IBM Software

Managing Tapes, Backups, and Automated Operations for z/VM Systems

SHARE Session 9147

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Agenda

- **Overview**

- **Storage management**

  – Backup and Restore Manager for z/VM

  – Tape Manager for z/VM

- **Systems management**

  – Operations Manager for z/VM

- **Demo**

  – Backup and Restore Manager with Operations Manager

Backup and Restore Manager for z/VM

Product Overview

- **Backup**

  - Requested by administrators

  - Full or incremental

  - Flexible selection of disks and files to back up

  - Review job before submitting for backup

  - Catalog housed in Shared File System
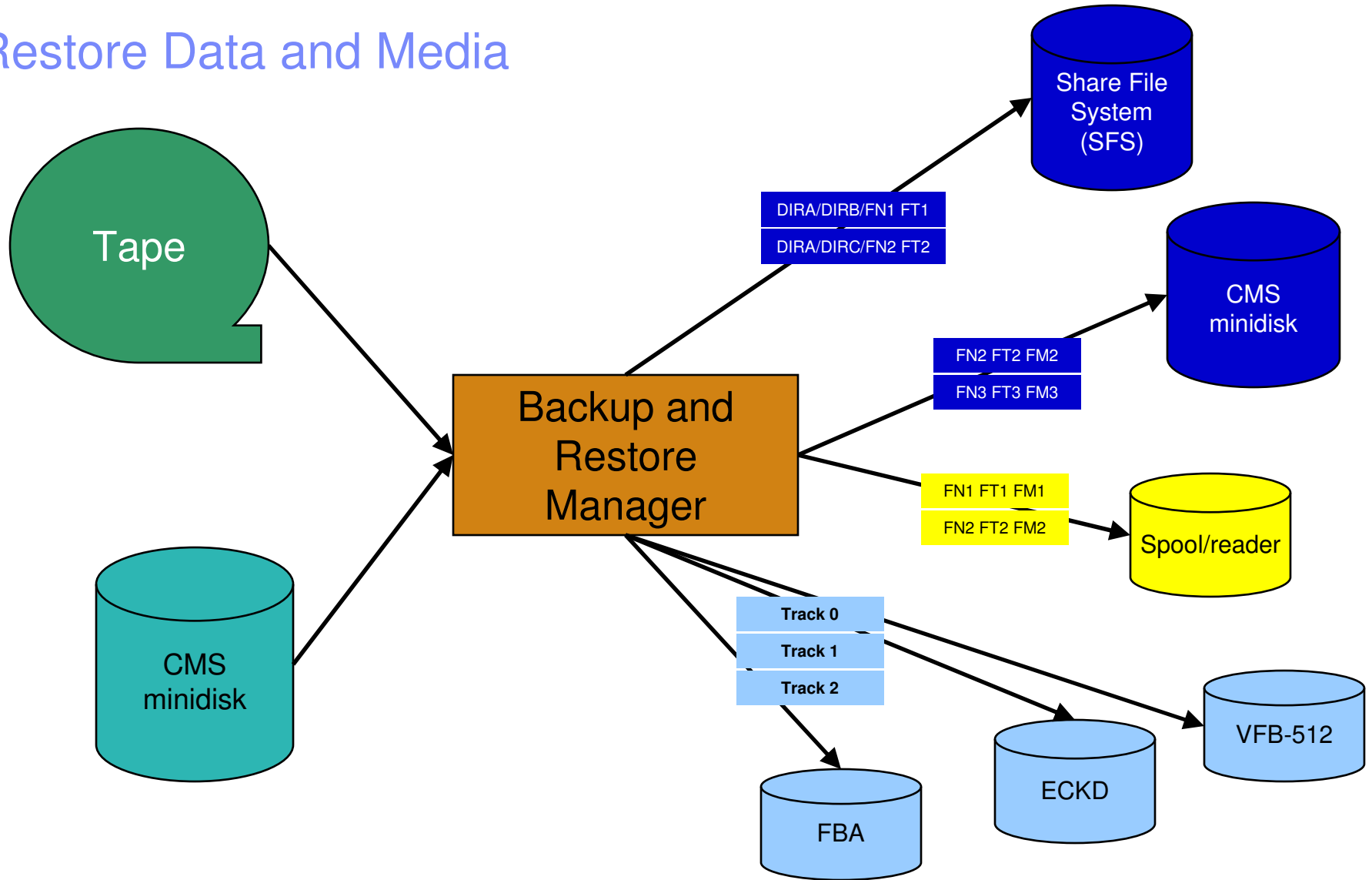
- **Restore**

  - Performed by users for their own data

    - Extend to other users via exit point

  - Performed by administrators for any data

  - Selection of data to restore

    - Full screen interface or commands

    - Individual files, with wildcard support

      - By file ID
      - By minidisk
      - By volume
      - By backup instance

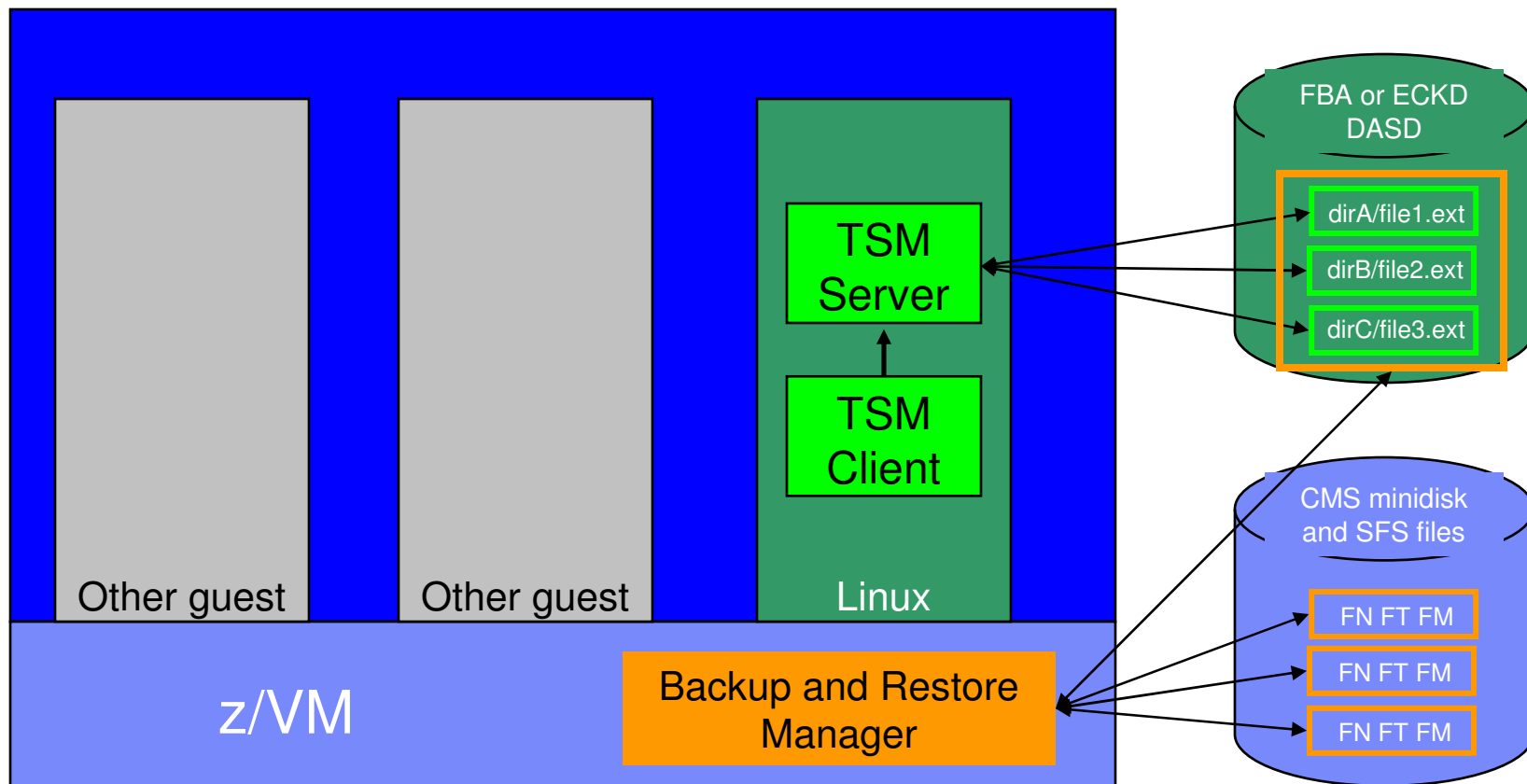**Integration with Tape Manager for z/VM**

Backup Data and Media
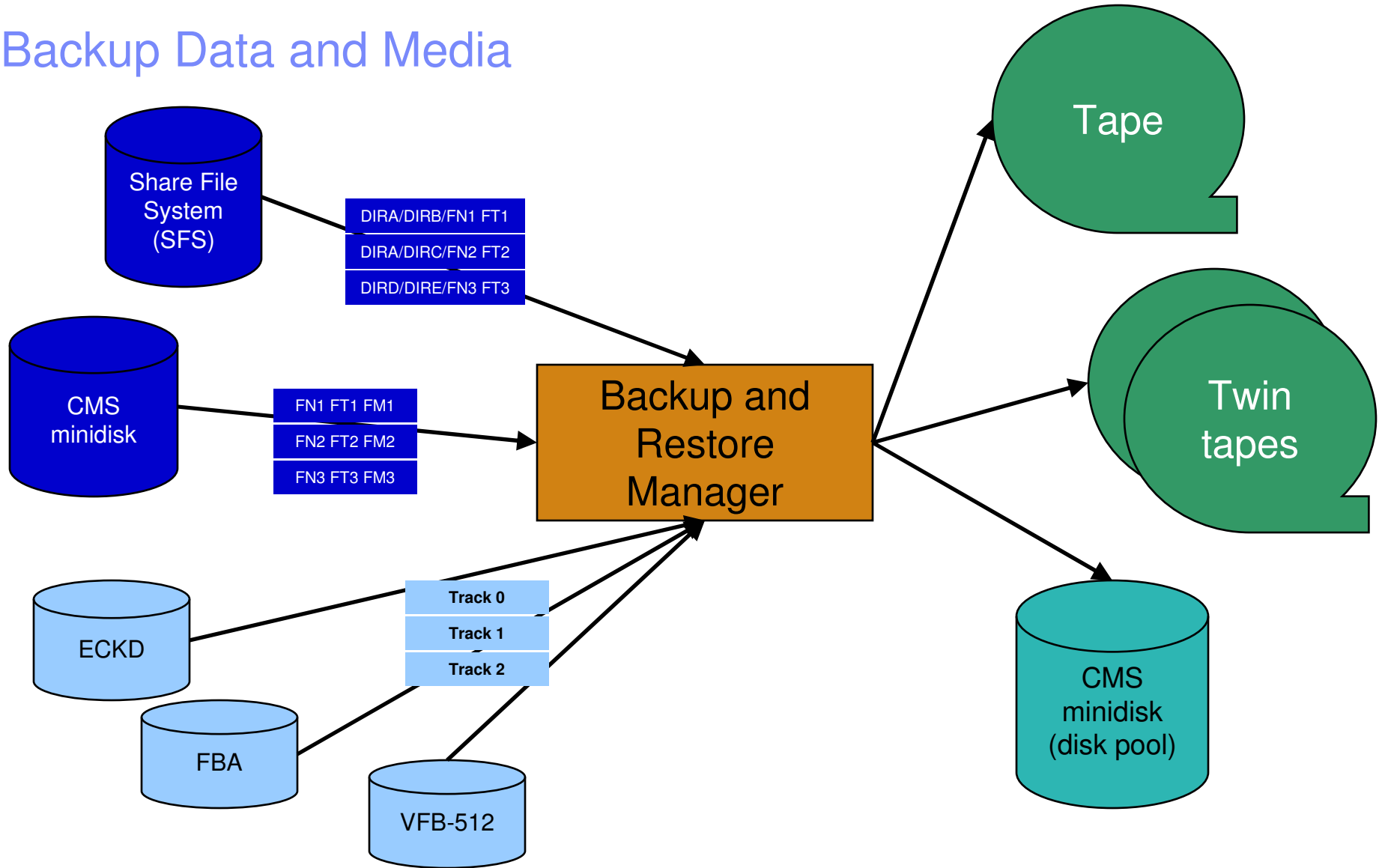
Restore Data and Media

Backup and Restore Manager and Linux Guests

Using Backup and Restore Manager with Tivoli Storage Manager

Key Benefits

- **System backups available for Disaster Recovery**
  - Retrieve a list of tapes associated with a specific backup (pull list for movement to off-site storage)

- **Guest backups available for restoring to a previous state or level**

- **Backups of user data available for**
  - Restoring to a previous state or level
  - Replacing files accidentally erased or corrupted

- **Users restore their own data**
  - No administrator interaction required

Key Benefits

- **Flexible selection of data to back up**
  - Include/exclude minidisks, directories, extents
  - Mask by filename, filetype, or SFS path
  - Review of a defined backup job before submission

- **Management of backup data**
  - Retention set as part of the backup job
  - Automatic aging and pruning of the backup catalog
    - Including associated tapes and disk pools
  - View/query the list of expired backups

- **Reduced backup window with concurrent processing**
  - Multiple worker service machines sharing the job
  - Suggest one worker service machine for each available tape drive

Backup and Restore Manager

z/VM

Master Backup Server (BKRBKUP)

✓ Job submission

✓ Worker monitoring

✓ Client interaction

Catalog Server (BKRCATLG)

Worker Task Server (BKRWRKnn)

✓ Metadata repository

✓ Stores job history
  ‣ Per client
  ‣ Per DASD
  ‣ Per SFS pool

✓ Keeps backup media history

✓ 1 or more server instances

✓ Interacts with source and target media

✓ Passes state information to BKRBKUP

✓ Passes metadata to BKRCATLG

Features and Functions

- **Backups requested by administrators only**

  – Incremental or full backups

- **Restores**

  – Full screen or command level interface

  – Requested by

  - Users for their own data, with no administrator intervention
  - Users for other users' data, if authorized via exit code
  - Administrators for any data

- **Data compression**

- **Encryption exits**

- **Integration with IBM Tape Manager for z/VM**

Defining a Backup Job

```
/* Include/Exclude definitions                                          */
/*********************************************************************/
```

FUNCTION	MEDIATYPE	OWNER		VDEV	VOLUME	DEVTYPE		START		END		SIZE
INCLUDE	MINIDISK	*	=	*	*	*	=	*	=	*	=	*
EXCLUDE	MINIDISK	FDISK	=	*	*	*	=	*	=	*	=	*
EXCLUDE	MINIDISK	$ALLOC$	=	*	*	*	=	*	=	*	=	*
EXCLUDE	MINIDISK	*LNX*	=	*	*	*	=	*	=	*	=	*
EXCLUDE	MINIDISK	MAINT	=	0123	*	*	=	*	=	*	=	*
EXCLUDE	MINIDISK	MAINT	=	0124	*	*	=	*	=	*	=	*
EXCLUDE	MINIDISK	VMSERV*	=	*	*	*	=	*	=	*	=	*
INCLUDE	MINIDISK	VMSERV*	=	019*	*	*	=	*	=	*	=	*
EXCLUDE	MINIDISK	*	=	*	*	*	=	*	=	*	>	3300
INCLUDE	MINIDISK	MAINT	=	012*	*	*	=	*	=	*	=	*

FUNCTION	MEDIATYPE	POOLNAME	OWNER	FS
INCLUDE	SFS	VMSYSU:	*	SFS
EXCLUDE	SFS	VMSYSU:	VMSERVU	*

Compression and Encryption Exits

- **Two general purpose User Data Processing Exits (UDPE)**
- **Intended for compression and encryption**
- **Each called with a block of data**
  - Accepts more, less, or no data in return
  - Output of exit 1 (compression) is input to exit 2 (encryption)
  - Output of exit 2 is appended to current block of data ready to write to tape, twin tapes, or disk
- **Name of exit(s) specified at the job level**
  - TEXT deck loaded dynamically when initially required
  - Use different exits for different backup jobs if desired
- **Compression routines provided**
  - Sample routine using basic run-length encoding provided as source code
  - Supported routine using CMS compression services provided Object Code Only
    - Can replace supplied dictionaries with ones you create using VM-supplied routines and your data
  - Compression recommended for disk only
    - Use hardware features of tape devices for compression on tape
  - Be aware of increased CPU consumption
- **Requirement for supported encryption routine understood**

Compression and Encryption Exits

Compress and encrypt data backed up to disk

```
BACKUP1 TEMPLATE

…
CONFIG BKR_OUT_EDF_UDPE1 = BKREXT3A
CONFIG BKR_OUT_EDF_UDPE2 = MYCRYPT
CONFIG BKR_OUT_EDF_UDPE2_PARM = MONTHLY
CONFIG BKR_OUT_EDF_UDPE2_PLEN = 7

…
INCLUDE …
EXCLUDE …
```

Block of data from DUMPCKD or similar

BKREXT3A TEXT

Compression routine
➤ Provided by Backup and Restore Manager
➤ Uses standard CMS compression services
➤ Based on provided or customized dictionaries

Backup data: compressed and encrypted

Backup and Restore Manager

MYCRYPT TEXT

Encryption routine
➤ Provided by customer or vendor

Compressed block of data

Compression and Encryption Exits

Encrypt and compress data backed up to tape

```
BACKUP2 TEMPLATE

…
CONFIG TAPE_EXIT1_NAME = NEWCRYPT
CONFIG TAPE_EXIT1_PARM = WEEKLY
CONFIG TAPE_EXIT1_PLEN = 8
…
INCLUDE …
EXCLUDE …
```

Block of data from DUMPSFS or similar

MYCRYPT TEXT

Encryption routine
➢ Provided by customer or vendor

Backup data: encrypted and compressed

Backup and Restore Manager

Encrypted block of data

Compression
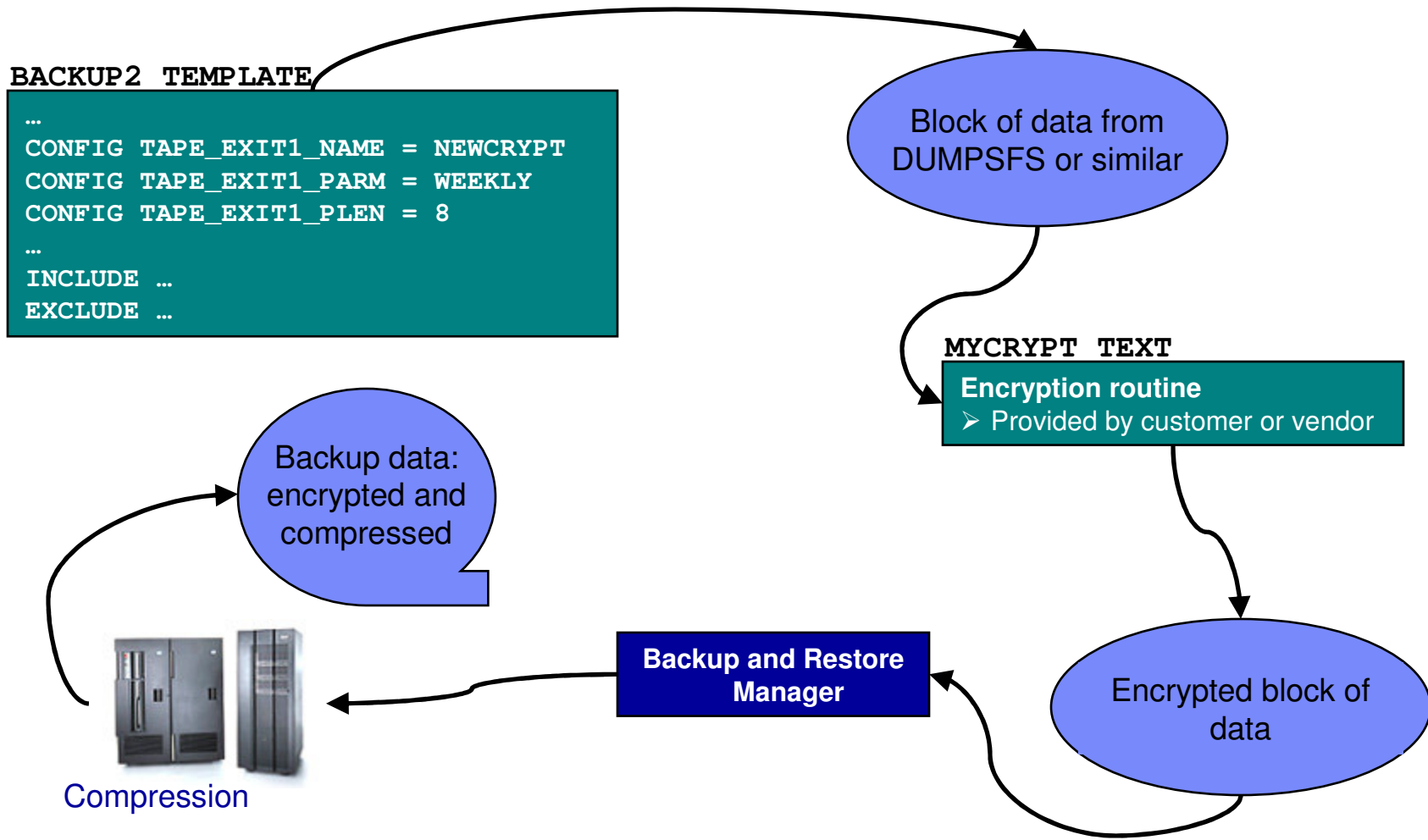
Backup and Restore Manager Summary

- **Flexibility**
  - Backup only what is needed via include, exclude, and masking statements
  - Mix and match source and target types

- **Productivity**
  - Review of backup job before submission
  - User driven restores with no administrator interaction

- **Control**
  - End users can only access restore data owned by them
    - Additional authorizations allowed via exit code
  - Automatic aging and pruning of backup catalog
  - Consistent backups using the object directory (not source)

Tape Manager for z/VM

Product Overview

- **Manage tapes**
  - Define tapes in a catalog, including:
    - Free or used
    - Retention/expiration information
    - ATL or manual mount
    - Data Security Erase
  - Group tapes together into pools
    - Ownership and access control
    - Media type

- **Manage devices**
  - Define available devices
    - Dedicated or assignable
  - Group devices together into device pools
    - ATL/VTS or manual mount
    - Any other grouping you choose (read only vs. write, location, etc.)
  - Share devices with other systems

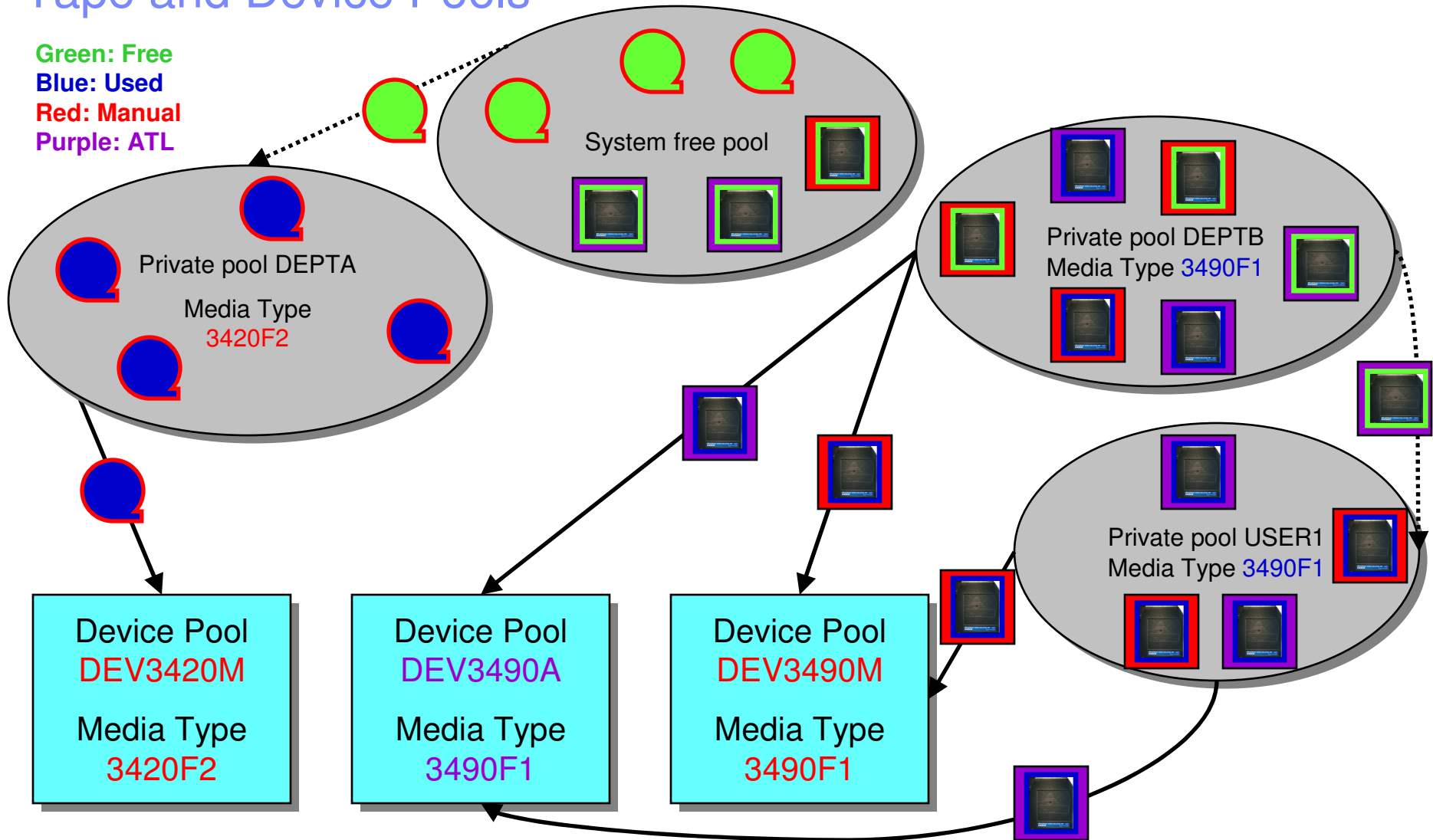- **Manage mount requests**
  - Volume specific and scratch requests
    - Standard Label
    - Non-Label
    - Bypass Label Processing

Key Benefits

- **Effective management of tapes in ATLs**
  - Granular access control
  - Expiration processing
  - Notification for low threshold for tape resources
  - Interacts with devices through DFSMSRMS on z/VM

- **Improved accuracy of manual tape processing**
  - Automated interface to Operator for manual mounts
  - Internal label verification at attach/give and detach (SL only)
  - Read/Write verification at attach/give

- **Integrated management of z/OS and z/VM tapes using DFSMSrmm on z/OS**
  - Optionally use RMM on z/OS as the tape catalog for z/VM and z/OS tapes
  - Tapes, access control, and retention managed by the existing RMM catalog
  - Accessible via Tape Manager on z/VM
  - Tapes managed by RMM
  - Devices managed by Tape Manager

Tape and Device Pools

Green: Free
Blue: Used
Red: Manual
Purple: ATL

System free pool

Private pool DEPTA

Media Type
3420F2

Private pool DEPTB
Media Type 3490F1

Private pool USER1
Media Type 3490F1

Device Pool
DEV3420M

Media Type
3420F2

Device Pool
DEV3490A

Media Type
3490F1

Device Pool
DEV3490M

Media Type
3490F1
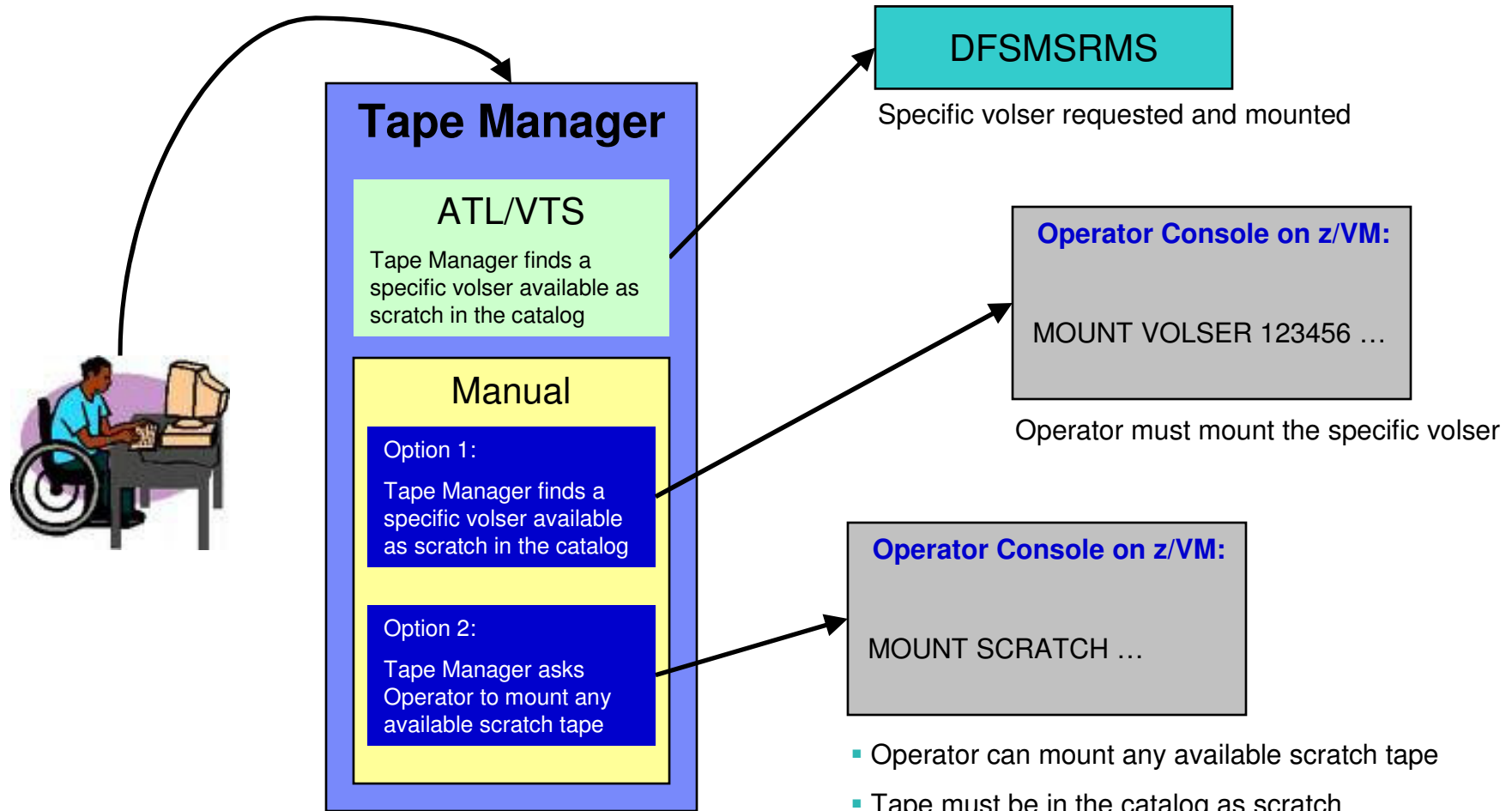
Access Control

Authority	Modify Pool Attributes and Delete Pool	Modify Tape Attributes	Add Tapes to the System Inventory (System Free Pool or Private Pools)	Delete Tapes from the System Inventory	Transfer Tapes into or out of this Pool; Delete External Tapes from this Private Pool	Modify Tapes	Read Tapes	Tape Attributes Modified Only as a Byproduct of Other Commands	Use Tape Pool as a Free Pool	Receive messages related to this pool
Sys Admin	✓	✓	✓	✓	✓			✓		
Pool Admin	✓	✓			✓	✓	✓	✓		
Tape					✓	✓	✓	✓		
Write						✓	✓	✓		
Read							✓	✓		
None										
Free									✓	
ExceptID										Threshold messages
MntID1 and MntID2										Mount messages, query and cancel mounts

Tape Mount Support: ATL, VTS, Manual

Verify authorization

Find an available and compatible device

Tape Manager for z/VM

Internal label verification at attach/give and detach (SL only)

Read/Write verification

DFSMSRMS on z/VM

ATL

VTS

Operator Console on z/VM

Manual Mount Drives
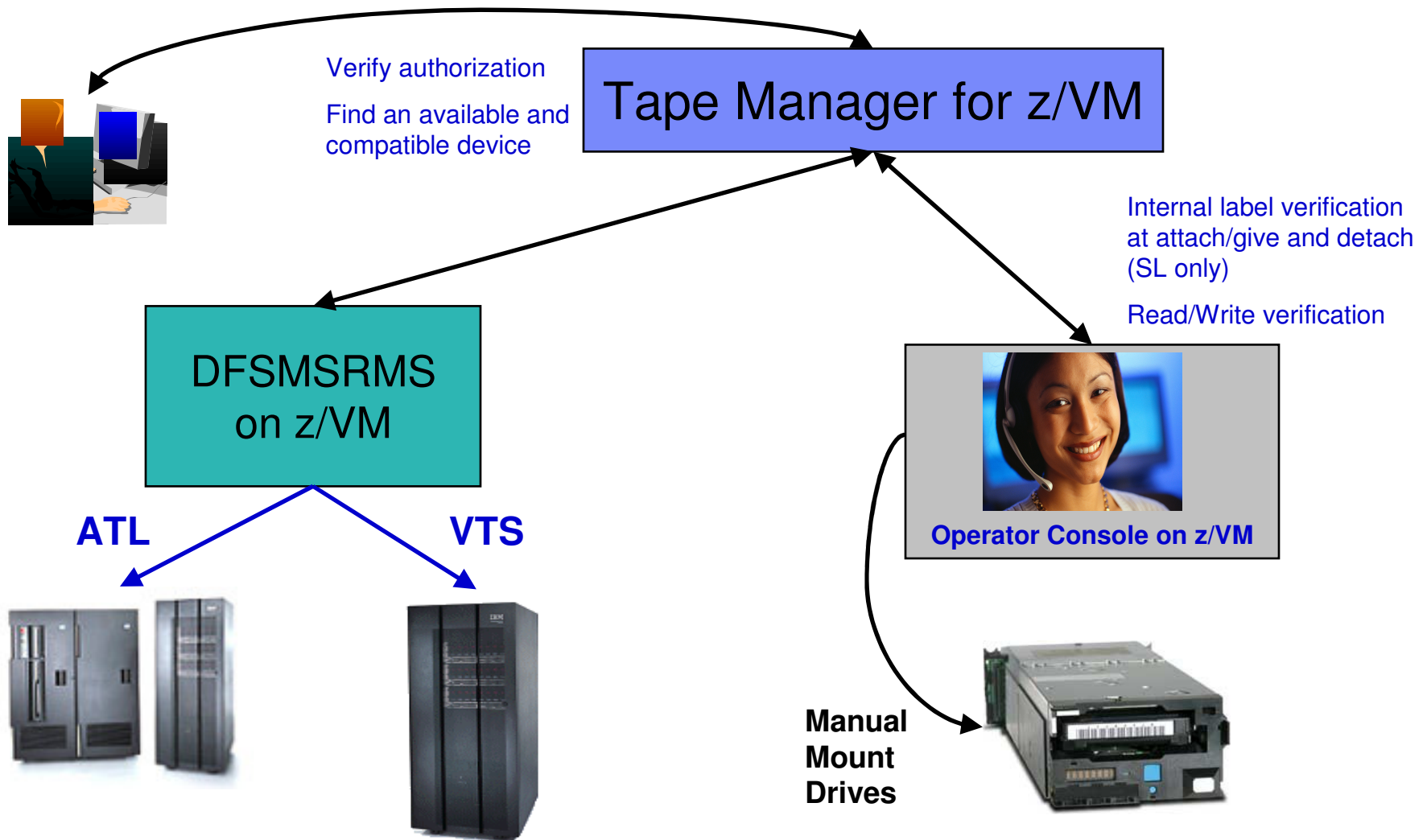
Scratch Mount Requests in Standard Mode

Tape Manager

ATL/VTS

Tape Manager finds a specific volser available as scratch in the catalog

Manual

Option 1:

Tape Manager finds a specific volser available as scratch in the catalog

Option 2:

Tape Manager asks Operator to mount any available scratch tape

DFSMSRMS

Specific volser requested and mounted

Operator Console on z/VM:

MOUNT VOLSER 123456 …

Operator must mount the specific volser

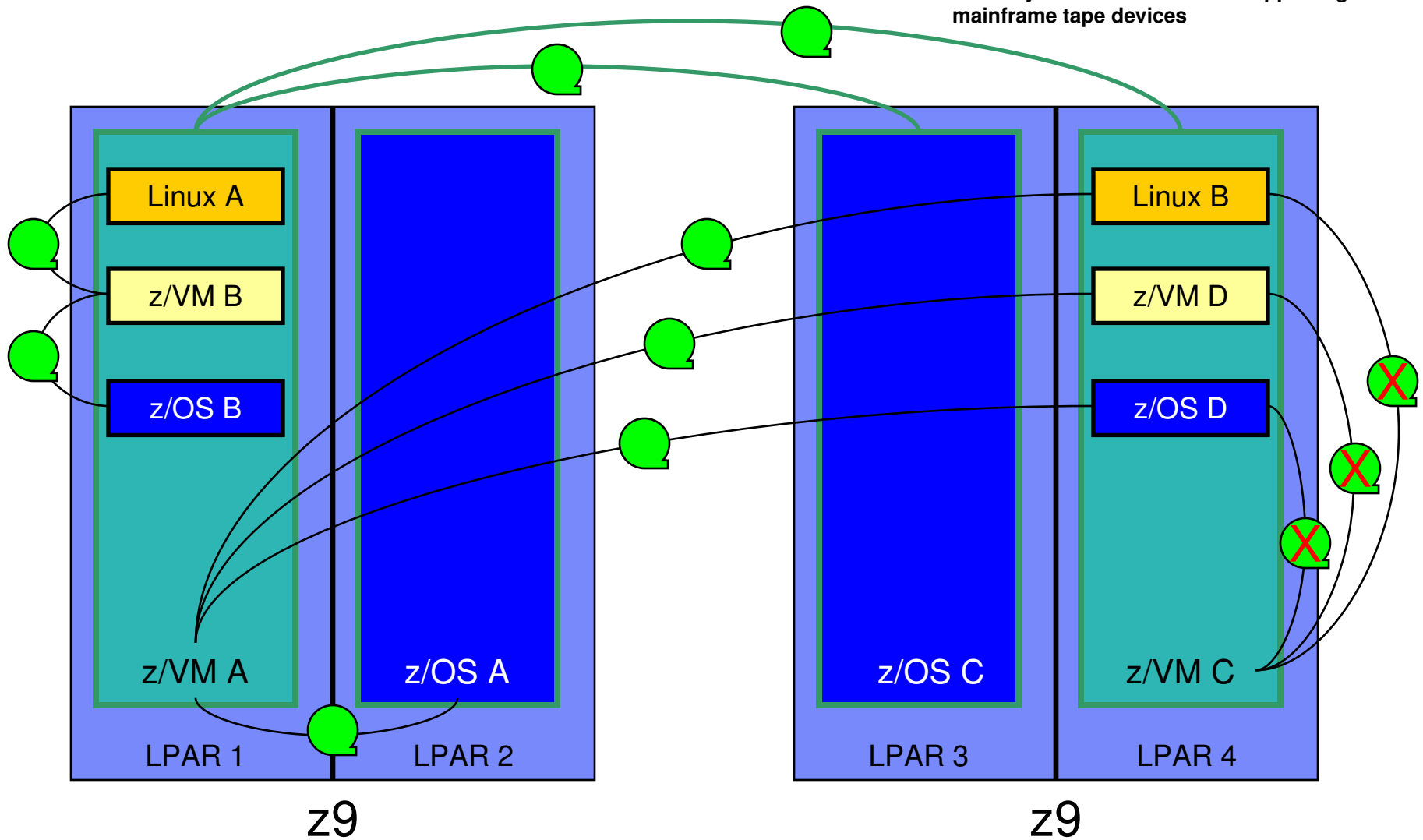**Operator Console on z/VM:**

MOUNT SCRATCH …

- Operator can mount any available scratch tape
- Tape must be in the catalog as scratch
- Tape must be in requesting mount pool or free pool

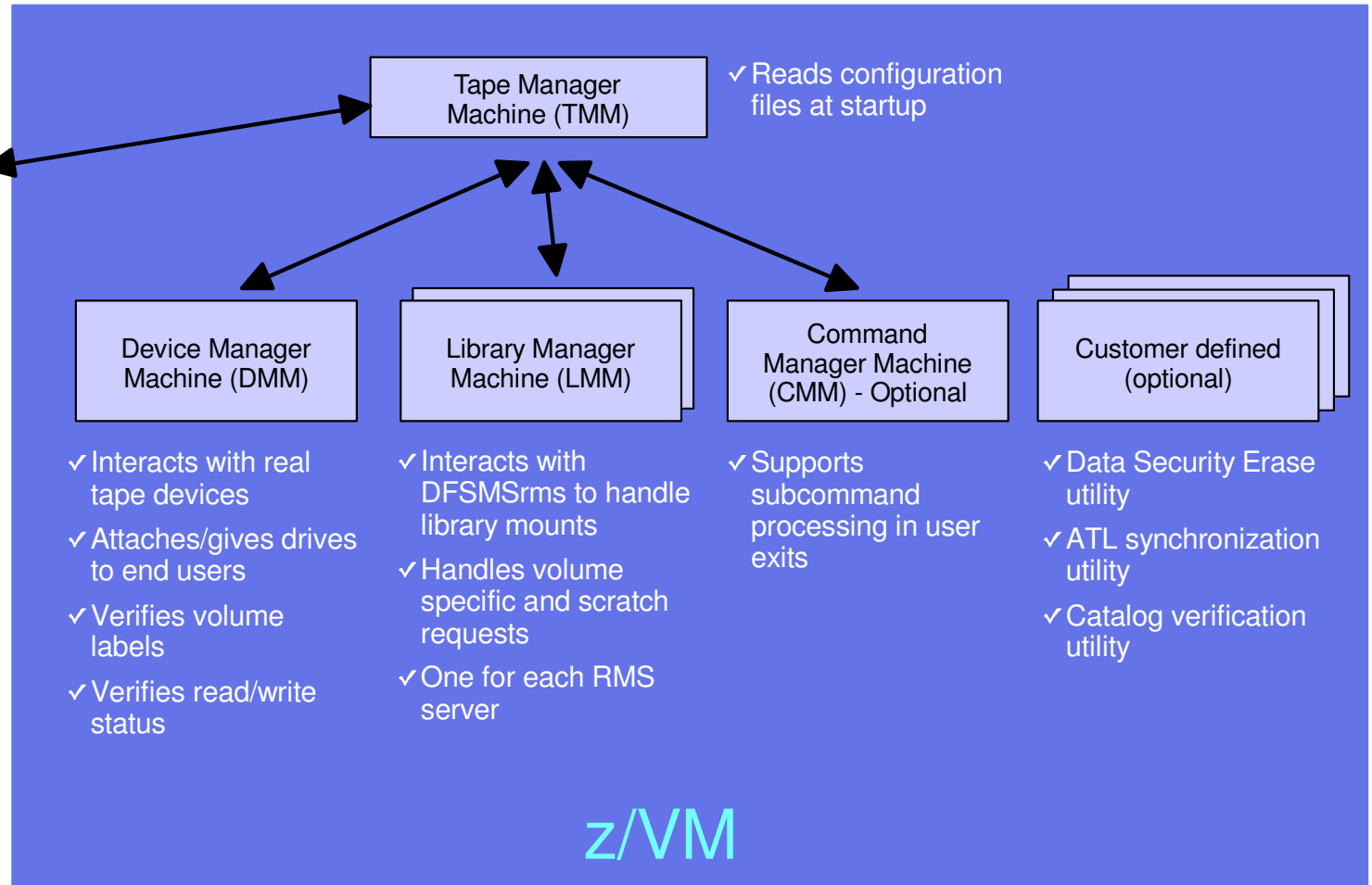Option 1 vs. Option 2 controlled by GENSCRATCH statement in SYS CONFIG

Sharing of Tape Devices

> z/VM systems with IBM Tape Manager

> z/OS systems with IBM Automated Tape Allocation Manager

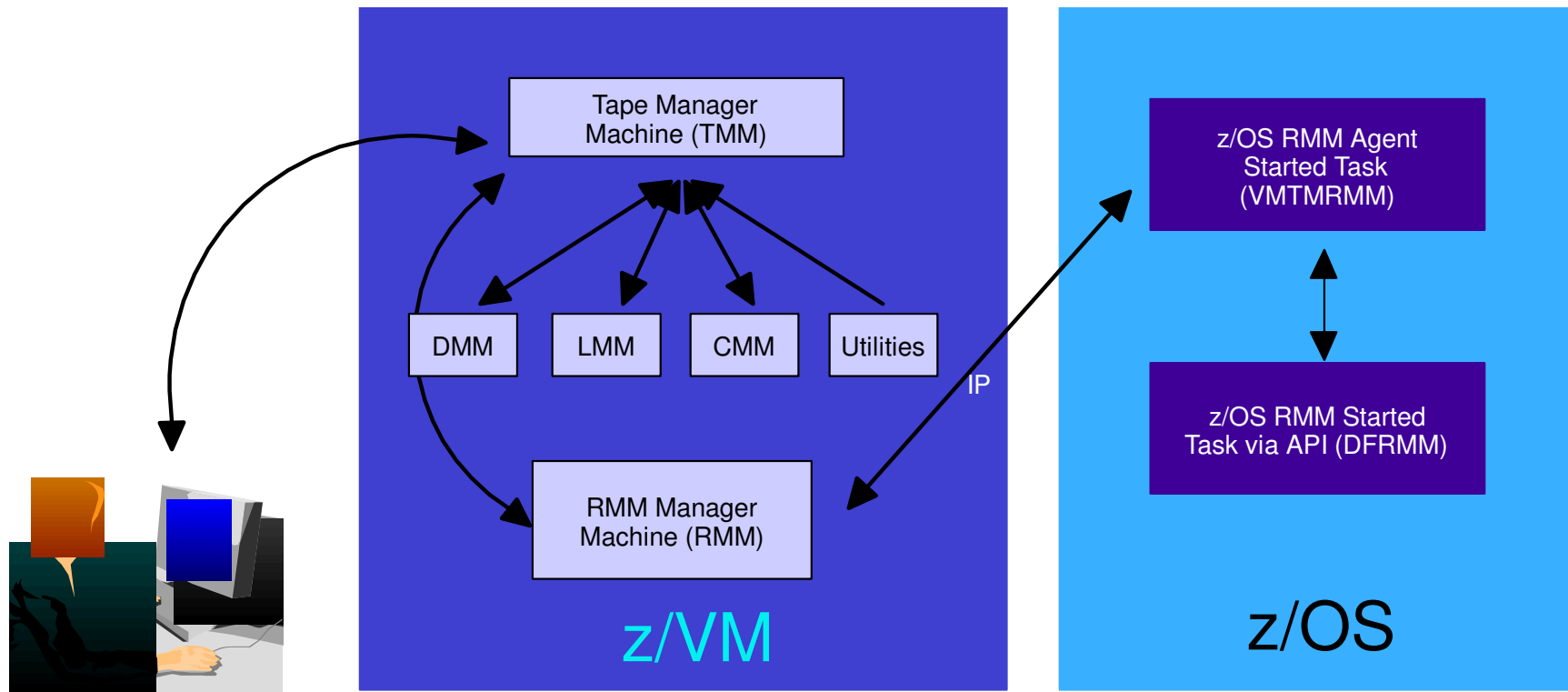> Linux systems with software supporting mainframe tape devices

Linux A

z/VM B

z/OS B

z/VM A

z/OS A

LPAR 1

LPAR 2

z9

Linux B

z/VM D

z/OS D

z/OS C

z/VM C

LPAR 3

LPAR 4

z9

Tape Manager in Standard Mode

Tape Manager
Machine (TMM)

✓ Reads configuration
files at startup

Device Manager
Machine (DMM)

Library Manager
Machine (LMM)

Command
Manager Machine
(CMM) - Optional

Customer defined
(optional)

✓ Interacts with real
tape devices

✓ Attaches/gives drives
to end users

✓ Verifies volume
labels

✓ Verifies read/write
status

✓ Interacts with
DFSMSrms to handle
library mounts

✓ Handles volume
specific and scratch
requests

✓ One for each RMS
server

✓ Supports
subcommand
processing in user
exits

✓ Data Security Erase
utility

✓ ATL synchronization
utility

✓ Catalog verification
utility

z/VM

Tape Manager in RMM Mode

z/VM

z/OS

Tape Manager
Machine (TMM)

DMM | LMM | CMM | Utilities

IP

RMM Manager
Machine (RMM)

z/OS RMM Agent
Started Task
(VMTMRMM)

z/OS RMM Started
Task via API (DFRMM)

Data Security Erase (DSE)

- **Erase (sensitive) data before tape is reused**

- **Option to enable DSE at tape pool or individual tape level**
  - DSE-enabled flag included in each catalog entry

- **DSE-enabled tapes marked as DSE-ready when freed**

- **Tape Manager DSE utility executed on a separate user ID**

  - Started manually or automatically with Operations Manager

  - Queries the catalog to find all tapes with DSE-ready flag on

  - Mounts each tape
    - Verifies volume label if possible
      - Configuration option to perform DSE on NL tapes or not
    - Erases tape
    - Turns off DSE-ready flag in catalog

  - Tape is now available for scratch unless its HOLD flag is on

ATL Verification

- **Utility to confirm all expected tapes are in the ATL**

  – Admin specifies ATL(s) to verify

- **Executed on separate user ID/service machine**

  – Started manually or automatically with Operations Manager

  – Issues query against catalog to find all tapes in specified ATL(s)

    • Requires Tape Manager Admin authority and RMS Admin authority

  – For each tape

    • Queries DFSMSrms for tape status

    • Takes action based on status and configuration options

      – Issues warning message

      – Issues warning message and sets HOLD flag

      – Issues warning message and changes to manual mount tape

Tape Manager Summary

- **Automate daily tape operations**
  - Manage mount requests
  - Control tape access
  - Perform label verification
  - Expire tapes

- **Efficiently manage tapes and tape drives**
  - Share devices
  - Control access to individual tapes in an ATL
  - Erase sensitive data before tape is reused

- **Improve productivity**
  - Support manual and ATL mount requests
  - Notify and interact with Operator on behalf of user for manual mounts
  - Perform label verification before and after tape use
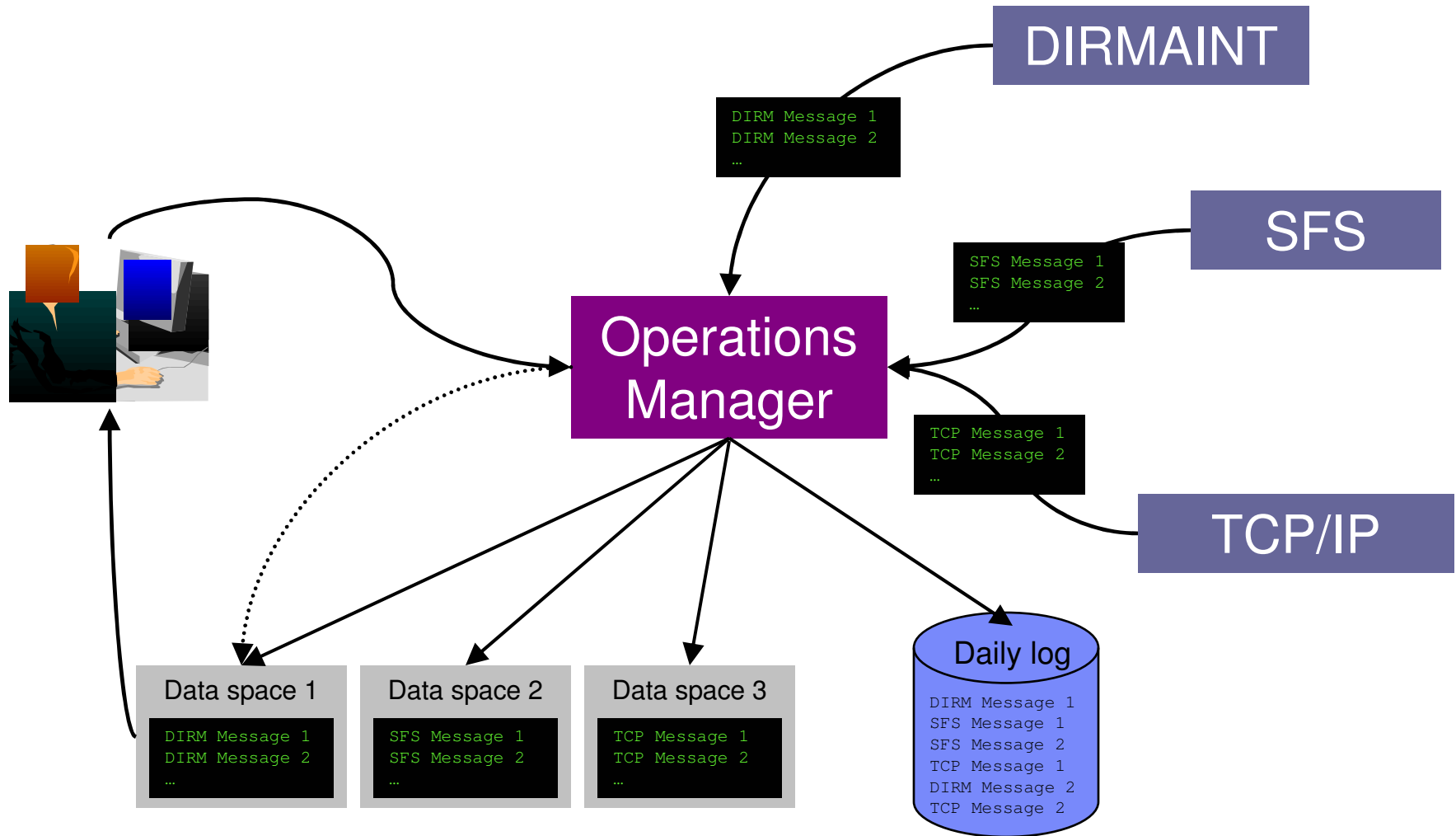 - Verify read/write attribute on manual mounts

Overview

- **Monitor service machines**

  – Capture console messages

  – Take predefined actions based on message text matching rules

- **View and interact with monitored consoles**

- **Schedule events/actions**

  – To occur on a regular schedule

  – To occur immediately

- **Automate multi-step tasks**

- **Dynamic configuration**

- **Separation of access control**

Key Benefits

- **Automation, automation, automation**
  - Routine tasks
    - Starting guest systems
    - Scheduling backups
  - Respond to predictable situations requiring some form of intervention
    - Route warning messages to users, administrators, or programmers
    - Re-ipl a service machine
    - Archive service machine log files to tape when approaching disk full

- **Increase productivity**
  - Problems can be identified and debugged faster
    - Administrators and operators can work together to resolve problems
  - Users receive faster response to typical roadblocks
  - Routine off-shift activities can be done more effectively with minimal operations staff

- **Improve system availability**
  - Monitor virtual machines and processes
    - Action instead of reaction
  - Reduce problems due to operator error

- **Resolve problems faster**

Monitor Service Machines

DIRMAINT

```
DIRM Message 1
DIRM Message 2
…
```

SFS

```
SFS Message 1
SFS Message 2
…
```

Operations Manager

```
TCP Message 1
TCP Message 2
…
```

TCP/IP

Data space 1
```
DIRM Message 1
DIRM Message 2
…
```

Data space 2
```
SFS Message 1
SFS Message 2
…
```

Data space 3
```
TCP Message 1
TCP Message 2
…
```

Daily log
```
DIRM Message 1
SFS Message 1
SFS Message 2
TCP Message 1
DIRM Message 2
TCP Message 2
```

Monitoring Service Machines

- **Define rules to**

  - Scan console messages for text matching

    - Includes column, wildcard, and exclusion support

  - Take actions based on matches

- **Multiple rules can apply to one message**

  - Rules processed in order of definition in the configuration file

  - FINAL option available to indicate no additional rules should be evaluated

In Operations Manager configuration file:
```
DEFRULE NAME(CPREAD),MATCH(*HCP*150A*CP*),MCOL(001:020),ACTION(CPREAD)
```

Monitor Service Machines

- **Predefined actions**
  - Suppress message from data space (thus console view)
    - Always sent to the log
  - Highlight message with color, blinking, etc.

- **Customer defined actions**
  - CP or CMS command, or EXEC to be executed

- **View consoles via GOMCMD command**
  - Authorized users can view individual consoles or a set of consoles
    - Multiple users can view/interact with the same console simultaneously
  - "Fullscreen mode"
    - Scroll up and down
    - Autoscroll (on or off) as new output is displayed on the console
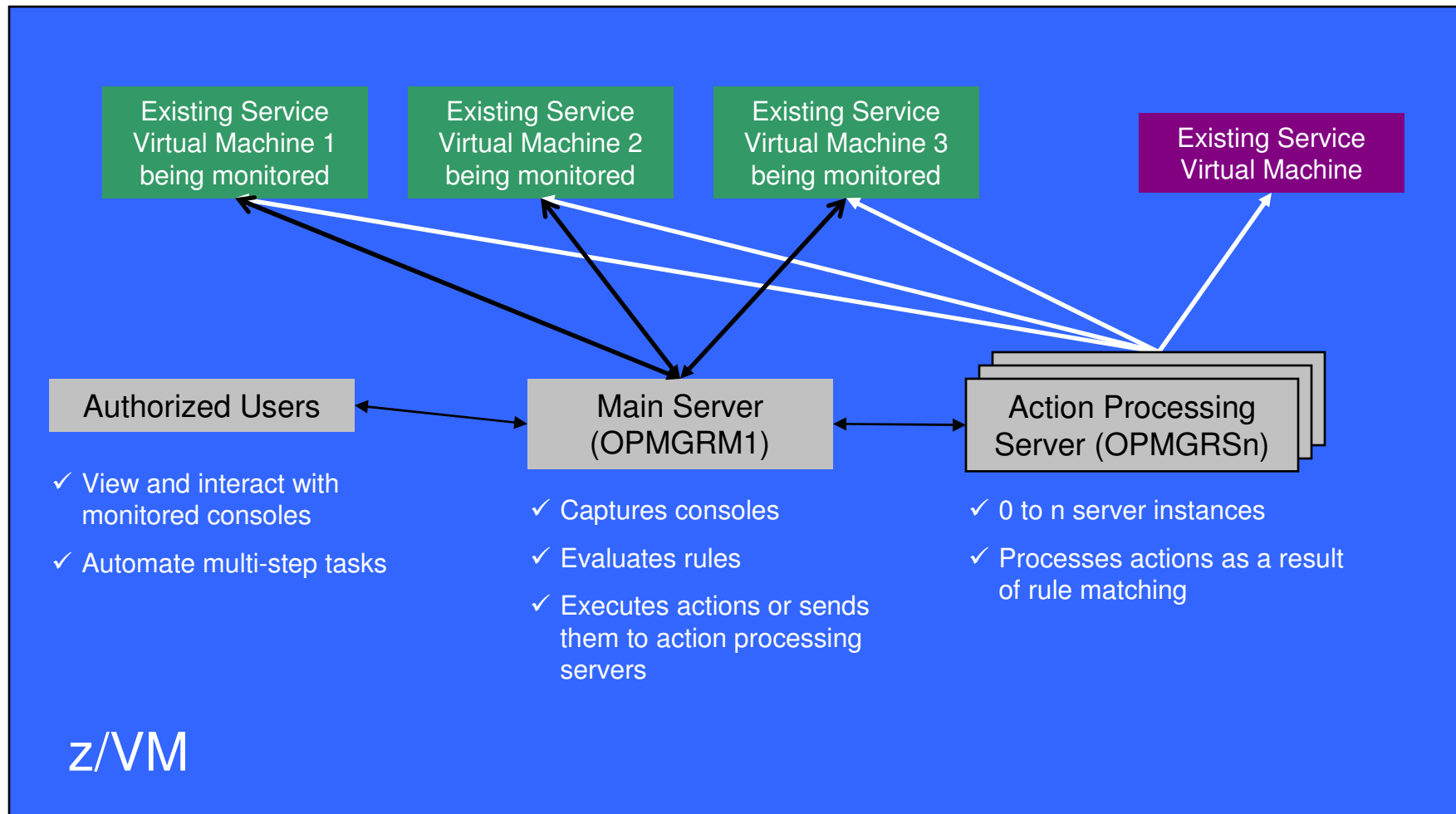   - Issue commands back to the monitored console from command line

Schedule Events and Actions

- **Define schedules**
  - Hourly, daily, weekly, monthly, or yearly
  - Once on specified month, day, year, and time
  - At regular intervals
    - Every x hours and y minutes
  - Within a specified window of time
    - Specify start time
    - Specify conflicting schedules
    - Specify maximum time to defer this schedule
  - Within limits
    - Restrict to specific days of the week: Monday through Sunday plus holidays
    - Restrict to certain hours of the day
- **Time based on local time of system**
  - Same as Query TIME
- **Specify the action associated with the schedule**
  - Actions specified are the same as those for console rules

Access Control

- **Users defined with access to one or more:**
  - **Control commands**
    - Manage the Operations Manager infrastructure
    - Define additional service machines to execute actions
    - Authorize users
    - Display status
    - Issue CP and CMS commands on an Operations Manager service machine
    - Define data space sizes
  - **Configuration commands**
    - Define rules, schedules, actions
    - Define holidays
    - Define user IDs to monitor for logoff status
    - Define groups
  - **Consoles**
    - Define user access to monitored consoles
  - **Additional access** based on access to modules
    - GOMCMD: issue commands to OPMGRM1 and return output
      - Must be authorized to the commands issued
    - GOMTDM: terminal device management

Operations Manager

Existing Service Virtual Machine 1 being monitored

Existing Service Virtual Machine 2 being monitored

Existing Service Virtual Machine 3 being monitored

Existing Service Virtual Machine

Authorized Users

Main Server (OPMGRM1)

Action Processing Server (OPMGRSn)

✓ View and interact with monitored consoles

✓ Automate multi-step tasks

✓ Captures consoles

✓ Evaluates rules

✓ Executes actions or sends them to action processing servers

✓ 0 to n server instances

✓ Processes actions as a result of rule matching

z/VM

Operations Manager Summary

- **Assist with automated operations**

  – Monitoring service machine consoles

  – Taking actions based on console text matching

  – Viewing consoles

  – Scheduling actions

Summary

- **IBM solutions exist for customers running z/VM and Linux guests**
  - Backup and Restore Manager for z/VM
  - Tape Manager for z/VM
  - Operations Manager for z/VM
  - Archive Manager for z/VM

- **Related sessions**
  - 9152: OMEGAMON XE on z/VM and Linux
    - Wednesday, 3:00pm
  - 9151: z/VM System and Performance Management
    - Wednesday, 4:30pm
  - **9145: Getting Started with IBM Backup and Restore Manager for z/VM**
    - **Friday, 9:30am**

- **Product Web sites**
  - http://www.ibm.com/software/stormgmt/zvm/
    - Publications
    - Pre-requisites
    - Announcements
    - Support

- **e-mail: Tracy Dean, tld1@us.ibm.com**