you could use a few SQL queries on the Job table to report how many:

- jobs have run
- jobs have been successful
- files have been backed up
- ...

However, these statistics are accurate only if your job retention is greater than your statistics period. Ie, if jobs are purged from the catalog, you won't be able to use them.
Now, you can use the **update stats [days=num]** console command to fill the JobHistory table with new Job records. If you want to be sure to take in account only **good jobs**, ie if one of your important job has failed but you have fixed the problem and restarted it on time, you probably want to delete the first *bad* job record and keep only the successful one. For that simply let your staff do the job, and update JobHistory table after two or three days depending on your organization using the **[days=num]** option.
These statistics records aren't used for restoring, but mainly for capacity planning, billings, etc.
The **Statistics Retention = <time>** director directive defines the length of time that Bareos will keep statistics job records in the Catalog database after the Job End time. This information is stored in the `JobHistory` table. When this time period expires, and if user runs `prune stats` command, Bareos will prune (remove) Job records that are older than the specified period.
You can use the following Job resource in your nightly **BackupCatalog** job to maintain statistics.

```
Job {
  Name = BackupCatalog
  ...
  RunScript {
    Console = "update stats days=3"
    Console = "prune stats yes"
    RunsWhen = After
    RunsOnClient = no
  }
}
```

30.3 PostgreSQL

30.3.1 Compacting Your PostgreSQL Database

Over time, as noted above, your database will tend to grow until Bareos starts deleting old expired records based on retention periods. After that starts, it is expected that the database size remains constant, provided that the amount of clients and files being backed up is constant.
Note that PostgreSQL uses multiversion concurrency control (MVCC), so that an UPDATE or DELETE of a row does not immediately remove the old version of the row. Space occupied by outdated or deleted row versions is only reclaimed for reuse by new rows when running **VACUUM**. Such outdated or deleted row versions are also referred to as *dead tuples*.
Since PostgreSQL Version 8.3, autovacuum is enabled by default, so that setting up a cron job to run VACUUM is not necesary in most of the cases. Note that there are two variants of VACUUM: standard VACUUM and VACUUM FULL. Standard VACUUM only marks old row versions for reuse, it does not free any allocated disk space to the operating system. Only VACUUM FULL can free up disk space, but it requires exclusive table locks so that it can not be used in parallel with production database operations and temporarily requires up to as much additional disk space that the table being processed occupies.
All database programs have some means of writing the database out in ASCII format and then reloading it. Doing so will re-create the database from scratch producing a compacted result, so below, we show you how you can do this for PostgreSQL.
For a PostgreSQL database, you could write the Bareos database as an ASCII file (`bareos.sql`) then reload it by doing the following:

```
pg_dump -c bareos > bareos.sql
cat bareos.sql | psql bareos
rm -f bareos.sql
```

Depending on the size of your database, this will take more or less time and a fair amount of disk space. For example, you can `cd` to the location of the Bareos database (typically `/var/lib/pgsql/data` or possible `/usr/local/pgsql/data`) and check the size.
Except from special cases PostgreSQL does not need to be dumped/restored to keep the database efficient. A normal process of vacuuming will prevent the database from getting too large. If you want to fine-tweak the database storage, commands such as VACUUM, VACUUM FULL, REINDEX, and CLUSTER exist specifically to keep you from having to do a dump/restore.
More details on this subject can be found in the PostgreSQL documentation. The page http://www.postgresql.org/docs/ contains links to the documentation for all PostgreSQL versions. The section *Rou-*

tine Vacuuming explains how VACUUM works and why it is required, see http://www.postgresql.org/docs/current/static/routine-vacuuming.html for the current PostgreSQL version.

What To Do When The Database Keeps Growing

Especially when a high number of files are beeing backed up or when working with high retention periods, it is probable that autovacuuming will not work. When starting to use Bareos with an empty Database, it is normal that the file table and other tables grow, but the growth rate should drop as soon as jobs are deleted by retention or pruning. The file table is usually the largest table in Bareos.
The reason for autovacuuming not beeing triggered is then probably the default setting of `autovacuum_vacuum_scale_factor = 0.2`, the current value can be shown with the following query or looked up in `postgresql.conf`:

```
bareos=# show autovacuum_vacuum_scale_factor;
 autovacuum_vacuum_scale_factor
 --------------------------------
  0.2
  (1 row)
```

Commands 30.16: SQL statement to show the autovacuum_vacuum_scale_factor parameter

In essence, this means that a VACUUM is only triggered when 20% of table size are obsolete. Consequently, the larger the table is, the less frequently VACUUM will be triggered by autovacuum. This make sense because vacuuming has a performance impact. While it is possible to override the autovacuum parameters on a table-by-table basis, it can then still be triggered at any time.
To learn more details about autovacuum see http://www.postgresql.org/docs/current/static/routine-vacuuming.html#AUTOVACUUM
The following example shows how to configure running VACUUM on the file table by using an admin-job in Bareos. The job will be scheduled to run at a time that should not run in parallel with normal backup jobs, here by scheduling it to run after the BackupCatalog job.
First step is to check the amount of dead tuples and if autovacuum triggers VACUUM:

```
bareos=# SELECT relname, n_dead_tup, last_vacuum, last_autovacuum, last_analyze, last_autoanalyze
FROM pg_stat_user_tables WHERE n_dead_tup > 0 ORDER BY n_dead_tup DESC;
-[ RECORD 1 ]----+------------------------------
relname          | file
n_dead_tup       | 2955116
last_vacuum      |
last_autovacuum  |
last_analyze     |
last_autoanalyze |
-[ RECORD 2 ]----+------------------------------
relname          | log
n_dead_tup       | 111298
last_vacuum      |
last_autovacuum  |
last_analyze     |
last_autoanalyze |
-[ RECORD 3 ]----+------------------------------
relname          | job
n_dead_tup       | 1785
last_vacuum      |
last_autovacuum  | 2015-01-08 01:13:20.70894+01
last_analyze     |
last_autoanalyze | 2014-12-27 18:00:58.639319+01
...
```

Commands 30.17: Check dead tuples and vacuuming on PostgreSQL

In the above example, the file table has a high number of dead tuples and it has not been vacuumed. Same for the log table, but the dead tuple count is not very high. On the job table autovacuum has been triggered. Note that the statistics views in PostgreSQL are not persistent, their values are reset on restart of the PostgreSQL service.
To setup a scheduled admin job for vacuuming the file table, the following must be done:

1. Create a file with the SQL statements for example
   `/usr/local/lib/bareos/scripts/postgresql_file_table_maintenance.sql`
   with the following content:

```
\t \x
SELECT relname, n_dead_tup, last_vacuum, last_autovacuum, last_analyze, last_autoanalyze
FROM pg_stat_user_tables WHERE relname='file';
VACUUM VERBOSE ANALYZE file;
SELECT relname, n_dead_tup, last_vacuum, last_autovacuum, last_analyze, last_autoanalyze
FROM pg_stat_user_tables WHERE relname='file';
\t \x
SELECT table_name,
  pg_size_pretty(pg_total_relation_size(table_name)) AS total_sz,
  pg_size_pretty(pg_total_relation_size(table_name) - pg_relation_size(table_name)) AS idx_sz
  FROM ( SELECT ('"' || relname || '"' ) AS table_name
    FROM pg_stat_user_tables WHERE relname != 'batch' ) AS all_tables
  ORDER BY pg_total_relation_size(table_name) DESC LIMIT 5;
```

Commands 30.18: SQL Script for vacuuming the file table on PostgreSQL

The SELECT statements are for informational purposes only, the final statement shows the total and index disk usage of the 5 largest tables.

2. Create a shell script that runs the SQL statements, for example `/usr/local/lib/bareos/scripts/postgresql_file_table_maintenance.sh` with the following content:

```
#!/bin/sh
psql bareos < /usr/local/lib/bareos/scripts/postgresql_file_table_maintenance.sql
```

Commands 30.19: SQL Script for vacuuming the file table on PostgreSQL

3. As in PostgreSQL only the database owner or a database superuser is allowed to run VACUUM, the script will be run as the `postgres` user. To permit the `bareos` user to run the script via `sudo`, write the following sudo rule to a file by executing `visudo -f /etc/sudoers.d/bareos_postgres_vacuum`:

```
bareos ALL = (postgres) NOPASSWD: /usr/local/lib/bareos/scripts/postgresql_file_table_maintenance.sh
```

Commands 30.20: sudo rule for allowing bareos to run a script as postgres

and make sure that `/etc/sudoers` includes it, usually by the line

```
#includedir /etc/sudoers.d
```

4. Create the following admin job in the director configuration

```
# PostgreSQL file table maintenance job
Job {
  Name = FileTableMaintJob
  JobDefs = DefaultJob
  Schedule = "WeeklyCycleAfterBackup"
  Type = Admin
  Priority = 20

  RunScript {
    RunsWhen = Before
    RunsOnClient = no
    Fail Job On Error = yes
    Command = "sudo -u postgres /usr/local/lib/bareos/scripts/postgresql_file_table_maintenance.sh"
  }
}
```

Commands 30.21: SQL Script for vacuuming the file table on PostgreSQL

In this example the job will be run by the schedule WeeklyCycleAfterBackup, the `Priority` should be set to a higher value than `Priority` in the BackupCatalog job.

30.3.2 Repairing Your PostgreSQL Database

The same considerations apply as for Repairing Your MySQL Database. Consult the PostgreSQL documents for how to repair the database.
For Bareos specific problems, consider using bareos-dbcheck program .

30.4 MySQL/MariaDB

30.4.1 Compacting Your MySQL Database

Over time, as noted above, your database will tend to grow. Even though Bareos regularly prunes files, **MySQL** does not automatically reuse the space, and instead continues growing.
It is assumed that you are using the **InnoDB** database engine (which is the default since MySQL Version 5.5).
It is recommended that you use the **OPTIMIZE TABLE** and **ANALYZE TABLE** statements regularly. This is to make sure that all indices are up to date and to recycle space inside the database files.
You can do this via the **mysqlcheck** command:

```
mysqlcheck -a -o -A
```

Please note that the database files are never shrunk by **MySQL**. If you really need to shrink the database files, you need to recreate the database. This only works if you use per-table tablespaces by setting the **innodb_file_per_table** configuration option. See http://dev.mysql.com/doc/refman/5.5/en/innodb-multiple-tablespaces.html for details.

```
mysqldump -f --opt bareos > bareos.sql
mysql bareos < bareos.sql
rm -f bareos.sql
```

Depending on the size of your database, this will take more or less time and a fair amount of disk space.

30.4.2 Repairing Your MySQL Database

If you find that you are getting errors writing to your MySQL database, or Bareos hangs each time it tries to access the database, you should consider running MySQL's database check and repair routines.
This can be done by running the **mysqlcheck** command:

```
mysqlcheck --all-databases
```

If the errors you are getting are simply SQL warnings, then you might try running `bareos-dbcheck` before (or possibly after) using the MySQL database repair program. It can clean up many of the orphaned record problems, and certain other inconsistencies in the Bareos database.
A typical cause of MySQL database problems is if your partition fills. In such a case, you will need to create additional space on the partition.

30.4.3 MySQL Table is Full

If you are running into the error **The table 'File' is full ...**, it is probably because on version 4.x MySQL, the table is limited by default to a maximum size of 4 GB and you have probably run into the limit. The solution can be found at: http://dev.mysql.com/doc/refman/5.0/en/full-table.html
You can display the maximum length of your table with:

```
mysql bareos
SHOW TABLE STATUS FROM bareos like "File";
```

If the column labeled "Max_data_length" is around 4Gb, this is likely to be the source of your problem, and you can modify it with:

```
mysql bareos
ALTER TABLE File MAX_ROWS=281474976710656;
```

30.4.4 MySQL Server Has Gone Away

If you are having problems with the MySQL server disconnecting or with messages saying that your MySQL server has gone away, then please read the MySQL documentation, which can be found at:
http://dev.mysql.com/doc/refman/5.0/en/gone-away.html

30.4.5 MySQL Temporary Tables

When doing backups with large numbers of files, MySQL creates some temporary tables. When these tables are small they can be held in system memory, but as they approach some size, they spool off to disk. The default location for these temp tables is /tmp. Once that space fills up, Bareos daemons such as the Storage daemon doing spooling can get strange errors. E.g.

```
Fatal error: spool.c:402 Spool data read error.
Fatal error: backup.c:892 Network send error to SD. ERR=Connection reset by
peer
```

What you need to do is setup MySQL to use a different (larger) temp directory, which can be set in the /etc/my.cnf with these variables set:

```
tmpdir=/path/to/larger/tmpdir
bdb_tmpdir=/path/to/larger/tmpdir
```

30.5 Performance Issues Indexes

TODO: This chapter needs verification/updating.
One of the most important considerations for improving performance on the Bareos database is to ensure that it has all the appropriate indexes. Several users have reported finding that their database did not have all the indexes in the default configuration. In addition, you may find that because of your own usage patterns, you need additional indexes.
The most important indexes for performance are the two indexes on the **File** table. The first index is on **FileId** and is automatically made because it is the unique key used to access the table. The other one is the (JobId, PathId, Filename) index. If these Indexes are not present, your performance may suffer a lot.

30.5.1 PostgreSQL Indexes

On PostgreSQL, you can check to see if you have the proper indexes using the following commands:

```
psql bareos
select * from pg_indexes where tablename='file';
```

If you do not see output that indicates that all three indexes are created, you can create the two additional indexes using:

```
psql bareos
CREATE INDEX file_jobid_idx on file (jobid);
CREATE INDEX file_jpf_idx on file (jobid, pathid, filenameid);
```

Make sure that you doesn't have an index on File (filenameid, pathid).

30.5.2 MySQL Indexes

On MySQL, you can check if you have the proper indexes by:

```
mysql bareos
show index from File;
```

If the indexes are not present, especially the JobId index, you can create them with the following commands:

```
mysql bareos
CREATE INDEX file_jobid_idx on File (JobId);
CREATE INDEX file_jpf_idx on File (JobId, FilenameId, PathId);
```

Though normally not a problem, you should ensure that the indexes defined for Filename and Path are both set to 255 characters. Some users reported performance problems when their indexes were set to 50 characters. To check, do:

```
mysql bareos
show index from Filename;
show index from Path;
```

and what is important is that for Filename, you have an index with Key_name "Name" and Sub_part "255". For Path, you should have a Key_name "Path" and Sub_part "255". If one or the other does not exist or the Sub_part is less that 255, you can drop and recreate the appropriate index with:

```
mysql bareos
DROP INDEX Path on Path;
CREATE INDEX Path on Path (Path(255));

DROP INDEX Name on Filename;
CREATE INDEX Name on Filename (Name(255));
```

30.5.3 SQLite Indexes

On SQLite, you can check if you have the proper indexes by:

```
sqlite <path>/bareos.db
select * from sqlite_master where type='index' and tbl_name='File';
```

If the indexes are not present, especially the JobId index, you can create them with the following commands:

```
sqlite <path>/bareos.db
CREATE INDEX file_jobid_idx on File (JobId);
CREATE INDEX file_jfp_idx on File (JobId, PathId, FilenameId);
```

30.6 Backing Up Your Bareos Database

If ever the machine on which your Bareos database crashes, and you need to restore from backup tapes, one of your first priorities will probably be to recover the database. Although Bareos will happily backup your catalog database if it is specified in the FileSet, this is not a very good way to do it, because the database will be saved while Bareos is modifying it. Thus the database may be in an instable state. Worse yet, you will backup the database before all the Bareos updates have been applied.
To resolve these problems, you need to backup the database after all the backup jobs have been run. In addition, you will want to make a copy while Bareos is not modifying it. To do so, you can use two scripts provided in the release **make_catalog_backup** and **delete_catalog_backup**. These files will be automatically generated along with all the other Bareos scripts. The first script will make an ASCII copy of your Bareos database into **bareos.sql** in the working directory you specified in your configuration, and the second will delete the **bareos.sql** file.
The basic sequence of events to make this work correctly is as follows:

- Run all your nightly backups
- After running your nightly backups, run a Catalog backup Job
- The Catalog backup job must be scheduled after your last nightly backup
- You use **RunBeforeJob** to create the ASCII backup file and **RunAfterJob** to clean up

Assuming that you start all your nightly backup jobs at 1:05 am (and that they run one after another), you can do the catalog backup with the following additional Director configuration statements:

```
# Backup the catalog database (after the nightly save)
Job {
  Name = "BackupCatalog"
  Type = Backup
  Client=rufus-fd
  FileSet="Catalog"
  Schedule = "WeeklyCycleAfterBackup"
  Storage = DLTDrive
  Messages = Standard
  Pool = Default
  # This creates an ASCII copy of the catalog
  # Arguments to make_catalog_backup.pl are:
  #  make_catalog_backup.pl <catalog-name>
  RunBeforeJob = "/usr/lib/bareos/scripts/make_catalog_backup.pl MyCatalog"
  # This deletes the copy of the catalog
  RunAfterJob  = "/usr/lib/bareos/scripts/delete_catalog_backup"
  # This sends the bootstrap via mail for disaster recovery.
  # Should be sent to another system, please change recipient accordingly
  Write Bootstrap = "|/usr/sbin/bsmtp -h localhost -f \"\(Bareos\) \" -s \"Bootstrap for Job %j\"  ↙
    ↪ root@localhost"
}

# This schedule does the catalog. It starts after the WeeklyCycle
```

```
Schedule {
  Name = "WeeklyCycleAfterBackup
  Run = Level=Full sun-sat at 1:10
}
# This is the backup of the catalog
FileSet {
  Name = "Catalog"
  Include {
    Options {
      signature=MD5
    }
    File = "/var/lib/bareos/bareos.sql" # database dump
    File = "/etc/bareos"                # configuration
  }
}
```

Configuration 30.22: Bareos Catalog Backup Job

It is preferable to write/send the bootstrap file to another computer. It will allow you to quickly recover the database backup should that be necessary. If you do not have a bootstrap file, it is still possible to recover your database backup, but it will be more work and take longer.

30.7 Database Size

As mentioned above, if you do not do automatic pruning, your Catalog will grow each time you run a Job. Normally, you should decide how long you want File records to be maintained in the Catalog and set the **File Retention** period to that time. Then you can either wait and see how big your Catalog gets or make a calculation assuming approximately 154 bytes for each File saved and knowing the number of Files that are saved during each backup and the number of Clients you backup.
For example, suppose you do a backup of two systems, each with 100,000 files. Suppose further that you do a Full backup weekly and an Incremental every day, and that the Incremental backup typically saves 4,000 files. The size of your database after a month can roughly be calculated as:

```
   Size = 154 * No. Systems * (100,000 * 4 + 10,000 * 26)
```

where we have assumed four weeks in a month and 26 incremental backups per month. This would give the following:

```
   Size = 154 * 2 * (100,000 * 4 + 10,000 * 26)
or
   Size = 308 * (400,000 + 260,000)
or
   Size = 203,280,000 bytes
```

So for the above two systems, we should expect to have a database size of approximately 200 Megabytes. Of course, this will vary according to how many files are actually backed up.
Below are some statistics for a MySQL database containing Job records for five Clients beginning September 2001 through May 2002 (8.5 months) and File records for the last 80 days. (Older File records have been pruned). For these systems, only the user files and system files that change are backed up. The core part of the system is assumed to be easily reloaded from the Red Hat rpms.
In the list below, the files (corresponding to Bareos Tables) with the extension .MYD contain the data records whereas files with the extension .MYI contain indexes.
You will note that the File records (containing the file attributes) make up the large bulk of the number of records as well as the space used (459 Mega Bytes including the indexes). As a consequence, the most important Retention period will be the **File Retention** period. A quick calculation shows that for each File that is saved, the database grows by approximately 150 bytes.

```
      Size in
       Bytes   Records    File
 ============  =========  ===========
         168          5  Client.MYD
       3,072             Client.MYI
 344,394,684  3,080,191  File.MYD
 115,280,896             File.MYI
   2,590,316    106,902  Filename.MYD
   3,026,944             Filename.MYI
         184          4  FileSet.MYD
       2,048             FileSet.MYI
```

```
      49,062      1,326  JobMedia.MYD
      30,720             JobMedia.MYI
     141,752      1,378  Job.MYD
      13,312             Job.MYI
       1,004         11  Media.MYD
       3,072             Media.MYI
   1,299,512     22,233  Path.MYD
     581,632             Path.MYI
          36          1  Pool.MYD
       3,072             Pool.MYI
           5          1  Version.MYD
       1,024             Version.MYI
```

This database has a total size of approximately 450 Megabytes.

Chapter 31

Bareos Security Issues

- Security means being able to restore your files, so read the Critical Items Chapter of this manual.
- The clients (**bareos-fd**) must run as root to be able to access all the system files.
- It is not necessary to run the Director as root.
- It is not necessary to run the Storage daemon as root, but you must ensure that it can open the tape drives, which are often restricted to root access by default. In addition, if you do not run the Storage daemon as root, it will not be able to automatically set your tape drive parameters on most OSes since these functions, unfortunately require root access.
- You should restrict access to the Bareos configuration files, so that the passwords are not world-readable. The **Bareos** daemons are password protected using CRAM-MD5 (i.e. the password is not sent across the network). This will ensure that not everyone can access the daemons. It is a reasonably good protection, but can be cracked by experts.
- If you are using the recommended ports 9101, 9102, and 9103, you will probably want to protect these ports from external access using a firewall and/or using tcp wrappers (**etc/hosts.allow**).
- By default, all data that is sent across the network is unencrypted. However, Bareos does support TLS (transport layer security) and can encrypt transmitted data. Please read the TLS (SSL) Communications Encryption section of this manual.
- You should ensure that the Bareos working directories are readable and writable only by the Bareos daemons.
- The default Bareos `grant_bareos_privileges` script grants all permissions to use the MySQL (and PostgreSQL) database without a password. If you want security, please tighten this up!
- Don't forget that Bareos is a network program, so anyone anywhere on the network with the console program and the Director's password can access Bareos and the backed up data.
- You can restrict what IP addresses Bareos will bind to by using the appropriate **DirAddress**, **FDAddress**, or **SDAddress** records in the respective daemon configuration files.

31.1 Configuring and Testing TCP Wrappers

The TCP wrapper functionality is available on different plattforms. Be default, it is activated on Bareos for Linux. With this enabled, you may control who may access your daemons. This control is done by modifying the file: **/etc/hosts.allow**. The program name that **Bareos** uses when applying these access restrictions is the name you specify in the daemon configuration file (see below for examples). You must not use the **twist** option in your **/etc/hosts.allow** or it will terminate the Bareos daemon when a connection is refused.

31.2 Secure Erase Command

From https://en.wikipedia.org/w/index.php?title=Data_erasure&oldid=675388437:

> Strict industry standards and government regulations are in place that force organizations to mitigate the risk of unauthorized exposure of confidential corporate and government data. Regulations in the United States include HIPAA (Health Insurance Portability and Accountability Act); FACTA (The Fair and Accurate Credit Transactions Act of 2003); GLB (Gramm-Leach Bliley); Sarbanes-Oxley Act (SOx); and Payment Card Industry Data Security Standards (PCI DSS) and the Data Protection Act in the United Kingdom. Failure to comply can result in fines and damage to company reputation, as well as civil and criminal liability.

Bareos supports the secure erase of files that usually are simply deleted. Bareos uses an external command to do the secure erase itself.
This makes it easy to choose a tool that meets the secure erase requirements.
To configure this functionality, a new configuration directive with the name **Secure Erase Command** has been introduced.
This directive is optional and can be configured in:

- Secure Erase Command Dir Director
- Secure Erase Command Sd Storage
- Secure Erase Command Fd Client

This directive configures the secure erase command globally for the daemon it was configured in.
If set, the secure erase command is used to delete files instead of the normal delete routine.
If files are securely erased during a job, the secure delete command output will be shown in the job log.

```
08-Sep 12:58 win-fd JobId 10: secure_erase: executing C:/cygwin64/bin/shred.exe "C:/temp/bareos-restores/C/ ↙
    ↪ Program Files/Bareos/Plugins/bareos_fd_consts.py"
08-Sep 12:58 win-fd JobId 10: secure_erase: executing C:/cygwin64/bin/shred.exe "C:/temp/bareos-restores/C/ ↙
    ↪ Program Files/Bareos/Plugins/bareos_sd_consts.py"
08-Sep 12:58 win-fd JobId 10: secure_erase: executing C:/cygwin64/bin/shred.exe "C:/temp/bareos-restores/C/ ↙
    ↪ Program Files/Bareos/Plugins/bpipe-fd.dll"
```

Logging 31.1: bareos.log

The current status of the secure erase command is also shown in the output of status director, status client and status storage.
If the secure erase command is configured, the current value is printed.
Example:

```
* status dir
backup1.example.com-dir Version: 15.3.0 (24 August 2015) x86_64-suse-linux-gnu ↙
    ↪ suse openSUSE 13.2 (Harlequin) (x86_64)
Daemon started 08-Sep-15 12:50. Jobs: run=0, running=0 mode=0 db=sqlite3
 Heap: heap=290,816 smbytes=89,166 max_bytes=89,166 bufs=334 max_bufs=335
 secure erase command='/usr/bin/wipe -V'
```

Example for Secure Erase Command Settings:

Linux: Secure Erase Command = "/usr/bin/wipe -V"

Windows: Secure Erase Command = "C:/cygwin64/bin/shred.exe"

Our tests with the `sdelete` command was not successful, as `sdelete` seems to stay active in the background.

Part IV

Appendix

Appendix A

System Requirements

- The minimum versions for each of the databases supported by Bareos are:
  - PostgreSQL 8.4 (since Bareos 13.2.3)
  - MySQL 4.1 or compatible fork (e.g. MariaDB)
  - SQLite 3
- Windows release is cross-compiled on Linux
- Bareos requires a good implementation of pthreads to work. This is not the case on some of the BSD systems.
- The source code has been written with portability in mind and is mostly POSIX compatible. Thus porting to any POSIX compatible operating system should be relatively easy.
- Jansson library: Bareos Version >= 15.2.0 offers a JSON API mode, see Bareos Developer Guide (api-mode-2-json) . On some platform, the Jansson library is directory available. On others it can easly be added. For some older platforms, we compile Bareos without JSON API mode.

Appendix B

Operating Systems

The Bareos project provides and supports packages that have been released at http://download.bareos.org/bareos/release/

However, the following tabular gives an overview, what components are expected on which platforms to run:

Operating Systems	Version	Client Daemon	Director Daemon	Storage Daemon
Linux				
Arch Linux		X	X	X
CentOS	current	v12.4	v12.4	v12.4
Debian	current	v12.4	v12.4	v12.4
Fedora	current	v12.4	v12.4	v12.4
Gentoo		X	X	X
openSUSE	current	v12.4	v12.4	v12.4
RHEL	current	v12.4	v12.4	v12.4
SLES	current	v12.4	v12.4	v12.4
Ubuntu	current	v12.4	v12.4	v12.4
Univention Corporate Linux	App Center	v12.4	v12.4	v12.4
MS Windows				
MS Windows 32bit	10/8/7 2008/Vista 2003/XP	v12.4 v12.4–v14.2	v15.2	v15.2
MS Windows 64bit	10/8/2012/7 2008/Vista	v12.4	v15.2	v15.2
Mac OS				
Mac OS X/Darwin		v14.2		
BSD				
FreeBSD	$\geq$ 5.0	X	X	X
OpenBSD		X		
NetBSD		X		
Unix				
AIX	$\geq$ 4.3	com-13.2	$\star$	$\star$
HP-UX		com-13.2		
Irix		$\star$		
Solaris	$\geq$ 8	com-12.4	com-12.4	com-12.4
True64		$\star$		

vVV.V	starting with Bareos version VV.V, this platform is official supported by the Bareos.org project
com-VV.V	starting with Bareos version VV.V, this platform is supported. However, pre-build packages are only available from Bareos.com
nightly	provided by Bareos nightly build. Bug reports are welcome, however it is not official supported
X	known to work
$\star$	has been reported to work by the community

B.1

B.1.1 Packages for the different Linux platforms

The following tables show what packages are included for the different platforms with Bareos on http://download.bareos.org/bareos/release/15.2/. Bareos tries to provide all packages for all platforms.
On extra packages, it depends if the distribution contains the required dependencies.
Packages names not containing the word **bareos** are required packages where we decided to include them ourselves.

	CentOS			Fedora		RHEL		
	5	6	7	21	22	5	6	7
bareos	X	X	X	X	X	X	X	X
bareos-bat		X	X	X	X		X	X
bareos-bconsole	X	X	X	X	X	X	X	X
bareos-client	X	X	X	X	X	X	X	X
bareos-common	X	X	X	X	X	X	X	X
bareos-database-common	X	X	X	X	X	X	X	X
bareos-database-mysql	X	X	X	X	X	X	X	X
bareos-database-postgresql	X	X	X	X	X	X	X	X
bareos-database-sqlite3	X	X	X	X	X	X	X	X
bareos-database-tools	X	X	X	X	X	X	X	X
bareos-devel	X	X	X	X	X	X	X	X
bareos-director	X	X	X	X	X	X	X	X
bareos-director-python-plugin		X	X	X	X		X	X
bareos-filedaemon	X	X	X	X	X	X	X	X
bareos-filedaemon-ceph-plugin								X
bareos-filedaemon-glusterfs-plugin			X	X	X			X
bareos-filedaemon-ldap-python-plugin		X	X	X	X		X	X
bareos-filedaemon-python-plugin		X	X	X	X		X	X
bareos-storage	X	X	X	X	X	X	X	X
bareos-storage-ceph								X
bareos-storage-fifo	X	X	X	X	X	X	X	X
bareos-storage-glusterfs			X	X	X			X
bareos-storage-python-plugin		X	X	X	X		X	X
bareos-storage-tape	X	X	X	X	X	X	X	X
bareos-tools	X	X	X	X	X	X	X	X
bareos-traymonitor		X	X	X	X		X	X
bareos-vadp-dumper			X					X
bareos-vmware-plugin			X					X
bareos-vmware-vix-disklib			X					X
bareos-webui		X	X	X	X		X	X
libfastlz	X	X	X	X	X	X	X	X
libfastlz-devel	X	X	X	X	X	X	X	X
lzo	X					X		
lzo-devel	X					X		

	SLE			openSUSE		
	SP3	SP4	12	13.1	13.2	42.1
bareos	X	X	X	X	X	X
bareos-bat	X	X	X	X	X	X
bareos-bconsole	X	X	X	X	X	X
bareos-client	X	X	X	X	X	X
bareos-common	X	X	X	X	X	X
bareos-database-common	X	X	X	X	X	X
bareos-database-mysql	X	X	X	X	X	X
bareos-database-postgresql	X	X	X	X	X	X
bareos-database-sqlite3	X	X	X	X	X	X
bareos-database-tools	X	X	X	X	X	X
bareos-devel	X	X	X	X	X	X
bareos-director	X	X	X	X	X	X

bareos-director-python-plugin	X	X	X	X	X	X
bareos-filedaemon	X	X	X	X	X	X
bareos-filedaemon-ldap-python-plugin	X	X	X	X	X	X
bareos-filedaemon-python-plugin	X	X	X	X	X	X
bareos-storage	X	X	X	X	X	X
bareos-storage-fifo	X	X	X	X	X	X
bareos-storage-python-plugin	X	X	X	X	X	X
bareos-storage-tape	X	X	X	X	X	X
bareos-tools	X	X	X	X	X	X
bareos-traymonitor	X	X	X	X	X	X
bareos-vadp-dumper	X		X			
bareos-vmware-plugin	X		X			
bareos-vmware-vix-disklib	X		X			
bareos-webui	X	X	X	X	X	
libfastlz	X	X	X	X	X	X
libfastlz-devel	X	X	X	X	X	X
libjansson-devel	X	X	X			
libjansson4	X	X	X			
libjansson4-32bit	X	X				
libjansson4-x86	X	X				
mhvtl	X		X	X	X	
php-ZendFramework2	X	X	X	X	X	X
python-py	X					
python-pyvmomi	X		X			
python-requests	X					
python-six	X					

	Debian			Univention	xUbuntu	
	6.0	7.0	8.0	4.0	12.04	14.04
bareos	X	X	X	X	X	X
bareos-bat	X	X	X	X	X	X
bareos-bconsole	X	X	X	X	X	X
bareos-client	X	X	X	X	X	X
bareos-common	X	X	X	X	X	X
bareos-database-common	X	X	X	X	X	X
bareos-database-mysql	X	X	X	X	X	X
bareos-database-postgresql	X	X	X	X	X	X
bareos-database-sqlite3	X	X	X	X	X	X
bareos-database-tools	X	X	X	X	X	X
bareos-dbg	X	X	X	X	X	X
bareos-devel	X	X	X	X	X	X
bareos-director	X	X	X	X	X	X
bareos-director-python-plugin	X	X	X	X	X	X
bareos-filedaemon	X	X	X	X	X	X
bareos-filedaemon-ceph-plugin			X			X
bareos-filedaemon-glusterfs-plugin			X			
bareos-filedaemon-ldap-python-plugin	X	X	X	X	X	X
bareos-filedaemon-python-plugin	X	X	X	X	X	X
bareos-storage	X	X	X	X	X	X
bareos-storage-ceph			X			X
bareos-storage-fifo	X	X	X	X	X	X
bareos-storage-glusterfs			X			
bareos-storage-python-plugin	X	X	X	X	X	X
bareos-storage-tape	X	X	X	X	X	X
bareos-tools	X	X	X	X	X	X
bareos-traymonitor	X	X	X	X	X	X
bareos-vadp-dumper			X			
bareos-vmware-plugin			X			
bareos-vmware-vix-disklib5			X			
bareos-webui		X	X		X	X
libfastlz	X	X	X	X	X	X
libfastlz-dev	X	X	X	X	X	X

libjansson-dbg	X					
libjansson-dev	X					
libjansson-doc	X					
libjansson4	X					
php5-zendframework2	X	X	X	X	X	X
univention-bareos				X		
univention-bareos-schema				X		

B.1.2 Univention Corporate Server

The Bareos version for the Univention App Center integraties into the Univention Enterprise Linux environment, making it easy to backup all the systems managed by the central Univention Corporate Server.

Preamble

The Univention Corporate Server is an enterprise Linux distribution based on Debian. It consists of an integrated management system for the centralised administration of servers, computer workplaces, users and their rights as well as a wide range of server applications. It also includes an Unvention App Center for the easy installation and management of extensions and appliances.
Bareos is part of the App Center and therefore an Univention environment can easily be extended to provide backup functionality for the Univention servers as well as for the connected client systems. Using the Univention Management Console (UMC), you can also create backup jobs for client computers (Windows or Linux systems), without the need of editing configuration files.
The Bareos Univention App is shipped with a default configuration for the director daemon and the storage daemon.
Please note! *You need to review some Univention configuration registry (UCR) variables. Most likely, you will want to set the location where the backups are stored. Otherwise, you may quickly run out of disk space on your backup server!*
You will find further information under Backup Storage.

Quick Start

- Determine the space requirements and where to store your backup data
- Set the `bareos/*` UCR variables according to your needs, see UCR variables
- Restart `bareos-dir`, `bareos-sd` and `bareos-fd` (or simply reboot the server)
- Install the Bareos file daemon on clients and copy configuration file from `/etc/bareos/autogenerated/client-configs/<hostname>.conf`, see Add a client to the backup
- Enable backup jobs for clients in the Univention Management Console

UCR variables

`bareos/filestorage` : /var/lib/bareos/storage (default)

- Location where to store the backup files. Make sure, it offers enough disk space for a configured backup volumes.

`bareos/max_full_volume_bytes` : 20 (default)

- Maximum size (in GB) of a volume for the `Full` backup pool

`bareos/max_full_volumes` : 1 (default)

- Maximum number of volumes for the `Full` backup pool

`bareos/max_diff_volume_bytes` : 10 (default)

- Maximum size (in GB) of a volume for the `Differential` backup pool

`bareos/max_diff_volumes` : 1 (default)

- Maximum number of volumes for the `Differential` backup pool

`bareos/max_incr_volume_bytes` : 1 (default)

- Maximum size (in GB) of a volume for the `Incremental` backup pool

`bareos/max_incr_volumes` : 1 (default)

- Maximum number of volumes for the `Incremental` backup pool

`bareos/backup_myself` : no (default)

no don't backup the server itself

yes backup the server itself

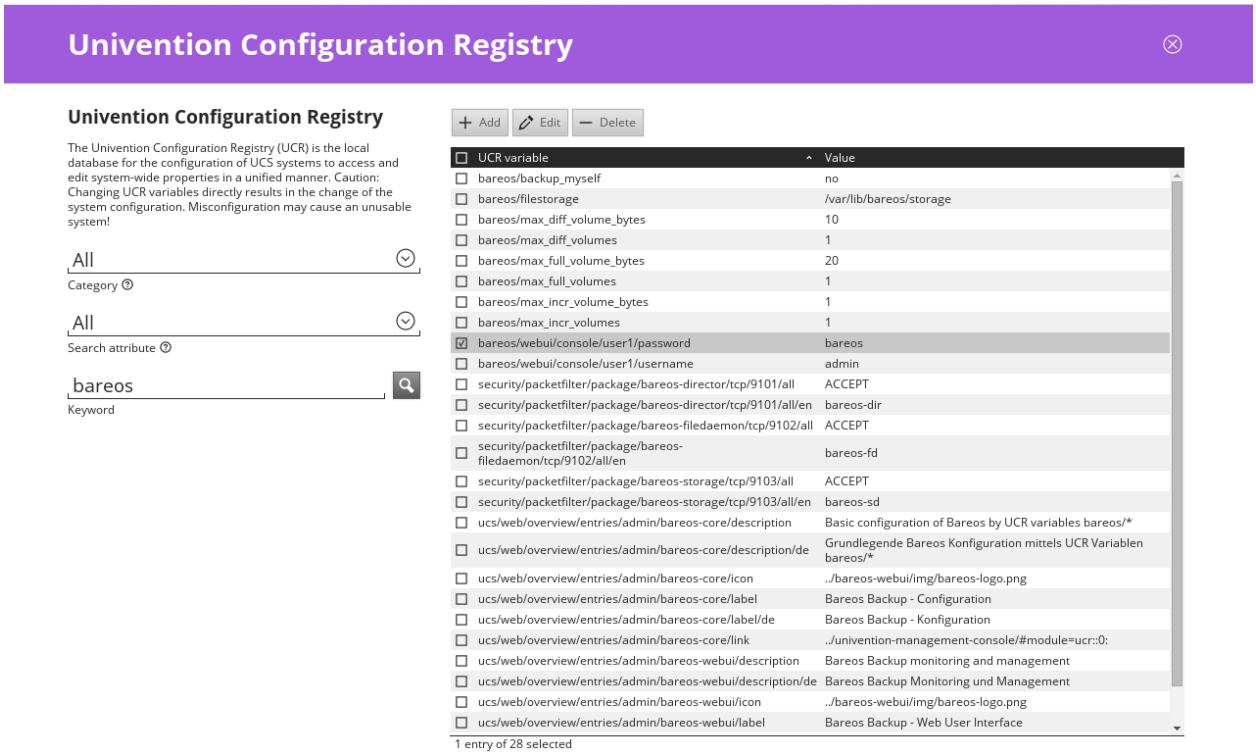
`bareos/webui/console/user1/username` : Administrator (default)

- User name to login at the bareos-webui

`bareos/webui/console/user1/password` : (no default value)

- Password to login at the bareos-webui

UCR variables can be set via the Univention Configuration Registry Web interface



or using the `ucr` command line tool:

```
root@ucs:~# ucr set bareos/backup_myself=yes
Setting bareos/backup_myself
File: /etc/bareos/bareos-dir.conf
[ ok ] Reloading Bareos Director: bareos-dir.
```

Commands B.1: Enable backup of the server itself

Please note! *univention-bareos < 15.2 did require a manual reload/restart of the bareos-dir service:*

```
root@ucs:~# service  bareos-dir reload
[ ok ] Reloading Bareos Director: bareos-dir.
```

Commands B.2: let bareos-dir reload its configuration

Setup

After installation of the Bareos app, Bareos is ready for operation. A default configuration is created automatically.
Bareos consists of three daemons called `director` (or `bareos-dir`), `storage-daemon` (or `bareos-sd`) and `filedaemon` (or `bareos-fd`). All three daemons are started right after the installation by the Univention App Center.
If you want to enable automatic backups of the server, you need to set the Univention configuration registry (UCR) variable `bareos/backup_myself` to *yes* and reload the director daemon.

Administration

For general tasks the bareos-webui can be used. Additional, there is the `bconsole` command line tool:

```
root@ucs:~# bconsole
Connecting to Director ucs:9101
1000 OK: ucs-dir Version: 15.2.2 (15 November 2015)
Enter a period to cancel a command.
*
```

Commands B.3: Starting the bconsole

For general information, see the Bconsole Tuturial.

Backup Schedule

As a result of the default configuration located at the `bareos-dir`, the backup schedule will look as follows:

Full Backups
- are written into the `Full` pool
- on the first saturday at 21:00 o'clock
- and kept for 365 days

Differential Backups
- are written into the `Differential` pool
- on every 2nd to 5th saturday at 21:00 o'clock
- and kept for 90 days

Incremental Backups
- are written into the `Incremental` pool
- on every day from monday to friday at 21:00 o'clock
- and kept for 30 days

That means full backups will be written every first saturday at 21:00 o'clock, differential backups every 2nd to 5th saturday at 21:00 o'clock and incremental backups from monday to friday at 21:00 o'clock. So you have got one full backup every month, four weekly differential and 20 daily incremental backups per month. This schedule is active for the Univention server backup of itself and all other clients, which are backed up through the `bareos-dir` on the Univention server.
There is also a special backup task, which is the Bareos backups itself for a possible disaster recovery. This backup has got its own backup cycle which starts after the main backups. The backup consists of a database backup for the metadata of the Bareos backup server and a backup of the Bareos configuration files under `/etc/bareos/`.

Backup data management

Data from the backup jobs is written to volumes, which are organized in pools (see chapter Pool Resource). The default configuration uses three different pools, called `Full`, `Differential` and `Incremental`, which are used for full backups, differential and incremental backups, respectively.
If you change the UCR variables, the configuration files will be rewritten automatically. After each change you will need to reload the director daemon.

```
root@ucs:~# ucr set bareos/max_full_volumes=10
Setting bareos/max_full_volumes
File: /etc/bareos/bareos-dir.conf
[ ok ] Reloading Bareos Director: bareos-dir.
root@ucs:~# ucr set bareos/max_full_volume_bytes=20
Setting bareos/max_full_volume_bytes
File: /etc/bareos/bareos-dir.conf
```

```
[ ok ] Reloading Bareos Director: bareos-dir.
```

Commands B.4: Example for changing the Full pool size to $10 * 20$ GB

Please note! *This only affects new volumes. Existing volumes will not change there size.*

Backup Storage

Please note! *Using the default configuration, Bareos will store backups on your local disk. You may want to store the data to another location to avoid using up all of your disk space.*
The location for backups is `/var/lib/bareos/storage` in the default configuration.
For example, to use a NAS device for storing backups, you can mount your NAS volume via NFS on `/var/lib/bareos/storage`. Alternatively, you can mount the NAS volume to another directory of your own choice, and change the UCR variable `bareos/filestorage` to the corresponding path. The directory needs to be writable by user `bareos`.

```
root@ucs:/etc/bareos# ucr set bareos/filestorage=/path/to_your/storage
Setting bareos/filestorage
File: /etc/bareos/bareos-sd.conf
```

Commands B.5: Example for changing the storage path

Please note! *You need to restart the Bareos storage daemon after having changed the storage path:*

```
root@ucs:/# service bareos-sd restart
```

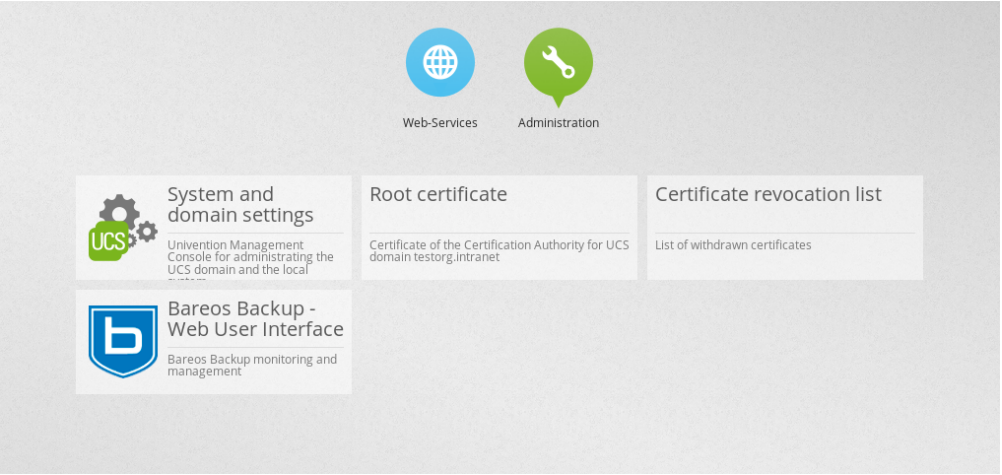
Bareos Webui Configuration

After installation you just need to setup your login credentials via UCR variables. Therefore, set the Univention configuration registry (UCR) variable `bareos/webui/console/user1/username` and `bareos/webui/consoles/user1/password` according to your needs. The director configuration is automatically reloaded if one of those two variables changes.
Alternatively you can also set those UCR variables via commandline.

```
root@ucs:~# ucr set bareos/webui/console/user1/username="bareos"
Setting bareos/webui/console/user1/username
File: /etc/bareos/bareos-dir.conf
[ ok ] Reloading Bareos Director: bareos-dir.
root@ucs:~# ucr set bareos/webui/console/user1/password="secret"
Setting bareos/webui/console/user1/password
File: /etc/bareos/bareos-dir.conf
[ ok ] Reloading Bareos Director: bareos-dir.
```

Commands B.6: Example for changing webui login credentials

When your login credentials are set, you can login into Bareos Webui by following the entry in your Administration UCS Overview or directly via `https://<UCS_SERVER>/bareos-webui/`.

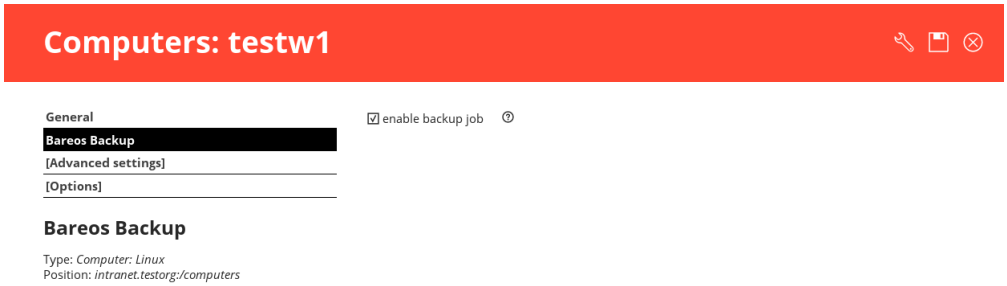


Add a client to the backup

Overview

- Install the Bareos client on the target system, see Adding a Bareos Client
- Use the Univention Management Console to add the client to the backup, see the screenshot below
- Copy the filedaemon configuration file from the Univention server to the target system

Server-side The Univention Bareos application comes with an automatism for the client and job configuration. If you want to add a client to the Bareos director configuration, you need use the Univention Management Console, select the client you want to backup and set the *enable backup job* checkbox to true, as shown in the screenshot below.



If the name of the client is **testw1.example.com**, corresponding configuration files will be generated/adapted:

- creates `/etc/bareos/autogenerated/fd-configs/testw1.example.com.conf`
- creates `/etc/bareos/autogenerated/clients/testw1.example.com.include`
- extends `/etc/bareos/autogenerated/clients.include`

The generated configuration files under `/etc/bareos/autogenerated/fd-configs/` are intended for the target systems. After you have installed the Bareos client on the target system, copy the generated client configuration over to the client and save it to

- on Linux: `/etc/bareos/bareos-fd.conf`
- on Windows: `C:\Program Files\Bareos \bareos -fd.conf`

```
root@ucs:~# CLIENTNAME=testw1.example.com
root@ucs:~# scp /etc/bareos/autogenerated/fd-configs/${CLIENTNAME}.conf ↙
    ↪ root@${CLIENTNAME}:/etc/bareos/bareos-fd.conf
```

Commands B.7: copy client configuration from the server to the testw1.example.com client (Linux)

Background All clients will be listed in the `/etc/bareos/autogenerated/clients.include` which points to a `/etc/bareos/autogenerated/clients/xxx.conf`. If you disable the Bareos backup for a client, the client will not be removed from the configuration files. Only the backup job will be set inactive.

```
root@ucs:/etc/bareos/autogenerated# cat clients.include
@/etc/bareos/autogenerated/clients/testw4.example.com.include
@/etc/bareos/autogenerated/clients/testw1.example.com.include
@/etc/bareos/autogenerated/clients/testw2.example.com.include
```

```
root@ucs:/etc/bareos/autogenerated/clients# ls -l
-rw-r--r-- 1 root root 430 16. Mai 15:15 generic.template
-rw-r----- 1 root bareos 518 21. Mai 14:49 testw2.example.com.include
-rw-r----- 1 root bareos 518 16. Mai 18:17 testw4.example.com.include
-rw-r----- 1 root bareos 513 21. Mai 14:46 testw1.example.com.include
-rw-r--r-- 1 root root 439 16. Mai 15:15 windows.template
```

The settings for each job resource are set by the job definition from the bareos-director default configuration and the template files you see above.
The files

- `/etc/bareos/autogenerated/clients/generic.template`
- `/etc/bareos/autogenerated/clients/windows.template`

are used as templates for new clients. For Windows clients the file `windows.template` is used, the `generic.template` is used for all other client types.
The client configuration file contains, as you can see below, the connection information and the job information:

```
root@ucs:/etc/bareos/autogenerated/clients# cat testw2.example.com.include
Client {
 Name = "testw2.example.com-fd"
 Address = "testw2.example.com"
 Password = "DBLtVnRKq5nRUOrnB3i3qAE38SiDtV8tyhzXIxqR"
 File Retention = 30 days # 30 days
 Job Retention = 6 months # six months
 AutoPrune = no # Prune expired Jobs/Files
}
Job {
 Name = "Backup-testw2.example.com" #job name
 Client = "testw2.example.com-fd" # client name
 JobDefs = "DefaultJob" # job definition for the job
 FileSet = "Windows All Drives" # FileSet (data which is backed up)
 Schedule = "WeeklyCycle" # schedule for the backup tasks
 Enabled = "Yes" #this is the ressource which is toggled on/off by enabling or disabling a backup from the ↙
    ↪ univention gui
 }
```

Bareos comes with a special cronjob called `univention-bareos`, which performs a restart every day at 20:30 o'clock (Remember: backups will be started at 21:00 o'clock!) and safely reload the configuration.

B.1.3 Debian.org / Ubuntu Universe

The distributions of Debian >= 8 include a version of Bareos. Ubuntu Universe >= 15.04 does also include these packages.
In the further text, these version will be named **Bareos (Debian.org)** (also for the Ubuntu Universe version, as this is based on the Debian version).
The source of these packages comes from a separate branch. For the release **bareos-14.2** this is https://github.com/bareos/bareos/tree/bareos-14.2-debian instead of the standard branch https://github.com/bareos/bareos/tree/bareos-14.2.
The Bareos project tries to limit the differences between these branches to a minimum.

Limitations of the Debian.org/Ubuntu Universe version of Bareos

- Debian.org does not include the libfastlz compression library and therefore the Bareos (Debian.org) packages do not offer the fileset options `compression=LZFAST`, `compression=LZ4` and `compression=LZ4HC`.
- Debian.org prefers that Bareos (Debian.org) is linked against GnuTLS instead of OpenSSL. Therefore, the Bareos (Debian.org) package only support Transport Encryption but no Data Encryption.

B.1.4 Mac OS X

The Bareos installer package for Mac OS X contains the Bareos File Daemon for Mac OS X 10.4 or later built as an universal binary for PPC and Intel processors.

Requirements

The Bareos File Daemon is only the client component of the backup system. For proper operation the file daemon needs to have access to a Bareos Director and Bareos Storage Daemon.

Installation

Download the Bareos File Daemon installer package from http://download.bareos.org/bareos/release/latest/MacOS/, open it and follow the directions given to you.

Configuration

After the installation is complete you have to adapt the configuration file to your needs. The file is located at `/usr/local/etc/bareos/bareos-fd.conf`.
Please note! *The configuration file contains passwords and therefore must not be accessible for any users except root. Use the following command line to edit the file as root-user:*

```
sudo /Applications/TextEdit.app/Contents/MacOS/TextEdit /usr/local/etc/bareos/bareos-fd.conf
```

Commands B.8: Adapt the bareos-fd configuration file

Operating the File Daemon

Use `launchctl` to enable and disable the bareos file daemon.

```
sudo launchctl load -w /Library/LaunchDaemons/org.bareos.bareos-fd.plist
```

Commands B.9: Load (start) the Bareos File Daemon

```
sudo launchctl unload -w /Library/LaunchDaemons/org.bareos.bareos-fd.plist
```

Commands B.10: Unload (stop) the Bareos File Daemon

Appendix C

Bareos Programs

This document describes the utility programs written to aid Bareos users and developers in dealing with Volumes external to Bareos and to perform other useful tasks.

C.1 Parameter

C.1.1 Specifying the Configuration File

Each of the utilities that deal with Volumes require a valid Storage daemon configuration file `bareos-sd.conf` (actually, the only part of the configuration file that these programs need is the **Device** resource definitions). This permits the programs to find the configuration parameters for your archive device (generally a tape drive). Using the **-c** option a custom storage daemon configuration file can be selected.

C.1.2 Specifying a Device Name For a Tape

Each of these programs require a **device-name** where the Volume can be found. In the case of a tape, this is the physical device name such as **/dev/nst0** or **/dev/rmt/0ubn** depending on your system. For the program to work, it must find the identical name in the Device resource of the configuration file. See below for specifying Volume names.
Please note that if you have Bareos running and you want to use one of these programs, you will either need to stop the Storage daemon, or **unmount** any tape drive you want to use, otherwise the drive will **busy** because Bareos is using it.

C.1.3 Specifying a Device Name For a File

If you are attempting to read or write an archive file rather than a tape, the **device-name** should be the full path to the archive location including the filename. The filename (last part of the specification) will be stripped and used as the Volume name, and the path (first part before the filename) must have the same entry in the configuration file. So, the path is equivalent to the archive device name, and the filename is equivalent to the volume name. The default file storage path is `/var/lib/bareos/storage/`.

C.1.4 Specifying Volumes

Often you must specify the Volume name to the programs below. The best method to do so is to specify a **bootstrap** file on the command line with the **-b** option. As part of the bootstrap file, you will then specify the Volume name or Volume names if more than one volume is needed. For example, suppose you want to read tapes **tape1** and **tape2**. First construct a **bootstrap** file named say, **list.bsr** which contains:

```
Volume=test1|test2
```

where each Volume is separated by a vertical bar. Then simply use:

```
bls -b list.bsr /dev/nst0
```

In the case of Bareos Volumes that are on files, you may simply append volumes as follows:

```
bls /tmp/test1\|test2
```

where the backslash (\) was necessary as a shell escape to permit entering the vertical bar (—).
And finally, if you feel that specifying a Volume name is a bit complicated with a bootstrap file, you can use the **-V** option (on all programs except **bcopy**) to specify one or more Volume names separated by the vertical bar (—). For example,

```
bls -V Vol001 /dev/nst0
```

You may also specify an asterisk (*) to indicate that the program should accept any volume. For example:

```
bls -V* /dev/nst0
```

C.2 Bareos Daemons

C.2.1 Daemon Command Line Options

Each of the three daemons (Director, File, Storage) accepts a small set of options on the command line. In general, each of the daemons as well as the Console program accepts the following options:

-c <file> Define the file to use as a configuration file. The default is the daemon name followed by **.conf** i.e. **bareos-dir.conf** for the Director, **bareos-fd.conf** for the File daemon, and **bareos-sd** for the Storage daemon.

-d nnn Set the debug level to **nnn**. Generally anything between 50 and 200 is reasonable. The higher the number, the more output is produced. The output is written to standard output. The debug level can also be set during runtime, see section bconsole: setdebug.

-f Run the daemon in the foreground. This option is needed to run the daemon under the debugger.

-g <group> Run the daemon under this group. This must be a group name, not a GID.

-s Do not trap signals. This option is needed to run the daemon under the debugger.

-t Read the configuration file and print any error messages, then immediately exit. Useful for syntax testing of new configuration files.

-u <user> Run the daemon as this user. This must be a user name, not a UID.

-v Be more verbose or more complete in printing error and informational messages. Recommended.

-? Print the version and list of options.

C.2.2 bareos-dir

Bareos Director. *TODO: Bareos Director describe command line arguments*

C.2.3 bareos-sd

Bareos Storage Daemon *TODO: Bareos Storage Daemon describe command line arguments*

C.2.4 bareos-fd

Bareos File Daemon *TODO: Bareos File Daemon describe command line arguments*

C.3 Interactive Programs

C.3.1 bconsole

There is an own chapter on `bconsole`. Please refer to chapter Bareos Console.

C.3.2 bareos-webui

For further information regarding the Bareos Webui, please refer to the chapter Installing Bareos Webui.

C.3.3 bat

The Bacula/Bareos Administration Tool (`bat`) is a native GUI for Bareos. Please note that, although `bat` is still a part of Bareos and still receives maintenance bugfixes, the main development effort will be spent on bareos-webui. For Version >= 15.2.0 we therefore encourage the use of Bareos Webui, which will, in the long term, replace `bat`. By now Bareos Webui does not have all the features `bat` offers.

C.4 Volume Utility Commands

Please note! *If you use Bareos with non-default block sizes defined in the pools, it might be neccessary to specifiy the **maximum block level** also in the storage device resource, see Direct access to Volumes with non-default blocksizes.*

C.4.1 bls

`bls` can be used to do an `ls` type listing of a Bareos tape or file. It is called:

```
Usage: bls [options] <device-name>
       -b <file>       specify a bootstrap file
       -c <file>       specify a Storage configuration file
       -D <director>   specify a director name specified in the Storage
                       configuration file for the Key Encryption Key selection
       -d <nn>         set debug level to <nn>
       -dt             print timestamp in debug output
       -e <file>       exclude list
       -i <file>       include list
       -j              list jobs
       -k              list blocks
    (no j or k option) list saved files
       -L              dump label
       -p              proceed inspite of errors
       -v              be verbose
       -V              specify Volume names (separated by |)
       -?              print this message
```

For example, to list the contents of a tape:

```
bls -V Volume-name /dev/nst0
```

Or to list the contents of a file:

```
bls /var/lib/bareos/storage/testvol
or
bls -V testvol /var/lib/bareos/storage
```

Note that, in the case of a file, the Volume name becomes the filename, so in the above example, you will replace the **Volume-name** with the name of the volume (file) you wrote.
Normally if no options are specified, **bls** will produce the equivalent output to the **ls -l** command for each file on the tape. Using other options listed above, it is possible to display only the Job records, only the tape blocks, etc. For example:

```
bls: butil.c:282-0 Using device: "/var/lib/bareos/storage" for reading.
12-Sep 18:30 bls JobId 0: Ready to read from volume "testvol" on device "FileStorage" (/var/lib/bareos/storage).
bls JobId 1: -rwxr-xr-x   1 root     root            4614 2013-01-22 22:24:11  /usr/sbin/service
bls JobId 1: -rwxr-xr-x   1 root     root           13992 2013-01-22 22:24:12  /usr/sbin/rtcwake
bls JobId 1: -rwxr-xr-x   1 root     root            6243 2013-02-06 11:01:29  /usr/sbin/update-fonts-scale
bls JobId 1: -rwxr-xr-x   1 root     root           43240 2013-01-22 22:24:10  /usr/sbin/grpck
bls JobId 1: -rwxr-xr-x   1 root     root           16894 2013-01-22 22:24:11  /usr/sbin/update-rc.d
bls JobId 1: -rwxr-xr-x   1 root     root            9480 2013-01-22 22:47:43  /usr/sbin/gss_clnt_send_err
...
bls JobId 456: -rw-r-----   1 root     bareos          1008 2013-05-23 13:17:45  /etc/bareos/bareos-fd.conf
bls JobId 456: -rw-r-----   1 bareos   bareos          6026 2013-04-22 12:00:33  /etc/bareos/bareos-sd.conf.dpkg-dist
bls JobId 456: drwxr-xr-x   2 root     root            4096 2013-07-04 17:40:21  /etc/bareos/
12-Sep 18:30 bls JobId 0: End of Volume at file 0 on device "FileStorage" (/var/lib/bareos/storage), Volume "testvol"
12-Sep 18:30 bls JobId 0: End of all volumes.
2972 files found.
```

Show Label Information

Using the -L the label information of a Volume is shown:

```
root@linux:~# bls -L /var/lib/bareos/storage/testvol
bls: butil.c:282-0 Using device: "/var/lib/bareos/storage" for reading.
12-Sep 18:41 bls JobId 0: Ready to read from volume "testvol" on device "FileStorage" (/var/lib/bareos/storage).

Volume Label:
Id                : Bareos 0.9 mortal
VerNo             : 10
VolName           : File002
PrevVolName       :
VolFile           : 0
LabelType         : VOL_LABEL
LabelSize         : 147
PoolName          : Default
MediaType         : File
PoolType          : Backup
HostName          : debian6
Date label written: 06-Mar-2013 17:21
```

Command 2: bls, Show Volume Label

Listing Jobs

If you are listing a Volume to determine what Jobs to restore, normally the **-j** option provides you with most of what you will need as long as you don't have multiple clients. For example:

```
root@linux:~# bls /var/lib/bareos/storage/testvol -j
bls: butil.c:282-0 Using device: "/var/lib/bareos/storage" for reading.
12-Sep 18:33 bls JobId 0: Ready to read from volume "testvol" on device "FileStorage" (/var/lib/bareos/storage).
Volume Record: File:blk=0:193 SessId=1 SessTime=1362582744 JobId=0 DataLen=158
Begin Job Session Record: File:blk=0:64705 SessId=1 SessTime=1362582744 JobId=1
   Job=BackupClient1.2013-03-06_17.22.48_05 Date=06-Mar-2013 17:22:51 Level=F Type=B
End Job Session Record: File:blk=0:6499290 SessId=1 SessTime=1362582744 JobId=1
   Date=06-Mar-2013 17:22:52 Level=F Type=B Files=162 Bytes=6,489,071 Errors=0 Status=T
Begin Job Session Record: File:blk=0:6563802 SessId=2 SessTime=1362582744 JobId=2
   Job=BackupClient1.2013-03-06_23.05.00_02 Date=06-Mar-2013 23:05:02 Level=I Type=B
End Job Session Record: File:blk=0:18832687 SessId=2 SessTime=1362582744 JobId=2
   Date=06-Mar-2013 23:05:02 Level=I Type=B Files=3 Bytes=12,323,791 Errors=0 Status=T
...
Begin Job Session Record: File:blk=0:319219736 SessId=299 SessTime=1369307832 JobId=454
   Job=BackupClient1.2013-09-11_23.05.00_25 Date=11-Sep-2013 23:05:03 Level=I Type=B
End Job Session Record: File:blk=0:319219736 SessId=299 SessTime=1369307832 JobId=454
   Date=11-Sep-2013 23:05:03 Level=I Type=B Files=0 Bytes=0 Errors=0 Status=T
Begin Job Session Record: File:blk=0:319284248 SessId=301 SessTime=1369307832 JobId=456
   Job=BackupCatalog.2013-09-11_23.10.00_28 Date=11-Sep-2013 23:10:03 Level=F Type=B
End Job Session Record: File:blk=0:320694269 SessId=301 SessTime=1369307832 JobId=456
   Date=11-Sep-2013 23:10:03 Level=F Type=B Files=12 Bytes=1,472,681 Errors=0 Status=T
12-Sep 18:32 bls JobId 0: End of Volume at file 0 on device "FileStorage" (/var/lib/bareos/storage), Volume "testvol"
12-Sep 18:32 bls JobId 0: End of all volumes.
```

Command 3: bls, Listing Jobs

Adding the **-v** option will display virtually all information that is available for each record.

Listing Blocks

Normally, except for debugging purposes, you will not need to list Bareos blocks (the "primitive" unit of Bareos data on the Volume). However, you can do so with:

```
bls -k /tmp/File002
bls: butil.c:148 Using device: /tmp
Block: 1 size=64512
Block: 2 size=64512
...
Block: 65 size=64512
Block: 66 size=19195
bls: Got EOF on device /tmp
End of File on device
```

By adding the **-v** option, you can get more information, which can be useful in knowing what sessions were written to the volume:

```
bls -k -v /tmp/File002
Date label written: 2002-10-19 at 21:16
Block: 1 blen=64512 First rec FI=VOL_LABEL SessId=1 SessTim=1035062102 Strm=0 rlen=147
Block: 2 blen=64512 First rec FI=6 SessId=1 SessTim=1035062102 Strm=DATA rlen=4087
Block: 3 blen=64512 First rec FI=12 SessId=1 SessTim=1035062102 Strm=DATA rlen=5902
Block: 4 blen=64512 First rec FI=19 SessId=1 SessTim=1035062102 Strm=DATA rlen=28382
...
Block: 65 blen=64512 First rec FI=83 SessId=1 SessTim=1035062102 Strm=DATA rlen=1873
Block: 66 blen=19195 First rec FI=83 SessId=1 SessTim=1035062102 Strm=DATA rlen=2973
bls: Got EOF on device /tmp
End of File on device
```

Armed with the SessionId and the SessionTime, you can extract just about anything.
If you want to know even more, add a second **-v** to the command line to get a dump of every record in every block.

```
bls -k -v -v /tmp/File002
bls: block.c:79 Dump block  80f8ad0: size=64512 BlkNum=1
               Hdrcksum=b1bdfd6d cksum=b1bdfd6d
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=VOL_LABEL Strm=0 len=147 p=80f8b40
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=SOS_LABEL Strm=-7 len=122 p=80f8be7
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=1 Strm=UATTR len=86 p=80f8c75
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=2 Strm=UATTR len=90 p=80f8cdf
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=3 Strm=UATTR len=92 p=80f8d4d
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=3 Strm=DATA len=54 p=80f8dbd
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=3 Strm=MD5 len=16 p=80f8e07
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=4 Strm=UATTR len=98 p=80f8e2b
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=4 Strm=DATA len=16 p=80f8ea1
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=4 Strm=MD5 len=16 p=80f8ec5
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=5 Strm=UATTR len=96 p=80f8ee9
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=5 Strm=DATA len=1783 p=80f8f5d
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=5 Strm=MD5 len=16 p=80f9668
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=6 Strm=UATTR len=95 p=80f968c
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=6 Strm=DATA len=32768 p=80f96ff
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=6 Strm=DATA len=32768 p=8101713
bls: block.c:79 Dump block  80f8ad0: size=64512 BlkNum=2
               Hdrcksum=9acc1e7f cksum=9acc1e7f
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=6 Strm=contDATA len=4087 p=80f8b40
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=6 Strm=DATA len=31970 p=80f9b4b
bls: block.c:92    Rec: VId=1 VT=1035062102 FI=6 Strm=MD5 len=16 p=8101841
...
```

C.4.2 bextract

If you find yourself using `bextract`, you probably have done something wrong. For example, if you are trying to recover a file but are having problems, please see the Restoring When Things Go Wrong chapter.
Normally, you will restore files by running a **Restore** Job from the **Console** program. However, `bextract` can be used to extract a single file or a list of files from a Bareos tape or file. In fact, `bextract` can be a useful tool to restore files to an empty system assuming you are able to boot, you have statically linked `bextract` and you have an appropriate **bootstrap** file.
Please note that some of the current limitations of `bextract` are:

1. It cannot restore access control lists (ACL) that have been backed up along with the file data.
2. It cannot restore encrypted files.
3. The command line length is relatively limited, which means that you cannot enter a huge number of volumes. If you need to enter more volumes than the command line supports, please use a bootstrap file (see below).
4. Extracting files from a Windows backup on a Linux system will only extract the plain files, not the additional Windows file information. If you have to extract files from a Windows backup, you should use the Windows version of `bextract`.

It is called:

```
Usage: bextract <options> <bareos-archive-device-name> <directory-to-store-files>
       -b <file>       specify a bootstrap file
       -c <file>       specify a Storage configuration file
       -D <director>   specify a director name specified in the Storage
                       configuration file for the Key Encryption Key selection
       -d <nn>         set debug level to <nn>
       -dt             print timestamp in debug output
       -e <file>       exclude list
       -i <file>       include list
       -p              proceed inspite of I/O errors
       -v              verbose
       -V <volumes>    specify Volume names (separated by |)
       -?              print this message
```

where **device-name** is the Archive Device (raw device name or full filename) of the device to be read, and **directory-to-store-files** is a path prefix to prepend to all the files restored.
NOTE: On Windows systems, if you specify a prefix of say d:/tmp, any file that would have been restored to **c:/My Documents** will be restored to **d:/tmp/My Documents**. That is, the original drive specification will be stripped. If no prefix is specified, the file will be restored to the original drive.

Extracting with Include or Exclude Lists

Using the **-e** option, you can specify a file containing a list of files to be excluded. Wildcards can be used in the exclusion list. This option will normally be used in conjunction with the **-i** option (see below). Both the **-e** and the **-i** options may be specified at the same time as the **-b** option. The bootstrap filters will be applied first, then the include list, then the exclude list.
Likewise, and probably more importantly, with the **-i** option, you can specify a file that contains a list (one file per line) of files and directories to include to be restored. The list must contain the full filename with the path. If you specify a path name only, all files and subdirectories of that path will be restored. If you specify a line containing only the filename (e.g. **my-file.txt**) it probably will not be extracted because you have not specified the full path.
For example, if the file **include-list** contains:

```
/etc/bareos
/usr/sbin
```

Then the command:

```
bextract -i include-list -V Volume /dev/nst0 /tmp
```

will restore from the Bareos archive **/dev/nst0** all files and directories in the backup from **/etc/bareos** and from **/usr/sbin**. The restored files will be placed in a file of the original name under the directory **/tmp** (i.e. /tmp/etc/bareos/... and /tmp/usr/sbin/...).

Extracting With a Bootstrap File

The **-b** option is used to specify a **bootstrap** file containing the information needed to restore precisely the files you want. Specifying a **bootstrap** file is optional but recommended because it gives you the most control over which files will be restored. For more details on the **bootstrap** file, please see Restoring Files with the Bootstrap File chapter of this document. Note, you may also use a bootstrap file produced by the **restore** command. For example:

```
bextract -b bootstrap-file /dev/nst0 /tmp
```

The bootstrap file allows detailed specification of what files you want restored (extracted). You may specify a bootstrap file and include and/or exclude files at the same time. The bootstrap conditions will first be applied, and then each file record seen will be compared to the include and exclude lists.

Extracting From Multiple Volumes

If you wish to extract files that span several Volumes, you can specify the Volume names in the bootstrap file or you may specify the Volume names on the command line by separating them with a vertical bar. See the section above under the **bls** program entitled **Listing Multiple Volumes** for more information. The same techniques apply equally well to the **bextract** program or read the Bootstrap chapter of this document.

Extracting Under Windows

Please note! *If you use* ***bextract*** *under Windows, the ordering of the parameters is essential.*
To use `bextract`, the Bareos Storage Daemon must be installed. As bextract works on tapes or disk volumes, these must be configured in the Storage Daemon configuration file, normally found at `C:\ProgrammData \ Bareos \bareos -sd.conf`. However, it is not required to start the Bareos Storage Daemon. Normally, if the Storage Daemon would be able to run, `bextract` would not be required.
After installing, `bextract` can be called via command line:

```
C:\Program Files\Bareos .\bextract.exe -c "C:\ProgrammData\Bareos\bareos-sd.conf" -V <Volume> ↙
    ↪ <YourStorage> <YourDestination>
```

Commands C.1: Call of bextract

If you want to use exclude or include files you need to write them like you do on Linux. That means each path begins with a "/" and not with "yourdrive:/". You need to specify the parameter **-e exclude.list** as first parameter. For example:

```
/Program Files/Bareos/bareos-dir.exe
/ProgramData/
```

Configuration C.2: Example exclude.list

```
C:\Program Files\Bareos .\bextract.exe -e exclude.list -c "C:\ProgrammData\Bareos\bareos-sd.conf" -V ↙
    ↪ <Volume> <YourStorage> <YourDestination>
```

Commands C.3: Call bextract with exclude list

C.4.3 bscan

If you find yourself using this program, you have probably done something wrong. For example, the best way to recover a lost or damaged Bareos database is to reload the database by using the bootstrap file that was written when you saved it (default Bareos-dir.conf file).
The **bscan** program can be used to re-create a database (catalog) records from the backup information written to one or more Volumes. This is normally needed only if one or more Volumes have been pruned or purged from your catalog so that the records on the Volume are no longer in the catalog, or for Volumes that you have archived. Note, if you scan in Volumes that were previously purged, you will be able to do restores from those Volumes. However, unless you modify the Job and File retention times for the Jobs that were added by scanning, the next time you run any backup Job with the same name, the records will be pruned again. Since it takes a long time to scan Volumes this can be very frustrating.
With some care, `bscan` can also be used to synchronize your existing catalog with a Volume. Although we have never seen a case of bscan damaging a catalog, since bscan modifies your catalog, we recommend that you do a simple ASCII backup of your database before running `bscan` just to be sure. See Compacting Your Database for the details of making a copy of your database.
`bscan` can also be useful in a disaster recovery situation, after the loss of a hard disk, if you do not have a valid **bootstrap** file for reloading your system, or if a Volume has been recycled but not overwritten, you can use `bscan` to re-create your database, which can then be used to **restore** your system or a file to its previous state.
It is called:

```
Usage: bscan [options] <Bareos-archive>
       -B <driver name>  specify the database driver name (default NULL) <postgresql|mysql|sqlite>
       -b bootstrap      specify a bootstrap file
       -c <file>         specify configuration file
       -d <nn>           set debug level to nn
       -dt               print timestamp in debug output
       -m                update media info in database
       -D <director>     specify a director name specified in the Storage
                         configuration file for the Key Encryption Key selection
       -n <name>         specify the database name (default Bareos)
       -u <user>         specify database user name (default Bareos)
       -P <password>     specify database password (default none)
       -h <host>         specify database host (default NULL)
       -t <port>         specify database port (default 0)
       -p                proceed inspite of I/O errors
       -r                list records
```

```
-s                synchronize or store in database
-S                show scan progress periodically
-v                verbose
-V <Volumes>      specify Volume names (separated by |)
-w <dir>          specify working directory (default from conf file)
-?                print this message
```

As Bareos supports loading its database backend dynamically you need to specify the right database driver to use using the **-B** option.
If you are using MySQL or PostgreSQL, there is no need to supply a working directory since in that case, bscan knows where the databases are. However, if you have provided security on your database, you may need to supply either the database name (**-b** option), the user name (**-u** option), and/or the password (**-p**) options.
NOTE: before `bscan` can work, it needs at least a bare bones valid database. If your database exists but some records are missing because they were pruned, then you are all set. If your database was lost or destroyed, then you must first ensure that you have the SQL program running (MySQL or PostgreSQL), then you must create the Bareos database (normally named bareos), and you must create the Bareos tables. This is explained in Prepare Bareos database chapter of the manual. Finally, before scanning into an empty database, you must start and stop the Director with the appropriate Bareos-dir.conf file so that it can create the Client and Storage records which are not stored on the Volumes. Without these records, scanning is unable to connect the Job records to the proper client.
Forgetting for the moment the extra complications of a full rebuild of your catalog, let's suppose that you did a backup to Volumes "Vol001" and "Vol002", then sometime later all records of one or both those Volumes were pruned or purged from the database. By using **bscan** you can recreate the catalog entries for those Volumes and then use the **restore** command in the Console to restore whatever you want. A command something like:

```
bscan -v -V Vol001\|Vol002 /dev/nst0
```

will give you an idea of what is going to happen without changing your catalog. Of course, you may need to change the path to the Storage daemon's conf file, the Volume name, and your tape (or disk) device name. This command must read the entire tape, so if it has a lot of data, it may take a long time, and thus you might want to immediately use the command listed below. Note, if you are writing to a disk file, replace the device name with the path to the directory that contains the Volumes. This must correspond to the Archive Device in the conf file.
Then to actually write or store the records in the catalog, add the **-s** option as follows:

```
bscan -s -m -v -V Vol001\|Vol002 /dev/nst0
```

When writing to the database, if `bscan` finds existing records, it will generally either update them if something is wrong or leave them alone. Thus if the Volumes you are scanning are all or partially in the catalog already, no harm will be done to that existing data. Any missing data will simply be added.
If you have multiple tapes, you should scan them with:

```
bscan -s -m -v -V Vol001\|Vol002\|Vol003 /dev/nst0
```

Since there is a limit on the command line length (511 bytes) accepted by `bscan`, if you have too many Volumes, you will need to manually create a bootstrap file. See the Bootstrap chapter of this manual for more details, in particular the section entitled Bootstrap for bscan. Basically, the .bsr file for the above example might look like:

```
Volume=Vol001
Volume=Vol002
Volume=Vol003
```

Note: `bscan` does not support supplying Volume names on the command line and at the same time in a bootstrap file. Please use only one or the other.
You should, always try to specify the tapes in the order they are written. If you do not, any Jobs that span a volume may not be fully or properly restored. However, bscan can handle scanning tapes that are not sequential. Any incomplete records at the end of the tape will simply be ignored in that case. If you are simply repairing an existing catalog, this may be OK, but if you are creating a new catalog from scratch, it will leave your database in an incorrect state. If you do not specify all necessary Volumes on a single bscan command, bscan will not be able to correctly restore the records that span two volumes. In other words, it is much better to specify two or three volumes on a single bscan command (or in a .bsr file) rather than run bscan two or three times, each with a single volume.

Note, the restoration process using bscan is not identical to the original creation of the catalog data. This is because certain data such as Client records and other non-essential data such as volume reads, volume mounts, etc is not stored on the Volume, and thus is not restored by bscan. The results of bscanning are, however, perfectly valid, and will permit restoration of any or all the files in the catalog using the normal Bareos console commands. If you are starting with an empty catalog and expecting bscan to reconstruct it, you may be a bit disappointed, but at a minimum, you must ensure that your Bareos-dir.conf file is the same as what it previously was – that is, it must contain all the appropriate Client resources so that they will be recreated in your new database **before** running bscan. Normally when the Director starts, it will recreate any missing Client records in the catalog. Another problem you will have is that even if the Volumes (Media records) are recreated in the database, they will not have their autochanger status and slots properly set. As a result, you will need to repair that by using the **update slots** command. There may be other considerations as well. Rather than bscanning, you should always attempt to recover you previous catalog backup.

Using bscan to Compare a Volume to an existing Catalog

If you wish to compare the contents of a Volume to an existing catalog without changing the catalog, you can safely do so if and only if you do **not** specify either the **-m** or the **-s** options. However, the comparison routines are not as good or as thorough as they should be, so we don't particularly recommend this mode other than for testing.

Using bscan to Recreate a Catalog from a Volume

This is the mode for which **bscan** is most useful. You can either **bscan** into a freshly created catalog, or directly into your existing catalog (after having made an ASCII copy as described above). Normally, you should start with a freshly created catalog that contains no data.
Starting with a single Volume named **TestVolume1**, you run a command such as:

```
bscan -V TestVolume1 -v -s -m /dev/nst0
```

If there is more than one volume, simply append it to the first one separating it with a vertical bar. You may need to precede the vertical bar with a forward slash escape the shell – e.g. **TestVolume1\|—TestVolume2**. The **-v** option was added for verbose output (this can be omitted if desired). The **-s** option that tells **bscan** to store information in the database. The physical device name **/dev/nst0** is specified after all the options. For example, after having done a full backup of a directory, then two incrementals, I reinitialized the SQLite database as described above, and using the bootstrap.bsr file noted above, I entered the following command:

```
bscan -b bootstrap.bsr -v -s /dev/nst0
```

which produced the following output:

```
bscan: bscan.c:182 Using Database: Bareos, User: bacula
bscan: bscan.c:673 Created Pool record for Pool: Default
bscan: bscan.c:271 Pool type "Backup" is OK.
bscan: bscan.c:632 Created Media record for Volume: TestVolume1
bscan: bscan.c:298 Media type "DDS-4" is OK.
bscan: bscan.c:307 VOL_LABEL: OK for Volume: TestVolume1
bscan: bscan.c:693 Created Client record for Client: Rufus
bscan: bscan.c:769 Created new JobId=1 record for original JobId=2
bscan: bscan.c:717 Created FileSet record "Users Files"
bscan: bscan.c:819 Updated Job termination record for new JobId=1
bscan: bscan.c:905 Created JobMedia record JobId 1, MediaId 1
bscan: Got EOF on device /dev/nst0
bscan: bscan.c:693 Created Client record for Client: Rufus
bscan: bscan.c:769 Created new JobId=2 record for original JobId=3
bscan: bscan.c:708 Fileset "Users Files" already exists.
bscan: bscan.c:819 Updated Job termination record for new JobId=2
bscan: bscan.c:905 Created JobMedia record JobId 2, MediaId 1
bscan: Got EOF on device /dev/nst0
bscan: bscan.c:693 Created Client record for Client: Rufus
bscan: bscan.c:769 Created new JobId=3 record for original JobId=4
bscan: bscan.c:708 Fileset "Users Files" already exists.
bscan: bscan.c:819 Updated Job termination record for new JobId=3
bscan: bscan.c:905 Created JobMedia record JobId 3, MediaId 1
bscan: Got EOF on device /dev/nst0
bscan: bscan.c:652 Updated Media record at end of Volume: TestVolume1
bscan: bscan.c:428 End of Volume. VolFiles=3 VolBlocks=57 VolBytes=10,027,437
```

The key points to note are that **bscan** prints a line when each major record is created. Due to the volume of output, it does not print a line for each file record unless you supply the **-v** option twice or more on the command line.
In the case of a Job record, the new JobId will not normally be the same as the original Jobid. For example, for the first JobId above, the new JobId is 1, but the original JobId is 2. This is nothing to be concerned about as it is the normal nature of databases. **bscan** will keep everything straight.
Although **bscan** claims that it created a Client record for Client: Rufus three times, it was actually only created the first time. This is normal.
You will also notice that it read an end of file after each Job (Got EOF on device ...). Finally the last line gives the total statistics for the bscan.
If you had added a second **-v** option to the command line, Bareos would have been even more verbose, dumping virtually all the details of each Job record it encountered.
Now if you start Bareos and enter a **list jobs** command to the console program, you will get:

```
+-------+----------+-----------------+------+-----+----------+----------+---------+
| JobId | Name     | StartTime       | Type | Lvl | JobFiles | JobBytes | JobStat |
+-------+----------+-----------------+------+-----+----------+----------+---------+
| 1     | usersave | 2002-10-07 14:59 | B    | F   | 84       | 4180207  | T       |
| 2     | usersave | 2002-10-07 15:00 | B    | I   | 15       | 2170314  | T       |
| 3     | usersave | 2002-10-07 15:01 | B    | I   | 33       | 3662184  | T       |
+-------+----------+-----------------+------+-----+----------+----------+---------+
```

which corresponds virtually identically with what the database contained before it was re-initialized and restored with bscan. All the Jobs and Files found on the tape are restored including most of the Media record. The Volume (Media) records restored will be marked as **Full** so that they cannot be rewritten without operator intervention.
It should be noted that **bscan** cannot restore a database to the exact condition it was in previously because a lot of the less important information contained in the database is not saved to the tape. Nevertheless, the reconstruction is sufficiently complete, that you can run **restore** against it and get valid results.
An interesting aspect of restoring a catalog backup using **bscan** is that the backup was made while Bareos was running and writing to a tape. At the point the backup of the catalog is made, the tape Bareos is writing to will have say 10 files on it, but after the catalog backup is made, there will be 11 files on the tape Bareos is writing. This there is a difference between what is contained in the backed up catalog and what is actually on the tape. If after restoring a catalog, you attempt to write on the same tape that was used to backup the catalog, Bareos will detect the difference in the number of files registered in the catalog compared to what is on the tape, and will mark the tape in error.
There are two solutions to this problem. The first is possibly the simplest and is to mark the volume as Used before doing any backups. The second is to manually correct the number of files listed in the Media record of the catalog. This procedure is documented elsewhere in the manual and involves using the **update volume** command in **bconsole**.

Using bscan to Correct the Volume File Count

If the Storage daemon crashes during a backup Job, the catalog will not be properly updated for the Volume being used at the time of the crash. This means that the Storage daemon will have written say 20 files on the tape, but the catalog record for the Volume indicates only 19 files.
Bareos refuses to write on a tape that contains a different number of files from what is in the catalog. To correct this situation, you may run a **bscan** with the **-m** option (but **without** the **-s** option) to update only the final Media record for the Volumes read.

After bscan

If you use **bscan** to enter the contents of the Volume into an existing catalog, you should be aware that the records you entered may be immediately pruned during the next job, particularly if the Volume is very old or had been previously purged. To avoid this, after running **bscan**, you can manually set the volume status (VolStatus) to **Read-Only** by using the **update** command in the catalog. This will allow you to restore from the volume without having it immediately purged. When you have restored and backed up the data, you can reset the VolStatus to **Used** and the Volume will be purged from the catalog.

C.4.4 bcopy

The `bcopy` program can be used to copy one Bareos archive file to another. For example, you may copy a tape to a file, a file to a tape, a file to a file, or a tape to a tape. For tape to tape, you will need two tape

drives. In the process of making the copy, no record of the information written to the new Volume is stored in the catalog. This means that the new Volume, though it contains valid backup data, cannot be accessed directly from existing catalog entries. If you wish to be able to use the Volume with the Console restore command, for example, you must first bscan the new Volume into the catalog.

```
Usage: bcopy [-d debug_level] <input-archive> <output-archive>
       -b bootstrap    specify a bootstrap file
       -c <file>       specify configuration file
       -D <director>   specify a director name specified in the Storage
                       configuration file for the Key Encryption Key selection
       -dnn            set debug level to nn
       -dt             print timestamp in debug output
       -i              specify input Volume names (separated by |)
       -o              specify output Volume names (separated by |)
       -p              proceed inspite of I/O errors
       -v              verbose
       -w dir          specify working directory (default /tmp)
       -?              print this message
```

By using a **bootstrap** file, you can copy parts of a Bareos archive file to another archive.
One of the objectives of this program is to be able to recover as much data as possible from a damaged tape. However, the current version does not yet have this feature.
As this is a new program, any feedback on its use would be appreciated. In addition, I only have a single tape drive, so I have never been able to test this program with two tape drives.

C.4.5 btape

This program permits a number of elementary tape operations via a tty command interface. It works only with tapes and not with other kinds of Bareos storage media (DVD, File, ...). The **test** command, described below, can be very useful for testing older tape drive compatibility problems. Aside from initial testing of tape drive compatibility with **Bareos**, **btape** will be mostly used by developers writing new tape drivers.
btape can be dangerous to use with existing **Bareos** tapes because it will relabel a tape or write on the tape if so requested regardless that the tape may contain valuable data, so please be careful and use it only on blank tapes.
To work properly, **btape** needs to read the Storage daemon's configuration file. As a default, it will look for **Bareos-sd.conf** in the current directory. If your configuration file is elsewhere, please use the **-c** option to specify where.
The physical device name must be specified on the command line, and this same device name must be present in the Storage daemon's configuration file read by **btape**

```
Usage: btape <options> <device_name>
       -b <file>     specify bootstrap file
       -c <file>     set configuration file to file
       -D <director> specify a director name specified in the Storage
                     configuration file for the Key Encryption Key selection
       -d <nn>       set debug level to nn
       -dt           print timestamp in debug output
       -p            proceed inspite of I/O errors
       -s            turn off signals
       -v            be verbose
       -?            print this message.
```

Using btape to Verify your Tape Drive

An important reason for this program is to ensure that a Storage daemon configuration file is defined so that Bareos will correctly read and write tapes.
It is highly recommended that you run the **test** command before running your first Bareos job to ensure that the parameters you have defined for your storage device (tape drive) will permit **Bareos** to function properly. You only need to mount a blank tape, enter the command, and the output should be reasonably self explanatory. Please see the Tape Testing Chapter of this manual for the details.

btape Commands

The full list of commands are:

```
Command    Description
=======    ===========
autochanger test autochanger
bsf        backspace file
bsr        backspace record
cap        list device capabilities
clear      clear tape errors
eod        go to end of Bareos data for append
eom        go to the physical end of medium
fill       fill tape, write onto second volume
unfill     read filled tape
fsf        forward space a file
fsr        forward space a record
help       print this command
label      write a Bareos label to the tape
load       load a tape
quit       quit btape
rawfill    use write() to fill tape
readlabel  read and print the Bareos tape label
rectest    test record handling functions
rewind     rewind the tape
scan       read() tape block by block to EOT and report
scanblocks Bareos read block by block to EOT and report
speed      report drive speed
status     print tape status
test       General test Bareos tape functions
weof       write an EOF on the tape
wr         write a single Bareos block
rr         read a single record
qfill      quick fill command
```

The most useful commands are:

- test – test writing records and EOF marks and reading them back.
- fill – completely fill a volume with records, then write a few records on a second volume, and finally, both volumes will be read back. This command writes blocks containing random data, so your drive will not be able to compress the data, and thus it is a good test of the real physical capacity of your tapes.
- readlabel – read and dump the label on a Bareos tape.
- cap – list the device capabilities as defined in the configuration file and as perceived by the Storage daemon.

The **readlabel** command can be used to display the details of a Bareos tape label. This can be useful if the physical tape label was lost or damaged.
In the event that you want to relabel a Bareos volume, you can simply use the **label** command which will write over any existing label. However, please note for labeling tapes, we recommend that you use the **label** command in the **Console** program since it will never overwrite a valid Bareos tape.

Testing your Tape Drive To determine the best configuration of your tape drive, you can run the new `speed` command available in the `btape` program.
This command can have the following arguments:

`file_size=n` Specify the Maximum File Size for this test (between 1 and 5GB). This counter is in GB.

`nb_file=n` Specify the number of file to be written. The amount of data should be greater than your memory ($file\_size * nb\_file$).

`skip_zero` This flag permits to skip tests with constant data.

`skip_random` This flag permits to skip tests with random data.

`skip_raw` This flag permits to skip tests with raw access.

`skip_block` This flag permits to skip tests with Bareos block access.

```
*speed file_size=3 skip_raw
btape.c:1078 Test with zero data and Bareos block structure.
btape.c:956 Begin writing 3 files of 3.221 GB with blocks of 129024 bytes.
++++++++++++++++++++++++++++++++++++++++
btape.c:604 Wrote 1 EOF to "Drive-0" (/dev/nst0)
btape.c:406 Volume bytes=3.221 GB. Write rate = 44.128 MB/s
...
btape.c:383 Total Volume bytes=9.664 GB. Total Write rate = 43.531 MB/s

btape.c:1090 Test with random data, should give the minimum throughput.
btape.c:956 Begin writing 3 files of 3.221 GB with blocks of 129024 bytes.
++++++++++++++++++++++++++++++++++++++++
btape.c:604 Wrote 1 EOF to "Drive-0" (/dev/nst0)
btape.c:406 Volume bytes=3.221 GB. Write rate = 7.271 MB/s
++++++++++++++++++++++++++++++++++++++++
...
btape.c:383 Total Volume bytes=9.664 GB. Total Write rate = 7.365 MB/s
```

When using compression, the random test will give your the minimum throughput of your drive . The test using constant string will give you the maximum speed of your hardware chain. (cpu, memory, scsi card, cable, drive, tape).
You can change the block size in the Storage Daemon configuration file.

C.4.6 bscrypto

`bscrypto` is used in the process of encrypting tapes (see also LTO Hardware Encryption). The storage daemon and the btools (`bls`, `bextract`, `bscan`, `btape`, `bextract`) will use a so called storage daemon plugin to perform the setting and clearing of the encryption keys. To bootstrap the encryption support and for populating things like the crypto cache with encryption keys of volumes that you want to scan, you need to use the bscrypto tool. The bscrypto tool has the following capabilities:

- Generate a new passphrase
  - to be used as a so called Key Encryption Key (KEK) for wrapping a passphrase using RFC3394 key wrapping with aes-wrap
    - or -
  - for usage as a clear text encryption key loaded into the tape drive.
- Base64-encode a key if requested
- Generate a wrapped passphrase which performs the following steps:
  - generate a semi random clear text passphrase
  - wrap the passphrase using the Key Encryption Key using RFC3394
  - base64-encode the wrapped key (as the wrapped key is binary, we always need to base64-encode it in order to be able to pass the data as part of the director to storage daemon protocol
- show the content of a wrapped or unwrapped keyfile.
  This can be used to reveal the content of the passphrase when a passphrase is stored in the database and you have the urge to change the Key Encryption Key. Normally it is unwise to change the Key Encryption Key, as this means that you have to redo all your stored encryption keys, as they are stored in the database wrapped using the Key Encryption Key available in the config during the label phase of the volume.
- Clear the crypto cache on the machine running the bareos-sd, which keeps a cache of used encryption keys, which can be used when the bareos-sd is restarted without the need to connect to the bareos-dir to retrieve the encryption keys.
- Set the encryption key of the drive
- Clear the encryption key of the drive
- Show the encryption status of the drive

- Show the encryption status of the next block (e.g. volume)
- Populate the crypto cache with data

C.5 Other Programs

The following programs are general utility programs and in general do not need a configuration file nor a device name.

C.5.1 bsmtp

`bsmtp` is a simple mail transport program that permits more flexibility than the standard mail programs typically found on Unix systems. It can even be used on Windows machines.
It is called:

```
Usage: bsmtp [-f from] [-h mailhost] [-s subject] [-c copy] [recipient ...t
       -4          forces bsmtp to use IPv4 addresses only.
       -6          forces bsmtp to use IPv6 addresses only.
       -8          set charset to UTF-8
       -a          use any ip protocol for address resolution
       -c          set the Cc: field
       -d <nn>     set debug level to <nn>
       -dt         print a timestamp in debug output
       -f          set the From: field
       -h          use mailhost:port as the SMTP server
       -s          set the Subject: field
       -r          set the Reply-To: field
       -l          set the maximum number of lines to send (default: unlimited)
       -?          print this message.
```

Commands C.4: bsmtp

If the **-f** option is not specified, `bsmtp` will use your userid. If the option **-h** is not specified `bsmtp` will use the value in the environment variable **bsmtpSERVER** or if there is none **localhost**. By default port 25 is used.
If a line count limit is set with the **-l** option, `bsmtp` will not send an email with a body text exceeding that number of lines. This is especially useful for large restore job reports where the list of files restored might produce very long mails your mail-server would refuse or crash. However, be aware that you will probably suppress the job report and any error messages unless you check the log file written by the Director (see the messages resource in this manual for details).
recipients is a space separated list of email recipients.
The body of the email message is read from standard input.
An example of the use of `bsmtp` would be to put the following statement in the Messages resource of your `bareos-dir.conf` file.

```
Mail Command     = "bsmtp -h mail.example.com -f \"\(Bareos\) %r\" -s \"Bareos: %t %e of %c %l\" %r"
Operator Command = "bsmtp -h mail.example.com -f \"\(Bareos\) %r\" -s \"Bareos: Intervention needed for %j ↙
    ↪ \" %r"
```

Configuration C.5: bsmtp in Message resource

You have to replace **mail.example.com** with the fully qualified name of your SMTP (email) server, which normally listens on port 25. For more details on the substitution characters (e.g. %r) used in the above line, please see the documentation of the MailCommand in the Messages Resource chapter of this manual.
It is HIGHLY recommended that you test one or two cases by hand to make sure that the **mailhost** that you specified is correct and that it will accept your email requests. Since **bsmtp** always uses a TCP connection rather than writing in the spool file, you may find that your **from** address is being rejected because it does not contain a valid domain, or because your message is caught in your spam filtering rules. Generally, you should specify a fully qualified domain name in the **from** field, and depending on whether your bsmtp gateway is Exim or Sendmail, you may need to modify the syntax of the from part of the message. Please test.
When running `bsmtp` by hand, you will need to terminate the message by entering a ctrl-d in column 1 of the last line.
If you are getting incorrect dates (e.g. 1970) and you are running with a non-English language setting, you might try adding a `LANG=C` immediately before the `bsmtp` call.

In general, `bsmtp` attempts to cleanup email addresses that you specify in the from, copy, mailhost, and recipient fields, by adding the necessary < and > characters around the address part. However, if you include a **display-name** (see RFC 5332), some SMTP servers such as Exchange may not accept the message if the **display-name** is also included in < and >. As mentioned above, you must test, and if you run into this situation, you may manually add the < and > to the Bareos Mail Command Dir Messages or Operator Command Dir Messages and when `bsmtp` is formatting an address if it already contains a < or > character, it will leave the address unchanged.

C.5.2 bareos-dbcheck

bareos-dbcheck is a simple program that will search for logical inconsistencies in the Bareos tables in your database, and optionally fix them. It is a database maintenance routine, in the sense that it can detect and remove unused rows, but it is not a database repair routine. To repair a database, see the tools furnished by the database vendor. Normally bareos-dbcheck should never need to be run, but if Bareos has crashed or you have a lot of Clients, Pools, or Jobs that you have removed, it could be useful.
It is called:

```
Usage: dbcheck [-c config ] [-B] [-C catalog name] [-d debug level] [-D driver name] <working-directory> <bareos-database> <
       -b                batch mode
       -C                catalog name in the director conf file
       -c                Director conf filename
       -B                print catalog configuration and exit
       -d <nn>           set debug level to <nn>
       -dt               print a timestamp in debug output
       -D <driver name>  specify the database driver name (default NULL) <postgresql|mysql|sqlite>
       -f                fix inconsistencies
       -v                verbose
       -?                print this message
```

As Bareos supports loading its database backend dynamically you need to specify the right database driver to use using the **-D** option.
If the **-B** option is specified, bareos-dbcheck will print out catalog information in a simple text based format. This is useful to backup it in a secure way.

```
$ bareos-dbcheck -B
catalog=MyCatalog
db_type=SQLite
db_name=regress
db_driver=
db_user=regress
db_password=
db_address=
db_port=0
db_socket=
```

If the **-c** option is given with the Director's conf file, there is no need to enter any of the command line arguments, in particular the working directory as dbcheck will read them from the file.
If the **-f** option is specified, **bareos-dbcheck** will repair (**fix**) the inconsistencies it finds. Otherwise, it will report only.
If the **-b** option is specified, **bareos-dbcheck** will run in batch mode, and it will proceed to examine and fix (if -f is set) all programmed inconsistency checks. If the **-b** option is not specified, **bareos-dbcheck** will enter interactive mode and prompt with the following:

```
Hello, this is the database check/correct program.
Please select the function you want to perform.
     1) Toggle modify database flag
     2) Toggle verbose flag
     3) Repair bad Filename records
     4) Repair bad Path records
     5) Eliminate duplicate Filename records
     6) Eliminate duplicate Path records
     7) Eliminate orphaned Jobmedia records
     8) Eliminate orphaned File records
     9) Eliminate orphaned Path records
    10) Eliminate orphaned Filename records
    11) Eliminate orphaned FileSet records
```

```
    12) Eliminate orphaned Client records
    13) Eliminate orphaned Job records
    14) Eliminate all Admin records
    15) Eliminate all Restore records
    16) All (3-15)
    17) Quit
Select function number:
```

By entering 1 or 2, you can toggle the modify database flag (-f option) and the verbose flag (-v). It can be helpful and reassuring to turn off the modify database flag, then select one or more of the consistency checks (items 3 through 9) to see what will be done, then toggle the modify flag on and re-run the check.
The inconsistencies examined are the following:

- Duplicate filename records. This can happen if you accidentally run two copies of Bareos at the same time, and they are both adding filenames simultaneously. It is a rare occurrence, but will create an inconsistent database. If this is the case, you will receive error messages during Jobs warning of duplicate database records. If you are not getting these error messages, there is no reason to run this check.
- Repair bad Filename records. This checks and corrects filenames that have a trailing slash. They should not.
- Repair bad Path records. This checks and corrects path names that do not have a trailing slash. They should.
- Duplicate path records. This can happen if you accidentally run two copies of Bareos at the same time, and they are both adding filenames simultaneously. It is a rare occurrence, but will create an inconsistent database. See the item above for why this occurs and how you know it is happening.
- Orphaned JobMedia records. This happens when a Job record is deleted (perhaps by a user issued SQL statement), but the corresponding JobMedia record (one for each Volume used in the Job) was not deleted. Normally, this should not happen, and even if it does, these records generally do not take much space in your database. However, by running this check, you can eliminate any such orphans.
- Orphaned File records. This happens when a Job record is deleted (perhaps by a user issued SQL statement), but the corresponding File record (one for each Volume used in the Job) was not deleted. Note, searching for these records can be **very** time consuming (i.e. it may take hours) for a large database. Normally this should not happen as Bareos takes care to prevent it. Just the same, this check can remove any orphaned File records. It is recommended that you run this once a year since orphaned File records can take a large amount of space in your database. You might want to ensure that you have indexes on JobId, FilenameId, and PathId for the File table in your catalog before running this command.
- Orphaned Path records. This condition happens any time a directory is deleted from your system and all associated Job records have been purged. During standard purging (or pruning) of Job records, Bareos does not check for orphaned Path records. As a consequence, over a period of time, old unused Path records will tend to accumulate and use space in your database. This check will eliminate them. It is recommended that you run this check at least once a year.
- Orphaned Filename records. This condition happens any time a file is deleted from your system and all associated Job records have been purged. This can happen quite frequently as there are quite a large number of files that are created and then deleted. In addition, if you do a system update or delete an entire directory, there can be a very large number of Filename records that remain in the catalog but are no longer used.

  During standard purging (or pruning) of Job records, Bareos does not check for orphaned Filename records. As a consequence, over a period of time, old unused Filename records will accumulate and use space in your database. This check will eliminate them. It is strongly recommended that you run this check at least once a year, and for large database (more than 200 Megabytes), it is probably better to run this once every 6 months.
- Orphaned Client records. These records can remain in the database long after you have removed a client.
- Orphaned Job records. If no client is defined for a job or you do not run a job for a long time, you can accumulate old job records. This option allow you to remove jobs that are not attached to any client (and thus useless).

- All Admin records. This command will remove all Admin records, regardless of their age.
- All Restore records. This command will remove all Restore records, regardless of their age.

If you are using MySQL, `bareos-dbcheck` will ask you if you want to create temporary indexes to speed up orphaned Path and Filename elimination.
If you are using bvfs (e.g. used by bareos-webui), don't eliminate orphaned path, else you will have to rebuild `brestore_pathvisibility` and `brestore_pathhierarchy` indexes.
Normally you should never need to run `bareos-dbcheck` in spite of the recommendations given above, which are given so that users don't waste their time running bareos-dbcheck too often.

C.5.3 bregex

`bregex` is a simple program that will allow you to test regular expressions against a file of data. This can be useful because the regex libraries on most systems differ, and in addition, regex expressions can be complicated.
To run it, use:

```
Usage: bregex [-d debug_level] -f <data-file>
       -f          specify file of data to be matched
       -l          suppress line numbers
       -n          print lines that do not match
       -?          print this message.
```

The <data-file> is a filename that contains lines of data to be matched (or not) against one or more patterns. When the program is run, it will prompt you for a regular expression pattern, then apply it one line at a time against the data in the file. Each line that matches will be printed preceded by its line number. You will then be prompted again for another pattern.
Enter an empty line for a pattern to terminate the program. You can print only lines that do not match by using the -n option, and you can suppress printing of line numbers with the -l option.
This program can be useful for testing regex expressions to be applied against a list of filenames.

C.5.4 bwild

`bwild` is a simple program that will allow you to test wild-card expressions against a file of data.
To run it, use:

```
Usage: bwild [-d debug_level] -f <data-file>
       -f          specify file of data to be matched
       -l          suppress line numbers
       -n          print lines that do not match
       -?          print this message.
```

The <data-file> is a filename that contains lines of data to be matched (or not) against one or more patterns. When the program is run, it will prompt you for a wild-card pattern, then apply it one line at a time against the data in the file. Each line that matches will be printed preceded by its line number. You will then be prompted again for another pattern.
Enter an empty line for a pattern to terminate the program. You can print only lines that do not match by using the -n option, and you can suppress printing of line numbers with the -l option.
This program can be useful for testing wild expressions to be applied against a list of filenames.

C.5.5 bpluginfo

The main purpose of bpluginfo is to display different information about Bareos plugin. You can use it to check a plugin name, author, license and short description. You can use -f option to display API implemented by the plugin. Some plugins may require additional '-a' option for val- idating a Bareos Daemons API. In most cases it is not required.

Appendix D

The Bootstrap File

TODO: This chapter is going to be rewritten (by Philipp).
The information in this chapter is provided so that you may either create your own bootstrap files, or so that you can edit a bootstrap file produced by Bareos. However, normally the bootstrap file will be automatically created for you during the `restore` in the Console program, or by using a Write Bootstrap [Dir Job] record in your Backup Jobs, and thus you will never need to know the details of this file.
The **bootstrap** file contains ASCII information that permits precise specification of what files should be restored, what volume they are on, and where they are on the volume. It is a relatively compact form of specifying the information, is human readable, and can be edited with any text editor.

D.1 Bootstrap File Format

The general format of a **bootstrap** file is:
<keyword>= <value>
Where each **keyword** and the **value** specify which files to restore. More precisely the **keyword** and their **values** serve to limit which files will be restored and thus act as a filter. The absence of a keyword means that all records will be accepted.
Blank lines and lines beginning with a pound sign (#) in the bootstrap file are ignored.
There are keywords which permit filtering by Volume, Client, Job, FileIndex, Session Id, Session Time, ...
The more keywords that are specified, the more selective the specification of which files to restore will be. In fact, each keyword is **AND**ed with other keywords that may be present.
For example,

```
Volume = Test-001
VolSessionId = 1
VolSessionTime = 108927638
```

directs the Storage daemon (or the **bextract** program) to restore only those files on Volume Test-001 **AND** having VolumeSessionId equal to one **AND** having VolumeSession time equal to 108927638.
The full set of permitted keywords presented in the order in which they are matched against the Volume records are:

Volume The value field specifies what Volume the following commands apply to. Each Volume specification becomes the current Volume, to which all the following commands apply until a new current Volume (if any) is specified. If the Volume name contains spaces, it should be enclosed in quotes. At lease one Volume specification is required.

Count The value is the total number of files that will be restored for this Volume. This allows the Storage daemon to know when to stop reading the Volume. This value is optional.

VolFile The value is a file number, a list of file numbers, or a range of file numbers to match on the current Volume. The file number represents the physical file on the Volume where the data is stored. For a tape volume, this record is used to position to the correct starting file, and once the tape is past the last specified file, reading will stop.

VolBlock The value is a block number, a list of block numbers, or a range of block numbers to match on the current Volume. The block number represents the physical block within the file on the Volume where the data is stored.

VolSessionTime The value specifies a Volume Session Time to be matched from the current volume.

VolSessionId The value specifies a VolSessionId, a list of volume session ids, or a range of volume session ids to be matched from the current Volume. Each VolSessionId and VolSessionTime pair corresponds to a unique Job that is backed up on the Volume.

JobId The value specifies a JobId, list of JobIds, or range of JobIds to be selected from the current Volume. Note, the JobId may not be unique if you have multiple Directors, or if you have reinitialized your database. The JobId filter works only if you do not run multiple simultaneous jobs. This value is optional and not used by Bareos to restore files.

Job The value specifies a Job name or list of Job names to be matched on the current Volume. The Job corresponds to a unique VolSessionId and VolSessionTime pair. However, the Job is perhaps a bit more readable by humans. Standard regular expressions (wildcards) may be used to match Job names. The Job filter works only if you do not run multiple simultaneous jobs. This value is optional and not used by Bareos to restore files.

Client The value specifies a Client name or list of Clients to will be matched on the current Volume. Standard regular expressions (wildcards) may be used to match Client names. The Client filter works only if you do not run multiple simultaneous jobs. This value is optional and not used by Bareos to restore files.

FileIndex The value specifies a FileIndex, list of FileIndexes, or range of FileIndexes to be selected from the current Volume. Each file (data) stored on a Volume within a Session has a unique FileIndex. For each Session, the first file written is assigned FileIndex equal to one and incremented for each file backed up.

This for a given Volume, the triple VolSessionId, VolSessionTime, and FileIndex uniquely identifies a file stored on the Volume. Multiple copies of the same file may be stored on the same Volume, but for each file, the triple VolSessionId, VolSessionTime, and FileIndex will be unique. This triple is stored in the Catalog database for each file.

To restore a particular file, this value (or a range of FileIndexes) is required.

FileRegex The value is a regular expression. When specified, only matching filenames will be restored.

```
FileRegex=^/etc/passwd(.old)?
```

Slot The value specifies the autochanger slot. There may be only a single **Slot** specification for each Volume.

Stream The value specifies a Stream, a list of Streams, or a range of Streams to be selected from the current Volume. Unless you really know what you are doing (the internals of Bareos), you should avoid this specification. This value is optional and not used by Bareos to restore files.

The **Volume** record is a bit special in that it must be the first record. The other keyword records may appear in any order and any number following a Volume record.
Multiple Volume records may be specified in the same bootstrap file, but each one starts a new set of filter criteria for the Volume.
In processing the bootstrap file within the current Volume, each filter specified by a keyword is **AND**ed with the next. Thus,

```
Volume = Test-01
Client = "My machine"
FileIndex = 1
```

will match records on Volume **Test-01 AND** Client records for **My machine AND** FileIndex equal to **one**.
Multiple occurrences of the same record are **OR**ed together. Thus,

```
Volume = Test-01
Client = "My machine"
Client = "Backup machine"
FileIndex = 1
```

will match records on Volume **Test-01 AND** (Client records for **My machine OR Backup machine**) **AND** FileIndex equal to **one**.
For integer values, you may supply a range or a list, and for all other values except Volumes, you may specify a list. A list is equivalent to multiple records of the same keyword. For example,

```
Volume = Test-01
Client = "My machine", "Backup machine"
FileIndex = 1-20, 35
```

will match records on Volume **Test-01 AND** (Client records for **My machine OR Backup machine**) **AND** (FileIndex 1 **OR** 2 **OR** 3 ... **OR** 20 **OR** 35).
As previously mentioned above, there may be multiple Volume records in the same bootstrap file. Each new Volume definition begins a new set of filter conditions that apply to that Volume and will be **OR**ed with any other Volume definitions.
As an example, suppose we query for the current set of tapes to restore all files on Client **Rufus** using the **query** command in the console program:

```
Using default Catalog name=MySQL DB=bareos
*query
Available queries:
     1: List Job totals:
     2: List where a file is saved:
     3: List where the most recent copies of a file are saved:
     4: List total files/bytes by Job:
     5: List total files/bytes by Volume:
     6: List last 10 Full Backups for a Client:
     7: List Volumes used by selected JobId:
     8: List Volumes to Restore All Files:
Choose a query (1-8): 8
Enter Client Name: Rufus
+-------+------------------+------------+-----------+----------+------------+
| JobId | StartTime        | VolumeName | StartFile | VolSesId | VolSesTime |
+-------+------------------+------------+-----------+----------+------------+
| 154   | 2002-05-30 12:08 | test-02    | 0         | 1        | 1022753312 |
| 202   | 2002-06-15 10:16 | test-02    | 0         | 2        | 1024128917 |
| 203   | 2002-06-15 11:12 | test-02    | 3         | 1        | 1024132350 |
| 204   | 2002-06-18 08:11 | test-02    | 4         | 1        | 1024380678 |
+-------+------------------+------------+-----------+----------+------------+
```

The output shows us that there are four Jobs that must be restored. The first one is a Full backup, and the following three are all Incremental backups.
The following bootstrap file will restore those files:

```
Volume=test-02
VolSessionId=1
VolSessionTime=1022753312
Volume=test-02
VolSessionId=2
VolSessionTime=1024128917
Volume=test-02
VolSessionId=1
VolSessionTime=1024132350
Volume=test-02
VolSessionId=1
VolSessionTime=1024380678
```

As a final example, assume that the initial Full save spanned two Volumes. The output from **query** might look like:

```
+-------+------------------+------------+-----------+----------+------------+
| JobId | StartTime        | VolumeName | StartFile | VolSesId | VolSesTime |
+-------+------------------+------------+-----------+----------+------------+
| 242   | 2002-06-25 16:50 | File0003   | 0         | 1        | 1025016612 |
| 242   | 2002-06-25 16:50 | File0004   | 0         | 1        | 1025016612 |
| 243   | 2002-06-25 16:52 | File0005   | 0         | 2        | 1025016612 |
| 246   | 2002-06-25 19:19 | File0006   | 0         | 2        | 1025025494 |
+-------+------------------+------------+-----------+----------+------------+
```

and the following bootstrap file would restore those files:

```
Volume=File0003
VolSessionId=1
VolSessionTime=1025016612
Volume=File0004
VolSessionId=1
VolSessionTime=1025016612
Volume=File0005
```

```
VolSessionId=2
VolSessionTime=1025016612
Volume=File0006
VolSessionId=2
VolSessionTime=1025025494
```

D.2 Automatic Generation of Bootstrap Files

One thing that is probably worth knowing: the bootstrap files that are generated automatically at the end of the job are not as optimized as those generated by the restore command. This is because during Incremental and Differential jobs, the records pertaining to the files written for the Job are appended to the end of the bootstrap file. As consequence, all the files saved to an Incremental or Differential job will be restored first by the Full save, then by any Incremental or Differential saves.
When the bootstrap file is generated for the restore command, only one copy (the most recent) of each file is restored.
So if you have spare cycles on your machine, you could optimize the bootstrap files by doing the following:

```
bconsole
restore client=xxx select all
done
no
quit
Backup bootstrap file.
```

The above will not work if you have multiple FileSets because that will be an extra prompt. However, the **restore client=xxx select all** builds the in-memory tree, selecting everything and creates the bootstrap file.
The **no** answers the **Do you want to run this (yes/mod/no)** question.

D.3 Bootstrap for bscan

If you have a very large number of Volumes to scan with **bscan**, you may exceed the command line limit (511 characters). In that case, you can create a simple bootstrap file that consists of only the volume names. An example might be:

```
Volume="Vol001"
Volume="Vol002"
Volume="Vol003"
Volume="Vol004"
Volume="Vol005"
```

D.4 Bootstrap Example

If you want to extract or copy a single Job, you can do it by selecting by JobId (code not tested) or better yet, if you know the VolSessionTime and the VolSessionId (printed on Job report and in Catalog), specifying this is by far the best. Using the VolSessionTime and VolSessionId is the way Bareos does restores. A bsr file might look like the following:

```
Volume="Vol001"
VolSessionId=10
VolSessionTime=1080847820
```

If you know how many files are backed up (on the job report), you can enormously speed up the selection by adding (let's assume there are 157 files):

```
FileIndex=1-157
Count=157
```

Finally, if you know the File number where the Job starts, you can also cause bcopy to forward space to the right file without reading every record:

```
VolFile=20
```

There is nothing magic or complicated about a BSR file. Parsing it and properly applying it within Bareos *is* magic, but you don't need to worry about that.
If you want to see a *real* bsr file, simply fire up the **restore** command in the console program, select something, then answer no when it prompts to run the job. Then look at the file **restore.bsr** in your working directory.

Appendix E

Verify File Integrity with Bareos

Since Bareos maintains a catalog of files, their attributes, and either SHA1 or MD5 signatures, it can be an ideal tool for improving computer security. This is done by making a snapshot of your system files with a **Verify** Job and then checking the current state of your system against the snapshot, on a regular basis (e.g. nightly).
The first step is to set up a **Verify** Job and to run it with:

```
Level = InitCatalog
```

The **InitCatalog** level tells **Bareos** simply to get the information on the specified files and to put it into the catalog. That is your database is initialized and no comparison is done. The **InitCatalog** is normally run one time manually.
Thereafter, you will run a Verify Job on a daily (or whatever) basis with:

```
Level = Catalog
```

The **Level = Catalog** level tells Bareos to compare the current state of the files on the Client to the last **InitCatalog** that is stored in the catalog and to report any differences. See the example below for the format of the output.
You decide what files you want to form your "snapshot" by specifying them in a **FileSet** resource, and normally, they will be system files that do not change, or that only certain features change.
Then you decide what attributes of each file you want compared by specifying comparison options on the **Include** statements that you use in the **FileSet** resource of your **Catalog** Jobs.

E.1 The Details

In the discussion that follows, we will make reference to the Verify Configuration Example that is included below in the **A Verify Configuration Example** section. You might want to look it over now to get an idea of what it does.
The main elements consist of adding a schedule, which will normally be run daily, or perhaps more often. This is provided by the **VerifyCycle** Schedule, which runs at 5:05 in the morning every day.
Then you must define a Job, much as is done below. We recommend that the Job name contain the name of your machine as well as the word **Verify** or **Check**. In our example, we named it **MatouVerify**. This will permit you to easily identify your job when running it from the Console.
You will notice that most records of the Job are quite standard, but that the **FileSet** resource contains **verify=pins1** option in addition to the standard **signature=SHA1** option. If you don't want SHA1 signature comparison, and we cannot imagine why not, you can drop the **signature=SHA1** and none will be computed nor stored in the catalog. Or alternatively, you can use **verify=pins5** and **signature=MD5**, which will use the MD5 hash algorithm. The MD5 hash computes faster than SHA1, but is cryptographically less secure.
The **verify=pins1** is ignored during the **InitCatalog** Job, but is used during the subsequent **Catalog** Jobs to specify what attributes of the files should be compared to those found in the catalog. **pins1** is a reasonable set to begin with, but you may want to look at the details of these and other options. They can be found in the FileSet Resource section of this manual. Briefly, however, the **p** of the **pins1** tells Verify to compare the permissions bits, the **i** is to compare inodes, the **n** causes comparison of the number of links, the **s** compares the file size, and the **1** compares the SHA1 checksums (this requires the **signature=SHA1** option to have been set also).

You must also specify the **Client** and the **Catalog** resources for your Verify job, but you probably already have them created for your client and do not need to recreate them, they are included in the example below for completeness.
As mentioned above, you will need to have a **FileSet** resource for the Verify job, which will have the additional **verify=pins1** option. You will want to take some care in defining the list of files to be included in your **FileSet**. Basically, you will want to include all system (or other) files that should not change on your system. If you select files, such as log files or mail files, which are constantly changing, your automatic Verify job will be constantly finding differences. The objective in forming the FileSet is to choose all unchanging important system files. Then if any of those files has changed, you will be notified, and you can determine if it changed because you loaded a new package, or because someone has broken into your computer and modified your files. The example below shows a list of files that I use on my Red Hat 7.3 system. Since I didn't spend a lot of time working on it, it probably is missing a few important files (if you find one, please send it to me). On the other hand, as long as I don't load any new packages, none of these files change during normal operation of the system.

E.2 Running the Verify

The first thing you will want to do is to run an **InitCatalog** level Verify Job. This will initialize the catalog to contain the file information that will later be used as a basis for comparisons with the actual file system, thus allowing you to detect any changes (and possible intrusions into your system).
The easiest way to run the **InitCatalog** is manually with the console program by simply entering **run**. You will be presented with a list of Jobs that can be run, and you will choose the one that corresponds to your Verify Job, **MatouVerify** in this example.

```
The defined Job resources are:
     1: MatouVerify
     2: usersrestore
     3: Filetest
     4: usersave
Select Job resource (1-4): 1
```

Next, the console program will show you the basic parameters of the Job and ask you:

```
Run Verify job
JobName:  MatouVerify
FileSet:  Verify Set
Level:    Catalog
Client:   MatouVerify
Storage:  DLTDrive
Verify Job:
Verify List: /tmp/regress/working/MatouVerify.bsr
OK to run? (yes/mod/no): mod
```

Here, you want to respond **mod** to modify the parameters because the Level is by default set to **Catalog** and we want to run an **InitCatalog** Job. After responding **mod**, the console will ask:

```
Parameters to modify:
     1: Level
     2: Storage
     3: Job
     4: FileSet
     5: Client
     6: When
     7: Priority
     8: Pool
     9: Verify Job
Select parameter to modify (1-5): 1
```

you should select number 2 to modify the **Level**, and it will display:

```
Levels:
     1: Initialize Catalog
     2: Verify Catalog
     3: Verify Volume to Catalog
     4: Verify Disk to Catalog
     5: Verify Volume Data (not yet implemented)
Select level (1-4): 1
```

Choose item 1, and you will see the final display:

```
Run Verify job
JobName:  MatouVerify
FileSet:  Verify Set
Level:    Initcatalog
Client:   MatouVerify
Storage:  DLTDrive
Verify Job:
Verify List: /tmp/regress/working/MatouVerify.bsr
OK to run? (yes/mod/no): yes
```

at which point you respond **yes**, and the Job will begin.
Thereafter the Job will automatically start according to the schedule you have defined. If you wish to immediately verify it, you can simply run a Verify **Catalog** which will be the default. No differences should be found.
To use a previous job, you can add `jobid=xxx` option in run command line. It will run the Verify job against the specified job.

```
*run jobid=1 job=MatouVerify
Run Verify job
JobName:     MatouVerify
Level:       Catalog
Client:      127.0.0.1-fd
FileSet:     Full Set
Pool:        Default (From Job resource)
Storage:     File (From Job resource)
Verify Job:  MatouVerify.2010-09-08_15.33.33_03
Verify List: /tmp/regress/working/MatouVerify.bsr
When:        2010-09-08 15:35:32
Priority:    10
OK to run? (yes/mod/no):
```

E.3 What To Do When Differences Are Found

If you have setup your messages correctly, you should be notified if there are any differences and exactly what they are. For example, below is the email received after doing an update of OpenSSH:

```
HeadMan: Start Verify JobId 83 Job=RufusVerify.2002-06-25.21:41:05
HeadMan: Verifying against Init JobId 70 run 2002-06-21 18:58:51
HeadMan: File: /etc/pam.d/sshd
HeadMan:       st_ino   differ. Cat: 4674b File: 46765
HeadMan: File: /etc/rc.d/init.d/sshd
HeadMan:       st_ino   differ. Cat: 56230 File: 56231
HeadMan: File: /etc/ssh/ssh_config
HeadMan:       st_ino   differ. Cat: 81317 File: 8131b
HeadMan:       st_size  differ. Cat: 1202 File: 1297
HeadMan:       SHA1 differs.
HeadMan: File: /etc/ssh/sshd_config
HeadMan:       st_ino   differ. Cat: 81398 File: 81325
HeadMan:       st_size  differ. Cat: 1182 File: 1579
HeadMan:       SHA1 differs.
HeadMan: File: /etc/ssh/ssh_config.rpmnew
HeadMan:       st_ino   differ. Cat: 812dd File: 812b3
HeadMan:       st_size  differ. Cat: 1167 File: 1114
HeadMan:       SHA1 differs.
HeadMan: File: /etc/ssh/sshd_config.rpmnew
HeadMan:       st_ino   differ. Cat: 81397 File: 812dd
HeadMan:       st_size  differ. Cat: 2528 File: 2407
HeadMan:       SHA1 differs.
HeadMan: File: /etc/ssh/moduli
HeadMan:       st_ino   differ. Cat: 812b3 File: 812ab
HeadMan: File: /usr/bin/scp
HeadMan:       st_ino   differ. Cat: 5e07e File: 5e343
HeadMan:       st_size  differ. Cat: 26728 File: 26952
HeadMan:       SHA1 differs.
HeadMan: File: /usr/bin/ssh-keygen
HeadMan:       st_ino   differ. Cat: 5df1d File: 5e07e
HeadMan:       st_size  differ. Cat: 80488 File: 84648
```

```
HeadMan:       SHA1 differs.
HeadMan: File: /usr/bin/sftp
HeadMan:       st_ino   differ. Cat: 5e2e8 File: 5df1d
HeadMan:       st_size  differ. Cat: 46952 File: 46984
HeadMan:       SHA1 differs.
HeadMan: File: /usr/bin/slogin
HeadMan:       st_ino   differ. Cat: 5e359 File: 5e2e8
HeadMan: File: /usr/bin/ssh
HeadMan:       st_mode  differ. Cat: 89ed File: 81ed
HeadMan:       st_ino   differ. Cat: 5e35a File: 5e359
HeadMan:       st_size  differ. Cat: 219932 File: 234440
HeadMan:       SHA1 differs.
HeadMan: File: /usr/bin/ssh-add
HeadMan:       st_ino   differ. Cat: 5e35b File: 5e35a
HeadMan:       st_size  differ. Cat: 76328 File: 81448
HeadMan:       SHA1 differs.
HeadMan: File: /usr/bin/ssh-agent
HeadMan:       st_ino   differ. Cat: 5e35c File: 5e35b
HeadMan:       st_size  differ. Cat: 43208 File: 47368
HeadMan:       SHA1 differs.
HeadMan: File: /usr/bin/ssh-keyscan
HeadMan:       st_ino   differ. Cat: 5e35d File: 5e96a
HeadMan:       st_size  differ. Cat: 139272 File: 151560
HeadMan:       SHA1 differs.
HeadMan: 25-Jun-2002 21:41
JobId:                  83
Job:                    RufusVerify.2002-06-25.21:41:05
FileSet:                Verify Set
Verify Level:           Catalog
Client:                 RufusVerify
Start time:             25-Jun-2002 21:41
End time:               25-Jun-2002 21:41
Files Examined:         4,258
Termination:            Verify Differences
```

At this point, it was obvious that these files were modified during installation of the RPMs. If you want to be super safe, you should run a **Verify Level=Catalog** immediately before installing new software to verify that there are no differences, then run a **Verify Level=InitCatalog** immediately after the installation.
To keep the above email from being sent every night when the Verify Job runs, we simply re-run the Verify Job setting the level to **InitCatalog** (as we did above in the very beginning). This will re-establish the current state of the system as your new basis for future comparisons. Take care that you don't do an **InitCatalog** after someone has placed a Trojan horse on your system!
If you have included in your **FileSet** a file that is changed by the normal operation of your system, you will get false matches, and you will need to modify the **FileSet** to exclude that file (or not to Include it), and then re-run the **InitCatalog**.
The FileSet that is shown below is what I use on my Red Hat 7.3 system. With a bit more thought, you can probably add quite a number of additional files that should be monitored.

E.4 A Verify Configuration Example

```
Schedule {
  Name = "VerifyCycle"
  Run = Level=Catalog sun-sat at 5:05
}
Job {
  Name = "MatouVerify"
  Type = Verify
  Level = Catalog                     # default level
  Client = MatouVerify
  FileSet = "Verify Set"
  Messages = Standard
  Storage = DLTDrive
  Pool = Default
  Schedule = "VerifyCycle"
}
#
# The list of files in this FileSet should be carefully
# chosen. This is a good starting point.
#
FileSet {
  Name = "Verify Set"
```

```
  Include {
    Options {
      verify=pins1
      signature=SHA1
    }
    File = /boot
    File = /bin
    File = /sbin
    File = /usr/bin
    File = /lib
    File = /root/.ssh
    File = /home/user/.ssh
    File = /var/named
    File = /etc/sysconfig
    File = /etc/ssh
    File = /etc/security
    File = /etc/exports
    File = /etc/rc.d/init.d
    File = /etc/sendmail.cf
    File = /etc/sysctl.conf
    File = /etc/services
    File = /etc/xinetd.d
    File = /etc/hosts.allow
    File = /etc/hosts.deny
    File = /etc/hosts
    File = /etc/modules.conf
    File = /etc/named.conf
    File = /etc/pam.d
    File = /etc/resolv.conf
  }
  Exclude = { }
}
Client {
  Name = MatouVerify
  Address = lmatou
  Catalog = Bareos
  Password = ""
  File Retention = 80d                # 80 days
  Job Retention = 1y                  # one year
  AutoPrune = yes                     # Prune expired Jobs/Files
}
Catalog {
  Name = Bareos
  dbname = verify; user = bareos; password = ""
}
```

Appendix F

Backward Compatibility

F.1 Tape Formats

One of the major goals of Backup softare is to ensure that you can restore tapes (the word tape should also include disk volumes) that you wrote years ago. This means that each new version of the software should be able to read old format tapes. The first problem you will have is to ensure that the hardware is still working some years down the road, and the second problem will be to ensure that the media will still be good, then your OS must be able to interface to the device, and finally Bareos must be able to recognize old formats. All the problems except the last are ones that we cannot solve, but by careful planning you can.

Since the very beginning of Bacula (January 2000) until today (2015), there have been three major Bacula/Bareos tape formats. The second format was introduced in Bacula version 1.27 in November of 2002. Bareos has been required to adapt the tape format to avoid potential trademark issues, but is able to read also the old Bacula tape formats.

Though the tape format is basically fixed, the kinds of data that we can put on the tapes are extensible, and that is how we added new features such as ACLs, Win32 data, encrypted data, ... Obviously, an older version of Bacula/Bareos would not know how to read these newer data streams, but each newer version of Bareos should know how to read all the older streams.

F.2 Compatibility between Bareos and Bacula

A Director and a Storage Daemon should (must) always run at the same version. This is true for Bareos as well as for Bacula. It is not possible to mix these components. This is because the protocol between Director and Storage Daemon itself is not versioned (also true for Bareos and Bacula). If you want to be able to switch back from Bareos to Bacula after using a Bareos director and storage daemon you have to enable the compatible mode in the Bareos storage daemon to have it write the data in the same format as the Bacula storage daemon.

The Bareos File Daemon is compatible with all version of the Bacula director (tested with version 5.2.13 and lower) when you enable the compatible mode in the config of the file daemon. The compatible option was set by default in Bareos < 15.2.0, and is disabled by default since Version Version >= 15.2.0 . To be sure this is enabled you can explicitly set the compatible option by putting the following in the `bareos-fd.conf`:

```
compatible=true
```

Configuration F.1: Compatibility directive

A Bareos director can only talk to Bacula file daemons of version 2.0 or higher.

These combinations of Bareos and Bacula are know to work together:

Director	Storage Daemon	File Daemon	Remarks
Bareos	Bareos	Bareos	
Bareos	Bareos	Bacula $\geq$ 2.0	
Bacula	Bacula	Bacula	
Bacula	Bacula	Bareos (compatibe mode)	

Other combinations like Bacula director (dir) with Bareos storage daemon (sd) will not work. However this wasn't even possible with different versions of bacula-dir and bacula-sd.

F.2.1 Upgrade from Bacula 5.2 to Bareos

Upgrade is supported from Bacula version 5.2.x. If you are running any older version of Bacula, please update to 5.2 first (see Bacula documentation). **Note:** Updating from the latest Bacula 7.0 to Bareos has not been tested.

Rename user and group before upgrading

To have bareos running without any permission hazzle, it is recommended to rename the user and group `bacula` to the user and group `bareos` before upgrading. That way, we minimize the effort for the user to recheck all config files and the rights on every script/directory etc. involved in the existing setup.
The required commands should look something like this:

```
usermod  -l bareos bacula
groupmod -n bareos bacula
```

MySQL

Proceed with the following steps:

- Stop bacula services
- Backup your catalog database:

  ```
  mysqldump bacula > /tmp/bacula_5.2.sql
  ```

- Make the user bareos have the same userid and the group bareos the same groupid as the user/group bacula had before. This will solve a lot of rights problems.
- Install Bareos packages
- Run the update script on the old bacula database:

  ```
  export db_name=bacula
  /usr/lib/bareos/update_bareos_tables
  unset db_name
  ```

- Backup upgraded DB:

  ```
  mysqldump bacula > /tmp/bacula.sql
  ```

- Create bareos database:

  ```
  /usr/lib/bareos/create_bareos_database
  ```

- Insert backuped db into new database:

  ```
  cat /tmp/bacula.sql | mysql bareos
  ```

- Grant permissions:

  ```
  /usr/lib/bareos/grant_mysql_privileges
  ```

- Adapt file permissions to bareos, if you have any file storage
- Adapt configs (not complete)
  - With bacula the default setting for pid files was `/var/run`, which may not work if the bareos-director runs as user bareos. Best way is to comment out the entry `Pid Directory = "/var/run"` in your director config. Bareos will set a working default value (supposed to be `/var/lib/bareos/`)

PostgreSQL

Renaming a postgresql database:

- Become postgresql user
- psql template1

```
ALTER DATABASE bacula RENAME TO bareos;
ALTER USER bacula RENAME TO bareos;
ALTER USER bareos UNENCRYPTED PASSWORD 'password';
```

Appendix G

Catalog Tables

Bareos stores its information in a database, named Catalog. It is configured by Catalog Resource.

G.1 Job

G.1.1 JobStatus

The status of a Bareos job is stored as abbreviation in the Catalog database table Job. It is also displayed by some bconsole commands, eg. `list jobs`.
This table lists the abbreviations together with its description and weight. The weight is used, when multiple states are applicable for a job. In this case, only the status with the highest weight/priority is applied.

Abbr.	Description	Weight
C	Created, not yet running	15
R	Running	15
B	Blocked	15
T	Completed successfully	10
E	Terminated with errors	25
e	Non-fatal error	20
f	Fatal error	100
D	Verify found differences	15
A	Canceled by user	90
I	Incomplete job	15
L	Committing data	15
W	Terminated with warnings	20
l	Doing data despooling	15
q	Queued waiting for device	15
F	Waiting for Client	15
S	Waiting for Storage daemon	15
m	Waiting for new media	15
M	Waiting for media mount	15
s	Waiting for storage resource	15
j	Waiting for job resource	15
c	Waiting for client resource	15
d	Waiting on maximum jobs	15
t	Waiting on start time	15
p	Waiting on higher priority jobs	15
i	Doing batch insert file records	15
a	SD despooling attributes	15

Appendix H

Howtos

H.1 Use a dummy device to test the backup

If your are testing your configuration, but don't want to store the backup data, it is possible to use a dummy FIFO device to test your configuration, see Stored configuration.
Obviously, it can not be used to do a restore.

```
Device {
  Name = NULL
  Media Type = NULL
  Device Type = Fifo
  Archive Device = /dev/null
  LabelMedia = yes
  Random Access = no
  AutomaticMount = no
  RemovableMedia = no
  MaximumOpenWait = 60
  AlwaysOpen = no
}
```

Configuration H.1: FIFO Storage Device Configuration

H.2 Backup Of Third Party Databases

If you are running a database in production mode on your machine, Bareos will happily backup the files, but if the database is in use while Bareos is reading it, you may back it up in an unstable state.
The best solution is to shutdown your database before backing it up, or use some tool specific to your database to make a valid live copy perhaps by dumping the database in ASCII format.

H.2.1 Backup of MSSQL Databases with Bareos Plugin

Version >= 13.2.0

Preparation

If you like to use the MSSQL-Plugin to backing up your Databases you need to consider some things:

- **Database Mode**
  The database need to run in **Full Recovery Mode**. Otherwise you are not able to use differential and incremental backups or to use point in time recovery.
  Please note! *If you set the databases into the mentionend mode you have to consider some maintance facts. The database doesn't shrink or delete the logs unanttended, so you have to shrink them manual once a week and you have to truncate the logs once in a month.*

- **Security and Access**
  For connections you can use a SQL-User or a integrated systemaccount (Windows NT user). Both connection types are supported.

  - Standard Security
    You have to provide user credentials within your options which do belong to user with the sufficent right performing restores and backups from the database. This way stands for an extra backup/restore user.
  - Trusted Security
    You use a systemaccount which have the sufficent rights to performing backups and restores on a database. This systemaccount have to be same account like the **bareos-filedeamon** runs on.

- **Permissions and Roles**
  - Server-Role
    The user should be in the groups **sysadmin** and **dbcreator**.
  - Database permissions
    The user have to be a **backupoperator** and **dbowner** of the database which you like to backup.

There is no difference for the rights and roles between using a systemaccount (trusted security method) or a extra backup user (standard security method). Please keep in mind if you use the trusted security method you have to use the same system account like the bareos-filedeamon runs on.

MSSQL Plugin Installation

For Bareos < 14.2, install the Bareos MSSQL plugin onto the MSSQL server you want to backup. Bareos >= 14.2 also allows to backup remote MSSQL servers (option `serveraddress`).

Bareos Windows-Installer Install the Bareos filedaemon including the component "Bareos FileDameon Plugins". Make sure, that you install the file daemon **without the "compatible" option**.

Manual install After downloading the plugin you need to copy it into `C:\Program Files\Bareos\Plugins`. Then you need to define the plugin directory and which plugin the **bareos-filedaemon** should use. You have to edit the **bareos-filedaemon** resource in `C:\Program Data\bareos-fd.conf` as follows:

```
FileDaemon {
  Name = mssqlserver-fd
  Maximum Concurrent Jobs = 20

  # remove comment in next line to load plugins from specified directory
  Plugin Directory = "C:/Program Files/Bareos/Plugins"

  Plugin Names = "mssqlvdi"
  compatible = no  # this is the default since bareos 15
}
```

Configuration H.2: MSSQL plugin configuration

Plugin Test

```
*status client=mssqlserver-fd
Connecting to Client mssqlserver-fd at 192.168.10.101:9102

mssqlserver-fd Version: 13.2.2 (12 November 2013)  VSS Linux Cross-compile Win64
Daemon started 18-Nov-13 11:51. Jobs: run=0 running=0.
Microsoft Windows Server 2012 Standard Edition (build 9200), 64-bit
 Heap: heap=0 smbytes=20,320 max_bytes=20,522 bufs=71 max_bufs=73
 Sizeof: boffset_t=8 size_t=8 debug=0 trace=1 bwlimit=0kB/s
Plugin Info:
 Plugin      : mssqlvdi-fd.dll
 Description: Bareos MSSQL VDI Windows File Daemon Plugin
 Version     : 1, Date: July 2013
 Author      : Zilvinas Krapavickas
 License     : Bareos AGPLv3
 Usage       :
  mssqlvdi:
  serveraddress=<hostname>:
  instance=<instance name>:
```

```
  database=<database name>:
  username=<database username>:
  password=<database password>:
  norecovery=<yes|no>:
  replace=<yes|no>:
  recoverafterrestore=<yes|no>:
  stopbeforemark=<log sequence number specification>:
  stopatmark=<log sequence number specification>:
  stopat=<timestamp>

 examples:
  timestamp: 'Apr 15, 2020 12:00 AM'
  log sequence number: 'lsn:15000000040000037'
```

bconsole H.3: status client

Configure the FileSet

To use the plugin you need to configure it in the fileset as a plugin resource. For each database instance you need to define a exclusive backup job and fileset.

```
Fileset {
  Name = "Mssql"
  Enable VSS = no
  Include {
    Options {
      Signature = MD5
    }
    Plugin = "mssqlvdi:instance=default:database=myDatabase:username=bareos:password=bareos"
  }
}
```

Configuration H.4: MSSQL FileSet

In this example we use the standard security method for the connection.
Used options in the plugin string are:

mssqlvdi This is the reference to the MSSQL plugin.

serveraddress (Version >= 14.2.2) Defines the server address to connect to (if empty defaults to localhost).

instance Defines the instance within the database server.

database Defines the database that should get backuped.

username and password Username and Password are required, when the connection is done using a MSSQL user. If the systemaccount the bareos-fd runs with has succifient permissions, this is not required.

It is recommend to define an additional restore job.
For every database separate job and FileSet are required.

Run Backups

Here you can see an example for a backup:

```
*run job=MSSQLBak
Using Catalog "MyCatalog"
Run Backup job
JobName:  MSSQLBak
Level:    Full
Client:   mssqlserver-fd
Format:   Native
FileSet:  Mssql
Pool:     File (From Job resource)
Storage:  File (From Job resource)
When:     2013-11-21 09:48:27
Priority: 10
```

```
OK to run? (yes/mod/no): yes
Job queued. JobId=7
You have no messages.
*mess
21-Nov 09:48 bareos-dir JobId 7: Start Backup JobId 7, ↙
    ↪ Job=MSSQLBak.2013-11-21_09.48.30_04
21-Nov 09:48 bareos-dir JobId 7: Using Device "FileStorage" to write.
21-Nov 09:49 bareos-sd JobId 7: Volume "test1" previously written, moving to end ↙
    ↪ of data.
21-Nov 09:49 bareos-sd JobId 7: Ready to append to end of Volume "test1" ↙
    ↪ size=2300114868
21-Nov 09:49 bareos-sd JobId 7: Elapsed time=00:00:27, Transfer rate=7.364 M ↙
    ↪ Bytes/second

21-Nov 09:49 bareos-dir JobId 7: Bareos bareos-dir 13.4.0 (01Oct13):
  Build OS:               x86_64-pc-linux-gnu debian Debian GNU/Linux 7.0 (wheezy)
  JobId:                  7
  Job:                    MSSQLBak.2013-11-21_09.48.30_04
  Backup Level:           Full
  Client:                 "mssqlserver-fd" 13.2.2 (12Nov13) Microsoft Windows ↙
    ↪ Server 2012 Standard Edition (build 9200), 64-bit,Cross-compile,Win64
  FileSet:                "Mssql" 2013-11-04 23:00:01
  Pool:                   "File" (From Job resource)
  Catalog:                "MyCatalog" (From Client resource)
  Storage:                "File" (From Job resource)
  Scheduled time:         21-Nov-2013 09:48:27
  Start time:             21-Nov-2013 09:49:13
  End time:               21-Nov-2013 09:49:41
  Elapsed time:           28 secs
  Priority:               10
  FD Files Written:       1
  SD Files Written:       1
  FD Bytes Written:       198,836,224 (198.8 MB)
  SD Bytes Written:       198,836,435 (198.8 MB)
  Rate:                   7101.3 KB/s
  Software Compression:   None
  VSS:                    no
  Encryption:             no
  Accurate:               no
  Volume name(s):         test1
  Volume Session Id:      1
  Volume Session Time:    1384961357
  Last Volume Bytes:      2,499,099,145 (2.499 GB)
  Non-fatal FD errors:    0
  SD Errors:              0
  FD termination status:  OK
  SD termination status:  OK
  Termination:            Backup OK
```

bconsole H.5: run MSSQL backup job

At least you gain a full backup which contains the follow:

```
@MSSQL/
@MSSQL/default/
@MSSQL/default/myDatabase/
@MSSQL/default/myDatabase/db-full
```

So if you perform your first full backup your are capable to perfom differntial and incremental backups.

Differntial FileSet example:

```
/@MSSQL/
/@MSSQL/default/
/@MSSQL/default/myDatabase/
/@MSSQL/default/myDatabase/db-full
/@MSSQL/default/myDatabase/db-diff
```

Incremental FileSet example:

```
*@MSSQL/
  *default/
    *myDatabase/
      *db-diff
      *db-full
      *log-2013-11-21 17:32:20
```

Restores

If you want to perfom a restore of a full backup without differentials or incrementals you have some options which helps you to restore even the corrupted database still exist. But you have to specifiy the options like plugin, instance and database during every backup.

replace=<yes|no> With this option you can replace the database if it still exist.

instance Defines the server instance whithin the database is running.

database Defines the database you want to backup.

If you want to restore the actual backup to a set of backup files which you can use to restore a database under an new name or perform any kind of special operations using for example the sql management studio, you can use a where setting for the restore other then '/'. When the where is set to '/' it will restore to the Virtual Device Interface (VDI).
When you specify for restore a where path which is lets say 'c:/temp' the plugin will restore the selected backup files under a relocated path under c:/temp/@MSSQL@/...
Example for a full restore:

```
*restore client=mssqlserver-fd
Using Catalog "MyCatalog"

First you select one or more JobIds that contain files
to be restored. You will be presented several methods
of specifying the JobIds. Then you will be allowed to
select which files from those JobIds are to be restored.

To select the JobIds, you have the following choices:
     1: List last 20 Jobs run
     2: List Jobs where a given File is saved
     3: Enter list of comma separated JobIds to select
     4: Enter SQL list command
     5: Select the most recent backup for a client
     6: Select backup for a client before a specified time
     7: Enter a list of files to restore
     8: Enter a list of files to restore before a specified time
     9: Find the JobIds of the most recent backup for a client
    10: Find the JobIds for a backup for a client before a specified time
    11: Enter a list of directories to restore for found JobIds
    12: Select full restore to a specified Job date
    13: Cancel
Select item:  (1-13): 5
Automatically selected FileSet: Mssql
+-------+-------+----------+-------------+---------------------+------------+
| JobId | Level | JobFiles | JobBytes    | StartTime           | VolumeName |
+-------+-------+----------+-------------+---------------------+------------+
|     8 | F     |        1 | 198,836,224 | 2013-11-21 09:52:28 | test1      |
+-------+-------+----------+-------------+---------------------+------------+
You have selected the following JobId: 8

Building directory tree for JobId(s) 8 ...
1 files inserted into the tree.

You are now entering file selection mode where you add (mark) and
remove (unmark) files to be restored. No files are initially added, unless
you used the "all" keyword on the command line.
Enter "done" to leave this mode.
```

```
cwd is: /
$ mark *
1 file marked.
$ done
Bootstrap records written to /var/lib/bareos/bareos-dir.restore.4.bsr

The job will require the following
   Volume(s)                 Storage(s)                SD Device(s)
===========================================================================

    test1                     File                      FileStorage

Volumes marked with "*" are online.


1 file selected to be restored.

The defined Restore Job resources are:
     1: RestoreMSSQL
     2: RestoreFiles
Select Restore Job (1-2): 1
Using Catalog "MyCatalog"
Run Restore job
JobName:         RestoreMSSQL
Bootstrap:       /var/lib/bareos/bareos-dir.restore.4.bsr
Where:           /
Replace:         Always
FileSet:         Mssql
Backup Client:   mssqlserver-fd
Restore Client:  mssqlserver-fd
Format:          Native
Storage:         File
When:            2013-11-21 17:12:05
Catalog:         MyCatalog
Priority:        10
Plugin Options:  *None*
OK to run? (yes/mod/no): mod
Parameters to modify:
     1: Level
     2: Storage
     3: Job
     4: FileSet
     5: Restore Client
     6: Backup Format
     7: When
     8: Priority
     9: Bootstrap
    10: Where
    11: File Relocation
    12: Replace
    13: JobId
    14: Plugin Options
Select parameter to modify (1-14): 14
Please enter Plugin Options string: ↙
    ↪ mssqlvdi:instance=default:database=myDatabase:replace=yes
Run Restore job
JobName:         RestoreMSSQL
Bootstrap:       /var/lib/bareos/bareos-dir.restore.4.bsr
Where:           /
Replace:         Always
FileSet:         Mssql
Backup Client:   mssqlserver-fd
Restore Client:  mssqlserver-fd
Format:          Native
```

```
Storage:          File
When:             2013-11-21 17:12:05
Catalog:          MyCatalog
Priority:         10
Plugin Options:   mssqlvdi:instance=default:database=myDatabase:replace=yes
OK to run? (yes/mod/no): yes
Job queued. JobId=10
You have messages.
*mess
21-Nov 17:12 bareos-dir JobId 10: Start Restore Job ↙
    ↪ RestoreMSSQL.2013-11-21_17.12.26_11
21-Nov 17:12 bareos-dir JobId 10: Using Device "FileStorage" to read.
21-Nov 17:13 damorgan-sd JobId 10: Ready to read from volume "test1" on device ↙
    ↪ "FileStorage" (/storage).
21-Nov 17:13 damorgan-sd JobId 10: Forward spacing Volume "test1" to file:block ↙
    ↪ 0:2499099145.
21-Nov 17:13 damorgan-sd JobId 10: End of Volume at file 0 on device ↙
    ↪ "FileStorage" (/storage), Volume "test1"
21-Nov 17:13 damorgan-sd JobId 10: End of all volumes.
21-Nov 17:13 bareos-dir JobId 10: Bareos bareos-dir 13.4.0 (01Oct13):
  Build OS:               x86_64-pc-linux-gnu debian Debian GNU/Linux 7.0 (wheezy)
  JobId:                  10
  Job:                    RestoreMSSQL.2013-11-21_17.12.26_11
  Restore Client:         mssqlserver-fd
  Start time:             21-Nov-2013 17:12:28
  End time:               21-Nov-2013 17:13:21
  Files Expected:         1
  Files Restored:         1
  Bytes Restored:         198,836,224
  Rate:                   3751.6 KB/s
  FD Errors:              0
  FD termination status:  OK
  SD termination status:  OK
  Termination:            Restore OK
```

bconsole H.6: restore MSSQL database

Restore a Backup Chain If you like to restore a specific state or a whole chain consists of full, incremental and differential backups you need to use the "norecovery=yes" option. After this the database is in "recovery mode". You can also use a option which put the database right after the restore back into the right mode. If you like to restore certains point with protocols or "LSN" it it not recommend to work with this option.

norecovery=<yes|no> This option must be set to yes, if the database server should not do a automatic recovery after the backup. Instead, additional manual maintenace operations are possible.

recoverafterrestore=<yes|no> With this command the database is right after backup in the correct mode. If you not use this you have to use the followed tsql statement:

```
Restore DATABASE yourDatabase WITH RECOVERY
GO
```

stopbeforemark=<log sequence number specification> used for point in time recovery.

stopatmark=<log sequence number specification> used for point in time recovery.

stopat=<timestamp> used for point in time recovery.

Followed is a example for a restore of full, differential and incremental backup with a replace of the original database:

```
*restore client=mssqlserver-fd

First you select one or more JobIds that contain files
to be restored. You will be presented several methods
of specifying the JobIds. Then you will be allowed to
```

```
select which files from those JobIds are to be restored.

To select the JobIds, you have the following choices:
     1: List last 20 Jobs run
     2: List Jobs where a given File is saved
     3: Enter list of comma separated JobIds to select
     4: Enter SQL list command
     5: Select the most recent backup for a client
     6: Select backup for a client before a specified time
     7: Enter a list of files to restore
     8: Enter a list of files to restore before a specified time
     9: Find the JobIds of the most recent backup for a client
    10: Find the JobIds for a backup for a client before a specified time
    11: Enter a list of directories to restore for found JobIds
    12: Select full restore to a specified Job date
    13: Cancel
Select item:  (1-13): 5
Automatically selected FileSet: Mssql
+-------+-------+----------+-------------+---------------------+------------+
| JobId | Level | JobFiles | JobBytes    | StartTime           | VolumeName |
+-------+-------+----------+-------------+---------------------+------------+
|     8 | F     |        1 | 198,836,224 | 2013-11-21 09:52:28 | test1      |
|    11 | D     |        1 |   2,555,904 | 2013-11-21 17:19:45 | test1      |
|    12 | I     |        1 |     720,896 | 2013-11-21 17:29:39 | test1      |
+-------+-------+----------+-------------+---------------------+------------+
You have selected the following JobIds: 8,11,12

Building directory tree for JobId(s) 8,11,12 ...
3 files inserted into the tree.

You are now entering file selection mode where you add (mark) and
remove (unmark) files to be restored. No files are initially added, unless
you used the "all" keyword on the command line.
Enter "done" to leave this mode.

cwd is: /
$ mark *
3 files marked.
$ lsmark
*@MSSQL/
  *default/
    *myDatabase/
      *db-diff
      *db-full
      *log-2013-11-21 17:32:20
$ done
Bootstrap records written to /var/lib/bareos/bareos-dir.restore.6.bsr

The job will require the following
   Volume(s)                 Storage(s)                SD Device(s)
===========================================================================

    test1                     File                      FileStorage

Volumes marked with "*" are online.


1 file selected to be restored.

The defined Restore Job resources are:
     1: RestoreMSSQL
     2: RestoreFiles
Select Restore Job (1-2): 1
Run Restore job
JobName:         RestoreMSSQL
```

```
Bootstrap:       /var/lib/bareos/bareos-dir.restore.6.bsr
Where:           /
Replace:         Always
FileSet:         Mssql
Backup Client:   mssqlserver-fd
Restore Client:  mssqlserver-fd
Format:          Native
Storage:         File
When:            2013-11-21 17:34:23
Catalog:         MyCatalog
Priority:        10
Plugin Options:  *None*
OK to run? (yes/mod/no): mod
Parameters to modify:
     1: Level
     2: Storage
     3: Job
     4: FileSet
     5: Restore Client
     6: Backup Format
     7: When
     8: Priority
     9: Bootstrap
    10: Where
    11: File Relocation
    12: Replace
    13: JobId
    14: Plugin Options
Select parameter to modify (1-14): 14
Please enter Plugin Options string: ↙
    ↪ mssqlvdi:instance=default:database=myDatabase:replace=yes:norecovery=yes
Run Restore job
JobName:         RestoreMSSQL
Bootstrap:       /var/lib/bareos/bareos-dir.restore.6.bsr
Where:           /
Replace:         Always
FileSet:         Mssql
Backup Client:   mssqlserver-fd
Restore Client:  mssqlserver-fd
Format:          Native
Storage:         File
When:            2013-11-21 17:34:23
Catalog:         MyCatalog
Priority:        10
Plugin Options:  ↙
    ↪ mssqlvdi:instance=default:database=myDatabase:replace=yes:norecovery=yes
OK to run? (yes/mod/no): yes
Job queued. JobId=14
21-Nov 17:34 bareos-dir JobId 14: Start Restore Job ↙
    ↪ RestoreMSSQL.2013-11-21_17.34.40_16
21-Nov 17:34 bareos-dir JobId 14: Using Device "FileStorage" to read.
21-Nov 17:35 damorgan-sd JobId 14: Ready to read from volume "test1" on device ↙
    ↪ "FileStorage" (/storage).
21-Nov 17:35 damorgan-sd JobId 14: Forward spacing Volume "test1" to file:block ↙
    ↪ 0:2499099145.
21-Nov 17:35 damorgan-sd JobId 14: End of Volume at file 0 on device ↙
    ↪ "FileStorage" (/storage), Volume "test1"
21-Nov 17:35 damorgan-sd JobId 14: End of all volumes.
21-Nov 17:35 bareos-dir JobId 14: Bareos bareos-dir 13.4.0 (01Oct13):
  Build OS:               x86_64-pc-linux-gnu debian Debian GNU/Linux 7.0 (wheezy)
  JobId:                  14
  Job:                    RestoreMSSQL.2013-11-21_17.34.40_16
  Restore Client:         mssqlserver-fd
  Start time:             21-Nov-2013 17:34:42
  End time:               21-Nov-2013 17:35:36
```

```
  Files Expected:          1
  Files Restored:          3
  Bytes Restored:          202,113,024
  Rate:                    3742.8 KB/s
  FD Errors:               0
  FD termination status:   OK
  SD termination status:   OK
  Termination:             Restore OK
```

bconsole H.7: restore MSSQL database chain

H.2.2 Backup of a PostgreSQL Database

In this section, we describe different methods how to do backups of the PostgreSQL databases.

Backup of a PostgreSQL Database by using the RunScript directive

One method to backup a PostgreSQL database is to use the `pg_dumpall` tool to dump the database into a file and then backup it as a normal file. After the backup, the file can be removed. It may also be an option not to remove it, so that the latest version is always available immediately. On the next job run it will be overwritten anyway.
This can be done by using Run Script $^{\text{Dir}}_{\text{Job}}$ directives inside a Job Resource, for example:

```
Job {
  Name = "BackupDatabase"
  JobDefs = "DefaultJob"
  Client = dbserver-fd
  Level = Full
  FileSet="Database"

  # This creates a dump of our database in the local filesystem on the client
  RunScript {
    FailJobOnError = Yes
    RunsOnClient = Yes
    RunsWhen = Before
    Command = "sh -c 'pg_dumpall -U postgres > /var/lib/bareos/postgresql_dump.sql'"
  }

  # This deletes the dump in our local filesystem on the client
  RunScript {
    RunsOnSuccess = Yes
    RunsOnClient = Yes
    RunsWhen = After
    Command = "rm /var/lib/bareos/postgresql_dump.sql"
  }
}

FileSet {
  Name = "Database"
  Include {
    Options {
      signature = MD5
      compression = gzip
    }
    # database dump file
    File = "/var/lib/bareos/postgresql_dump.sql"
  }
}
```

Configuration H.8: RunScript job resource for a PostgreSQL backup

Note that redirecting the `pg_dumpall` output to a file requires to run the whole command line through a shell, otherwise the `pg_dumpall` would not know what do with the `>` character and the job would fail. As no shell features like redirection or piping are used for the `rm`, the `sh -c` is not needed there. See Run Script $^{\text{Dir}}_{\text{Job}}$ for more details.

Backup of a PostgreSQL Databases by using the bpipe plugin

Instead of creating a temporary database dump file, the bpipe plugin can be used. For general information about bpipe, see the bpipe Plugin section. The bpipe plugin is configured inside the Include $^{\text{Dir}}_{\text{FileSet}}$ section of a File Set, e.g.:

```
FileSet {
  Name = "postgresql-all"
  Include {
    Plugin = "bpipe:file=/POSTGRESQL/dump.sql:reader=pg_dumpall -U postgres:writer=psql -U postgres"
    Options {
      signature = MD5
      compression = gzip
    }
  }
}
```

Configuration H.9: bpipe directive for PostgreSQL backup

This causes the File Daemon to call bpipe plugin, which will write its data into the "pseudo" file `/POSTGRESQL/dump.sql` by calling the program `pg_dumpall -U postgres` to read the data during backup. The `pg_dumpall` command outputs all the data for the database, which will be read by the plugin and stored in the backup. During restore, the data that was backed up will be sent to the program specified in the last field, which in this case is psql. When psql is called, it will read the data sent to it by the plugin then write it back to the same database from which it came from.
This can also be used, to backup a database that is running on a remote host:

```
FileSet {
  Name = "postgresql-remote"
  Include {
    Plugin = "bpipe:file=/POSTGRESQL/dump.sql:reader=pg_dumpall -h <hostname> -U <username> -W <password>: ↙
    ↪ writer=psql -h <hostname> -U <username> -W <password>"
    Options {
      signature = MD5
      compression = gzip
    }
  }
}
```

Configuration H.10: bpipe directive to backup a PostgreSQL database that is running on a remote host

Backup of a PostgreSQL Databases by using the PGSQL-Plugin

The PGSQL-Plugin supports an online (Hot) backup of database files and database transaction logs (WAL) archiving (with pgsql-archlog) and backup. With online database and transaction logs the backup plugin can perform Poin-In-Time-Restore up to a single selected transaction or date/time.
Database recovery is performed fully automatic with dedicated pgsql-restore utility.
For a full description, see https://github.com/bareos/contrib-pgsql-plugin/wiki.

H.2.3 Backup of a MySQL Database

In this section, we describe different methods to do a full backup of a MySQL database.

Backup of a MySQL Databases by using the Python MySQL plugin

The Pyhton plugin from https://github.com/bareos/bareos-contrib/tree/master/fd-plugins/mysql-python makes a backup of all or selected MySQL databases from the Bareos File Daemon or any other MySQL server.
Following settings must be done on the Bareos client (Bareos File Daemon):

- install and enable the Bareos File Daemon Python plugin
- install the Python MySQL plugin (for some platforms it is available prepackaged from http://download.bareos.org/bareos/contrib/, on the other platforms: copy the plugin files to the Bareos Plugin Directory)
- disable bacula compatibility (default for Bareos >= 15.2)

```
FileDaemon {
  Name = mysql-fd
  ...
  Plugin Directory = /usr/lib64/bareos/plugins
  Plugin Name = "python"
  compatible = no
```

```
}
```

Configuration H.11: bareos-fd.conf: enable Python FD plugins

Configure the plugin in the Bareos Director:

```
FileSet {
    Name = "mysql"
    Include {
      Options {
        signature = MD5
        compression = lz4
      }
      Plugin = "python:module_path=/usr/lib64/bareos/plugins:module_name=bareos-fd-mysql:db=test,wikidb"
      #Plugin = "python:module_path=/usr/lib64/bareos/plugins:module_name=bareos-fd-mysql:mysqlhost=dbhost: ↙
    ↪ mysqluser=bareos:mysqlpassword=bareos"
    }
}
```

Configuration H.12: bareos-dir.conf: Python FD MySQL plugin

In the above example the plugin creates and saves a dump from the databases called *test* and *wikidb*, running on the file-daemon. The commented example below specifies an explicit MySQL server called `dbhost`, and connects with user *bareos*, password *bareos*, to create and save a backup of all databases.
The plugin creates a pipe internally, thus no extra space on disk is needed. You will find one file per database in the backups in the virtual directory `/_mysqlbackups_`.
List of supported options:

db comma separated list of databases to save, where each database will be stored in a separate file. If ommited, all databases will be saved.

dumpbinary command (with or without full path) to create the dumps. Default: *mysqldump*

dumpoptions options for dumpbinary, default: "*–events –single-transaction*"

drop_and_recreate if not set to *false*, adds *–add-drop-database –databases* to dumpoptions

mysqlhost MySQL host to connect to, default: *localhost*

mysqluser MySQL user. Default: unset, the user running the file-daemon will be used (usually root)

mysqlpassword MySQL password. Default: unset (better use `my.cnf` to store passwords)

On restore, the database dumps are restored to the subdirectory `_mysqlbackups_` in the restore path. The database restore must be triggered manually (`mysql < _mysqlbackups_/DATABASENAME.sql`).

Backup of a MySQL Database by using the RunScript directive

One method to backup a MySQL database is to use the `mysqldump` tool to dump the database into a file and then backup it as a normal file. After the backup, the file can be removed. It may also be an option not to remove it, so that the latest version is always available immediately. On the next job run it will be overwritten anyway.
This can be done by using Run Script $^{\text{Dir}}_{\text{Job}}$ directives, for example:

```
Job {
  Name = "BackupDatabase"
  JobDefs = "DefaultJob"
  Client = dbserver-fd
  Level = Full
  FileSet="Database"

  # This creates a dump of our database in the local filesystem on the Client
  RunScript {
    FailJobOnError = Yes
    RunsOnClient = Yes
    RunsWhen = Before
    Command = "sh -c 'mysqldump --user=<username> --password=<password> --opt --all-databases > /var/lib/ ↙
    ↪ bareos/mysql_dump.sql'"
  }

  # This deletes the dump in the local filesystem on the Client
  RunScript {
```

```
    RunsOnSuccess = Yes
    RunsOnClient = Yes
    RunsWhen = After
    Command = "rm /var/lib/bareos/mysql_dump.sql"
  }
}

FileSet {
  Name = "Database"
  Include {
    Options {
      signature = MD5
      compression = gzip
    }
  # database dump file
  File = "/var/lib/bareos/mysql_dump.sql"
  }
}
```

Configuration H.13: RunScript job resource for a MySQL backup

Note that redirecting the `mysqldump` output to a file requires to run the whole command line through a shell, otherwise the `mysqldump` would not know what do with the `>` character and the job would fail. As no shell features like redirection or piping are used for the `rm`, the `sh -c` is not needed there. See Run Script [Dir Job] for more details.

Backup of a MySQL Databases by using the bpipe plugin

Instead of creating a temporary database dump file, the bpipe plugin can be used. For general information about bpipe, see the bpipe Plugin section. The bpipe plugin is configured inside the Include section of a File Set, e.g.:

```
FileSet {
  Name = "mysql-all"
  Include {
    Plugin = "bpipe:file=/MYSQL/dump.sql:reader=mysqldump --user=<user> --password=<password> --opt --all- ↙
     ↪ databases:writer=mysql --user=<user> --password=<password>"
    Options {
      signature = MD5
      compression = gzip
    }
  }
}
```

Configuration H.14: bpipe fileset for MySQL backup

This can also be used, to backup a database that is running on a remote host:

```
FileSet{
  Name = "mysql-all"
  Include {
    Plugin = "bpipe:file=/MYSQL/dump.sql:reader=mysqldump --host=<hostname> --user=<user> --password=< ↙
     ↪ password> --opt --all-databases:writer=mysql --host=<hostname> --user=<user> --password=<password>"
    Options {
      signature = MD5
      compression = gzip
    }
  }
}
```

Configuration H.15: bpipe directive to backup a MySQL database that is running on a remote host

If you do not want a direct restore of your data in your plugin directive, as shown in the examples above, there is the possibility to restore the dump to the filesystem first, which offers you more control over the restore process, e.g.:

```
FileSet{
  Name = "mysql-all"
  Include {
    Plugin = "bpipe:file=/MYSQL/dump.sql:reader=mysqldump --host=<hostname> --user=<user> --password=< ↙
     ↪ password> --opt --all-databases:writer=/usr/lib/bareos/scripts/bpipe-restore.sh"
    Options {
      signature = MD5
      compression = gzip
    }
```

```
  }
}
```

Configuration H.16: bpipe directive to backup a MySQL database and restore the dump to the filesystem first

A very simple corresponding shell script (`bpipe-restore.sh`) to the method above might look like the following one:

```
#!/bin/bash
cat - > /tmp/dump.sql
exit 0
```

Configuration H.17: bpipe shell script for a restore to filesystem

Appendix I

Disaster Recovery Using Bareos

I.1 General

When disaster strikes, you must have a plan, and you must have prepared in advance, otherwise the work of recovering your system and your files will be considerably greater. For example, if you have not previously saved the partitioning information for your hard disk, how can you properly rebuild it if the disk must be replaced?
Unfortunately, many of the steps one must take before and immediately after a disaster are very much dependent on the operating system in use. As a consequence, this chapter will discuss in detail disaster recovery only for selected operating systems.

I.1.1 Important Considerations

Here are a few important considerations concerning disaster recovery that you should take into account before a disaster strikes.

- If the building which houses your computers burns down or is otherwise destroyed, do you have off-site backup data?
- Disaster recovery is much easier if you have several machines. If you have a single machine, how will you handle unforeseen events if your only machine is down?
- Do you want to protect your whole system and use Bareos to recover everything? Or do you want to try to restore your system from the original installation disks, apply any other updates and only restore the user files?

I.2 Steps to Take Before Disaster Strikes

- Create a rescue or CDROM for your systems. Generally, they are offered by each distribution, and there are many good rescue disks on the Web
- Ensure that you always have a valid bootstrap file for your backup and that it is saved to an alternate machine. This will permit you to easily do a full restore of your system.
- If possible copy your catalog nightly to an alternate machine. If you have a valid bootstrap file, this is not necessary, but can be very useful if you do not want to reload everything.
- Ensure that you always have a valid bootstrap file for your catalog backup that is saved to an alternate machine. This will permit you to restore your catalog more easily if needed.
- Try out how to use the Rescue CDROM before you are forced to use it in an emergency situation.
- Make a copy of your Bareos .conf files, particularly your bareos-dir.conf, and your bareos-sd.conf files, because if your server goes down, these files will be needed to get it back up and running, and they can be difficult to rebuild from memory.

I.3 Bare Metal Recovery of Bareos Clients

A so called "Bare Metal" recovery is one where you start with an empty hard disk and you restore your machine.
Generally, following components are required for a Bare Metal Recovery:

- A rescue CDROM containing a copy of your OS and including the Bareos File daemon, including all libraries
- The Bareos client configuration files
- Useful: a copy of your hard disk information
- A full Bareos backup of your system

I.3.1 Linux

From the Relax-and-Recover web site (http://relax-and-recover.org):

> Relax-and-Recover is a setup-and-forget Linux bare metal disaster recovery solution. It is easy to set up and requires no maintenance so there is no excuse for not using it.

Relax-and-Recover (ReaR) is quite easy to use with Bareos.

Installation

Bareos is a supported backend for ReaR >= 1.15. To use the `BAREOS_CLIENT` option, ReaR >= 1.17 is required. If ReaR >= 1.17 is not part of your distribution, check the download section on the ReaR website.

Configuration

Assuming you have a working Bareos configuration on the system you want to protect with ReaR and Bareos references this system by the name `bareosclient-fd`, the only configuration for ReaR is:

```
BACKUP=BAREOS
BAREOS_CLIENT=bareosclient-fd
```

You also need to specify in your ReaR configuration file (`/etc/rear/local.conf`) where you want to store your recovery images. Please refer to the ReaR documentation for details.
For example, if you want to create an ISO image and store it to an NFS server with the IP Address 192.168.10.1, you can use the following configuration:

```
# This is default:
#OUTPUT=ISO
# Where to write the iso image
# You can use NFS, if you want to write your iso image to a nfs server
# If you leave this blank, it will
# be written to: /var/lib/rear/output/
OUTPUT_URL=nfs://192.168.10.1/rear
BACKUP=BAREOS
BAREOS_CLIENT=bareosclient-fd
```

Configuration I.1: Full Rear configuration in /etc/rear/local.conf

Backup

If you have installed and configured ReaR on your system, type

```
root@linux:~# rear -v mkrescue
```

Commands I.2: Create Rescue Image

to create the rescue image. If you used the configuration example above, you will get a bootable ISO image which can be burned onto a CD.
Please note! *This will not create a Bareos backup on your system! You will have to do that by other means, e.g. by a regular Bareos backup schedule. Also* `rear mkbackup` *will not create a backup. In this configuration it will only create the rescue ISO (same as the* `rear mkrescue` *command).*

Recovery

In case, you want to recover your system, boot it using the generated ReaR recovery ISO. After booting log in as user `root` and type

```
root@linux:~# rear recover
```

Commands I.3: Restore your system using Rear and Bareos

ReaR will now use the most recent backup from Bareos to restore your system. When the restore job has finished, ReaR will start a new shell which you can use to verify if the system has been restored correctly. The restored system can be found under the `/mnt/local` directory. When you are done¡ with the verification, type 'exit' to leave the shell, getting back to the recovery process. Finally, you will be asked to confirm that everything is correct. Type 'yes' to continue. After that, ReaR will restore your bootloader. Recovery is complete.

I.4 Restoring a Bareos Server

Above, we considered how to recover a client machine where a valid Bareos server was running on another machine. However, what happens if your server goes down and you no longer have a running Director, Catalog, or Storage daemon? There are several solutions:

1. Bring up static versions of your Director, Catalog, and Storage daemon on the damaged machine.
2. Move your server to another machine.
3. Use a Hot Spare Server on another Machine.

The first option, is very difficult because it requires you to have created a static version of the Director and the Storage daemon as well as the Catalog. If the Catalog uses MySQL or PostgreSQL, this may or may not be possible. In addition, to loading all these programs on a bare system (quite possible), you will need to make sure you have a valid driver for your tape drive.
The second suggestion is probably a much simpler solution, and one I have done myself. To do so, you might want to consider the following steps:

- Install the same database server as on the original system.
- Install Bareos and initialize the Bareos database.
- Ideally, you will have a copy of all the Bareos conf files that were being used on your server. If not, you will at a minimum need create a bareos-dir.conf that has the same Client resource that was used to backup your system.
- If you have a valid saved Bootstrap file as created for your damaged machine with WriteBootstrap, use it to restore the files to the damaged machine, where you have loaded a static Bareos File daemon using the Rescue disk). This is done by using the restore command and at the yes/mod/no prompt, selecting **mod** then specifying the path to the bootstrap file.
- If you have the Bootstrap file, you should now be back up and running, if you do not have a Bootstrap file, continue with the suggestions below.
- Using **bscan** scan the last set of backup tapes into your MySQL, PostgreSQL or SQLite database.
- Start Bareos, and using the Console **restore** command, restore the last valid copy of the Bareos database and the Bareos configuration files.
- Move the database to the correct location.
- Start the database, and restart Bareos. Then use the Console **restore** command, restore all the files on the damaged machine, where you have loaded a Bareos File daemon using the Rescue disk.

For additional details of restoring your database, please see the Restoring When Things Go Wrong chapter.

Appendix J

Troubleshooting

J.1 Client Access Problems

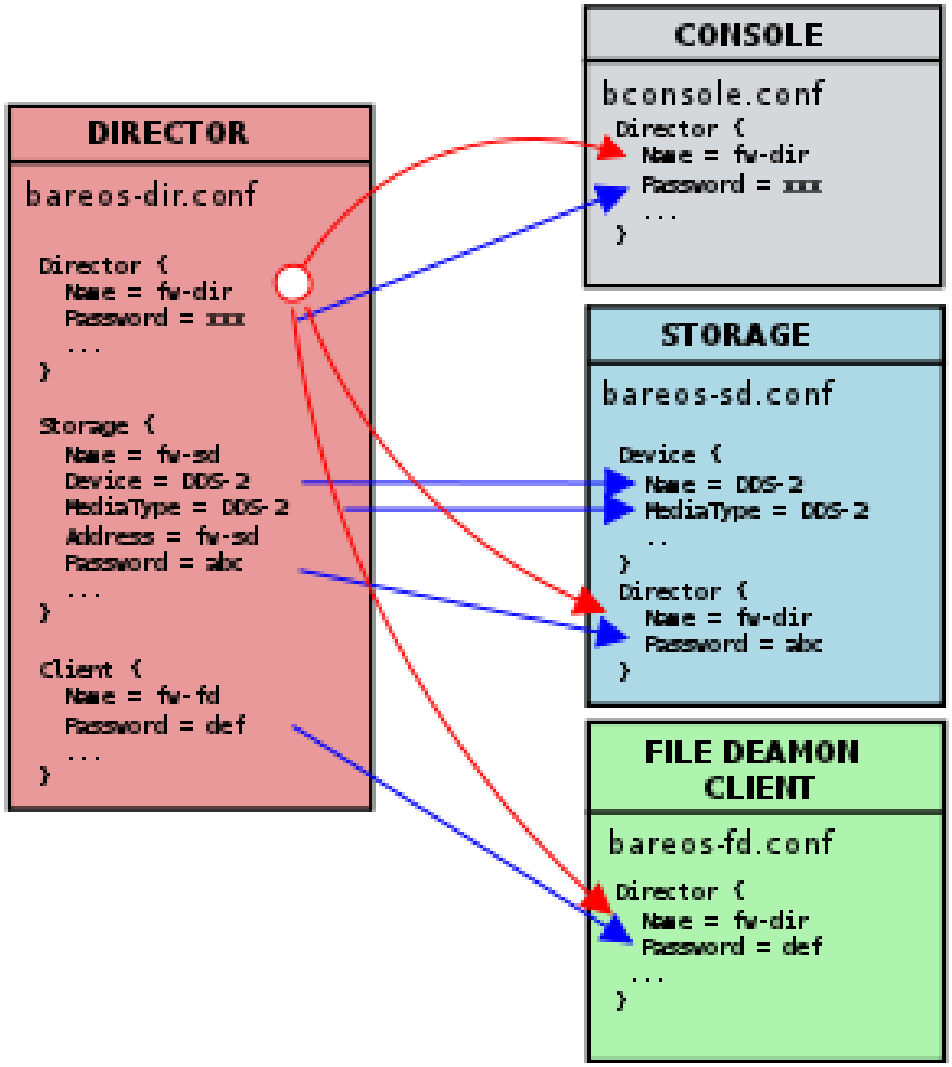
There are several reasons why Bareos could not contact a client on a different machine. They are:

- Check if the client file daemon is really running.
- The Client address or port is incorrect or not resolved by DNS. See if you can ping the client machine using the same address as in the Client record.
- You have a firewall, and it is blocking traffic on port 9102 between the Director's machine and the Client's machine (or on port 9103 between the Client and the Storage daemon machines).
- If your system is using Tcpwrapper (**hosts.allow** or **hosts.deny** file), verify that is permitting access.
- Your password or names are not correct in both the Director and the Client machine. Try configuring everything identical to how you run the client on the same machine as the Director, but just change the address. If that works, make the other changes one step at a time until it works.
- You may also be having problems between your File daemon and your Storage daemon. The name you use in the Storage resource of your Director's conf file must be known (resolvable) by the File daemon, because it is passed symbolically to the File daemon, which then resolves it to get an IP address used to contact the Storage daemon.

Some of the DNS and Firewall problems can be circumvented by configuring clients in network passive mode, see the section about Passive Clients.

J.1.1 Authorization Errors

For security reasons, Bareos requires that both the File daemon and the Storage daemon know the name of the Director as well as its password. As a consequence, if you change the Director's name or password, you must make the corresponding change in the Storage daemon's and in the File daemon's configuration files.
During the authorization process, the Storage daemon and File daemon also require that the Director authenticates itself, so both ends require the other to have the correct name and password.
If you have edited the configuration files and modified any name or any password, and you are getting authentication errors, then your best bet is to go back to the original configuration files generated by the Bareos installation process. Make only the absolutely necessary modifications to these files – e.g. add the correct email address. Then follow the instructions in the Running Bareos chapter of this manual. You will run a backup to disk and a restore. Only when that works, should you begin customization of the configuration files.
Another reason that you can get authentication errors is if you are running Multiple Concurrent Jobs in the Director, but you have not set them in the File daemon or the Storage daemon. Once you reach their limit, they will reject the connection producing authentication (or connection) errors.
Some users report that authentication fails if there is not a proper reverse DNS lookup entry for the machine. This seems to be a requirement of gethostbyname(), which is what Bareos uses to translate names into IP addresses. If you cannot add a reverse DNS entry, or you don't know how to do so, you can avoid the problem by specifying an IP address rather than a machine name in the appropriate Bareos configuration file.
Here is a picture that indicates what names/passwords in which files/Resources must match up:



In the left column, you will find the Director, Storage, and Client resources, with their names and passwords – these are all in **bareos-dir.conf**. The right column is where the corresponding values should be found in the Console, Storage daemon (SD), and File daemon (FD) configuration files.
Another thing to check is to ensure that the Bareos component you are trying to access has **Maximum Concurrent Jobs** set large enough to handle each of the Jobs and the Console that want to connect simultaneously. Once the maximum connections has been reached, each Bareos component will reject all new connections.

J.2 Concurrent Jobs

Bareos can run multiple concurrent jobs. Using the **Maximum Concurrent Jobs** directive, you can configure how many and which jobs can be run simultaneously. The Director's default value for **Maximum Concurrent Jobs** is "1".
To initially setup concurrent jobs you need to define **Maximum Concurrent Jobs** in the Director's configuration file (bareos-dir.conf) in the Director, Job, Client, and Storage resources.
Additionally the File daemon, and the Storage daemon each have their own **Maximum Concurrent Jobs** directive that sets the overall maximum number of concurrent jobs the daemon will run. The default for both the File daemon and the Storage daemon is "20".
For example, if you want two different jobs to run simultaneously backing up the same Client to the same Storage device, they will run concurrently only if you have set **Maximum Concurrent Jobs** greater than one in the Director resource, the Client resource, and the Storage resource in bareos-dir.conf.
We recommend that you read the Data Spooling of this manual first, then test your multiple concurrent backup including restore testing before you put it into production.

Below is a super stripped down bareos-dir.conf file showing you the four places where the the file must be modified to allow the same job **NightlySave** to run up to four times concurrently. The change to the Job resource is not necessary if you want different Jobs to run at the same time, which is the normal case.

```
#
# Bareos Director Configuration file -- bareos-dir.conf
#
Director {
  Name = rufus-dir
  Maximum Concurrent Jobs = 4
  ...
}
Job {
  Name = "NightlySave"
  Maximum Concurrent Jobs = 4
  Client = rufus-fd
  Storage = File
  ...
}
Client {
  Name = rufus-fd
  Maximum Concurrent Jobs = 4
  ...
}
Storage {
  Name = File
  Maximum Concurrent Jobs = 4
  ...
}
```

Configuration J.1: Concurrent Jobs Example

J.3 Tape Labels: ANSI or IBM

By default, Bareos uses its own tape label (see Tape Formats and Label Type $^{\text{Dir}}_{\text{Pool}}$). However, Bareos also supports reading and write ANSI and IBM tape labels.

J.3.1 Reading

Reading ANSI/IBM labels is important, if some of your tapes are used by other programs that also support ANSI/IBM labels. For example, LTFS tapes are indicated by an ANSI label.
If your are running Bareos in such an environment, you must set Check Labels $^{\text{Sd}}_{\text{Device}}$ to yes, otherwise Bareos will not recognize that these tapes are already in use.

J.3.2 Writing

To configure Bareos to also write ANSI/IBM tape labels, use Label Type $^{\text{Dir}}_{\text{Pool}}$ or Label Type $^{\text{Sd}}_{\text{Device}}$. With the proper configuration, you can force Bareos to require ANSI or IBM labels.
Even though Bareos will recognize and write ANSI and IBM labels, it always writes its own tape labels as well.
If you have labeled your volumes outside of Bareos, then the ANSI/IBM label will be recognized by Bareos only if you have created the HDR1 label with **BAREOS.DATA** in the filename field (starting with character 5). If Bareos writes the labels, it will use this information to recognize the tape as a Bareos tape. This allows ANSI/IBM labeled tapes to be used at sites with multiple machines and multiple backup programs.

J.4 Tape Drive

This chapter is concerned with testing and configuring your tape drive to make sure that it will work properly with Bareos using the **btape** program.

J.4.1 Get Your Tape Drive Working

In general, you should follow the following steps to get your tape drive to work with Bareos. Start with a tape mounted in your drive. If you have an autochanger, load a tape into the drive. We use **/dev/nst0** as the tape drive name, you will need to adapt it according to your system.

Do not proceed to the next item until you have succeeded with the previous one.

1. Make sure that Bareos (the Storage daemon) is not running or that you have **unmount**ed the drive you will use for testing.

2. Use tar to write to, then read from your drive:

```
mt -f /dev/nst0 rewind
tar cvf /dev/nst0 .
mt -f /dev/nst0 rewind
tar tvf /dev/nst0
```

3. Make sure you have a valid and correct Device resource corresponding to your drive. For Linux users, generally, the default one works. For FreeBSD users, there are two possible Device configurations (see below). For other drives and/or OSes, you will need to first ensure that your system tape modes are properly setup (see below), then possibly modify you Device resource depending on the output from the btape program (next item). When doing this, you should consult the Storage Daemon Configuration of this manual.

4. If you are using a Fibre Channel to connect your tape drive to Bareos, please be sure to disable any caching in the NSR (network storage router, which is a Fibre Channel to SCSI converter).

5. Run the btape **test** command:

```
btape /dev/nst0
test
```

   It isn't necessary to run the autochanger part of the test at this time, but do not go past this point until the basic test succeeds. If you do have an autochanger, please be sure to read the Autochanger chapter of this manual.

6. Run the btape **fill** command, preferably with two volumes. This can take a long time. If you have an autochanger and it is configured, Bareos will automatically use it. If you do not have it configured, you can manually issue the appropriate **mtx** command, or press the autochanger buttons to change the tape when requested to do so.

7. Run Bareos, and backup a reasonably small directory, say 60 Megabytes. Do three successive backups of this directory.

8. Stop Bareos, then restart it. Do another full backup of the same directory. Then stop and restart Bareos.

9. Do a restore of the directory backed up, by entering the following restore command, being careful to restore it to an alternate location:

```
restore select all done
yes
```

   Do a **diff** on the restored directory to ensure it is identical to the original directory. If you are going to backup multiple different systems (Linux, Windows, Mac, Solaris, FreeBSD, ...), be sure you test the restore on each system type.

10. If you have an autochanger, you should now go back to the btape program and run the autochanger test:

```
btape /dev/nst0
auto
```

    Adjust your autochanger as necessary to ensure that it works correctly. See the Autochanger chapter of this manual for a complete discussion of testing your autochanger.

J.5 Autochanger

J.5.1 Testing Autochanger and Adapting mtx-changer script

In case, Bareos does not work well with the Autochanger, it is preferable to "hand-test" that the changer works. To do so, we suggest you do the following commands:
Make sure Bareos is not running.
`/usr/lib/bareos/scripts/mtx-changer /dev/sg0 list 0 /dev/nst0 0`
This command should print:

```
1:
2:
3:
...
```

or one number per line for each slot that is occupied in your changer, and the number should be terminated by a colon (**:**). If your changer has barcodes, the barcode will follow the colon. If an error message is printed, you must resolve the problem (e.g. try a different SCSI control device name if **/dev/sg0** is incorrect). For example, on FreeBSD systems, the autochanger SCSI control device is generally **/dev/pass2**.
`/usr/lib/bareos/scripts/mtx-changer /dev/sg0 listall 0 /dev/nst0 0`
This command should print:

```
Drive content:         D:Drive num:F:Slot loaded:Volume Name
D:0:F:2:vol2        or D:Drive num:E
D:1:F:42:vol42
D:3:E

Slot content:
S:1:F:vol1             S:Slot num:F:Volume Name
S:2:E               or S:Slot num:E
S:3:F:vol4

Import/Export tray slots:
I:10:F:vol10           I:Slot num:F:Volume Name
I:11:E              or I:Slot num:E
I:12:F:vol40
```

`/usr/lib/bareos/scripts/mtx-changer /dev/sg0 transfer 1 2`
This command should transfer a volume from source (1) to destination (2)
`/usr/lib/bareos/scripts/mtx-changer /dev/sg0 slots`
This command should return the number of slots in your autochanger.
`/usr/lib/bareos/scripts/mtx-changer /dev/sg0 unload 1 /dev/nst0 0`
If a tape is loaded from slot 1, this should cause it to be unloaded.
`/usr/lib/bareos/scripts/mtx-changer /dev/sg0 load 3 /dev/nst0 0`
Assuming you have a tape in slot 3, it will be loaded into drive (0).
`/usr/lib/bareos/scripts/mtx-changer /dev/sg0 loaded 0 /dev/nst0 0`
It should print "3" Note, we have used an "illegal" slot number 0. In this case, it is simply ignored because the slot number is not used. However, it must be specified because the drive parameter at the end of the command is needed to select the correct drive.
`/usr/lib/bareos/scripts/mtx-changer /dev/sg0 unload 3 /dev/nst0 0`
will unload the tape into slot 3.
Once all the above commands work correctly, assuming that you have the right **Changer Command** in your configuration, Bareos should be able to operate the changer. The only remaining area of problems will be if your autoloader needs some time to get the tape loaded after issuing the command. After the **mtx-changer** script returns, Bareos will immediately rewind and read the tape. If Bareos gets rewind I/O errors after a tape change, you will probably need to configure the `load_sleep` paramenter in the config file `/etc/bareos/mtx-changer.conf`. You can test whether or not you need a **sleep** by putting the following commands into a file and running it as a script:

```
#!/bin/sh
/usr/lib/bareos/scripts/mtx-changer /dev/sg0 unload 1 /dev/nst0 0
/usr/lib/bareos/scripts/mtx-changer /dev/sg0 load 3 /dev/nst0 0
mt -f /dev/st0 rewind
mt -f /dev/st0 weof
```

If the above script runs, you probably have no timing problems. If it does not run, start by putting a **sleep 30** or possibly a **sleep 60** in the script just after the mtx-changer load command. If that works, then you should configure the `load_sleep` paramenter in the config file `/etc/bareos/mtx-changer.conf` to the specified value so that it will be effective when Bareos runs.
A second problem that comes up with a small number of autochangers is that they need to have the cartridge ejected before it can be removed. If this is the case, the **load 3** will never succeed regardless of how long you wait. If this seems to be your problem, you can insert an eject just after the unload so that the script looks like:

```
#!/bin/sh
/usr/lib/bareos/scripts/mtx-changer /dev/sg0 unload 1 /dev/nst0 0
mt -f /dev/st0 offline
/usr/lib/bareos/scripts/mtx-changer /dev/sg0 load 3 /dev/nst0 0
mt -f /dev/st0 rewind
mt -f /dev/st0 weof
```

If this solves your problems, set the parameter `offline` in the config file `/etc/bareos/mtx-changer.conf` to "1".

J.6 Restore

J.6.1 Restore a pruned job using a pattern

It is possible to configure Bareos in a way, that job information are still stored in the Bareos catalog, while the individual file information are already pruned.
If all File records are pruned from the catalog for a Job, normally Bareos can restore only all files saved. That is there is no way using the catalog to select individual files. With this new feature, Bareos will ask if you want to specify a Regex expression for extracting only a part of the full backup.

```
Building directory tree for JobId(s) 1,3 ...
There were no files inserted into the tree, so file selection
is not possible.Most likely your retention policy pruned the files

Do you want to restore all the files? (yes|no): no

Regexp matching files to restore? (empty to abort): /etc/.*
Bootstrap records written to /tmp/regress/working/zog4-dir.restore.1.bsr
```

See also FileRegex bsr option for more information.

J.6.2 Problems Restoring Files

The most frequent problems users have restoring files are error messages such as:

```
04-Jan 00:33 z217-sd: RestoreFiles.2005-01-04_00.31.04 Error:
block.c:868 Volume data error at 20:0! Short block of 512 bytes on
device /dev/tape discarded.
```

or

```
04-Jan 00:33 z217-sd: RestoreFiles.2005-01-04_00.31.04 Error:
block.c:264 Volume data error at 20:0! Wanted ID: "BB02", got ".".
Buffer discarded.
```

Both these kinds of messages indicate that you were probably running your tape drive in fixed block mode rather than variable block mode. Fixed block mode will work with any program that reads tapes sequentially such as tar, but Bareos repositions the tape on a block basis when restoring files because this will speed up the restore by orders of magnitude when only a few files are being restored. There are several ways that you can attempt to recover from this unfortunate situation.
Try the following things, each separately, and reset your Device resource to what it is now after each individual test:

1. Set "Block Positioning = no" in your Device resource and try the restore. This is a new directive and untested.

2. Set "Minimum Block Size = 512" and "Maximum Block Size = 512" and try the restore. If you are able to determine the block size your drive was previously using, you should try that size if 512 does not work. This is a really horrible solution, and it is not at all recommended to continue backing up your data without correcting this condition. Please see the Tape Drive section for more on this.

3. Try editing the restore.bsr file at the Run xxx yes/mod/no prompt before starting the restore job and remove all the VolBlock statements. These are what causes Bareos to reposition the tape, and where problems occur if you have a fixed block size set for your drive. The VolFile commands also cause repositioning, but this will work regardless of the block size.

4. Use bextract to extract the files you want – it reads the Volume sequentially if you use the include list feature, or if you use a .bsr file, but remove all the VolBlock statements after the .bsr file is created (at the Run yes/mod/no) prompt but before you start the restore.

J.6.3 Restoring Files Can Be Slow

Restoring files is generally **much** slower than backing them up for several reasons. The first is that during a backup the tape is normally already positioned and Bareos only needs to write. On the other hand, because restoring files is done so rarely, Bareos keeps only the start file and block on the tape for the whole job rather than on a file by file basis which would use quite a lot of space in the catalog.
Bareos will forward space to the correct file mark on the tape for the Job, then forward space to the correct block, and finally sequentially read each record until it gets to the correct one(s) for the file or files you want to restore. Once the desired files are restored, Bareos will stop reading the tape.
Finally, instead of just reading a file for backup, during the restore, Bareos must create the file, and the operating system must allocate disk space for the file as Bareos is restoring it.
For all the above reasons the restore process is generally much slower than backing up (sometimes it takes three times as long).

J.6.4 Restoring When Things Go Wrong

This and the following sections will try to present a few of the kinds of problems that can come up making restoring more difficult. We will try to provide a few ideas how to get out of these problem situations. In addition to what is presented here, there is more specific information on restoring a Client and your Server in the Disaster Recovery Using Bareos chapter of this manual.

Problem My database is broken.

Solution For SQLite, use the vacuum command to try to fix the database. For either MySQL or PostgreSQL, see the vendor's documentation. They have specific tools that check and repair databases, see the Catalog Maintenance sections of this manual for links to vendor information.

Assuming the above does not resolve the problem, you will need to restore or rebuild your catalog. Note, if it is a matter of some inconsistencies in the Bareos tables rather than a broken database, then running bareos-dbcheck might help, but you will need to ensure that your database indexes are properly setup.

Problem How do I restore my catalog?

Solution with a Catalog backup If you have backed up your database nightly (as you should) and you have made a bootstrap file, you can immediately load back your database (or the ASCII SQL output). Make a copy of your current database, then re-initialize it, by running the following scripts:

```
./drop_bareos_tables
./make_bareos_tables
```

After re-initializing the database, you should be able to run Bareos. If you now try to use the restore command, it will not work because the database will be empty. However, you can manually run a restore job and specify your bootstrap file. You do so by entering the **run** command in the console and selecting the restore job. If you are using the default bareos-dir.conf, this Job will be named **RestoreFiles**. Most likely it will prompt you with something such as:

```
Run Restore job
JobName:    RestoreFiles
Bootstrap:  /home/user/bareos/working/restore.bsr
Where:      /tmp/bareos-restores
Replace:    always
FileSet:    Full Set
Client:     rufus-fd
Storage:    File
When:       2005-07-10 17:33:40
Catalog:    MyCatalog
Priority:   10
OK to run? (yes/mod/no):
```

A number of the items will be different in your case. What you want to do is: to use the mod option to change the Bootstrap to point to your saved bootstrap file; and to make sure all the other items such as Client, Storage, Catalog, and Where are correct. The FileSet is not used when you specify a bootstrap file. Once you have set all the correct values, run the Job and it will restore the backup of your database, which is most likely an ASCII dump.

You will then need to follow the instructions for your database type to recreate the database from the ASCII backup file. See the Catalog Maintenance chapter of this manual for examples of the command needed to restore a database from an ASCII dump (they are shown in the Compacting Your XXX Database sections).

Also, please note that after you restore your database from an ASCII backup, you do NOT want to do a **make_bareos_tables** command, or you will probably erase your newly restored database tables.

Solution with a Job listing If you did save your database but did not make a bootstrap file, then recovering the database is more difficult. You will probably need to use `bextract` to extract the backup copy. First you should locate the listing of the job report from the last catalog backup. It has important information that will allow you to quickly find your database file. For example, in the job report for the CatalogBackup shown below, the critical items are the Volume name(s), the Volume Session Id and the Volume Session Time. If you know those, you can easily restore your Catalog.

```
22-Apr 10:22 HeadMan: Start Backup JobId 7510,
Job=CatalogBackup.2005-04-22_01.10.0
22-Apr 10:23 HeadMan: Bareos 1.37.14 (21Apr05): 22-Apr-2005 10:23:06
  JobId:                  7510
  Job:                    CatalogBackup.2005-04-22_01.10.00
  Backup Level:           Full
  Client:                 Polymatou
  FileSet:                "CatalogFile" 2003-04-10 01:24:01
  Pool:                   "Default"
  Storage:                "DLTDrive"
  Start time:             22-Apr-2005 10:21:00
  End time:               22-Apr-2005 10:23:06
  FD Files Written:       1
  SD Files Written:       1
  FD Bytes Written:       210,739,395
  SD Bytes Written:       210,739,521
  Rate:                   1672.5 KB/s
  Software Compression:   None
  Volume name(s):         DLT-22Apr05
  Volume Session Id:      11
  Volume Session Time:    1114075126
  Last Volume Bytes:      1,428,240,465
  Non-fatal FD errors:    0
  SD Errors:              0
  FD termination status:  OK
  SD termination status:  OK
  Termination:            Backup OK
```

From the above information, you can manually create a bootstrap file, and then follow the instructions given above for restoring your database. A reconstructed bootstrap file for the above backup Job would look like the following:

```
Volume="DLT-22Apr05"
VolSessionId=11
VolSessionTime=1114075126
FileIndex=1-1
```

Where we have inserted the Volume name, Volume Session Id, and Volume Session Time that correspond to the values in the job report. We've also used a FileIndex of one, which will always be the case providing that there was only one file backed up in the job.

The disadvantage of this bootstrap file compared to what is created when you ask for one to be written, is that there is no File and Block specified, so the restore code must search all data in the Volume to find the requested file. A fully specified bootstrap file would have the File and Blocks specified as follows:

```
Volume="DLT-22Apr05"
VolSessionId=11
VolSessionTime=1114075126
VolFile=118-118
VolBlock=0-4053
FileIndex=1-1
```

Once you have restored the ASCII dump of the database, you will then to follow the instructions for your database type to recreate the database from the ASCII backup file. See the Catalog Maintenance chapter of this manual for examples of the command needed to restore a database from an ASCII dump (they are shown in the Compacting Your XXX Database sections).

Also, please note that after you restore your database from an ASCII backup, you do NOT want to do a **make_bareos_tables** command, or you will probably erase your newly restored database tables.

Solution without a Job Listing If you do not have a job listing, then it is a bit more difficult. Either you use the bscan program to scan the contents of your tape into a database, which can be very time consuming depending on the size of the tape, or you can use the bls program to list everything on the tape, and reconstruct a bootstrap file from the bls listing for the file or files you want following the instructions given above.

There is a specific example of how to use **bls** below.

Problem Trying to restore the last known good full backup by specifying item 3 on the restore menu then the JobId to restore, but Bareos then reports:

```
   1 Job 0 Files
```

and restores nothing.

Solution Most likely the File records were pruned from the database either due to the File Retention period expiring or by explicitly purging the Job. By using the "llist jobid=nn" command, you can obtain all the important information about the job:

```
llist jobid=120
           JobId: 120
             Job: save.2005-12-05_18.27.33
         Job.Name: save
      PurgedFiles: 0
             Type: B
            Level: F
     Job.ClientId: 1
      Client.Name: Rufus
        JobStatus: T
        SchedTime: 2005-12-05 18:27:32
        StartTime: 2005-12-05 18:27:35
          EndTime: 2005-12-05 18:27:37
         JobTDate: 1133803657
     VolSessionId: 1
   VolSessionTime: 1133803624
          JobFiles: 236
        JobErrors: 0
  JobMissingFiles: 0
       Job.PoolId: 4
        Pool.Name: Full
    Job.FileSetId: 1
  FileSet.FileSet: BackupSet
```

Then you can find the Volume(s) used by doing:

```
sql
select VolumeName from JobMedia,Media where JobId=1 and JobMedia.MediaId=Media.MediaId;
```

Finally, you can create a bootstrap file as described in the previous problem above using this information.

Bareos will ask you if you would like to restore all the files in the job, and it will collect the above information and write the bootstrap file for you.

Problem You don't have a bootstrap file, and you don't have the Job report for the backup of your database, but you did backup the database, and you know the Volume to which it was backed up.

Solution Either `bscan` the tape (see below for bscanning), or better use `bls` to find where it is on the tape, then use `bextract` to restore the database. For example,

```
./bls -j -V DLT-22Apr05 /dev/nst0
```

Might produce the following output:

```
bls: butil.c:258 Using device: "/dev/nst0" for reading.
21-Jul 18:34 bls: Ready to read from volume "DLT-22Apr05" on device "DLTDrive"
(/dev/nst0).
Volume Record: File:blk=0:0 SessId=11 SessTime=1114075126 JobId=0 DataLen=164
...
Begin Job Session Record: File:blk=118:0 SessId=11 SessTime=1114075126
JobId=7510
   Job=CatalogBackup.2005-04-22_01.10.0 Date=22-Apr-2005 10:21:00 Level=F Type=B
End Job Session Record: File:blk=118:4053 SessId=11 SessTime=1114075126
JobId=7510
   Date=22-Apr-2005 10:23:06 Level=F Type=B Files=1 Bytes=210,739,395 Errors=0
Status=T
...
21-Jul 18:34 bls: End of Volume at file 201 on device "DLTDrive" (/dev/nst0),
Volume "DLT-22Apr05"
21-Jul 18:34 bls: End of all volumes.
```

Of course, there will be many more records printed, but we have indicated the essential lines of output. From the information on the Begin Job and End Job Session Records, you can reconstruct a bootstrap file such as the one shown above.

Problem How can I find where a file is stored?

Solution Normally, it is not necessary, you just use the **restore** command to restore the most recently saved version (menu option 5), or a version saved before a given date (menu option 8). If you know the JobId of the job in which it was saved, you can use menu option 3 to enter that JobId.

If you would like to know the JobId where a file was saved, select restore menu option 2.

You can also use the **query** command to find information such as:

```
*query
Available queries:
     1: List up to 20 places where a File is saved regardless of the
directory
     2: List where the most recent copies of a file are saved
     3: List last 20 Full Backups for a Client
     4: List all backups for a Client after a specified time
     5: List all backups for a Client
     6: List Volume Attributes for a selected Volume
     7: List Volumes used by selected JobId
     8: List Volumes to Restore All Files
     9: List Pool Attributes for a selected Pool
    10: List total files/bytes by Job
    11: List total files/bytes by Volume
    12: List Files for a selected JobId
    13: List Jobs stored on a selected MediaId
    14: List Jobs stored for a given Volume name
    15: List Volumes Bareos thinks are in changer
    16: List Volumes likely to need replacement from age or errors
Choose a query (1-16):
```

Problem I didn't backup my database. What do I do now?

Solution This is probably the worst of all cases, and you will probably have to re-create your database from scratch and then bscan in all your volumes, which is a very long, painful, and inexact process.

There are basically three steps to take:

1. Ensure that your SQL server is running (MySQL or PostgreSQL) and that the Bareos database (normally bareos) exists. See the Prepare Bareos database chapter of the manual.
2. Ensure that the Bareos databases are created. This is also described at the above link.
3. Start and stop the Bareos Director using the propriate bareos-dir.conf file so that it can create the Client and Storage records which are not stored on the Volumes. Without these records, scanning is unable to connect the Job records to the proper client.

When the above is complete, you can begin bscanning your Volumes. Please see the bscan section of the Volume Utility Tools of this chapter for more details.

TODO: add the debug chapter?

Appendix K

Debugging

If you are running on a Linux system, and you have a set of working configuration files, it is very unlikely that **Bareos** will crash. As with all software, however, it is inevitable that someday, it may crash.
This chapter explains what you should do if one of the three **Bareos** daemons (Director, File, Storage) crashes. When we speak of crashing, we mean that the daemon terminates abnormally because of an error. There are many cases where Bareos detects errors (such as PIPE errors) and will fail a job. These are not considered crashes. In addition, under certain conditions, Bareos will detect a fatal in the configuration, such as lack of permission to read/write the working directory. In that case, Bareos will force itself to crash with a SEGFAULT. However, before crashing, Bareos will normally display a message indicating why. For more details, please read on.

K.1 Traceback

Each of the three Bareos daemons has a built-in exception handler which, in case of an error, will attempt to produce a traceback. If successful the traceback will be emailed to you.
For this to work, you need to ensure that a few things are setup correctly on your system:

1. You must have a version of Bareos with debug information and not stripped of debugging symbols. When using a packaged version of Bareos, this requires to install the Bareos debug packages (`bareos-debug` on RPM based systems, `bareos-dbg` on Debian based systems).

2. On Linux, `gdb` (the GNU debugger) must be installed. On some systems such as Solaris, `gdb` may be replaced by `dbx`.

3. By default, btraceback uses `bsmtp` to send the traceback via email. Therefore it expects a local mail transfer daemon running. It send the traceback to `root@localhost` via `localhost`.

4. Some Linux distributions, e.g. Ubuntu, disable the possibility to examine the memory of other processes. While this is a good idea for hardening a system, our debug mechanismen will fail. To disable this feature, run (as root):

```
root@linux:~#
      test -e /proc/sys/kernel/yama/ptrace_scope && echo 0 > /proc/sys/kernel/yama/ptrace_scope
```

Commands K.1: disable ptrace protection to enable debugging (required on Ubuntu Linux)

If all the above conditions are met, the daemon that crashes will produce a traceback report and email it. If the above conditions are not true, you can run the debugger by hand as described below.

K.2 Testing The Traceback

To "manually" test the traceback feature, you simply start **Bareos** then obtain the **PID** of the main daemon thread (there are multiple threads). The output produced here will look different depending on what OS and what version of the kernel you are running.

```
root@linux:~#  ps fax | grep bareos-dir
 2103 ?        S      0:00 /usr/sbin/bareos-dir
```

Commands K.2: get the process ID of a running Bareos daemon

which in this case is 2103. Then while Bareos is running, you call the program giving it the path to the Bareos executable and the **PID**. In this case, it is:

```
root@linux:~#  btraceback /usr/sbin/bareos-dir 2103
```

Commands K.3: get traceback of running Bareos director daemon

It should produce an email showing you the current state of the daemon (in this case the Director), and then exit leaving **Bareos** running as if nothing happened. If this is not the case, you will need to correct the problem by modifying the `btraceback` script.

K.2.1 Getting A Traceback On Other Systems

It should be possible to produce a similar traceback on systems other than Linux, either using `gdb` or some other debugger. Solaris with `dbx` loaded works quite fine. On other systems, you will need to modify the `btraceback` program to invoke the correct debugger, and possibly correct the `btraceback.gdb` script to have appropriate commands for your debugger. Please keep in mind that for any debugger to work, it will most likely need to run as root.

K.3 Manually Running Bareos Under The Debugger

If for some reason you cannot get the automatic traceback, or if you want to interactively examine the variable contents after a crash, you can run Bareos under the debugger. Assuming you want to run the Storage daemon under the debugger (the technique is the same for the other daemons, only the name changes), you would do the following:

1. The Director and the File daemon should be running but the Storage daemon should not.
2. Start the Storage daemon under the debugger:

   ```
   root@linux:~# gdb /usr/sbin/bareos-sd
   (gdb) run -f -s -d 200
   ```

   Commands K.4: run the Bareos Storage daemon in the debugger

   Parameter:

   -f foreground

   -s no signals

   -d nnn debug level

   See section daemon command line options for a detailed list of options.
3. At this point, Bareos will be fully operational.
4. In another shell command window, start the Console program and do what is necessary to cause Bareos to die.
5. When Bareos crashes, the **gdb** shell window will become active and **gdb** will show you the error that occurred.
6. To get a general traceback of all threads, issue the following command:

   ```
   (gdb) thread apply all bt
   ```

   Commands K.5: run the Bareos Storage daemon in the debugger

   After that you can issue any debugging command.

Appendix L

Release Notes

The technical changelog is automatically generated from the Bareos bug tracking system, see http://bugs.bareos.org/changelog_page.php.
Please note, that some of the subreleases are only internal development releases.
Open issues for a specific version are shown at http://bugs.bareos.org/roadmap_page.php.
The overview about new feature of a release are shown at https://github.com/bareos/bareos and in the Index of this document.
This chapter concentrates on things to do when updating an existing Bareos installation.
Please note! *While all the source code is published on GitHub, the releases of packages on http://download.bareos.org is limited to the initial versions of a major release. Later maintenance releases are only published on https://download.bareos.com.*

Bareos-15.2

bareos-15.2.3

Code Release	2016-03-11
Database Version	2004 (unchanged)
Release Ticket	Ticket #625
Url	https://download.bareos.com/bareos/release/15.2/

For upgrading from 14.2, please see releasenotes for 15.2.1.
This release contains several bugfixes and enhancements. Excerpt:

- VMWare plugin can now restore to VMDK file
- Ceph support for SLES12 included
- Multiple gfapi and ceph enhancements
- NDMP enhancements and bugfixes
- Windows: multiple VSS Jobs can now run concurrently in one FD, installer fixes
- bpipe: fix stderr/stdout problems
- reload command enhancements (limitations eliminated)
- label barcodes now can run without interaction

bareos-15.2.2

Code Release	2015-11-19
Database Version	2004 Database update required (if coming from bareos-14.2). See the Updating Bareos section.
Release Ticket	Ticket #554
Url	http://download.bareos.org/bareos/release/15.2/ https://download.bareos.com/bareos/release/15.2/

First stable release of the Bareos 15.2 branch.
When coming from bareos-14.2.x, the following things have changed (same as in bareos-15.2.1):

- The default setting for the Bacula Compatbile mode in Compatible Fd Client and Compatible Sd Storage have been changed from *yes* to *no*.
- The configuration syntax for Storage Daemon Cloud Backends Ceph and GlusterFS have changed. Before bareos-15.2, options have been configured as part of the Archive Device Sd Device directive, while now the Archive Device contains only information text and options are defined via the Device Options Sd Device directive. See examples in Device Options Sd Device.

bareos-15.2.1

Code Release	2015-09-16
Database Version	2004
	Database update required, see the Updating Bareos section.
Release Ticket	Ticket #501
Url	http://download.bareos.org/bareos/release/15.2/

Beta release.

- The default setting for the Bacula Compatbile mode in Compatible Fd Client and Compatible Sd Storage have been changed from *yes* to *no*.
- The configuration syntax for Storage Daemon Cloud Backends Ceph and GlusterFS have changed. Before bareos-15.2, options have been configured as part of the Archive Device Sd Device directive, while now the Archive Device contains only information text and options are defined via the Device Options Sd Device directive. See examples in Device Options Sd Device.

Bareos-14.2

It is known, that `drop_database` scripts will not longer work on PostgreSQL < 8.4. However, as `drop_database` scripts are very seldom needed, package dependencies do not yet enforce PostgreSQL >= 8.4. We plan to ensure this in future version of Bareos.

bareos-14.2.6

Code Release	2015-12-03
Database Version	2003 (unchanged)
Release Ticket	Ticket #474
Url	https://download.bareos.com/bareos/release/14.2/

This release contains several bugfixes.

bareos-14.2.5

Code Release	2015-06-01
Database Version	2003 (unchanged)
Release Ticket	Ticket #447
Url	https://download.bareos.com/bareos/release/14.2/

This release contains several bugfixes and added the platforms `Debian 8` and `Fedora 21`.

bareos-14.2.4

Code Release	2015-03-23
Database Version	2003 (unchanged)
Release Ticket	Ticket #420
Url	https://download.bareos.com/bareos/release/14.2/

This release contains several bugfixes, including one major bugfix (Ticket #437), relevant for those of you using backup to disk with autolabeling enabled.
It can lead to loss of a 64k block of data when all of this conditions apply:

- backups are written to disk (tape backups are not affected)
- autolabelling is enabled
- a backup spans over multiple volumes

- the additional volumes are newly created and labeled during the backup

If existing volumes are used for backups spanning over multiple volumes, the problem does not occur.
We recommend to update to the latest packages as soon as possible.
If an update is not possible immediately, autolabeling should be disabled and volumes should be labelled manually until the update can be installed.
If you are affected by the 64k bug, we recommend that you schedule a full backup after fixing the problem in order to get a proper full backup of all files.

bareos-14.2.3

Code Release	2015-02-02
Database Version	2003 (unchanged)
Release Ticket	Ticket #393
Url	https://download.bareos.com/bareos/release/14.2/

bareos-14.2.2

Code Release	2014-12-12
Database Version	2003 (unchanged) Database update required if updating from version < 14.2. See the Updating Bareos section for details.
Url	http://download.bareos.org/bareos/release/14.2/ https://download.bareos.com/bareos/release/14.2/

First stable release of the Bareos 14.2 branch.

bareos-14.2.1

Code Release	2014-09-22
Database Version	2003 Database update required, see the Updating Bareos section.
Url	http://download.bareos.org/bareos/release/14.2/

Beta release.

Bareos-13.2

bareos-13.2.5

Code Release	2015-12-03
Database Version	2002 (unchanged)
Url	https://download.bareos.com/bareos/release/13.2/

This release contains several bugfixes.

bareos-13.2.4

Code Release	2014-11-05
Database Version	2002 (unchanged)
Url	https://download.bareos.com/bareos/release/13.2/

bareos-13.2.3

Code Release	2014-03-11
Database Version	2002 Database update required, see the Updating Bareos section.
Url	https://download.bareos.com/bareos/release/13.2/

It is known, that `drop_database` scripts will not longer work on PostgreSQL < 8.4. However, as `drop_database` scripts are very seldom needed, package dependencies do not yet enforce PostgreSQL >= 8.4. We plan to ensure this in future version of Bareos.

bareos-13.2.2

Code Release	2013-11-19
Database Version	2001 (unchanged)
Url	http://download.bareos.org/bareos/release/13.2/ https://download.bareos.com/bareos/release/13.2/

Bareos-12.4

bareos-12.4.8

Code Release	2015-11-18
Database Version	2001 (unchanged)
Url	https://download.bareos.com/bareos/release/12.4/

This release contains several bugfixes.

bareos-12.4.6

Code Release	2013-11-19
Database Version	2001 (unchanged)
Url	http://download.bareos.org/bareos/release/12.4/ https://download.bareos.com/bareos/release/12.4/

bareos-12.4.5

Code Release	2013-09-10
Database Version	2001 (unchanged)
Url	https://download.bareos.com/bareos/release/12.4/

bareos-12.4.4

Code Release	2013-06-17
Database Version	2001 (unchanged)
Url	http://download.bareos.org/bareos/release/12.4/ https://download.bareos.com/bareos/release/12.4/

bareos-12.4.3

Code Release	2013-04-15
Database Version	2001 (unchanged)
Url	http://download.bareos.org/bareos/release/12.4/ https://download.bareos.com/bareos/release/12.4/

bareos-12.4.2

Code Release	2013-03-03
Database Version	2001 (unchanged)

bareos-12.4.1

Code Release	2013-02-06
Database Version	2001 (initial)

This have been the initial release of Bareos.
Information about migrating from Bacula to Bareos are available at Howto upgrade from Bacula to Bareos and in section Compatibility between Bareos and Bacula.

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Part V

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