Ethernet and Token-Ring

Network Print Server

Technical Reference Manual

Edition Notice

Second Edition (March, 1996)

This edition applies to the IBM Network Print Server. This document is provided on an "as is" basis as a supplement to the *Network Print Server Administrator's Guide* that was shipped with the Network Print Server.

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PREFACE

Thank you for purchasing the IBM Network Print Server. Our goal in developing this product is to enable you to connect your printers anywhere in your network, allowing all network users access to shared printer resources.

ABOUT THIS MANUAL

This manual contains a detailed technical description of the IBM Network Print Server and how to use the print server in network printing environment. If you are not familiar with the basic functions of your NPS print server, please refer to the appropriate *Administrator's Guide* that was shipped with the product.

This manual is provided on an "as is" basis as a supplement to your Administrator's Guide.

Throughout this manual, the IBM Network Print Server is referred to as the either the print server or the network print server (NPS). Also in the following sections, examples of print configurations and menus are provided. The actual print configurations and menus may not match this manual as those items may have been updated since this manual was published.

The Technical Reference is divided into these major parts:

I Sections 1 and 2 contain an introduction to networks in general, and the Ethernet and Token Ring networks in particular.

II Sections 3 and 4 is a general introduction to the NPS print server and its internal functions.

III Sections 5 to 8 describes how to set up and use the NPS print servers for network printing and printing related tasks.

There are also sections on how to pin-point and solve problems that might occur during the installation and operation of the NPS print server.

TRADEMARK ACKNOWLEDGEMENTS

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SECTION 1

INTRODUCTION TO LOCAL NETWORKS

A *local network* is defined as follows:

A local network is a communications network that provides interconnection of a variety of data communicating devices within a small area.

The need to interconnect equipment within a single building (or group of buildings) has made local networks indispensable for business, government agencies, universities, and other organizations.

Types of Local Networks

There are two basic types of local networks: *circuit switching* and *packet broadcasting*.

Circuit switching The network consists of a central switch to which all devices attach. Two devices communicate by setting up a circuit through the switch. The circuit consists of a path and dedicated resources for transferring data between the two devices. The most familiar example of a circuit-switching network is the *private branch exchange* (PBX), used by common telephone nets.

Packet broadcasting Devices share a communications network in which a transmission from any one device is heard by all other devices. Data to be transmitted are broken up into small blocks, called *packets*. Packets include both user data and control information that indicate the destination of the data. Each packet is sent onto a network and may be received by all other devices on the network. Examples of packet broadcasting networks are *Ethernet* and *Token Ring*.

The key to packet broadcasting is the use of a transmission medium shared by a number of devices. An early example of this is the *multi-drop line*. The multi-drop line is used for communication between one primary station (a host computer) and a number of secondary stations (terminals and printers). For local networks, peer communication among a number of cooperating devices is required. This type of network is referred to as a ***local area network*** **(LAN)** and has the following key characteristics:

- A transmission medium is shared among the attached devices.
- Transmission is in the form of packets.
- A transmission from any one station is received by all other stations hence the term *packet broadcasting*).
- There is no master station – all stations cooperate to assure orderly use of the transmission medium.

LAN Medium Access Techniques

The two most common techniques are CSMA/CD (Carrier Sense Multiple Access with Collision Detection) and Token Passing. The main commercial applications of these techniques are Ethernet and Token Ring respectively.

Ethernet

The majority of installed LANs are based on Ethernet, which is a passive bus network that utilizes CSMA/CD. The system was developed in 1976 by Metcalfe and Boggs of Xerox. (The name Ethernet derives from the conception that space contained a mysterious 'ether' medium without which light could not propagate. We now know that this ether medium does not exist in space – in LANs, however, a medium is definitely required).

The basic function of Ethernet is quite simple:

1. If the medium is idle, transmit.
2. If the medium is busy, listen continuously until idle, then transmit immediately.

   This method is very effective at light loads, but the risk of collisions (two stations trying to transmit at the same time) increases rapidly with higher loads. This introduces the need for the CD (collision detection) part of CSMA/CD:

3. If a collision is detected during transmission, immediately cease transmitting the frame, and transmit a brief jamming signal to assure that all stations know that there has been a collision.
4. Wait a random amount of time (increasing exponentially at each retry), then attempt to transmit again according to step 1 above.

Token Ring

Token Ring (also referred to as the *Newhall Ring*) is the oldest ring control technique, originally proposed in 1969 by Olof Söderblom. It is based on the use of a small frame (*token*) that circulates around the ring when all stations are idle. This is the basic function of a Token Ring network:

1. Before a station can transmit data, it must wait until a token passes by. The station then seizes the token and appends the fields needed to construct a frame.
2. There is now no token on the ring, so all other stations wishing to transmit must wait.
3. The receiving station copies the data addressed to it, and generates a receipt.
4. When the frame has completed the round trip, the sending station removes the frame and generates a free token.
5. An important implication of this technique is the inefficiency under light loads due to the fact that a station must wait for the token before it can transmit. Under heavy loads, however, it becomes relatively more efficient since no collisions occur.

SECTION 2

ETHERNET AND TOKEN RING NETWORKS

This section describes the physical properties of the Ethernet and Token Ring networks, and the different communications protocols used.

Ethernet Medias

Ethernet is always a 10 Mbit/s base band network (that's what the '10base' stands for in the descriptions below). However, there are at present three cabling methods in use:

Thick-wire Ethernet (10base5) This is the original 'yellow cable' Ethernet (the specifications, among many other things actually specify the color of the cable!). It is a thick coaxial cable to which devices are attached by mounting a Transceiver on the cable itself, called a MAU (Media Attachment Unit). A needle protruding from the MAU makes a connection to the inner core. The connection between the MAU and the Ethernet device is made using a 15-bin DSUB, the interface being known as an AUI (Attachment Unit Interface) connector. Today this type of Ethernet is mostly used for backbones.

Thin-wire Ethernet (10base2) Until not too long ago, this was the most used cabling type. It is a thin 50 ohm coaxial cable, sometimes referred to as 'Cheapernet'. The connection to different Ethernet devices is done using 'T' connectors to tap into the network; the actual connector is a BNC type.

Twisted-pair Ethernet (10baseT) Today, this is the most common cabling method for new installations. It is the cheapest of the three cabling methods, and since the network cable does not have to pass by each device, it is more reliable than the coaxial methods (when using 10baseT, each device has its own cable, connected to a so-called hub, which can dynamically disconnect a particular cable if there appears to be an error which would disrupt the entire network). The physical connector is an RJ-45 type connector, which is similar to standard phone plugs.

The twisted-pair cable may be shielded (STP) or unshielded (UTP). Shielded cables are required in Germany and some other countries due to EMI reasons.

Ethernet Frame Formats

Data is sent in frames, also called packets, on an Ethernet network. A frame contains the information regarding the frame itself, in addition to the data sent by the user. There are basically two different frame types on Ethernet networks:

- **Ethernet II or DIX**
- **IEEE 802.3**

There are three variations of the IEEE 802.3 frame type; the ‘raw’ format, encapsulated in an IEEE 802.2 LLC frame, and encapsulated in a SNAP frame. The frame formats are further described in *Theory of Operation: The Frame Handler*, page 26.

The IBM NPS print servers have automatic detection of and adaption to all frame types.

Ethernet Address

Each Ethernet station has a unique address consisting of 12 hexadecimal digits. The NPS print server Ethernet address consists of two parts:

- The first 6 digits are always **00:40:8C**.
- The remaining 6 digits is a running number unique for each NPS Ethernet print server.

The Ethernet address is coded into the NPS print server hardware, but you may change it to a Locally Administrated Address (LAA) as described on page 109.

Token Ring Medias

Token Ring is either a 4 Mbit/s or 16 Mbit/s base band network. The units on a Token Ring network are connected in a ring topology, meaning that the ‘last’ unit is connected to the ‘first’ unit completing a closed loop where the token can circulate. However, the ring topology is in practice merely logical, since the units are generally connected to a central MAU (Multistation Access Unit) forming a physical star topology.

The Token Ring MAU (not to be confused with the Ethernet MAU, see *Ethernet Medias*, page 14) can be either passive or active. A passive MAU is simply a switch board with a number of connectors accessing the small ring inside. An active MAU has in addition signal conditioners to allow for longer cables, and sometimes one or more Token Ring stations for ring monitoring purposes.

Token Ring networks use two main types of cabling, STP and UTP:

Shielded Twisted-Pair (STP)

The STP, or Media Type 1, is the cable system defined by the original Token Ring specification. It allows for more units and longer cabling distances than UTP, but is more expensive and more difficult to handle. The most common STP cabling is the IBM Cabling System.

The STP cable is connected to the Token Ring unit with a 9-pin D-sub connector, and to the MAU with an IBM Cabling System connector.

Unshielded Twisted-Pair (UTP) This is the cabling system used in most installations today. The cable is cheaper and easier to handle than STP, but is more limited as for the number of units and cabling distances. Also, the standard UTP cabling is not recommended for 16 Mbit/s networks, but there are screened or foiled UTP cabling that come close to STP in performance.

The UTP cable connectors are standard phone plugs (RJ-45).

Token Ring Frame Formats

Data is sent in frames, also called packets, on a Token Ring network. A frame contains the information regarding the frame itself, in addition to the data sent by the user. There are two different frame types on Token Ring networks:

MAC frames MAC frames are used for maintaining the ring, and don't contain any data. They are handled by the MAC software in the Token Ring stations.

LLC frames LLC frames contain data, and can be encapsulated in either an IEEE 802.2 LLC frame or a SNAP frame. The frame formats are further described in *Theory of Operation: The Frame Handler*, page 26.

All IBM NPS print servers automatically detect and adapt to any frame type.

Token Ring Node Address

Each Token Ring station has a unique address consisting of 12 hexadecimal digits. The NPS print server Node address consists of two parts:

- The first 6 digits are always **00:02:31**.
- The remaining 6 digits is a running number unique for each NPS Token Ring print server.

The Node address is coded into the NPS print server hardware, but you may change it to a Locally Administrated Address (LAA) as described on page 110.

Repeaters

A repeater is a signal amplifier and does not affect the logical network where it is connected. It is used for connecting two network segments, and it can also connect different types of Ethernet or Token Ring attachments together.

If you use 10base2, 10base5, STP or UTP medias, repeaters are used if the cable length exceeds the specified.

For 10BaseT the hubs are normally placed at reasonable distances from the network devices, and no repeaters are used.

When using repeaters, there are no NPS print server parameters that need to be configured.

Bridges

A bridge relieves two segments of a network by only passing information that is from one segment to the other. Traffic within one segment will not reach the other segment. Typically one replaces a repeater with a bridge when it is necessary to separate network segments because of heavy load, security or other reasons. It can also be used for converting from Ethernet to Token ring, or for tunnelling one packet type into another. Typically the set-up of a bridge is minimal - it configures itself by listening to the traffic.

When using bridges in Ethernet networks, there are no NPS print server parameters that need to be configured. For Token Ring networks, there is a parameter controlling the source routing mode that in rare cases may need adjustment.

Routers

A router is a device for off-loading the traffic between networks. It separates two or more logical networks (which have separate network addresses), and only passes the traffic it is set up to pass between the networks. The main difference between bridges and routers is that routers control the paths of the network traffic.

There is also a device called *brouter*, which combines the functions of a bridge and a router.

The NPS print servers automatically sense when the traffic is coming via a router. However, the automatic router sensing is not a standard feature in all network environments. If you experience problems with routed traffic, you may specify a default router and a net mask in the NPS print server configuration.

Network Protocols

This section provides an overview of the different protocols used for network communications. Let's start with a definition of the term protocol:

A protocol *is a set of rules governing the communication and exchange of data between devices in a communications system.*

Communication over a network is far more complex than for example the serial communication between a computer and a printer (where the RS-232 is a common protocol). To make things a bit easier for us, the International Standards Organization (ISO) has defined the **OSI** (Open Systems Interconnection) model, where the network communication is divided into seven layers. The table below describes the function of each layer:

Layer	Function	Description
1	APPLICATION	The top layer (i.e. closest to the user) provides services to the user such as file server protocol and network management.
2	PRESENTATION	Performs transformations on data to provide a standardized application interface and common communication services. Examples are encryption, text compression, and reformatting.
3	SESSION	Provides the control structure for communication between applications; establishes, manages, and terminates connections between cooperating applications.
4	TRANSPORT	Provides reliable and transparent transfer of data between end points, end-to-end error recovery, and flow control.
5	NETWORK	Provides upper layers with independence from the data transmission and switching technologies used to connect systems. Responsible for establishing, maintaining, and terminating connections (X.25, layer 3).
6	DATA LINK	Provides for the reliable transfer of data across the physical link, sends blocks of data (frames) with the necessary synchronization, error control, and flow control (HDLC, SDLC, BiSync).
7	PHYSICAL	Concerned with transmission of unstructured bit stream over the physical link; involves such parameters as signal voltage swing and bit duration; deals with mechanical, electrical, and procedural characteristics to establish, maintain, and deactivate the physical link (RS-232, RS-449, X.21).

The OSI model layers

Novell NetWare

The following protocols make up the Novell implementation of the OSI model:

The IPX Protocol IPX (Internetwork Packet Exchange) is the Novell network, transport and session level protocol. It corresponds to the IP and UDP protocols in the TCP/IP environment (see below).

The NCP Protocol NCP (NetWare Core Protocols) is the Novell protocol covering the presentation, session, and transport layers in the OSI model. Third-party devices (the NPS print server is a third-party device from Novell's point of view) must support NCP in order to manage local printing using PSERVER (see *Network printing: Novell NetWare*, page 35).

The SPX Protocol SPX (Sequenced Packet Exchange) is the normal Novell transport layer protocol. Third-party devices must support SPX in order to manage remote printing using RPRINTER or NPRINTER (see *Network printing: Novell NetWare*, page 35).

LAN Server/LAN Manager

The NetBIOS Protocol NetBIOS (Network Basic Input/Output System) is the LAN Server/LAN Manager session level protocol.

Applications can communicate using either *sessions* or *datagrams*. Sessions provides reliable data transfer, while datagram communication (handled by the *data link* layer) does not guarantee the receipt of data.

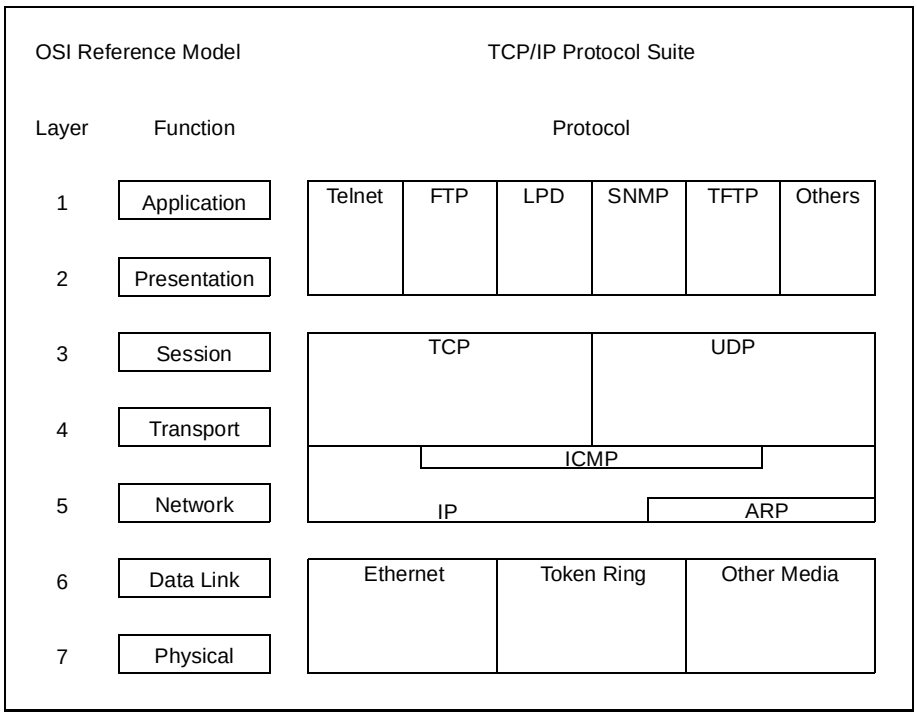
The NetBEUI Protocol NetBEUI (NetBIOS Extended User Interface) is the LAN Server/LAN Manager protocol covering the transport and network layers in the OSI model. It is optimized for high performance in smaller LANs or LAN segments.

The LLC Protocol LLC (Logical Link Control) is the LAN Server/LAN Manager data link layer protocol. The *Connectionless Service* (IEEE 802.2 type 1) provides no guarantee of delivery, while the *Connection-oriented Service* (IEEE 802.2 type 2) provides reliable data transfer.

TCP/IP

The TCP/IP environment embraces a wide range of different protocols, generally referred to as the *TCP/IP suite*. When a system is claimed to have *TCP/IP support*, this should be read as the system supports most, but not necessarily all, of the TCP/IP suite.

The diagram below illustrates a typical OSI model implementation in the TCP/IP environment:



OSI model implementation in the TCP/IP environment

The Telnet Protocol Telnet is a protocol for terminal emulation (typically VT100 or 3270 traffic) over a TCP/IP network. It does not handle the emulation itself – this is done by the application program (on most systems called 'telnet' – just to add to the general confusion!). The telnet protocol also includes printing functionality, generally referred to as *Reverse Telnet*.

The FTP Protocol FTP (File Transfer Protocol) is a generic application level protocol used for file exchange over the network. It is designed to run in interactive mode, is fairly easy to use, and it is part of all the existing TCP/IP systems that we know of.

The TFTP Protocol TFTP (Trivial File Transfer Protocol) is, as suggested by its name, a lesser cousin of the FTP protocol. It is primarily used when booting up disk-less work stations, but is occasionally used (however not recommended) for printing purposes.

The SNMP Protocol SNMP (Simple Network Management Protocol) is an application for network management, e.g. verifying traffic and planning of traffic load. See also *NETWORK MANAGEMENT*, page 91.

The LPD Protocol

LPD (Line Printer Daemon) is an application level protocol used for remote printing. Its primary use is to send print data from one host to another. Two applications using LPD are *lpr* and *lpq*. LPD is almost exclusively found on Berkeley type UNIX systems, such as SunOS.

The BOOTP Protocol

BOOTP (Bootstrap Protocol) is an application level protocol used for reading operating environment parameters (such as the Internet address) at power-up.

The PROS Protocol

PROS (Patrik & Ricard Operating System) is an proprietary application level protocol, more printer oriented than the standard TCP/IP applications. In particular, it supports bi-directional printing, featuring automatic logging of printer status and feedback. PROS uses the TCP protocol for transport, which it accesses via *Sockets* (Berkeley networking support).

The following UNIX systems support PROS: SUN (Sparc, SUN3, SUN Servers), SCO UNIX, Interactive UNIX on 386 machines, DEC Workstations, and HP Workstation.

The PROS source code can be up-loaded from the NPS print server via *ftp*.

The TCP Protocol

TCP (Transmission Control Protocol) is the most important transport level protocol, used by the Telnet and FTP application protocols. It is more advanced than UDP (see below), in particular, it has end-to-end error recovery that ensures that data safely arrives at the destination.

The UDP Protocol

UDP (User Datagram Protocol) is the other transport level protocol, used for NFS (Network File System), TFTP, and SNMP. Unlike TCP, UDP does not provide end-to-end error recovery, and is therefore not classified as a reliable protocol. In practice, UDP works fine for small networks, while the increased need for error recovery makes TCP necessary in larger networks.

The IP Protocol

IP (Internet Protocol) represents the network layer in the OSI model. It is primarily responsible for connecting devices over the network using the *Internet Address*.

The ICMP Protocol

ICMP (Internet Control Message Protocol) cooperates with IP in the network layer to control multiple network routing and similar tasks. It manifests itself to the user in the form of the *ping* command, which is used to check IP communication.

The ARP Protocol

ARP (Address Resolution Protocol) is a low level transport layer protocol. Its purpose is to map IP (Internet) to Ethernet addresses.

The RARP Protocol

RARP (Reverse Address Resolution Protocol) is a low level transport layer protocol. Its purpose is to read the Internet address at power-up.

Apple EtherTalk

he following protocols make up the Apple EtherTalk implementation of the OSI odel:

AP (Printer Access Protocol) is an application layer protocol for print data manage- ent. It compares to LPD in the TCP/IP suite.

TP (AppleTalk Transaction Protocol) is a session and transport layer protocol, corre- ponding to TCP in the TCP/IP suite.

DP (Datagram Delivery Protocol) is a network layer protocol, comparable to IP in the CP/IP suite.

TMP (Routing Table Maintenance Protocol) is a network layer protocol responsible r routing information management. Together with ZIP and AEP (see below), it makes the Apple equivalent to ICMP in the TCP/IP suite.

IP (Zone Information Protocol), not to be confused with the data compression tech- que, is a protocol that handles the AppleTalk Zone function. A zone is a segment of sers forming a sub net of the Ethernet network. Zone management is primarily used to rganize long lists of entities.

EP (Apple Echo Protocol) is a protocol for verifying communication, similar to the TCP/IP suite ICMP protocol.

ARP (AppleTalk Address Resolution Protocol) is a network layer protocol perform- g the same functions as ARP in the TCP/IP suite.

SECTION 3

IBM NPS PRINT SERVERS – INTRODUCTION

This section gives a brief overview of the NPS print server family. If you are unfamiliar with your NPS print server and its functions, we recommend you to also browse through the User's Manual to get a general idea of the NPS print server functions.

The IBM NPS print servers are multi-protocol stand-alone network print servers for the Ethernet or Token Ring environment. They support Novell NetWare, LAN Server, LAN Manager, TCP/IP and Apple EtherTalk simultaneously. NPS print servers make it possible to connect your printers anywhere in an Ethernet or Token Ring network, allowing all network users access to shared printer resources.

They are extremely user-friendly both to install and to use, because of its powerful built-in features. The features are controlled using a configuration file concept, which makes it easy for you to alter settings, and for us to add new functions.

The NPS print servers act as a host at a *node* in the Ethernet or Token Ring network, with its own unique address. It receives the packets addressed to it, unpacks them, and converts the print data to a format suitable for standard printers.

Ethernet 10baseT

The NPS is pocket-sized plug-in network print server for the Ethernet environment. It plugs directly to your printer's parallel (Centronics) port, and connects to thenetwork via a twisted-pair (10baseT) Ethernet cable.

The supported network environments are Novell NetWare, LAN Server and LAN Manager, TCP/IP and Apple EtherTalk.

Ethernet 10base2

The only difference is the connection to the network via a thin-wire (10base2) Ethernet cable.

Token Ring Media Type 3

The NPS is a pocket-sized plug-in network print server for the Token Ring environment. It plugs directly to your printer's parallel (Centronics)port, and connects to the network via a UTP (Media Type 3) Token Ring cable.

The supported network environments areNovell NetWare, LAN Server, LANManager and TCP/IP.

Token Ring Media Type 1

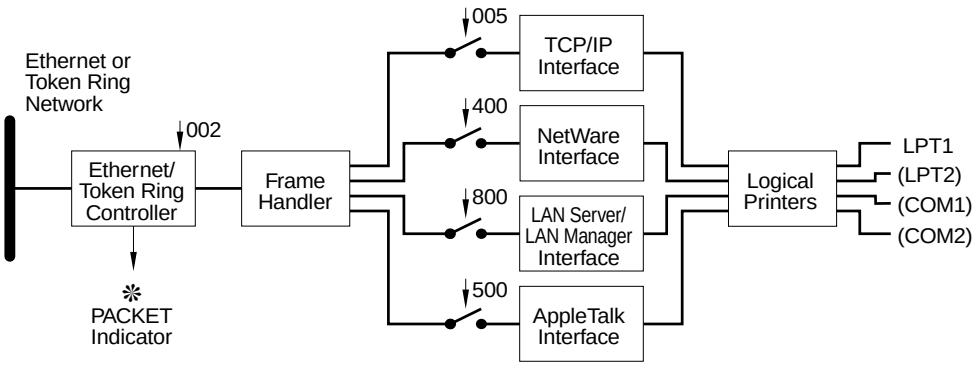
The only difference is the connection to the network via an STP (Media Type 1) Token Ring cable.

SECTION 4

THEORY OF OPERATION

This section contains a technical description of the internal structure of the IBM NPS print servers, and the basic data and control flow. It is not necessary to read this in order to use the print server functions and features (they are all described from the user's point of view in the following sections), but the information given here should serve as a guide to understanding the relations and interactions between the different function blocks.

The block diagram below is a schematic overview of the IBM NPS print server, from the network attachment to the left to the printers to the right. The different function blocks will be shown in more detail later in this section.



The IBM NPS Print Server – a schematic overview

The following conventions apply to all diagrams in this section:

- Each box is a function block performing a specific task (or group of tasks).
- The thick lines connecting the boxes represent data flow; generally print data but also control data used by the different protocols. The data flow is always bi-directional unless otherwise indicated.
- The thin lines (arrows) represent control flow (e.g. the PACKET indicator is controlled by the *Ethernet/Token Ring Controller*).
- Three-digit numbers are NPS print server parameters (e.g. parameter 400 enables or disables the *NetWare Interface*).
- Switches indicate the possibility to select (enable, bypass) a function block.

The Ethernet Controller

The Ethernet controller handles the receiving and transmitting of frames on the Ethernet media. Together with the Frame Handler, it represents the two lowest layers (the physical layer and the data link layer) of the OSI model. It is controlled by the *Ethernet Address* parameter (002).

The Token Ring Controller

The Token Ring controller handles the receiving and transmitting of frames on the Token Ring media. Together with the Frame Handler, it represents the two lowest layers (the physical layer and the data link layer) of the OSI model. It is controlled by the *Node Address* and *Source Routing Mode* parameters (002 and 019).

The Frame Handler

The frame handler is responsible for passing frames (data packets) between the Ethernet controller and the TCP/IP, NetWare, LAN Server/LAN Manager and AppleTalk interfaces. It also takes care of the encapsulation of 802.2 and SNAP type frames as shown in the following diagrams.

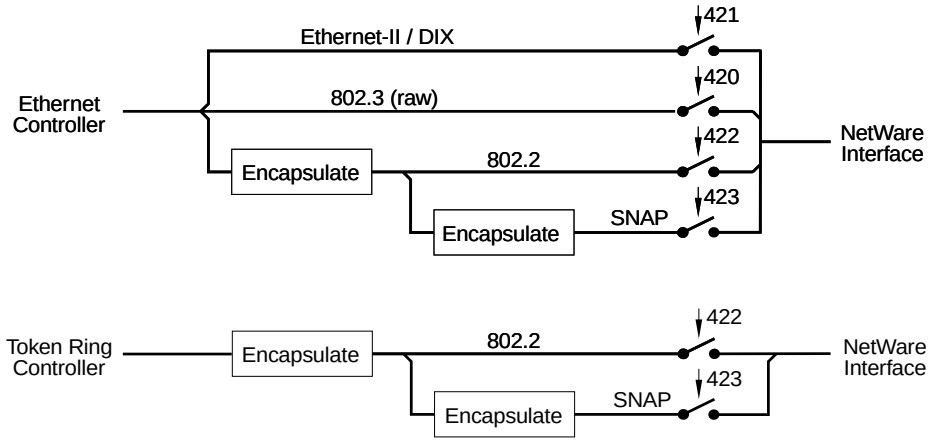
The actions of the frame handler require no special considerations since the detection, transmission and encapsulation of frames is fully automatic. The only parameters affecting the frame handler are the *Frame Type Enable* switches for Novell NetWare (parameters 420 - 423), see *Novell NetWare* below.

Novell NetWare

Ethernet network data may be sent ‘raw’ in an 802.3 packet. This is a violation of the IEEE 802.3 specification which states that data must be encapsulated by an IEEE 802.2 LLC header, but has become quite common. In practice there is no problem, since certain fields in Novell 802.3 packets can distinguish them from ‘proper’ 802.2 packets. Novell data can also be sent in 802.2 LLC packets and in SNAP (which in turn is encapsulated in 802.2 packets). So for Novell, there are actually four different packet types in use, called Ethernet-II, 802.3, 802.2 and SNAP.

Token Ring network data can be sent in either 802.2 or SNAP frames.

The NPS print servers have automatic support for all frame types, but you may disable one or more frame types if necessary.



The Frame Handler – Novell NetWare

All four frame types are by default enabled (the switches are closed). You don't have to be concerned with which frame type is used on your Novell network, since the frame handler automatically adopts to the frame type used in the network. However, there is one complication when two or more network sections using different frame types are interconnected:

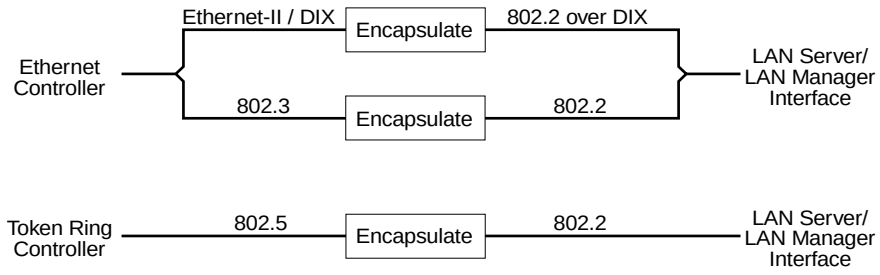
The NPS print server will at power-up log in to the first host it finds, which is a random process by nature. If this host is attached to a different network section than the host on which the NPS print server should service queues (or the host specified in the CONFSERV parameter), the result will be that your NPS server is unavailable.

The solution is to disable all frame types except the one used by the network section where the host on which the NPS print server should service queues is attached.

LAN Server/LAN Manager

Ethernet network data is encapsulated in either an IEEE 802.2 or an 802.2 over DIX frame. The NPS print servers have automatic sensing for both 802.3 and Ethernet-II frame types.

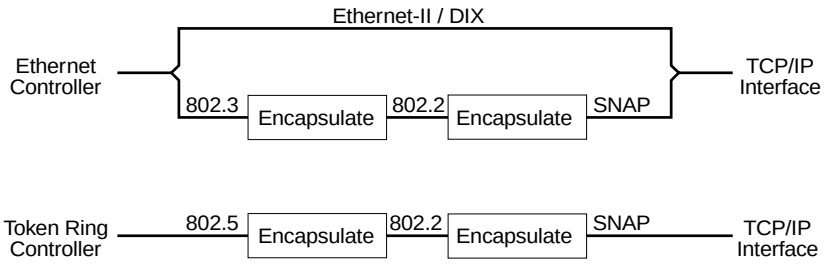
Token Ring network data is always encapsulated in an IEEE 802.2 frame.



The Frame Handler – LAN Server/LAN Manager

TCP/IP

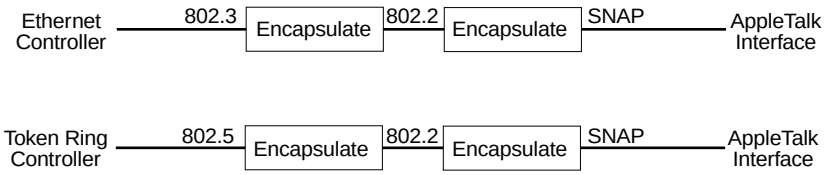
When sending TCP/IP over IEEE 802.3 networks, the data is always encapsulated in a so-called SNAP frame, which in turn is encapsulated in an IEEE 802.2 LLC frame. This frame type therefore goes by the names 802.2, 802.3 or SNAP, but of course one implies the other, and the three names all refer to the same frame type. The NPS print severs have automatic sensing for both 802.3 and Ethernet-II frame types in the TCP/IP environment.



The Frame Handler – TCP/IP

Apple EtherTalk

AppleTalk networks use the SNAP frame type exclusively for both Ethernet and Token Ring.

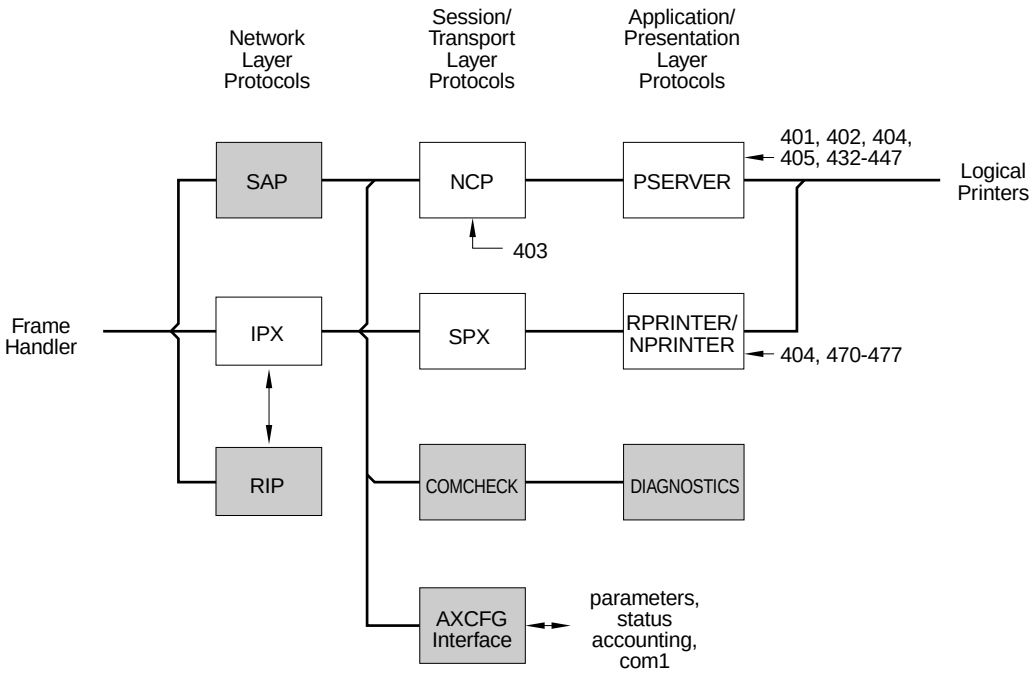


The Frame Handler – Apple EtherTalk

Note: The Token Ring NPS print servers does currently not support AppleTalk.

The NetWare Interface

The main function of the NetWare interface is to unpack the print data in the received frames and pass it on to the *Logical Printers* block. It also packs data returned from the Logical Printers (e.g. printer status) into the proper frame format and passes it back to the frame handler.



The NetWare Interface

The function blocks represent the different protocols used by NetWare; the left-most column is the lower layer (Network layer protocols), and the right-most column is the top layer (application and presentation layer protocols). The shaded boxes are those protocols not directly involved in the printing process. Refer to Section 2 – *The Ethernet Network* for details on the OSI model and the protocols.

The *AXCFG Interface* communicates with the AXCFG configuration utility, see also *PARAMETER EDITING*, page 91.

Printing in the Novell NetWare environment is discussed in *Network Printing: Novell NetWare*, page 35.

The LAN Server/LAN Manager Interface

The main function of the LAN Server/LAN Manager interface is to unpack the print data in the received frames and pass it on to the *Logical Printers* block. It also packs data returned from the Logical Printers (e.g. printer status) into the proper frame format and passes it back to the frame handler.

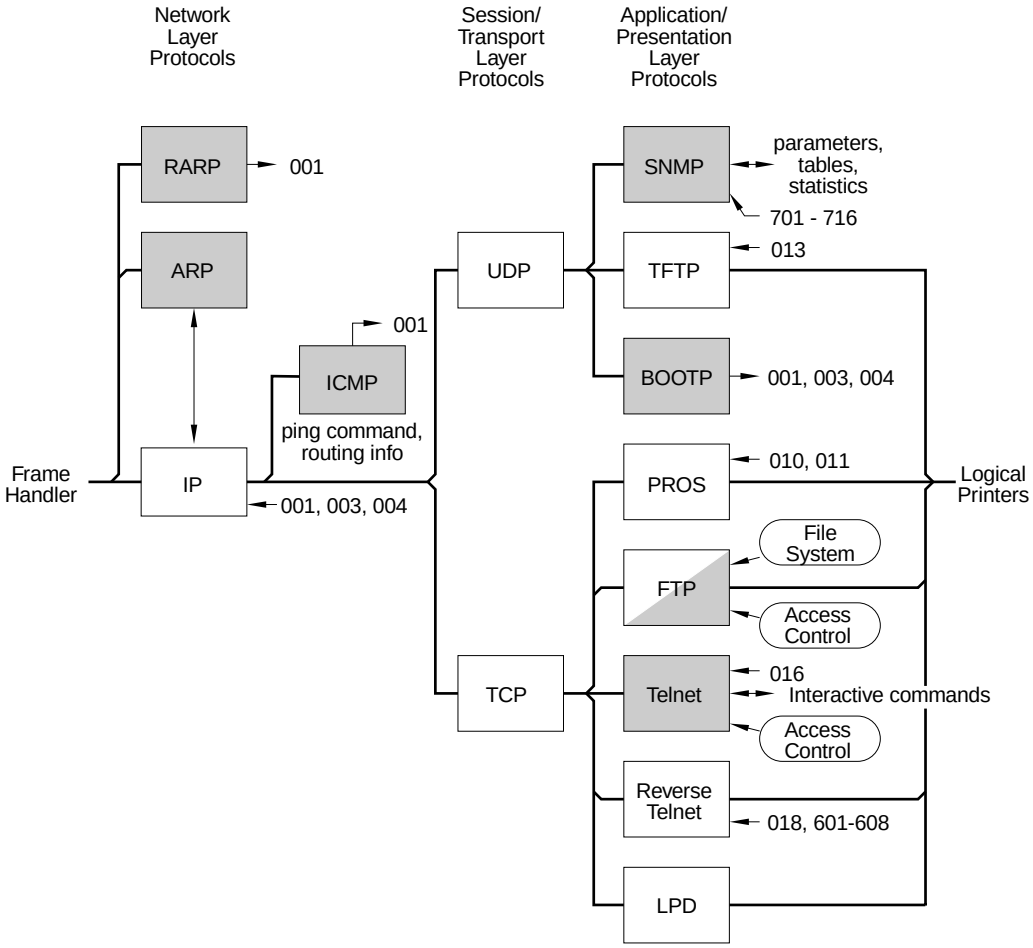
The function blocks represent the different protocols used by LAN Server and LAN Manager; the left-most column is the lower layer (data link layer protocols), and the right-most column is the top layer (application and presentation layer protocols). The shaded boxes are those protocols not directly involved in the printing process. Refer to Section 2 – *The Ethernet Network* for details on the OSI model and the protocols.

The *AXCFG Interface* communicates with the AXCFG configuration utility, see also *PARAMETER EDITING*, page 91.

Printing in the LAN Server/LAN Manager environment is discussed in *Network Printing: LAN Server/LAN Manager*, page 41.

The TCP/IP Interface

The main function of the TCP/IP interface is to unpack the print data in the received frames and pass it on to the *Logical Printers* block. It also packs data returned from the Logical Printers (e.g. printer status) into the proper frame format and passes it back to the frame handler.



The TCP/IP Interface

The function blocks represent the different protocols used by TCP/IP; the left-most column is the lower layer (Network layer protocols), and the right-most column is the top layer (application and presentation layer protocols). The shaded boxes are those protocols not directly involved in the printing process. Refer to *Ethernet and Token Ring Networks: TCP/IP*, page 20 for details on the OSI model and the protocols.

The *ARP* block is responsible for mapping IP (Internet) addresses to network (Ethernet or Token Ring) addresses.

The *RARP* and *BOOTP* blocks are mainly used for setting the Internet Address and setting up a default router and net mask. See *Network Printing*: *TCP/IP*, page 43 for details.

SNMP is used for network management, see *NETWORK MANAGEMENT*, page 91.

Access Control is the log-in procedure for FTP and Telnet, see *Access Control*, page 82.

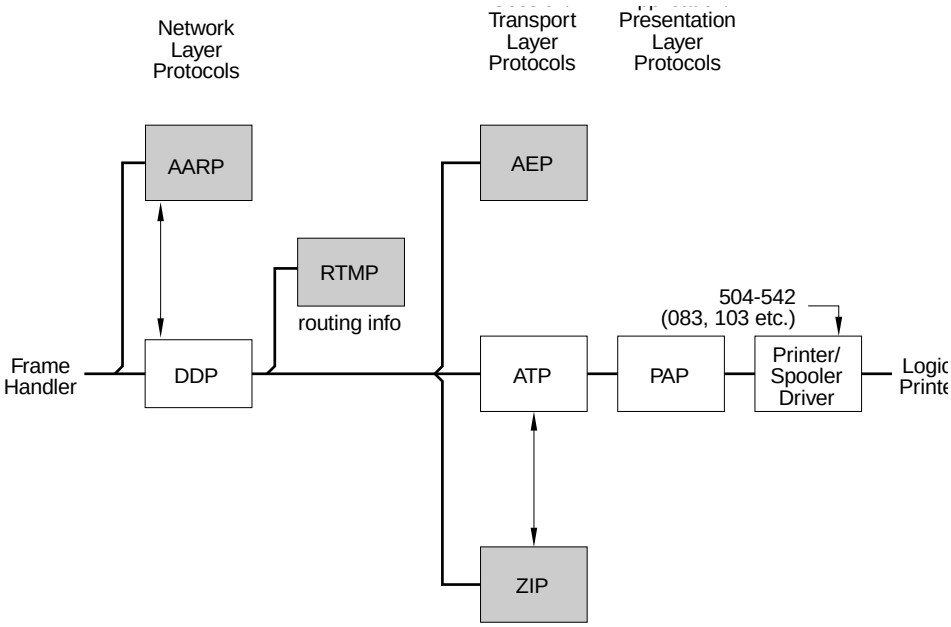
File System is the NPS print server file system, see *The File System*, page 84.

Printing in the TCP/IP environment is discussed in *Network Printing*: *TCP/IP*,

page 43.

The AppleTalk Interface

The main function of the AppleTalk interface is to unpack the print data in the received frames and pass it on to the *Logical Printers* block. It also packs data returned from the Logical Printers (e.g. printer status) into the proper frame format and passes it back to the frame handler.



The AppleTalk Interface

The function blocks represent the different protocols used by AppleTalk; the left-most column is the lower layer (network layer protocols), followed by the session/transport and application/presentation layer protocols. Refer to *Ethernet and Token Ring Networks: Apple EtherTalk*, page 22 for details on the OSI model and the protocols.

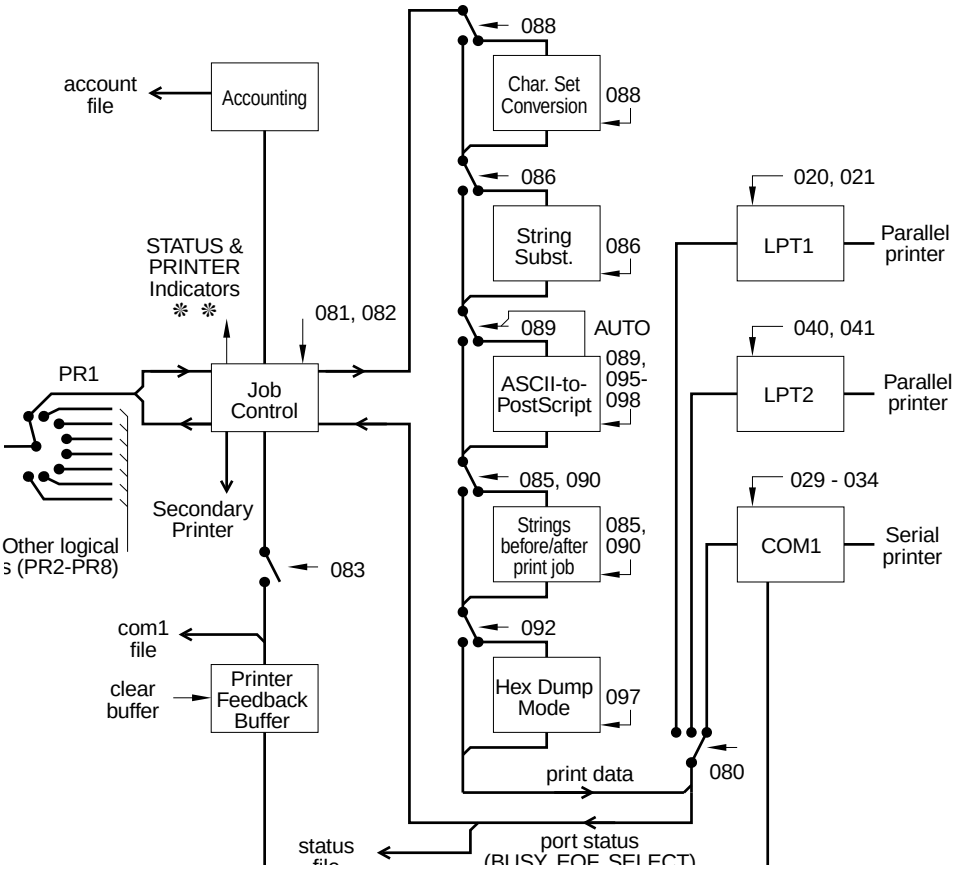
The right-most box (Printer/Spooler Driver) is the interface to the Apple Macintosh printing environment, see *Network Printing: Apple EtherTalk*, page 70. The shaded boxes are those protocols not directly involved in the printing process.

Printing in the Apple EtherTalk environment is discussed in *Network Printing: Apple EtherTalk*, page 70.

Logical Printers

The Logical Printers block processes print data from the NetWare, TCP/IP and AppleTalk interfaces and passes it on to the physical printers. The data processing is handled by five filters (*Character Set Conversion* through *Hex Dump Mode*).

The diagram below shows the first of eight logical printers (pr1). All logical printers are identical except from the fact that they have individual sets of parameters governing the function, see *THE PARAMETER LIST*, page 101.



The Logical Printers – PR1

The eight-position switch represents the selection of a logical printer (pr1 - pr8). This selection is done in different ways depending on the protocol used, see *Network Printing*, page 35.

The *Job Control* block handles the data flow – outbound print data and inbound port status, printer feedback data, and accounting information. The *status* and *account* files are discussed in *FTP and Telnet*, page 82.

The filters *Character Set Conversion* through *Hex Dump Mode* perform the print data processing. The functions of each filter is described in *Logical Printers*,

page 72. The filters process data sequentially in the order indicated by the diagram above.

The *LPT1* block represents the parallel printer port.

The switches represent the data flow control. As an example, the ASCII-to-PostScript filter is invoked both by parameter 089 and by the filter itself (when set to AUTO_PS).

Note that the switches are not shown in their factory default position.

SECTION 5

NETWORK PRINTING

This section covers topics concerning network printing in general, and printing using the NPS print servers in particular.

Novell NetWare

Before Novell added PSERVER (the print server software) to their NetWare products, network printing services were part of the NetWare operating system. The only alternative was to attach a local printer to your workstation, but this printer was not available from other stations. All network printers (five at maximum) had to be physically attached to the file server, which soon became impractical as the networks grew.

The need for more printers, less work for the file server, and the ability to place printers at remote locations allowed third-party vendors to step in with their own products (including the NPS print servers). As we shall see, the introduction of PSERVER in NetWare version 2.2 did not entirely set aside the advantage in using these products.

The PSERVER software introduced two new ways to attach your network printers – locally and remotely:

Local Printers

A local network printer is physically attached to a *Print Server*, which can be either a workstation running PSERVER, or an NPS print server. Each print server requires a Novell NetWare user licence. You can attach up to four network printers per user licence, depending on which NPS print server you are using.

Remote Printers

A remote printer is physically attached to either a workstation running RPRINTER or NPRINTER (the remote printer software), or an NPS print server. The remote printers are controlled by a print server (*not* an NPS print server!), which is either located at the file server running PSERVER.NLM, or a dedicated workstation running PSERVER.EXE. Up to 16 remote printers may be controlled by each print server, so you can have 16 times as many network printers for the same number of NetWare licenses.

The drawbacks of remote printing are lower printing speed and higher network load than with local printing. However, NetWare version 4 contains a new remote printer software called NPRINTER with improved performance.

Servers and Queues

In the Novell NetWare environment, printing is always done sending the print job to a *Print Queue*. A queue is a subdirectory in the file server. The print job is passed on to a *Print Server,* which has one ore more printers locally or remotely attached to it. The printer that should receive the job is determined by *Queue-to-Printer Relationships.* There are four possible combinations:

- **One queue serving one printer**

  This is the most basic setup, only suitable for very small networks.

- **Multiple queues serving one printer**

  This setup gives the additional possibility of giving higher priorities to certain queues. To make sure that short print jobs are serviced before long ones, you can create one high priority queue “memos” for short print jobs, and one low priority queue “reports” for longer jobs.

- **One queue serving multiple printers**

  Printing several large jobs can create a severe backlog. You can reduce this by adding more printers to your queue. A queued job will be sent to the first printer that becomes available.

- **Multiple queues serving multiple printers**

  This setup combines the advantages of multiple queues and multiple printers. The table below shows a typical medium-size network setup with six queues and three printers:

Printer number	Queue name	Priority
0	MEMOS	1
0	REPORTS	2
0	BIGJOBS	3
0	PRINTQ_0	4
1	MEMOS	1
1	BIGJOBS	2
1	PRINTQ_1	3
2	BIGJOBS	1
2	PRINTQ_2	2

This is how the setup works:

Small jobs sent to “memos” are printed on printer 0 or 1 with highest priority. Medium-sized jobs are sent to “reports”, and printed on printer 0 after the “memos” jobs. Large jobs are sent to “bigjobs”, and are printed on the first available printer after “memos” and “reports”. Jobs sent to “printq_x” are printed on printer x with lowest priority.

Note: Queue priorities are currently not supported by the NPS print servers.

Establishing Queue-to-Printer Relationships

There are several different ways of establishing queue-to-printer relationships depending on how the NPS print server is integrated to your network. The first thing to consider is whether you want to attach your printers locally (*Print Server Mode*), remotely (*Remote Printer Mode*), or both. Secondly, you must decide if the NPS print server should log in to your network automatically or parameter controlled. In print server mode, you have the additional choice of using a *Configuration File Server* setup for the login procedure.

Print Server Mode

The print server mode means that the NPS print server emulates a workstation running PSERVER. The NPS print server will log in to one, some, or all file servers on your network depending on which login method you choose. The print server mode provides higher print speed and lower network load than remote printer mode, and is the recommended method unless the number of NetWare user licences is a major issue.

The NPS print server is default configured to support both modes simultaneously, and there is no need to change any NPS print server parameters as long as you use the automatic login procedure. However, if you plan to use only one mode, you can edit the following parameter to speed up the login procedure:

- **404 NetWare Mode (NETWARE MENU)**
  This parameter specifies the NetWare mode for the NPS print server. The default setting is BOTH. Change to PSERVER or RPRINTER as appropriate for single-mode operation.

The Automatic Login Procedure

This is the default login procedure, and also the easiest. Queue-to-printer relationships are established by adding a print server and linking it to one or more print queues using PCONSOLE. If you have more than one file server, you must repeat these steps for each file server using the NPS print server. (This is described in detail in your *Network Administrator's Guide*.)

You can specify a logical printer as destination by appending *!n* to the queue name, where *n* is the logical printer number (1 – 8). If *!n* is omitted, print jobs will be directed to logical printer 1.

The drawback of this method is that it soon becomes unworkable as your network grows. One reason for this is that the NPS print server logs in to every file server on the network at power-up, which can be extremely time-consuming for large networks. It is also difficult to administrate the print queues on a large number of file servers. For medium to large size networks, we recommend either the configuration file server or parameter controlled login procedure described below.

The Configuration File Server Login Procedure

Setting up the configuration file server requires a few additional steps, but simplifies queue setup and maintenance if you have several file servers. It will also speed up the NPS print server login procedure significantly for large networks.

Queue-to-printer relationships are established as described in your *Network Adminis-*

trator's Guide. As usual, you can specify a logical printer as destination by appending *!n* to the queue name, where *n* is the logical printer number (1 – 8). If *!n* is omitted, print jobs will be directed to logical printer 1. The queues on all file servers are set up on one single server, which will be your *configuration file server.*

You will also have to set up the NPS print server for logging in to the configuration file server. This is done by entering the configuration file server name into the parameter below.

- **402 Configuration File Server Name (NETWARE MENU)**
  This parameter specifies the file server where queue-to-printer relationships for the entire network are stored. The default setting is <empty>. The automatic login procedure is disabled when a file server is specified. Any queue-to-printer relationships set up for the automatic login procedure will be ignored.

The NPS print server will at power-up log in to the configuration file server, read the queue and printer information, and then log in to any additional file servers as necessary. The advantage of this method is that you can easily manage a great number of queues (up to 100 queues and 16 file servers are supported). The drawback is that if the configuration file server for some reason is unavailable at power-up, the NPS print server will also be unavailable.

The Parameter Controlled Login Procedure

This method is similar to the automatic login procedure, but the NPS print server will only log in to the file servers specified by the LOGIN parameters (see below). Its main virtue is fast login. You can also direct print jobs to specific logical printers without having to append a *!n* extension to the queue names. The limitation is that you can only specify up to 16 print queues. If you need more queues than that, use the configuration file server procedure instead.

The queue-to-printer relationships are established in the same way as described for the automatic login procedure above. You don't have to add the *!n* extension to the queue names to specify a logical printer, since this is controlled by the LOGIN parameters. Any *!n* extensions found will be overridden by the LOGIN definitions.

Finally, configure your NPS print server by specifying which queues at which file servers the print server should service. This is done by editing the LOGIN parameters:

- **432 – 447 Print Server Queue Attachment 1 – 16 (NETWARE MENU)**
  These parameters specify explicit links between a print queue at a specified file server and a logical printer. The default setting is <empty>. Up to 16 queue-to-printer relationships may be specified using parameters 432 through 447. The relationships must match the print queue assignments made in PCONSOLE, and must also be defined in consecutive order (LOGIN1, LOGIN2, etc.)

The NPS print server will at power-up log in to the file servers specified by the LOGIN parameters (KILROY and BOZO in the example below). This method allows a maximum of 16 queues (at up to 16 servers), but has the advantage that a failing file server will not affect the other servers on the network (if KILROY is unavailable, the queues MARTIN and PATRIK will still be serviced).

Example:

```
432. LOGIN1  : KILROY THOMAS PR1
433. LOGIN2  : KILROY RICARD PR1
434. LOGIN3  : BOZO MARTIN PR2
435. LOGIN4  : BOZO PATRIK PR5
```

Remote Printer Mode

The remote printer mode means that the NPS print server emulates a workstation running the NetWare remote printer software RPRINTER or NPRINTER. The NPS print server will log in to some or all NetWare print servers on your network depending on which login method you choose. The remote printer mode allows up to 16 printers per NetWare user licence, but at lower print speed and higher network load than the print server mode. It is only recommended when the number of NetWare user licences is a major issue.

The NPS print server is default configured to support both modes simultaneously, and there is no need to change any NPS print server parameters as long as you use the automatic login procedure. However, if you plan to use only one mode, you can edit the following parameter to speed up the login procedure:

- **404 NetWare Mode (NETWARE MENU)**
  This parameter specifies the NetWare mode for the NPS print server. The default setting is BOTH. Change to PSERVER or RPRINTER as appropriate for single-mode operation.

The Automatic Login Procedure

This is the default login procedure, and also the easiest. Queue-to-printer relationships are established by defining a printer at the NetWare print server, and linking it to one or more print queues using PCONSOLE. (This is described in detail in your *Network Administrator's Guide*.) If you have more than one NetWare print server, repeat these steps for each print server to which you want to attach remote printers. You can use queues on more than one file server by repeating the setup procedure on each additional file server.

You can specify a logical printer as destination by appending *!n* to the printer name, where *n* is the logical printer number (1 – 8). If *!n* is omitted, print jobs will be directed to logical printer 1.

If you have a large number of NetWare print servers, you can speed up the login procedure by specifying to which print servers you want the NPS print server to log in. This is done using the parameter controlled login procedure below.

The Parameter Controlled Login Procedure

This method is similar to the automatic login procedure, but the NPS print server will only log in to the NetWare print servers specified by the RPRINT parameters (see below). It provides a faster login, but limits the number of NetWare print servers to eight. If this is insufficient, use the automatic login procedure, or preferably, consider using the print server mode instead. Remember that you can use the print server mode and remote printer mode simultaneously. A good idea is to use the print server mode for

queues where printing speed is of vital importance, and remote printer mode for seldom used queues in order to keep the number of NetWare user licences down.

The queue-to-printer relationships are established in the same way as described for the automatic login procedure above. Logical printer destinations are specified by appending *!n* to the printer name.

Finally, configure your NPS print server by specifying which NetWare print servers it should log in to. This is done by editing the RPRINT parameters:

- **470 – 477 Remote Printer Attachment 1 – 8 (NETWARE MENU)**
  These parameters specify a printer number at a NetWare print server to which to attach the NPS print server. The default setting is <empty>. Up to eight remote printers may be specified using parameters 470 through 477. The remote printers must have been previously set up in PCONSOLE, and must also be specified in consecutive order (RPRINT1, RPRINT2, etc.)

The NPS print server will at power-up log in to the NetWare print servers specified by the RPRINT parameters (ADMIN_1, ADMIN_2, and KILROY_NLM in the example below), and attach as remote printers to the specified printer numbers. Remote printers on other print servers than the specified will be unavailable when the RPRINT parameters are used.

Example:

```
470. RPRINT1 : ADMIN_1 1
471. RPRINT2 : ADMIN_2 12
472. RPRINT3 : KILROY_NLM 1
473. RPRINT4 : KILROY_NLM 2
```

Print Methods

There are two different methods in the Novell NetWare to transfer a print job to a queue. CAPTURE is the best choice when you want to print on a network printer from your applications. NPRINT requires the additional step of creating a print file, but offers you the choice between local and network printing at all times since it doesn’t occupy a local printer port.

The CAPTURE program is used to capture output destined for a local printer and redirect to a network print queue. When the CAPTURE command is issued, NETX (or whichever shell you use) modifies DOS so that it lets the shell monitor the printer port you are capturing. Any print data sent to that port by DOS or an application program is intercepted and sent to the queue you named in the CAPTURE command.

If you later decide to stop capturing, issue the ENDCAP command. The shell stops monitoring the printer port, and local printing resumes.

NPRINT is a replacement for (and an improvement on) the DOS PRINT command. Use NPRINT when you want to print an existing file on a network printer.

The table below shows a summary of the CAPTURE and NPRINT parameters:

Parameter	Short	Values	Default	CAPTURE	NPRINT
Show	SH	None	None	Yes	No
Job=Job-Name	J=	Any PRINTCON job configuration	Default job	Yes	Yes
Queue=QueueName	Q=	Any valid print queue name	Queue for Spooler 0	Yes	Yes
Server=ServerName	S=	Any valid file server name	Default server	Yes	Yes
Local=n	L=	1, 2, or 3	1	Yes	No
Form=FormName (or =n)	F=	Any valid form name or number	0	Yes	Yes
Create=Path	CR=	File name including path	None	Yes	No
Copies=n	C=	1-999	1	Yes	Yes
Timeout=n	TI=	0-1000	8	Yes	No
Autoendcap	A	None	On	Yes	No
No Autoendcap	NA	None	Off	Yes	No
Keep	K	None	Off	Yes	No
Tabs=n	T=	0-18	8	Yes	Yes
No Tabs	NT	None	Off	Yes	Yes
Banner=BannerName	B=	Any string up to 12 characters	LST:	Yes	Yes
Name=Name	NAM=	Any string up to 12 characters	Username	Yes	Yes
No Banner	NB	None	Off	Yes	Yes
Form Feed	FF	None	On	Yes	Yes
No Form Feed	NFF	None	Off	Yes	Yes
Notify	NOTI	None	Off	Yes	Yes
No Notify	NNOTI	None	On	Yes	Yes
Domain=DomainName	DO=	Any valid NNS domain name	None	Yes	Yes
Delete	D	None	Off	No	Yes

Example:

```
CAPTURE /L=1 /Q=DESKTOP /TI=30 /NT /NB /FF /NOTI
```

This command captures LPT1 print jobs and sends them to the queue DESKTOP with a 30 seconds time-out, no tab expansion, no banner page, appends a Form Feed, and notifies when the printout is completed.

LAN Server/LAN Manager

Printing through an NPS print server in a LAN Server or LAN Manager environment is managed by the *NPS Manager* utility delivered with your print server. Refer to the *Network Administrator's Guide* for instructions on how to install and use NPS Manager.

NPS Manager is used to install NPS print servers on your network, and also to show detailed information about each individual NPS print server port.

Each NPS print server port appears as a print queue destination by the OS/2 Print Manager. Print queue destinations are referred to as *devices* in OS/2 version 1.x, and as *ports* in version 2.x. They appear as *pipe names*, e.g. \PIPE\AX110086_LP1. Assigning NPS print server ports as print queue destinations follow the standard procedures under OS/2. The procedures are identical for LAN Server and LAN Manager, but differs between OS/2 versions 1.x and 2.x.

Print jobs can be sent indirectly through the file server from any MS-DOS, Windows or OS/2 application. They can also be cancelled, held, etc., using standard OS/2 procedures.

It is also possible to print directly from a workstation, given that it runs NPS Manager, OS/2 and workstation software.

The following parameters control printing in the LAN Server/LAN Manager environment:

- **800 LAN Server/LAN Manager Protocol Enabled (LS/LM MENU)**
  This parameter switches the NPS print server LAN Server/LAN Manager support on and off. The default setting is YES. Changing to NO will disable the LAN Server/LAN Manager support, and the NPS printer ports will not appear in the *NPS Manager list.*
- **810 Printer 1 Name (LS/LM MENU)**
  This parameter specifies the name of the first network printer. The default name is *AX<nnnnnn>_LP1*. You may change this to any name not exceeding 16 characters. The Printer 2 through Printer 8 names are specified by parameters 820, 830, 840, 850, 860, 870 and 880 respectively.
- **811 Printer 1 Logical Printer (LS/LM MENU)**
  This parameter specifies the logical printer assigned to Printer 1. The default setting is *PR1*. The Printer 2 through Printer 8 logical printers are specified by parameters 821, 831, 841, 851, 861, 871 and 881 respectively.

Printing from IBM Hosts

The NPS print servers support printing from IBM hosts, given that the appropriate software is installed on the server handling the host protocol (typically SNA) and the IBM printer data streams. Examples of supported products are:

IBM Communications Manager, IBM PC Support, and IBM PSF/2.

The first two support non-AFP printing. As they use the standard OS/2 printer drivers, almost any printer data stream can be generated. PSF/2 enables distributed AFP printing. It is limited to PCL and PPDS printers, since it uses internal printer drivers.

Both PC Support and PSF/2 rely on Communications Manager for the host communication.

TCP/IP

Printing with the NPS print server in the TCP/IP environment can be done in either interactive or integrated mode. *Interactive Mode* means that the NPS print server appears as a host to which you log in. Printing is performed as a host-to-host file transfer using FTP or Reverse Telnet. The only preparation required is installing the NPS print server on your network, which includes finding a free Internet address and downloading it to the NPS print server.

In the *Integrated Mode*, the NPS print server is integrated into the host printer spooler. The printer (or printers) will appear as directly connected to the spooler. This mode requires installation as above, and an additional integration step.

Integrating the NPS print server into your host's spooler system can be done either automatically or manually. The automatic integration is done by running the *axinstall* script, as described in the *Network Administrator's Guide*.

Due to the large number of host, Unix variation and print method combinations, there will always be instances where *axinstall* will fail. For these cases, the following pages contain guidelines for manual integration.

We recommend you to start by trying *axinstall*. If you experience any problems during the integration, or if the test printout at the end of *axinstall* fails, then integrate the NPS print server manually.

Always read the *read.me* file before you begin the manual integration. This file contains last-minute information that may not be covered in this manual.

The installation and integration procedures are described individually for each type of UNIX system (BSD, System V and IBM AIX) in this section. The installation procedure is the same regardless of the print method, but you will have to select a print method before carrying out the integration.

Printing from BSD-Type UNIX Systems

The following print methods are available for BSD-type systems (Sun-OS, Ultrix, etc.). Use the table below to select the print method that is best fitted for your printing requirements. Detailed integration procedures are given for each method on the following pages.

Print Method	Advantages	Limitations
LPD	Easy to set up – add a remote printer to /etc/printcap using the rm and rp fields.	No printer status logging. printcap capabilities are not available. lpr options (e.g. multiple copies) are not available.
FTP	Uses industry standard network software on the host.	No printer status logging. May conflict with other input or output filter. Does not allow both input and output filter.
PROS A	The communication with the NPS print server is logged to a log file, including printer status and feedback. Easy to integrate – the NPS print server appears as a device to the system. All printcap options available, including input/ output filters.	A C compiler is required to build the PROS drivers. A daemon must be active for each printer attached to the NPS print server.
PROS B	The communication with the NPS print server is logged to a log file, including printer status and feedback. All printcap options available, including input or output filter.	A C compiler is required to build the PROS drivers. May conflict with other input or output filter. Does not allow both input and output filter.
Reverse Telnet	Easy to set up if Reverse Telnet drivers are already installed.	No printer status logging. Drivers are not supplied with the NPS print server. Existing drivers may be slow.

The Printcap File

BSD-type systems use the *printcap* file (printer capability data base) for describing printers. The spooling system accesses the printcap file every time it is used, allowing dynamic addition and deletion of printers. Each entry in the data base describes one printer, and contains a number of fields separated by colons.

The first field is the abbreviation and the full name of the printer, separated by a ‘|’ character. The following fields contain printer capabilities, see the table below.

Entries may continue onto multiple lines by giving a ‘\’ as the last character of a line.

The table below summarizes the most common printer capabilities. For a complete list, please refer to the printcap description in your Unix documentation.

Parameter	Type	Default	Description
ff=FormFeedStr	String	\f	Specifies the Form Feed string.
if=InputFilter	String	NULL	Specifies an input filter. Print data passes through this filter before it is written to the spool directory.
lf=ErrorLogFile	String	NULL	Species the file were error reports are logged. If this field is omitted, errors are logged to /usr/adm/lpd-errs.
lp=filename	String	/dev/lp	Specifies the file or device to which print data will be sent.
mx=MaxFileSize	Numeric	1000	Specifies the maximum file size in BUFSIZ blocks (generally 1 kbyte). Larger files will be truncated. mx=0 allows unlimited file sizes.
of=OutputFilter	String	NULL	Specifies an output filter. Print data passes through this filter at print-time.
rm=RemoteMachine	String	NULL	Specifies a remote machine. Used by LPD as the NPS print server host name (alias).
rp=RemotePrinter	String	NULL	Specifies a printer at a remote machine. Used by LPD to specify an NPS print server logical printer.
sd=SpoolDirectory	String	/usr/spool/lpd	Specifies the spool directory where print jobs are buffered.
sh	Boolean	FALSE	Suppress header page. If omitted, the spooler will insert a header page before each print job.

Notes on the LPD Print Method

The LPD protocol was developed as a remote print method for Berkeley type UNIX hosts. It was primarily intended for transmission of print jobs between hosts rather than to a print server. Due to the design of the LPD protocol, there will be some limitations when printing via a print server as explained below.

LPD operates by a few commands and the transfer of two files – the control file, and the data file. The control file contains information such as user ID, number of copies, banner page information, and system specific information. The data file contains the raw print data.

When the print data reaches its destination host for interpretation using the printcap file, it is normally intended to be printed locally. But, in the case of remote printing (i.e. using a print server), the LPD daemon often transmits data to the remote host in reversed order; first the data file, then the control file.

If the remote host is a workstation or a mainframe, the reversed order poses no problems; the actual printing will not start until both files are received and processed. However, for a print server with it's limited data storage capabilities, the reversed order represents a major problem. Adding a hard disk or more memory is one possible workaround, but today's large print jobs with hundreds of kilobytes per page would generate unnecessary delays when the printing cannot start until all data is transferred. There would also be a size limitation of the print jobs depending on the amount of installed memory.

The NPS print server solution is to disregard of the control file all together, thus eliminating the delays and file size limitations. The obvious drawback is that the control data is lost, so that multiple copies, banner pages, etc. will not be supported. If you can do without these functions, the LPD print method is recommended due to the simple integration procedure, otherwise choose one of the other print methods.

Installation

Regardless of the printing mode you intend to use, the first step is to install the NPS print server on your host. Please note that the installation and integration procedures require that you have *root* privileges on the system.

Start with assigning an Internet Address and a host name (alias) to the NPS print server by adding the following line to your system host table (*/etc/hosts*):

Example:

```
192.36.253.96          salesdept
```

(192.36.253.96 and salesdept are examples only)

DO NOT use the default or example Internet address when installing your NPS print server. Always consult your network manager before assigning an Internet Address.

If applicable, update your alias name data bases (Yellow Pages, YP/NIS), typically by the commands **cd /var/yp** and **make**.

The next step is to down-load the Internet Address to the NPS print server. This can be done in three ways, using either the *arp*, *rarp*, or *bootp* method.

Setting the Internet Address using arp

Enter the following commands to set the Internet Address. The alias (*salesdept*) must match the one assigned above, and the Ethernet Address (here 00:40:8c:10:00:86) should be the serial number of your NPS print server.

```
arp -s salesdept 00:40:8c:10:00:86 temp
ping salesdept
```

(salesdept and 00:40:8c:10:00:86 are examples only)

The host should respond *salesdept is alive* or something similar to indicate that communication is established.

Notes:

1. The syntax of the *arp* command is system dependent. Consult your host's reference manual (or use the **man arp** command) if you're uncertain about the proper syntax.
2. If you need to run the *arp* command again, the NPS print server *must* be restarted (power-off/power-on) before it can accept a new Internet Address.
3. If *rarp* or *bootp* is running on your network and the NPS print server is present in */etc/ethers*, it is *not* possible to change the Internet Address using the *arp* command.
4. The NPS print server and the host must be on the same logical network segment (not separated by a router).

Setting the Internet Address using rarp

The *rarp* method sets the Internet address automatically every time the NPS print server is powered on. The main advantage with this is that you don't have to down-load the Internet address individually to each NPS print server as when using the *arp* method.

This is how it works: The NPS print server broadcasts a request to a *rarp* daemon at power-up. If the daemon is active, and a matching entry is found in the *Ethernet Address Table*, the daemon down-loads the Internet address to the NPS print server. If the daemon isn't active or the table entry is not found, the Internet address remains unchanged.

Follow these steps to use the *rarp* method:

1. Update your host table (*/etc/hosts*) as described earlier.
2. Edit the Ethernet Address table on your host (typically the file */etc/ethers*) by appending the following line:

```
00:40:8c:10:00:86  salesdept
```

(salesdept and 00:40:8c:10:00:86 are examples only)

3. Start the rarp daemon (if it isn't already running) by the command **rarpd -a** (this is system dependent, consult your system documentation).
4. Restart the NPS print server to down-load the Internet address.

Setting the Internet Address using bootp

The *bootp* method is similar to *rarp* but gives two additional advantages:

- The network configuration data for the entire network can be in one place which makes it easy to maintain.
- In addition to the Internet address, the default router address and the net mask are down-loaded to the NPS print server automatically every time it is powered on.

This is how it works: The NPS print server broadcasts a request containing its Ethernet address to a *bootp* daemon at power-up. If the daemon is active, and a matching entry is found in the *Boot Table*, the daemon down-loads the Internet address, default router address and net mask to the NPS print server. If the daemon isn't active or the table entry isn't found, the Internet address, default router address and net mask remains unchanged.

Follow these steps to use the *bootp* method:

1. Update your host table (*/etc/hosts*) as described earlier.
2. Edit (or create) the boot table on your host (typically the file */etc/bootptab*) by appending the following entry:

```
salesdept:ht=ether:vm=rfc1048:ha=00408c100086:\
   :ip=192.36.253.96:sm=255.255.255.0:\
   :gw=192.36.253.254
```

(salesdept and the ha, ip, sm, *and* gw *fields are examples only)*

- *ht=* is the Hardware Type field. Set this to *ether* for Ethernet, or *tr* for Token Ring.

- *vm=* is the Vendor Magic field, specifying *bootp* report format. Should typically be *rfc1048*.
- *ha=* is the Hardware Address field. Set this to the Ethernet address or Token Ring node address of your NPS print server.
- *ip=* is the Internet Address field. Set this to the Internet address of your NPS print server.
- *sm=* is the Subnet Mask field. Set this to the net mask value for your network.
- *gw=* is the Gateway field. Set this to your default router address.

3. Start the *bootp* daemon (if it isn't already running) by the command **bootpd** (this is system dependent, consult your system documentation).
4. Restart the NPS print server to down-load the Internet address, default router address and net mask.

Integration for LPD Printing

This is the recommended print method for BSD-type systems. It is easy to set up, but is also fairly limited. The drawbacks are that printcap capabilities other than *rm*, *rp*, and *sd* are not supported, neither are *lpr* options such as multiple copies available.

Automatic Integration

Run the *axinstall* script and follow the instructions on the screen. Choose **LPD** at the Print Method prompt.

Manual Integration

1. Add the following line to your printcap file:

```
sales_1|NPS 550 LPT1 at salesdept:lp=:rm=salesdept:\
:rp=pr1:sd=/usr/spool/sales_1
```

- *sales_1* is the short name for the printer
- *NPS 550 LPT1 at salesdept* is the full printer name
- *lp=* doesn't do anything, but is required by some systems
- *rm=salesdept* is the host name (alias) of your NPS print server
- *rp=pr1* specifies the logical printer for sales_1
- *sd=/usr/spool/sales_1* is the spool directory

2. Create a spooling directory by the command **mkdir /usr/spool/sales_1**.

Test Printout

Print the file *test* using the *lpr* command:

```
lpr -Psales_1 test
```

Integration of Additional Printers

Repeat the integration process (automatically or manually) for each additional printer attached to your NPS print server. Each printer must have its own printcap entry as well as a unique name and spool directory.

Integration for FTP Printing

The FTP print method is a bit more complex to set up than LPD, but offers more printing options. This is the method to choose if you intend to use printcap capabilities not available through LPD, but don't need the additional features offered by PROS (such as printer status logging).

Automatic Integration

Run the *axinstall* script and follow the instructions on the screen. Choose **FTP** at the Print Method prompt.

Note: The automatic integration only provides basic printing functions (no banner page, etc.). To get full control over the printcap capabilities, edit the printcap file after the automatic integration or use the manual integration.

Manual Integration

1. Log in to the NPS print server using FTP, and up-load the files *ftp_bsd* and *printcap.ftp* from the *bsd* directory.
2. Copy *ftp_bsd* to *ftp_bsd-sales_1*.
3. Edit *ftp_bsd-sales_1* as described in the file header. This is where you specify the Internet Address, Logical Printer, FTP path, user name and password.
4. Move the modified file to the directory where you keep your printer filters, and make it executable by the command **chmod +x ftp_bsd-sales_1**.
5. Create a error log file by the command **touch /usr/adm/sales_1-log**.
6. Create a spool directory by the commands **cd /usr/spool** and **mkdir sales_1**.
7. Create a printer spooler dummy file by the command **touch sales_1/null**.
8. Edit *printcap.ftp* as described in the file header (see example below). This is the point where you should tailor the printer capabilities to meet your specific needs.
9. Append the new printcap entry by the command **cat printcap.ftp >> /etc/printcap**.

Example: This is what the new printcap entry might look like:

```
sales_1|NPS 550 LPT1 at salesdept:\
       :lp=/usr/spool/sales_1/null:\
       :ff=\r\f:sh:lf=/usr/adm/sales_1-log:\
       :of=/usr/local/lib/ftp_bsd-sales_1:\
       :sd=/usr/spool/sales_1
```

It is not allowed to use input filters with the FTP print method. However, you may combine the *ftp_bsd* filter with your own output filter by taking the following steps:

1. Create a script called *newfilter* containing the lines below in the */usr/local/lib* directory (or wherever you keep your printer filters).

```
#!/bin/sh
/usr/local/lib/myfilter | /usr/local/lib/ftp_bsd-sales_1
```

2. Make the script executable by the command **chmod +x newfilter**.
3. Replace **ftp_bsd-sales_1** with **newfilter** in the output filter (of) field of your new printcap entry.

Test Printout

Print the file *test* using the *lpr* command:

```
lpr -Psales_1 test
```

lpr -Psales_1 test

Integration of Additional Printers

Repeat the integration process (automatically or manually) for each additional printer attached to your NPS print server. Each printer must have its own printcap entry and output filter as well as a unique name and spool directory.

Example:

These are the two new printcap entries required when integrating two printers at the *salesdept* print server:

```
sales_1|NPS 550 LPT1 at salesdept:\
       :lp=/usr/spool/sales_1/null:\
       :ff=\r\f:sh:lf=/usr/adm/sales_1-log:\
       :of=/usr/local/lib/ftp_bsd-sales_1:\
       :sd=/usr/spool/sales_1
sales_2|NPS 550 LPT2 at salesdept:\
       :lp=/usr/spool/sales_2/null:\
       :ff=\r\f:sh:lf=/usr/adm/sales_2-log:\
       :of=/usr/local/lib/ftp_bsd-sales_2:\
       :sd=/usr/spool/sales_2
```

Integration for PROS A Printing

PROS A is the most powerful print method, featuring full support of the printcap capabilities as well as automatic logging of printer status and feedback. It is fairly easy to integrate since the NPS print server appears as a device (Named Pipe) to the system. The drawbacks are that you must run a PROS daemon for each printer, and you also need a C compiler on your host to make the PROS daemon.

If you don't have a C compiler, use the FTP method described above. If you have a compiler, but don't want to run daemons on your system, use the almost as powerful PROS B method.

Automatic Integration

Run the *axinstall* script and follow the instructions on the screen. Choose **PROS A** at the Print Method prompt.

Note:

The automatic integration only provides basic printing functions (no banner page, etc.). To get full control over the printcap capabilities, edit the *printcap* file after the automatic integration or use the manual integration.

Manual Integration

1. Create and move to a directory for the print server daemon using the commands **mkdir /usr/local/lib/axis** and **cd /usr/local/lib/axis**.
2. Log in to the NPS print server using FTP and up-load the files *makefile* and *prosd.c* from the *npipe* directory.
3. Edit the *makefile* to fit your system requirements as described in the file header.
4. Use **make** to compile the PROS daemon.
5. Create a named pipe for the printer by the command **mknod /dev/salesdept.pr1 p**,

where *salesdept* is the alias for the NPS print server, and *pr1* is the logical printer.

6. To make the daemon start automatically when booting up your host, add the following statement to one of the system start-up files (e.g. */etc/rc.local*):

```
/usr/local/lib/axis/prosd myhost /dev/salesdept.pr1 salesdept
pr1 netprinter 2> /usr/adm/salesdept_pr1_log 1>&2 &
```

If you want to store the printer feedback data in a separate file, use this statement:

```
/usr/local/lib/axis/prosd myhost /dev/salesdept.pr1 salesdept
pr1 netprinter 2> /usr/adm/salesdept_pr1_log 1>>
/usr/adm/salesdept_pr1_pfb &
```

- */usr/local/lib/axis/prosd* is the path and file name of the PROS daemon
- *myhost* is the name of the host where you are doing the integration
- */dev/salesdept.pr1* is the path and file name of the named pipe
- *salesdept* is the name of your NPS print server
- *pr1* is the logical printer to be used
- *netprinter* is the PROS protocol password
- */usr/adm/salesdept_pr1_log* is the path and file name of the error log file
- */usr/adm/salesdept_pr1_pfb* is the path and file name of the printer readback data file.

7. Start the Bourne shell, if you're not already there, by the command **sh**.
8. Start a daemon by the command **nohup** followed by one of the statements given at step 6 above.
9. Create a spooler directory by the command **mkdir /usr/spool/sales_1**.
10. Add a printcap entry for the printer to */etc/printcap*. All printcap capabilities are available, including both input and output filters. The printcap entry should contain at least the following fields:

```
sales_1|NPS 550 LPT1 at salesdept:\
       :lp=/dev/salesdept.pr1:\
       :sd=/usr/spool/sales_1
```

Note: Ultrix systems may require an output filter to work properly. If you are not using a filter, there is a straight-through dummy filter called *xf* that can be used by adding a **:of=xf:** field to the printcap entry.

Test Printout

Test the PROS daemon by printing the file *test* using the *cat* command:

```
cat test > /dev/salesdept.pr1
```

If the daemon works, print the file through the spooler using *lpr*:

```
lpr -Psales_1 test
```

Integration of Additional Printers

Repeat the integration process (automatically or manually) for each additional printer attached to your NPS print server. Each printer must have its own daemon, printcap entry, a unique name and spool directory. If you integrate manually, note that the first

three steps (i.e. compiling the PROS daemon) need only to be done once.

Integration for PROS B Printing

PROS B uses an output filter rather than a daemon. The integration procedure is therefore similar to FTP, with the additional step of compiling the PROS drivers. It retains all the features of PROS A except the simultaneous use of both input and output filters.

If you don't have a C compiler, use the FTP method described above.

Automatic Integration

Run the *axinstall* script and follow the instructions on the screen. Choose **PROS B** at the Print Method prompt.

Note: The automatic integration only provides basic printing functions (no banner page, etc.). To get full control over the *printcap* capabilities, edit the *printcap* file after the automatic integration or use the manual integration.

Manual Integration

1. Create a work directory by the command **mkdir /usr/local/lib/axis**.
2. Log in to the NPS print server using FTP and up-load the files *makepros*, *prosbsd.c*, and *printcap.pro* from the *bsd* directory to the work directory.
3. Edit the file *makepros* as described in the file header. This is where you specify the name of the host to integrate the printer on, the alias for your NPS print server, the logical printer to use, output filter name, and printer feedback data destination.
4. Compile the executable *prosbsd* filter by the command **sh makepros**.
5. Rename *prosbsd* to *prosbsd-sales_1* and move it the directory where you keep your printer filters by the command. **cp prosbsd /usr/local/lib/prosbsd-sales_1**.
6. Create a error log file by the command **touch /usr/adm/sales_1-log**.
7. Create a spool directory by the commands **cd /usr/spool** and **mkdir sales_1**.
8. Create a printer spooler dummy file by the command **touch sales_1/null**.
9. Edit *printcap.pro* as described in the file header (see example below). This is the point where you should tailor the printer capabilities to meet your specific needs.
10. Append the printcap entry by the command **cat printcap.pro >> /etc/printcap**.

Example: This is what the new printcap entry might look like:

```
sales_1|NPS 550 LPT1 at salesdept:\
       :lp=/usr/spool/sales_1/null:\
       :ff=\r\f:sh:lf=/usr/adm/sales_1-log:\
       :of=/usr/local/lib/prosbsd-sales_1:\
       :sd=/usr/spool/sales_1
```

It is not allowed to use both input and output filters with the PROS B print method. However, you may combine the ftp_bsd filter with your own output filter by taking the following steps:

1. Create a script called *newfilter* containing the lines below in the */usr/local/lib* directory (or wherever you keep your printer filters).

```
#!/bin/sh
/usr/local/lib/myfilter | /usr/local/lib/prosbsd-sales_1
```

2. Make the script executable by the command **chmod +x newfilter**.
3. Replace **prosbsd-sales_1** with **newfilter** in the output filter (of) field of your new printcap entry.

Using the PROS driver as Input Filter

We recommend you to use the PROS driver as output filter since this enables banner pages and Form Feeds between jobs to be processed by the spooler. If you don't require these functions, you may install prosbsd as an input filter by replacing the **:of=** field by an **:if=** field in the printcap entries. The main reason for using input filters is that the user ID appears in the accounting list.

Test Printout

Test the PROS driver by printing the file *test* using the *cat* command:

```
cat test | /usr/local/lib/prosbsd-sales_1
```

If the driver works, print the file through the spooler using *lpr*:

```
lpr -Psales_1 test
```

Integration of Additional Printers

Repeat the integration process (automatically or manually) for each additional printer attached to your NPS print server. Each printer must have its own printcap entry and output filter as well as a unique name and spool directory.

Example: These are the two new printcap entries required when integrating two printers at the *salesdept* print server:

```
sales_1|NPS 550 LPT1 at salesdept:\
       :lp=/usr/spool/sales_1/null:\
       :ff=\r\f:sh:lf=/usr/adm/sales_1-log:\
       :of=/usr/local/lib/prosbsd-sales_1:\
       :sd=/usr/spool/sales_1
sales_2|NPS 550 LPT2 at salesdept:\
       :lp=/usr/spool/sales_2/null:\
       :ff=\r\f:sh:lf=/usr/adm/sales_2-log:\
       :of=/usr/local/lib/prosbsd-sales_2:\
       :sd=/usr/spool/sales_2
```

Printing from System V UNIX Systems

The following print methods are available for System V systems (Solaris, SCO UNIX, Interactive UNIX, etc.). Use the table below to select the print method that is best fitted for your printing requirements. Detailed integration procedures are given for each method on the following pages.

Print Method	Advantages	Limitations
FTP	Uses industry standard network software on the host.	No printer status logging. No filters or interface programs can be used.
PROS A	The communication with the NPS print server is logged to a log file, including printer status and feedback. Easy to integrate – the NPS print server appears as a device to the system. Any filters and interface programs can be used.	A C compiler is required to build the PROS drivers. A daemon must be active for each printer attached to the NPS print server.
PROS B	Fatal errors are mailed to the user that initiated the print job.	A C compiler is required to build the PROS drivers. No filters or interface programs can be used.
Reverse Telnet	Easy to set up if Reverse Telnet drivers are already installed.	No printer status logging. Drivers are not supplied with the NPS print server. Existing drivers may be slow.

Installation

Regardless of the printing mode you intend to use, the first step is to install the NPS print server on your host. Please note that the installation and integration procedures require that you have *root* privileges on the system.

Start with assigning an Internet Address and a host name (alias) to the NPS print server by adding the following line to your system host table (*/etc/hosts*):

```
192.36.253.96          salesdept
```

(192.36.253.96 and salesdept are examples only)

DO NOT use the default or example Internet address when installing your NPS print server. Always consult your network manager before assigning an Internet Address.

If applicable, update your alias name data bases (Yellow Pages, YP/NIS), typically by the commands **cd /var/yp** and **make**.

The next step is to down-load the Internet Address to the NPS print server. This can be done in three ways, using either the *arp*, *rarp*, or *bootp* method.

Setting the Internet Address using arp

Enter the following commands to set the Internet Address. The alias (*salesdept*) must match the one assigned above, and the Ethernet Address (here 00:40:8c:10:00:86) should be the server identification number of your NPS print server:

```
arp -s salesdept 00:40:8c:10:00:86 temp
ping salesdept
```

(salesdept and 00:40:8c:10:00:86 are examples only)

The host should respond *salesdept is alive* or something similar to indicate that communication is established.

Notes:

1. The syntax of the *arp* command is system dependent. Consult your host's reference manual (or use the **man arp** command) if you're uncertain about the proper syntax.
2. If you need to run the *arp* command again, the NPS print server *must* be restarted (power-off/power-on) before it can accept a new Internet Address.
3. If *rarp* or *bootp* is running on your network and the NPS print server is present in */etc/ethers*, it is *not* possible to change the Internet Address using the *arp* command.
4. The NPS print server and the host must be on the same logical network segment (not separated by a router).

Setting the Internet Address using rarp

The *rarp* method sets the Internet address automatically every time the NPS print server is powered on. The main advantage with this is that you don't have to down-load the Internet address individually to each NPS print server as when using the *arp* method.

This is how it works: The NPS print server broadcasts a request to a *rarp* daemon at power-up. If the daemon is active, and a matching entry is found in the *Ethernet Address Table*, the daemon down-loads the Internet address to the NPS print server. If the daemon isn't active or the table entry isn't found, the Internet address remains unchanged.

Follow these steps to use the *rarp* method:

1. Update your host table (*/etc/hosts*) as described earlier.
2. Edit the Ethernet Address table on your host (typically the file */etc/ethers*) by appending the following line:

   ```
   00:40:8c:10:00:86  salesdept
   ```

   (salesdept and 00:40:8c:10:00:86 are examples only)

3. Update your alias name data bases (Yellow Pages, YP/NIS), typically by the commands **cd /var/yp** and **make**.
4. Start the rarp daemon (if it isn't already running) by the command **rarpd -a** (this is system dependent, consult your system documentation).
5. Restart the NPS print server to down-load the Internet address.

Setting the Internet Address using bootp

The *bootp* method is similar to *rarp* but gives two additional advantages:

- The network configuration data for the entire network can be in one place which makes it easy to maintain.
- The Internet address, the default router address, and the net mask are down-loaded to the NPS print server automatically every time it is powered on.

This is how it works: The NPS print server broadcasts a request containing its Ethernet address to a *bootp* daemon at power-up. If the daemon is active, and a matching entry is found in the *Boot Table*, the daemon down-loads the Internet address, default router address and net mask to the NPS print server. If the daemon isn't active or the table entry isn't found, the Internet address, default router address and net mask remains unchanged.

Follow these steps to use the *bootp* method:

1. Update your host table (*/etc/hosts*) as described earlier.
2. Edit (or create) the boot table on your host (typically the file */etc/bootptab*) by appending the following entry:

```
salesdept:ht=ether:vm=rfc1048:ha=00408c100086:\
   :ip=192.36.253.96:sm=255.255.255.0:\
   :gw=192.36.253.254
```

(salesdept and the ha, ip, sm, *and* gw *fields are examples only)*

   - *ht=* is the Hardware Type field. Set this to *ether* for Ethernet, or *tr* for Token Ring.
   - *vm=* is the Vendor Magic field, specifying *bootp* report format. Should typically be *rfc1048*.
   - *ha=* is the Hardware Address field. Set this to the Ethernet address or Token Ring node address of your NPS print server.
   - *ip=* is the Internet Address field. Set this to the Internet address of your NPS print server.
   - *sm=* is the Subnet Mask field. Set this to the net mask value for your network.
   - *gw=* is the Gateway field. Set this to your default router address.
3. Start the *bootp* daemon (if it isn't already running) by the command **bootpd** (this is system dependent, consult your system documentation).
4. Restart the NPS print server to down-load the Internet address, default router address and net mask.

Integration for FTP Printing

This is the recommended print method for System V systems. It does not require a C compiler and BSD socket-type networking supports as the PROS methods do, but has the drawback of not supporting status logging and filters or interface programs.

Automatic Integration

Run the *axinstall* script and follow the instructions on the screen. Choose **FTP** at the Print Method prompt.

Note: There is no real reason to integrate manually for FTP unless you want to modify the interface program in some way. We recommend that you start with automatic integration, and turn to manual only if *axinstall* for some reason fails.

Manual Integration

1. Create a directory to keep the print server interface programs by the command **mkdir /usr/local/lib/axis**.
2. Log in to the NPS print server using FTP, and up-load the file *ftp_sysv* from the *sysv* directory to the interface program directory.
3. Copy *ftp_sysv* to *ftp_sysv-sales_1*.
4. Edit *ftp_sysv-sales_1* as described in the file header. This is where you specify the Internet Address, Logical Printer, FTP path, user name and password.
5. Make the modified file executable by the command **chmod +x ftp_sysv-sales_1**.
6. Enter the Bourne shell (if not already there) by the commands **sh**, **SHELL=/bin/sh,** and **export SHELL**.
7. Turn off the LP printer service by the command **/usr/lib/lpshut**.
8. Create a new system printer by the command **/usr/lib/**
   lpadmin -p sales_1 -i ftp_sysv-sales_1 -v /dev/null, where *sales_1* is the name of the new printer.
9. Restart the LP printer service by the command **/usr/lib/lpsched**.
10. Enable requests for print jobs on the new printer by the command **/usr/lib/**
    accept sales_1, and enable the printer by **/usr/bin/enable sales_1**.
11. Exit the Bourne shell by **exit**.

Test Printout

Start by printing the file *test* using the interface program:

```
ftp_sysv-sales_1 x x x 1 x test
```

The ‘x’ characters represent parameters required by the system. They must be present, but the values are ignored. The ‘1’ is the number of copies.

If the interface program works, print the file through the spooler using *lp*:

```
lp -d sales_1 test
```

Integration of Additional Printers

Repeat the integration process (automatically or manually) for each additional printer attached to your NPS print server. Each printer must have its own interface program as well as a unique name.

Integration for PROS A Printing

PROS A is the most powerful print method, featuring automatic logging of printer status and feedback as well as allowing you to use any existing filters or interface programs. It is fairly easy to integrate since the NPS print server appears as a device

(Named Pipe) to the system. The drawbacks are that you must run a PROS daemon for each printer, and you also need a C compiler on your host to make the PROS daemon.

If you don't have a C compiler, use the FTP method described above. If you have a compiler, but don't want to run daemons on your system, use the almost-as-powerful PROS B method.

Automatic Integration

Run the axinstall script and follow the instructions on the screen. Choose **PROS A** at the Print Method prompt.

Note: There is generally no real reason to integrate manually for PROS A. We recommend that you start with automatic integration, and turn to manual only if you experience problems with *axinstall*.

Manual Integration

1. Create and move to a directory for the print server daemon using the commands **mkdir /usr/local/lib/axis** and **cd /usr/local/lib/axis**.
2. Log in to the NPS print server using FTP and up-load the files *makefile* and *prosd.c* from the *npipe* directory.
3. Edit *makefile* according to the instructions in the file header. (Some System V systems require L1_OPTIONS and L2_OPTIONS modifications, which is one of the reason that *axinstall* might fail).
4. Use **make** to compile the PROS daemon.
5. Create a named pipe for the printer by the command **mknod /dev/salesdept.pr1 p**, where *salesdept* is the alias for the NPS print server, and *pr1* is the logical printer.
6. Make the pipe accessible from lp only by the commands **chown lp /dev/salesdept.pr1** and **chmod 600 /dev/salesdept.pr1**.
7. To make the daemon start automatically when booting up your host, add the following statement to one of the system start-up files (e.g. */etc/inittab*):

Note: Some systems recreate */etc/inittab* at boot-time. To make sure that your added statement are not lost, you should also put the statements in a file named */etc/conf/init.d/axis-init*. (Any file name will do, as long as it is placed in the *init.d* directory).

If you prefer to start the daemon manually, skip to step 9 below.

```
axis::respawn:/usr/local/lib/axis/prosd myhost
/dev/salesdept.pr1 salesdept pr1 netprinter 2>
/usr/adm/salesdept_pr1_log 1>&2
```

If you want to store the printer feedback data in a separate file, use this statement:

```
axis::respawn:/usr/local/lib/axis/prosd myhost
/dev/salesdept.pr1 salesdept pr1 netprinter 2>
/usr/adm/salesdept_pr1_log 1>> /usr/adm/salesdept_pr1_pfb &
```

- */usr/local/lib/axis/prosd* is the path and file name of the PROS daemon
- *myhost* is the name of the host where you are doing the integration
- */dev/salesdept.pr1* is the path and file name of the named pipe
- *salesdept* is the name of your NPS print server
- *pr1* is the logical printer to be used

- *netprinter* is the PROS protocol password
- */usr/adm/salesdept_pr1_log* is the path and file name of the error log file
- */usr/adm/salesdept_pr1_pfb* is the path and file name of the printer read-back data file.

8. Start the daemon by the command **telinit q**.
9. Enter the Bourne shell (if not already there) by the commands **sh**, **SHELL=/bin/sh,** and **export SHELL**.
10. If you did not start the daemon automatically according to steps 7-8 above, start it now by the command **nohup** followed by one of the statements given at step 7 (leave out the *axis::respawn:* part, and append a '&' character to make the daemon run in the background).
11. Turn off the LP printer service by the command **/usr/lib/lpshut**.
12. Create a new system printer by the command **/usr/lib/lpadmin -p sales_1 -m standard -v /dev/salesdept.pr1**, where *sales_1* is the name of the new printer and *salesdept.pr1* is the daemon. You may use any interface program by replacing *standard* with the name of the interface program.
13. Restart the LP printer service by the command **/usr/lib/lpsched**.
14. Enable requests for print jobs on the new printer by the command **/usr/lib/accept sales_1**, and enable the printer by **/usr/bin/enable sales_1**.
15. Exit the Bourne shell by **exit**.

Test Printout

Test the PROS daemon by printing the file *test* using the *cat* command:

```
cat test > /dev/salesdept.pr1
```

If the daemon works, print the file through the spooler using *lpr*:

```
lp -d sales_1 test
```

Integration of Additional Printers

Repeat the integration process (automatically or manually) for each additional printer attached to your NPS print server. Each printer must have its own daemon and system printer entry. Also, each *inittab* entry must have a unique label ('axis' in the previous examples).

If you integrate manually, note that the first four steps (i.e. compiling the PROS daemon) need only to be done once.

Stopping the PROS Daemon

Should you ever want to stop a PROS daemon running on your system, this must be done in different ways depending on how the daemon was started.

- If the daemon was started automatically (steps 7-8 above), you should stop it by replacing *respawn* with *off* in the inittab entry, and then run **telinit q** to initialize the new inittab settings.
- If the daemon was started manually (step 10 above), first find out the daemon's process number by the command **ps -elf | grep prosd**, then stop the daemon by the

command **kill -9 <process number>**.

Integration for PROS B Printing

PROS B uses an interface program rather than a daemon. The integration procedure is therefore similar to FTP, with the additional step of compiling the PROS drivers. It retains all the features of PROS A, and has the additional benefit that the user will be notified by main when a fatal error occurs.

If you don't have a C compiler, use the FTP method described above.

Automatic Integration

Run the *axinstall* script and follow the instructions on the screen. Choose **PROS B** at the Print Method prompt.

Note: There is no real reason to integrate manually for PROS B unless you want to modify the interface program in some way. We recommend that you start with automatic integration, and turn to manual only if *axinstall* for some reason fails.

Manual Integration

1. Create a work directory by the command **mkdir /usr/local/lib/axis**.
2. Log in to the NPS print server using FTP and up-load the files *makepros* and *prossysv.c* from the *sysv* directory to the work directory.
3. Edit the file *makepros* as described in the file header. This is where you specify the name of the host to integrate the printer on, the alias for your NPS print server (*salesdept*), the logical printer to use (*pr1*), interface program name (*prossysv-sales_1*), and printer feedback data destination. (Some System V systems require L1_OPTIONS and L2_OPTIONS modifications, which is one of the reasons that *axinstall* might fail)
4. Compile the executable *prossysv-sales_1* program by the command **sh makepros**.
5. Enter the Bourne shell (if not already there) by the commands **sh**, **SHELL=/bin/sh,** and **export SHELL**.
6. Turn off the LP printer service by the command **/usr/lib/lpshut**.
7. Create a new system printer by the command **/usr/lib/lpadmin -p sales_1 -i prossysv-sales_1 -v /dev/null**, where *sales_1* is the name of the new printer and *prossysv-sales_1* is the interface program. If you want to write printer feedback data to a file, replace */dev/null* with a path and file name.
8. Restart the LP printer service by the command **/usr/lib/lpsched**.
9. Enable requests for print jobs on the new printer by the command **/usr/lib/accept sales_1**, and enable the printer by **/usr/bin/enable sales_1**.
10. Exit the Bourne shell by **exit**.

Test Printout

Start by printing the file *test* using the interface program:

```
prossysv-sales_1 x x x 1 x test
```

The 'x' characters represent parameters required by the system. They must be present, but the values are ignored. The '1' is the number of copies.

If the interface program works, print the file through the spooler using *lp*:

```
lp -d sales_1 test
```

Integration of Additional Printers

Repeat the integration process (automatically or manually) for each additional printer attached to your NPS print server. Each printer must have its own interface program as well as a unique name.

Printing from IBM AIX Systems

The following print methods are available for IBM AIX systems (RS/6000). Use the table below to select the print method that is best fitted for your printing requirements. Detailed integration procedures are given for each method on the following pages.

Print Method	Advantages	Limitations
LPD	Easy to set up – just install the NPS print server as a remote queue in SMIT.	No printer status logging. Spooler features such as banner pages, filters, or multiple copies are not available.
FTP	Uses industry standard network software on the host.	No printer status logging.
PROS	The communication with the NPS print server is logged to a log file, including printer status and feedback. Status information can be mailed back to the user.	A C compiler is required to build the PROS drivers.

Installation

Regardless of the printing mode you intend to use, the first step is to install the NPS print server on your host. Please note that the installation and integration procedures require that you have *root* privileges on the system.

Start with assigning an Internet Address and a host name (alias) to the NPS print server by adding the following line to your system host table (*/etc/hosts*):

```
192.36.253.96          salesdept
```

(192.36.253.96 and salesdept are examples only)

DO NOT use the default or example Internet address when installing your NPS print server. Always consult your network manager before assigning an Internet Address.

If applicable, update your alias name data bases (Yellow Pages, YP/NIS), typically by the commands **cd /var/yp** and **make**.

The next step is to down-load the Internet Address to the NPS print server. This can be done in three ways, using either the *arp*, *rarp*, or *bootp* method.

Setting the Internet Address using arp

Enter the following commands to set the Internet Address. The *ether* argument applies to Ethernet only. The Token Ring equivalent is *802.5*. The alias (*salesdept*) must match the one assigned above, and the Ethernet Address (Node Address for Token Ring), here 00:40:8c:10:00:86, should equal the serial number of your NPS print server:

```
arp -s ether salesdept 00:40:8c:10:00:86 temp
ping salesdept
```

(salesdept and 00:40:8c:10:00:86 are examples only)

The host should respond *salesdept is alive* or something similar to indicate that communication is established.

Notes:

1. The syntax of the *arp* command is system dependent. Consult your host's reference manual (or use the **man arp** command) if you're uncertain about the proper syntax.
2. If you need to run the *arp* command again, the NPS print server *must* be restarted (power-off/power-on) before it can accept a new Internet Address.
3. If *rarp* or *bootp* is running on your network and the NPS print server is present in */etc/ethers*, it is *not* possible to change the Internet Address using the *arp* command.
4. The NPS print server and the host must be on the same logical network segment (not separated by a router).

Setting the Internet Address using rarp

The *rarp* method sets the Internet address automatically every time the NPS print server is powered on. The main advantage with this is that you don't have to down-load the Internet address individually to each NPS print server as when using the *arp* method.

This is how it works: The NPS print server broadcasts a request to a *rarp* daemon at power-up. If the daemon is active, and a matching entry is found in the *Ethernet Address Table*, the daemon down-loads the Internet address to the NPS print server. If the daemon isn't active or the table entry isn't found, the Internet address remains unchanged.

Follow these steps to use the *rarp* method:

1. Update your host table (*/etc/hosts*) as described earlier.
2. Edit the Ethernet Address table on your host (typically the file */etc/ethers*) by appending the following line:

   ```
   00:40:8c:10:00:86  salesdept
   ```

   (salesdept and 00:40:8c:10:00:86 are examples only)

3. Update your alias name data bases (Yellow Pages, YP/NIS), typically by the commands **cd /var/yp** and **make**.
4. Start the rarp daemon (if it isn't already running) by the command **rarpd -a** (this is system dependent, consult your system documentation).
5. Restart the NPS print server to down-load the Internet address.

Setting the Internet Address using bootp

The *bootp* method is similar to *rarp* but gives two additional advantages:

- The network configuration data for the entire network can be in one place which makes it easy to maintain.
- The Internet address, the default router address, and the net mask are down-loaded to the NPS print server automatically every time it is powered on.

This is how it works: The NPS print server broadcasts a request containing its Ethernet address to a *bootp* daemon at power-up. If the daemon is active, and a matching entry is found in the *Boot Table*, the daemon down-loads the Internet address, default router address and net mask to the NPS print server. If the daemon isn't active or the table entry isn't found, the Internet address, default router address and net mask remains unchanged.

Follow these steps to use the *bootp* method:

1. Update your host table (*/etc/hosts*) as described earlier.
2. Edit (or create) the boot table on your host (typically the file */etc/bootptab*) by appending the following entry:

```
salesdept:ht=ether:vm=rfc1048:ha=00408c100086:\
   :ip=192.36.253.96:sm=255.255.255.0:\
   :gw=192.36.253.254
```

(salesdept and the ha, ip, sm, *and* gw *fields are examples only)*

   - *ht=* is the Hardware Type field. Set this to *ether* for Ethernet, or *tr* for Token Ring.
   - *vm=* is the Vendor Magic field, specifying *bootp* report format. Should typically be *rfc1048*.
   - *ha=* is the Hardware Address field. Set this to the Ethernet address or Token Ring node address of your NPS print server.
   - *ip=* is the Internet Address field. Set this to the Internet address of your NPS print server.
   - *sm=* is the Subnet Mask field. Set this to the net mask value for your network.
   - *gw=* is the Gateway field. Set this to your default router address.
3. Start the *bootp* daemon (if it isn't already running) by the command **bootpd** (this is system dependent, consult your system documentation).
4. Restart the NPS print server to down-load the Internet address, default router address and net mask.

Integration for LPD Printing

The LPD print method is easy to set up, but provides neither status logging nor spooler features.

There is no automatic integration available for IBM AIX.

Automatic Integration

Run the *axinstall* script and follow the instructions on the screen. Choose **LPD** at the Print Method prompt.

Manual Integration

1. Set up a queue and a spooler device for the NPS print server using SMIT. Enter the command **smit mkrque** and fill in the following fields (user entries in bold):

```
NAME of queue to add                    salesrq_1
DESTINATION HOST for remote jobs        salesdept
... SHORT FORM FILTER ...               /usr/lpd/bsdshort
... LONG FORM FILTER ...                /usr/lpd/bsdlong
Name of QUEUE on remote printer         pr1
NAME of device to add                   sales_1
```

   - *salesrq_1* is the name of the new queue
   - *salesdept* is the host name (alias) of your NPS print server
   - *pr1* specifies the logical printer for sales_1
   - *sales_1* is the name of the new device

2. Press <*Enter*> to accept the new entries, and exit SMIT.

Test Printout

Print the file *test* using the *qprt* command:

```
qprt -Psales_1 test
```

Integration of Additional Printers

Repeat the integration process for each additional printer attached to your NPS print server. Each printer must have its own queue and device name.

Integration for FTP Printing

The FTP print method is a bit more complex to set up than LPD, but offers more printing options. This is the method to choose if you don't have access to a C compiler, or if you don't need the additional features offered by PROS (such as printer status and feedback logging).

Automatic Integration

Run the *axinstall* script and follow the instructions on the screen. Choose **FTP** at the Print Method prompt.

Manual Integration

1. Create and move to a directory for the print server programs using the commands **mkdir /usr/lpd/axis** and **cd /usr/lpd/axis**.
2. Log in to the NPS print server using FTP and up-load the back-end program *ftp_piobe* from the *aix* directory.
3. Copy *ftp_piobe* to *ftp_piobe-sales_1*.
4. Edit *ftp_piobe-sales_1* as described in the file header. This is where you specify the Internet Address, Logical Printer, FTP path, user name and password.
5. Make the back-end program executable by **chmod +x ftp_piobe-sales_1**.
6. Set up a virtual printer using SMIT. Enter the command **smit mkvirprt** and answer the questions an the screen (user entries in bold):

   Select *Printer or plotter attached to the host.*

   At the *Device* prompt, type **null**.

   Select a printer type. If in doubt, select *ASCII printer.*

   Select header and trailer options (**n** for none, **a** for each file, **g** for each job).

   Enter the print queue name: **sales_1**.

   At the default queue prompt, type **y** if you want *sales_1* as default, otherwise **n**.
7. Set up the back-end program using SMIT once again. Enter the command **smit chquedev** and follow the instructions on the screen.
8. Select the printer queue assigned above (*sales_1*), and the device *null*.
9. You are now presented with a screen of options – the only one you have to change is the *BACKEND PROGRAM pathname* entry. Type **/usr/lpd/axis/ftp_piobe-sales_1**.
10. Press <*Enter*> to accept the new entries, and exit SMIT.

Test Printout

Print the file *test* using the *qprt* command:

```
qprt -Psales_1 test
```

Integration of Additional Printers

Repeat the integration process for each additional printer attached to your NPS print server. Each printer must have its own back-end program and a unique name.

Integration for PROS Printing

PROS is the most powerful print method, offering printer status and feedback logging either to a file or as mail back to the user. The integration procedure is similar to FTP, with the additional step of compiling the PROS drivers.

If you don’t have a C compiler, use the FTP method described above.

Automatic Integration

Run the *axinstall* script and follow the instructions on the screen. Choose **PROS B** at the Print Method prompt.

Manual Integration

1. Create and move to a directory for the print server programs using the commands **mkdir /usr/lpd/axis** and **cd /usr/lpd/axis**.
2. Log in to the NPS print server using FTP and up-load the files *makefile*, *prosaix.c*, and *pros_piobe* from the *aix* directory.
3. Compile the executable file *prosaix* by the command **make**.
4. Copy *pros_piobe* to *pros_piobe-sales_1*.
5. Edit *pros_piobe-sales_1* as described in the file header. This is where you specify the Internet Address, Logical Printer, PROS path, user name and password.
6. Make the back-end program executable by **chmod +x pros_piobe-sales_1**.
7. Set up a virtual printer using SMIT. Enter the command **smit mkvirprt** and answer the questions an the screen (user entries in bold):

   Select *Printer or plotter attached to the host*.

   At the *Device* prompt, type **null**.

   Select a printer type. If in doubt, select *ASCII printer.*

   Select header and trailer options (**n** for none, **a** for each file, **g** for each job).

   Enter the print queue name: **sales_1**.

   At the default queue prompt, type **y** if you want *sales_1* as default, otherwise **n**.
8. Set up the back-end program using SMIT once again. Enter the command **smit chquedev** and follow the instructions on the screen.
9. Select the printer queue assigned above (*sales_1*), and the device *null*.
10. You are now presented with a screen of options – the only one you have to change is the *BACKEND PROGRAM pathname* entry. Type **/usr/lpd/axis/pros_piobe-sales_1**.
11. Press <*Enter*> to accept the new entries, and exit SMIT.

Test Printout

Print the file *test* using the *qprt* command:

```
qprt -Psales_1 test
```

Integration of Additional Printers

Repeat the integration process for each additional printer attached to your NPS print server. Each printer must have its own back-end program and a unique name.

Printing from Other UNIX Systems

The automatic integration script *axistall* supports a wide range of different UNIX systems. When *axistall* is started, it tries to recognize your system by looking for certain files that are specific for different systems. The following UNIX systems can currently be automatically detected:

- **SunOS 4** (Sun BSD, Solaris 1.x)
- **SunOS 5** (Sun SYS V, Solaris 2.x)
- **AIX** (IBM RS/6000)
- **HP-UX** (HP 9000)
- **ULTRIX** (Digital Ultrix)
- **SGI** (Silicon Graphics, IRIX)
- **BSD** (Berkley UNIX)
- **SYS V R3** (UNIX System V Release 3)
- **SYS V R4** (UNIX System V Release 4)

For more unusual UNIX systems, there is no automatic integration. However, since most UNIX systems resemble either BSD or System V, you should be able to integrate your NPS print server manually. You will need a working knowledge about your system to manage various peculiarities as indicated by the SINIX example below.

In most cases, the FTP print method can be used. Up-load the files */bsd/ftp_bsd* and */sysv/ftp_sysv* and study the file headers. See also the manual integration instructions for FTP printing on BSD (page 49) and System V systems (page 57).

If your system has BSD socket-type networking support, you can also consider the PROS B print method. Up-load the file */bsd/prosbsd* and study the file header. See also the manual integration instructions for PROS B printing on BSD systems (page 52).

Integration Example: HP 9000

HP 9000 is supported by *axinstall*, so you may use the automatic installation procedure. Alternatively, you can configure the NPS print server as an HP JetDirect card, which is a standard print server selection on the HP 9000 system. This is a simple and straightforward procedure, but with the limitation that only one printer can be attached to the NPS print server.

Start with installing the NPS print server on the host as described on page 54. Then proceed with the integration:

Automatic Integration

Run the *axinstall* script and follow the instructions on the screen. Choose **FTP**, **LPD**, **PROS A** or **PROS B** at the Print Method prompt.

Manual Integration

This procedure involves editing the NPS print server *config* file. If you are unfamiliar with this, consult Section 9 – *Parameter Editing, TCP/IP* before continuing.

1. Log in to the NPS print server using FTP, and up-load the *config* file by the command **get config**.
2. Exit FTP, and edit the *config* file. Modify parameters 018 (Reverse Telnet Options Enabled) and 601 (Reverse Telnet port number for pr1) as below:

```
018. RTN_OPT  : NO
601. RTEL_PR1 : 9100
```

3. Log in again, and down-load the modified *config* file to the NPS print server by the command **put config CONFIG**.
4. Restart the NPS print server by the command **get hardreset**, which will also close the FTP session.

Test Printout

Print the file *test* using the *lpr* command:

```
lpr -Psales_1 test
```

Integration Example: SINIX

The SINIX system is a derivate of the AT&T System V UNIX operating system. The problem here is that the spooler is not compatible with the standard System V spooler.

However, unlike the standard System V spooler, there is a network connection feature originally used to connect printers attached to Siemens-Nixdorf TACLAN Terminal Servers to the spooler via the LAN. This method uses TCP/IP Reverse Telnet for communication, which is supported by the NPS print server.

As always, the first step is to install the NPS print server on the host as described on page 54. Then proceed with the integration:

Manual Integration

This procedure involves editing the NPS print server config file. If you are unfamiliar with this, consult Section 9 – *Parameter Editing, TCP/IP* before continuing.

1. Log in to the NPS print server using FTP, and up-load the *config* file by the command **get config**.
2. Exit FTP, and edit the *config* file. Modify parameters 601 through 608 (Reverse Telnet port numbers for pr1 through pr8) as below:

```
601. RTEL_PR1 : 9001
602. RTEL_PR2 : 9002
603. RTEL_PR3 : 9003
604. RTEL_PR4 : 9004
605. RTEL_PR5 : 9005
606. RTEL_PR6 : 9006
607. RTEL_PR7 : 9007
608. RTEL_PR8 : 9008
```

3. Log in again, and down-load the modified *config* file to the NPS print server by the command **put config CONFIG**.
4. Restart the NPS print server by the command **get hardreset**, which will also close

the FTP session.

5. Edit the file */usr/spool/spooler/CONFIG*, which is the SINIX spooler configuration file. Add the following lines:

   - Add a printer definition by the following line:

   sales_1 '/opt/etc/interface -addr=salesdept -port=9001' /dev/null

   - Set up a printer group by adding the following line to the *printer groups* section:

   sales_1 (sales_1) 'Printer attached to NPS print server'

   - Include the printer in the *administrator* section by adding **sales_1** to any one of the administrator lines.

6. Exit the editor, and convert the *CONFIG* file to binary format (CONFIG.bin) by the command **digest**.

7. Restart the printer queue daemon by the command **lpr -rr**.

Test Printout

Print the file *test* using the *lpr* command:

```
lpr -dru=sales_1 test
```

Integration of Additional Printers

Repeat the integration process for each additional printer attached to your NPS print server. Each printer must have its own printer definition and group entry as well as a unique name.

Notes:

1. You may use any back-end program instead of *interface*, e.g. *lphplj* for HP LaserJet printers.

2. It is not necessary to use different Reverse Telnet port numbers for different print servers. Since the servers have unique Internet addresses, there will be no conflict.

Printing from IBM MVS Systems

Use the FTP method to print from an MVS mainframe. Up-load the sample JCL script */mvs/jcl_ex* from the NPS print server and follow the instructions in the file header.

Printing from MS-DOS Systems

Printing from MS-DOS systems is done by redirecting printer output using e.g. PREDIR from FTP Software. PREDIR is supplied with the PC/TCP package from version 2.05 patch level III. It uses the LPD protocol to transfer print jobs.

Up-load the file */pctcp/pc_tcp.cfg* from the NPS print server and follow the instructions.

Apple EtherTalk

The NPS print server makes it possible to connect any PostScript printer to an Ethernet network running AppleTalk. By default, the NPS print server will present itself to the network as a LaserWriter printer named *AXIS<nnnnnn>_LPT1*, where <nnnnnn> are the last six digits of the NPS print server serial number. This printer will appear in the Macintosh *Chooser* menu together with any locally attached printers.

The following parameters control printing in the AppleTalk environment:

- **500 AppleTalk Protocol Enabled (APPLETALK MENU)**
  This parameter switches the NPS print server AppleTalk support on and off. The default setting is YES. Changing to NO will disable the AppleTalk support, and no network printers will appear in the *Chooser* menu.
- **502 AppleTalk Zone (APPLETALK MENU)**
  This parameter specifies the AppleTalk zone for the NPS print server printers. The default setting is *<empty>*, which will place the NPS printers in the default zone as defined on the Apple Internet Router. You may change this to any valid zone name not exceeding 32 characters. If your network has only one zone, leave this parameter empty.
- **503 HP Zoner Enabled (APPLETALK MENU)**
  This parameter switches the NPS print server support for the HP Zoner utility (and compatible products) on and off. The default setting is YES, which enables HP Zoner users to move NPS printers between AppleTalk zones. To disable this possibility, change the parameter setting to NO.
- **505 Binary Transfer Enabled (APPLETALK MENU)**
  This parameter switches the NPS print server support for printing in binary mode on and off. The default setting is NO. If your printer supports binary mode, large bitmapped images will print much faster with this parameter set to YES.
- **510 Printer 1 Name (APPLETALK MENU)**
  This parameter specifies the name of the first network printer. The default name is *AXIS<nnnnnn>_LPT1*. You may change this to any name not exceeding 32 characters. The Printer 2 through Printer 4 names are specified by parameters 520, 530, and 540.
- **511 Printer 1 Type (APPLETALK MENU)**
  This parameter specifies the type of the first network printer. The default type is *LaserWriter*. You may change this to any valid printer type not exceeding 32 characters, but this requires that a driver for that type is installed. Leaving this field empty will prevent Printer 1 from appearing in the *Chooser* menu. The Printer 2 through Printer 4 types are specified by parameters 521, 531, and 541 respectively.
- **512 Printer 1 Logical Printer (APPLETALK MENU)**
  This parameter specifies the logical printer assigned to Printer 1. The default setting is *PR1*. The Printer 2 through Printer 4 logical printers are specified by parameters 522, 532, and 542 respectively.

Print Methods

Printing in the Macintosh environment is a bi-directional operation – the printer receives print jobs, and returns information about available fonts, available memory, and printing progress back to the Mac. The NPS print server can be configured for two different print methods – *Spooler Mode* and *Printer Mode*. Spooler mode, which is the default setting, is recommended for reasons described below.

Spooler Mode

Spooler mode, or background printing, means that print jobs are buffered for later printing. The spooler mode support is a unique feature of the NPS print server. Assuming that the attached printer is a standard LaserWriter printer, the NPS print server generates the appropriate printer responses and returns them to the Macintosh printer driver. This will greatly enhance printing speed (up to 30 times faster), since you can use Centronics interface instead of the 9600 baud serial interface required by other Apple network products.

In order to guarantee correct printouts, the NPS print server by default does not report any printer resident PostScript fonts. This means that all fonts are down-loaded with each print job, which can be time-consuming. If your printer contains the standard PostScript fonts of the Adobe 35N set (which is true for all US and European LaserWriters), you can avoid down-loading of these fonts by changing the following parameter:

- **504 PostScript Font Set (APPLETALK MENU)**
  This parameter specifies which PostScript fonts that should be reported as resident in the attached printer. The default setting is *DEFAULT*, meaning that no fonts are resident. You may change this to *35N* to avoid down-loading the standard PostScript fonts.

Printer Mode

Printer mode, or foreground printing, means that print jobs are sent immediately to the printer. The NPS print server transfers print jobs to the printer and reads back any information the printer may produce in response. This requires a serial printer, or a printer that accepts print data through the parallel interface and returns printer responses through the serial interface.

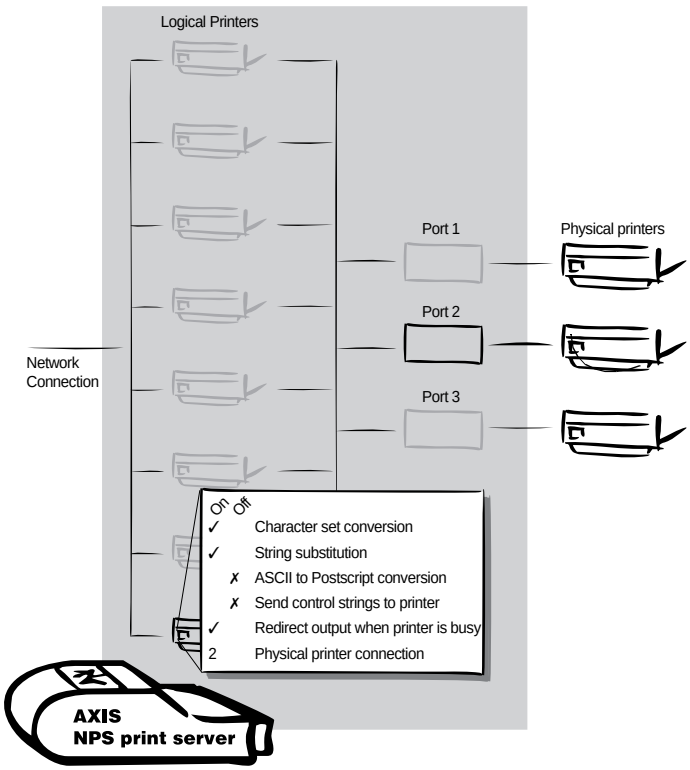
There is no explicit parameter to select printer mode – the mode is determined by the Read-Back Port parameter for each logical printer:

- **083 PR1 Read-Back Port (APPLETALK MENU)**
  This parameter specifies from which port PR1 printer read-back should be read. The default setting is *NONE*, meaning that bi-directional printing is disabled. The AppleTalk printer assigned to PR1 will operate in spooler mode. Changing to *COM1* configures the serial port as read-back data input, and the printer runs in printer mode.

SECTION 6

LOGICAL PRINTERS

One of the most powerful features of the NPS print server is the Logical Printer concept. A logical printer is an advanced device driver acting as an interface between the network and the physical printer. The NPS print server has eight logical printers, that together with the multiple protocol supports provides excellent printing flexibility. Several properties are individually configurable for each logical printer. The figure below illustrates the logical printer concept:



Logical Printers – schematic overview

Physical Printer Port

The parameters below control the physical printer ports.

- **080 PR1 Physical Printer Port (PRINTER1 MENU)**
  This parameter specifies which port logical printer PR1 is attached to. PR2 through PR8 ports are specified by parameters 100, 120, 140, 160, 180, 200, and 220 respectively. The default port assignments are shown in the table above.
- **020 LPT1 Centronics Interface Timing (OUTPUT MENU)**
  This parameter controls the transfer rate for the LPT1 port. The default setting is *STNDRD* (standard Centronics timing). If your printer supports high-speed communication, you may change to *FAST* or *HISPEED* for higher performance. The slower *IBM_PC* setting is intended for older printers that don't support the standard Centronics timing.
- **021 LPT1 Busy Status Time-Out (OUTPUT MENU)**
  This parameter specifies the waiting time before a printer busy status is reported for LPT1. The default time-out is 60 seconds.
- **029 reserved parameter**
- **030 reserved parameter**
- **031 reserved parameter**
- **032 reserved parameter**
- **033 reserved parameter**
- **034 reserved parameter**
- **040 reserved parameter**
- **041 reserved parameter**
- **049 reserved parameter**
- **050 reserved parameter**
- **051 reserved parameter**
- **052 reserved parameter**
- **053 reserved parameter**
- **054 reserved parameter**

Action at Printer Busy

If the printer attached to the addressed logical printer is busy when a print job arrives, a busy status is reported to the host after the amount of time specified by parameters 21.

The following parameters control the printer-busy action for each logical printer (only PR1 is shown here):

- **081 PR1 Secondary Printer (PRINTER1 MENU)**
  This parameter specifies a secondary logical printer for PR1. The default setting is *PR1* (no redirection).
- **082 PR1 Wait on Busy (PRINTER1 MENU)**
  This parameter specifies if a busy status should be returned to the host. The default setting is *YES* (no attempt to use the secondary printer is made). When set to *NO*, the printout is redirected to the logical printer specified by parameter 81. If this printer is busy as well, a busy status is returned to the host.

Example: The following entries in your *config* file will redirect PR1 print jobs to PR3 when the printer assigned to PR1 is busy:

```
080. PR1_OUT  : LPT1
081. PR1_SCND : PR3
082. PR1_WAIT : NO
120. PR3_OUT  : LPT2
```

Notes:

1. The secondary logical printer must be assigned to a different printer port than the primary logical printer.
2. Logical printer redirection cannot be nested. If the printer assigned to PR3 in the example above is also busy, the print job will be held waiting even if PR3 is further redirected.
3. The primary and secondary printers should have the same properties (Character Set Conversion, String Substitutions, etc.) to avoid corrupted printouts from the secondary printer.

Character Set Conversion

A common problem in a multiple host environment is that different hosts use different ASCII character sets. As a result, language specific characters (such as å ü ô ñ) are sometimes printed incorrectly.

The NPS print server solution to this problem is to invoke a character set conversion filter in a logical printer, and then assign this logical printer to the host causing the problem.

The character set conversion function is individually configurable for each logical printer:

- **088 PR1 Character Set Conversion (PRINTER1 MENU)**
  This parameter specifies a character set conversion filter for PR1. The default setting is *NONE* (no character set conversion). The selectable filters are shown in the table below. The PR2 through PR8 filters are specified by parameters 108, 128, 148, 168, 188, 208, and 228 respectively.

Conversion	Description
NONE	No conversion (true binary transfer). This is the default setting.
ISO>IBM	Convert ISO 8859-2 ASCII codes to IBM PC Set 2.
7UK>IBM	Convert 7-bit UK English ASCII codes to IBM PC Set 2.
7SW>IBM	Convert 7-bit Swedish ASCII codes to IBM PC Set 2.
7GE>IBM	Convert 7-bit German ASCII codes to IBM PC Set 2.
7FR>IBM	Convert 7-bit French ASCII codes to IBM PC Set 2.
7ND>IBM	Convert 7-bit Norwegian/Danish ASCII codes to IBM PC Set 2.
DEC>IBM	Convert 7-bit DEC ASCII codes to IBM PC Set 2.

Example: Your network contains three hosts using the character sets IBM PC Set 2, ISO 8859-2, and DEC. In order to direct their print jobs to the same printer, LPT1, you should assign each host to a separate logical printer, and install character set conversion filters. Edit the following entries in your *config* file:

```
080. PR1_OUT  : LPT1
088. PR1_CSET : NONE
100. PR2_OUT  : LPT1
108. PR2_CSET : ISO>IBM
120. PR3_OUT  : LPT1
128. PR3_CSET : DEC>IBM
```

The logical printer PR1 prints data transparently without conversion, PR2 converts ISO 8859-2 data to IBM PC Set 2, and PR3 converts DEC data to IBM PC Set 2. This will produce correct printouts for all language specific characters.

Using any of the character set conversion filters requires that your printer is set up for IBM PC Set 2. If this for some reason is impractical, there is an alternative method using *Strings Before and After Print Jobs*, see page 76.

Note: If none of the character set conversion filters match your requirements, you may the *String Substitution* function (see page 77) to translate specific characters.

Strings Before and After Print Jobs

These string functions are used to insert data (plain text or printer control commands) before and after each print job. The strings are specified individually for each logical printer:

- **085 PR1 String Before Print Job (PRINTER1 MENU)**
  This parameter specifies a sequence of data to be inserted before each PR1 print job. The default setting is <empty>. The PR2 through PR8 strings are specified by parameters 105, 125, 145, 165, 185, 205, and 225 respectively.
- **090 PR1 String After Print Job (PRINTER1 MENU)**
  This parameter specifies a sequence of data to be appended after each PR1 print job. The default setting is <empty>. The PR2 through PR8 strings are specified by parameters 110, 130, 150, 170, 190, 210, and 230 respectively.

Notes:

1. The strings must be entered as hexadecimal byte values.
2. The maximum length of each string is 255 bytes.
3. The string may continue onto multiple lines.
4. Spaces between the byte values are not required, but improve readability.

Example 1: Assume that the logical printer PR5 is configured as a PostScript printer. To append the PostScript End of File character (ctrl-D, hex 04) after each print job, edit the following entry in your *config* file:

```
170. PR5_AFT  : 04
```

Example 2: You have a laser printer with dual input bins, and want to print on pre-printed forms when using the logical printer PR4. The standard forms are taken from bin 1, and the pre-printed forms are taken from bin 2. The strings before and after print jobs should then contain commands to select bin 2 (**^{E}C&l4H**) and bin 1 (**^{E}C&l1H**) respectively. Edit the following entries in your *config* file:

```
145. PR4_BEF  : 1B 26 6C 34 48
150. PR4_AFT  : 1B 26 6C 31 48
```

Example 3: Your network hosts use the character sets PC-850 and ISO 8859-2, and your printer is set up for PC-850. You can not use the character set conversion filters since the filter output is always in PC Set 2. The solution is to direct the ISO 8859-2 print jobs to PR2, and use the PR2 before and after strings to switch character sets in the printer. Edit the following entries in your *config* file:

```
105. PR2_BEF  : 1B 28 32 4E
110. PR2_AFT  : 1B 28 31 32 55
```

These strings are PCL commands used by HP LaserJet printers. The first, **^{E}C(2N**, selects ISO 8859-2 before a PR2 print job, and the second, **^{E}C(12U**, restores the PC-850 character set after the print job.

Example 4: A common task is to replace the UNIX New Line (hex 0A) with an ASCII New Line (hex 0D 0A). The standard method is to use *String Substitutions* (see Example 1, next page), but this can sometimes cause problems when printing graphics. An alternative method is to make the printer take care of the UNIX New Line translation by sending a control command before the print job. For HP LaserJet printers, make the following changes to your *config* file:

```
105. PR2_BEF  : 1B 26 6B 32 47
110. PR2_AFT  : 1B 26 6B 30 47
```

These strings are PCL commands used by HP LaserJet printers. The first, **^{E}C&k2G**, makes the printer replace UNIX New Lines with ASCII New Lines, and the second, **^{E}C&k0G**, restores the standard New Line interpretation.

String Substitutions

The string substitution function performs search-and-replace operations on the print data. The primary application is to replace printer control commands. Up to 20 string substitutions may be specified individually for each logical printer:

- **086 PR1 String Substitutions (PRINTER1 MENU)**
  This parameter specifies a number of search-and-replace operations for the PR1 print data. The default setting is <empty> for PR1 through PR4, and UNIX New Line to ASCII New Line *(see Example 1 below)* for PR5 through PR8. The PR2 through PR8 strings are specified by parameters 106, 126, 146, 166, 186, 206, and 226 respectively.

Notes:

1. The strings must be entered as hexadecimal byte values.
2. Each search and replace sub string must be preceded by a count byte indicating the string length excluding the count byte.
3. Up to 20 search-and-replace sub string pairs may be specified for each logical printer.
4. The maximum length of each string is 255 bytes.
5. The string may continue onto multiple lines.
6. Spaces between the byte values are not required, but improve readability.

Example 1: To replace the UNIX New Line (hex 0A) with an ASCII NewLine (hex 0D 0A) for logical printer PR1, edit the following entry in your *config* file:

```
086. PR1_STR  : 01 0A 02 0D 0A
```

‘01’ is the match sub string count byte (length of the match string), ‘0A’ is the match sub string, ‘02’ is the substitute count byte, and ‘0D 0A’ is the substitute sub string. All occurrences of ‘0A’ in the print data will now be replaced by ‘0D 0A’. This is the default setting for logical printers PR5 through PR8.

String Substitutions may cause problems when printing graphics. If you experience corrupted graphics printouts when using the New Line replacement, use the method described in Example 4 on the previous page.

Example 2: To replace the UNIX New Line (hex 0A) with an ASCII NewLine (hex 0D 0A), and the printer command **^{E}CG1** (hex 1B 47 31) with **^{E}CY** (hex 1B 59) for logical printer PR2, edit the following entry in your *config* file:

```
106. PR2_STR  : 01 0A 02 0D 0A 03 1B 47 31 02 1B 59
                   ↑     ↑        ↑           ↑
```

The arrows above indicate the sub string count bytes.

Note: Extensive use of string substitutions may decrease the throughput rate of the NPS print server.

PostScript Functions

The NPS print server can translate standard ASCII print data into PostScript format. This makes it possible to print both ASCII and PostScript data on a PostScript printer without having to switch language in the printer. The PostScript functions are controlled by a number of parameters as described below.

ASCII to PostScript Conversion

This function is activated by invoking a filter that converts ASCII data into PostScript format. The filter can be configured individually for each logical printer:

- **089 PR1 Printer Language Translation (PRINTER1 MENU)**
  This parameter specifies printer language translation mode for PR1 print data. The PR2 through PR8 strings are specified by parameters 109, 129, 149, 169, 189, 209, and 229 respectively.

Conversion	Description
NONE	No conversion (true binary transfer). This is the default setting.
POSTSCR	Print data is always converted to PostScript format.
AUTO_PS	Non-PostScript data is converted, PostScript data remains unchanged.

The table below shows the recommended conversion settings for different print data formats and printer modes:

Print Data Format	Printer Mode	Conversion
ASCII	ASCII	NONE
PostScript	ASCII	Not applicable
Mixed	ASCII	Not applicable
ASCII	PostScript	POSTSCR
PostScript	PostScript	NONE
Mixed	PostScript	AUTO_PS
ASCII	Auto-Switching	NONE
PostScript	Auto-Switching	NONE
Mixed	Auto-Switching	NONE

Example: The following entries in your *config* file will activate pass-through (no filter) for PR1, ASCII to PostScript conversion for PR2. On PR3 the incoming data will be searched, ASCII data will be converted to PostScript, PostScript data will pass-through without conversion:

```
089. PR1_FILT : NONE
109. PR2_FILT : POSTSCR
129: PR3_FILT : AUTO_PS
```

Use this configuration when print jobs directed to PR1 are already in PostScript format, print jobs directed to PR2 are in ASCII format and direct print jobs to PR3 when you are not sure if it is ASCII or PostScript format.

PostScript Page Size

When the ASCII to PostScript filter is invoked, the PostScript page size is specified by a parameter. The page size may be set individually for each logical printer:

- **095 PR1 PostScript Page Size (PRINTER1 MENU)**
  This parameter specifies the PostScript page size for PR1 print data. The PR2 through PR8 page sizes are specified by parameters 115, 135, 155, 175, 195, 215, and 235 respectively.

Page Size	Description
A4	A4 size paper (European), 210 × 297 mm. This is the default setting.
LETTER	Letter size paper (US), 8.5 × 11 inches.
LEGAL	Legal size paper (US), 8.5 × 14 inches.
EXECUT	Executive size paper (US), 7.25 × 10.5 inches.

Note: This parameter has no function when the ASCII to PostScript Conversion is set to NONE.

PostScript Page Orientation

When the ASCII to PostScript filter is invoked, the PostScript page orientation is specified by a parameter. The page orientation may be set individually for each logical printer:

- **096 PR1 PostScript Page Orientation (PRINTER1 MENU)**
  This parameter specifies the PostScript page orientation for PR1 print data. The PR2 through PR8 page orientations are specified by parameters 116, 136, 156, 176, 196, 216, and 236 respectively.

Orientation	Description
PORTR	Portrait orientation. This is the default setting.
LANDS	Landscape orientation (rotated 90°).
R_PORTR	Reverse portrait orientation (rotated 180°).
R_LANDS	Reverse landscape orientation (rotated 270°).

Note: This parameter has no function when the ASCII to PostScript Conversion is set to NONE.

PostScript Page Format

When the ASCII to PostScript filter is invoked, the PostScript page format is specified by a parameter. The page format may be set individually for each logical printer:

- **097 PR1 PostScript Page Format (PRINTER1 MENU)**
  This parameter specifies the PostScript page format (maximum page length, maximum print position, characters per inch, lines per inch, left margin, and top margin) for PR1 print data. The PR2 through PR8 page orientations are specified by parameters 117, 137, 157, 177, 197, 217, and 237 respectively.

See *The Parameter List*, page 132 for a detailed description of this parameter.

Note: This parameter affects the page length in hex dump mode (see below), otherwise it has no function when the ASCII to PostScript Conversion is set to NONE.

PostScript Font

You may specify a PostScript font to be used when the ASCII to PostScript filter is active. The specified font must be available in the attached PostScript printer. An invalid font name may cause a PostScript error and terminate the printout.

- **098 PR1 PostScript Font (PRINTER1 MENU)**
  This parameter specifies the PostScript font for PR1 print data. The PR2 through PR8 PostScript fonts are specified by parameters 118, 138, 158, 178, 198, 218, and 238 respectively.

If no font name is specified, Courier (fixed pitch) will be used.

Note: This parameter has no function when the ASCII to PostScript Conversion is set to NONE.

Example: The following entry in your *config* file will select the Helvetica proportional font as the PR2 PostScript font:

```
118. PR2_FONT : Helvetica
```

Hex Dump Mode

When hex dump mode is activated, the print data will be printed as hexadecimal byte values rather than characters. Printer control commands are also printed as byte values, and have therefore no effect on the printer. This function is used for debugging corrupted or missing printouts, see also *Solving Problems*, page 95. The hex dump mode is invoked individually for each logical printer:

- **092 PR1 Hex Dump Mode (PRINTER1 MENU)**
  This parameter specifies whether or not PR1 print data should be printed as hexadecimal byte values. The default setting is NO. The PR2 through PR8 PostScript fonts are specified by parameters 118, 138, 158, 178, 198, 218, and 238 respectively.

Note: The page length for hex dump printouts is determined by the *Maximum Page Length* setting of the *PostScript Page Format* parameter, i.e. parameter 089 sets the page length for PR1 hex dumps, etc.

Below is a short example of a hex dump printout:

```
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00000  23 21 2F 62 69 6E 2F 73 68 0D 0A 65 63  #!/bin/sh--#--ec
00010  68 6F 20 2D 6E 20 07 0D 0A              ho -n ------
```

SECTION 7

FTP AND TELNET

This section describes how to log in to the NPS print server, the file system, and how to print interactively using FTP. The NPS print server appears as a host with its own file system on your network. To log in, enter the command **ftp <hostname>** or **telnet <hostname>** (the hostname is assumed to be *salesdept* in this section).

In the following sections, examples of print configurations are provided. These print configurations may not match as the actual print configuration page may have been updated since this manual was published.

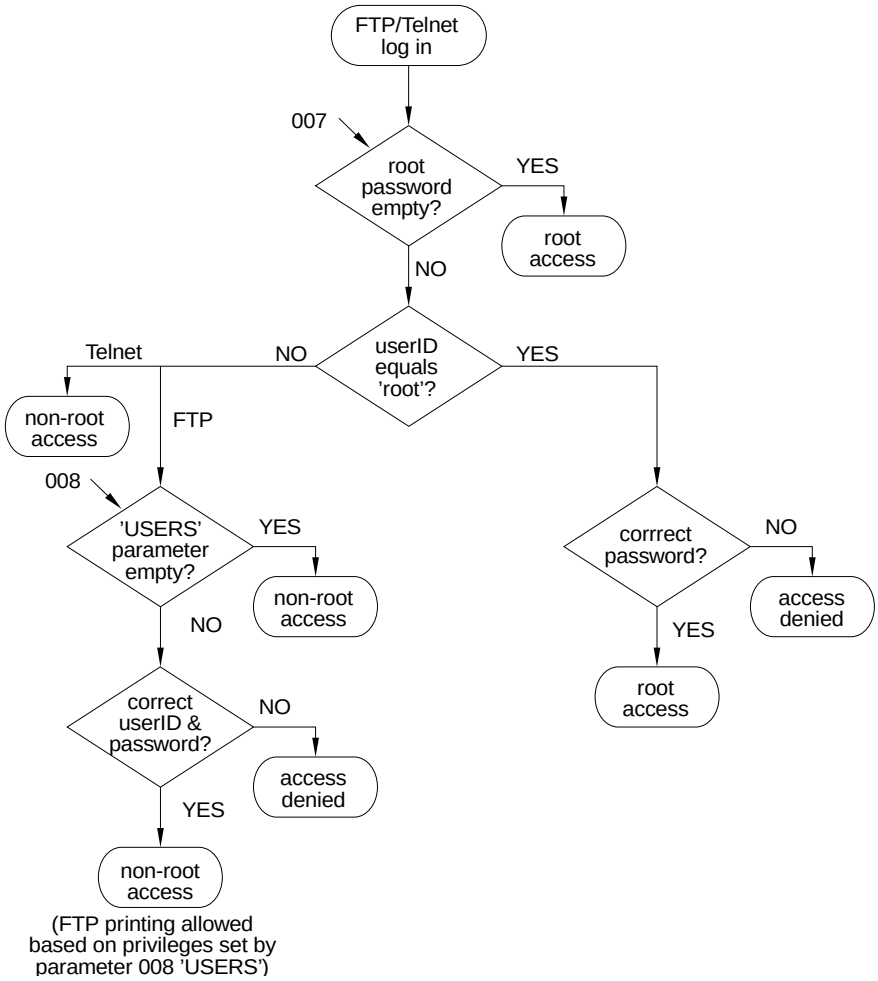
Access Control

When you log in to the NPS print server, you will be prompted for a *user ID* and a *password*.

You must log in as *root* to have full access to the file system (all users may up-load files, but only root is allowed to edit the parameter list).

The flow chart on the next page shows the log-in procedure. The following notes explain the different options in more detail:

- If the *Root Password* (parameter 007) is empty, all users will have root privileges and the password prompt is bypassed.
- If you log in as *root*, you will be prompted for the root password. If the password is correct (according to parameter 007) you will get root privileges, otherwise access is denied.
- If you log in using Telnet as any other user, you will get restricted (non-root) access, see *Telnet Log-In*, page 87. In the case of FTP, access depends on parameter 008 *User Authority and Printer Access*. If this parameter is empty, you will get restricted (non-root) access as described in *FTP Log-In*, page 84.
- If parameter 008 contains authority properties (see *The Parameter List*, page 113 for a description on this parameter), an authority check is made. If your user ID and password is valid, you will get restricted (non-root) access as described in the *FTP Log-In* section below, otherwise access is denied.



NPS Print Server Access Control

FTP Log-In

Use the command **ftp salesdept** to log in to the NPS print server (assuming that *salesdept* is the host name for your NPS print server). Below is a sample NPS FTP session that demonstrates how to print the *read.me* file:

```
> ftp salesdept
Connected to salesdept.
220 NPS FTP Printer Server V4.20 Jul 25 1994 ready.
Userid for logging in on salesdept (matsl)? root
331 User name ok, need password
Password for logging is as root on salesdept? pass    (not vis-
ible)
230 User logged in
ftp:salesdept> get read.me
local file (default read.me):
Transferred 37241 bytes in 7 seconds (42561 bits/sec, 5320
bytes/sec)
226 Transfer complete.
ftp:salesdept> put read.me pr1
Transferred 37255 bytes in 1 seconds (298040 bits/sec, 37255
bytes/sec)
226 Transfer complete.
ftp:salesdept> bye
>
```

FTP Commands

The following commands are available under FTP (this file can be viewed by **remotehelp**, and you can also up-load it to your workstation by **get help**):

```
 NPS FTP Printer Server. The following commands are supported.
  remotehelp      print this list
  ls              directory list
  dir             directory list, full format
  cd  <path>      change directory to <path>
  pwd             print working directory
  get config      get parameter file from NPS
  get defaults    get default parameter list for NPS
  get reset       reset NPS as soon as no connection open
  get hardreset   reset NPS immediately
  get status      get printer status file from NPS
  get account     get account file from NPS
  get <file>      get <file> from NPS
  put config      transfer parameter file to NPS
  put CONFIG      transfer parameter file to NPS , store per-
manently
  put <file> prx  printout of <file> on logical printer x,
x=1..8
  open            open ftp connection to NPS
  user            log in on NPS
  close           close ftp connection to NPS
  quit            as close, then exit ftp
```

The File System

Below is an extract from the NPS print server file system:

account	The accounting file, see page 88.
aix/	A directory containing files used in the integration process for IBM AIX systems, see page 61.
ftp_piobe	The back-end program for FTP printing.
makefile	The makefile for creating the PROS driver.
pros_piobe	The back-end program for PROS printing.
prosaix.c	The source code for the PROS driver.
axinstall	The automatic integration script, see page 43.
bsd/	A directory containing files used in the integration process for BSD-type UNIX systems, see page 44.
ftp_bsd	An output filter template for FTP printing.
makepros	The makefile for creating the PROS B driver.
printcap.ftp	A printcap entry template for FTP printing.
printcap.lpd	A printcap entry template for LPD printing.
printcap.pro	A printcap entry template for PROS printing.
prosbsd.c	The source code for the PROS B driver.
com1	Reserved file.
config	The parameter list containing the current configuration. See page 92 on how to edit this file.
defaults	A parameter list file containing the factory default settings for all parameters except the Internet address.
help	A text file with help on FTP commands, see page 84.
mvs/	A directory containing files used in the integration process for IBM MVS systems, see page 69.
jcl_ex	A sample JCL script for FTP printing.
npipe/	A directory containing files used for creating a PROS daemon, see page 50 (BSD) and page 58 (System V).
makefile	The makefile for creating the PROS daemon.
prosd.c	The source code for the PROS daemon.
pctcp/	A directory containing files used for printing from MS-DOS systems, see page 69.
pc_tcp.cfg	A PC/TCP configuration file template.
prX (X = 1..8)	*pr1 through pr8* are logical printer output devices (write-only) used for interactive FTP printing. The example on page 84 shows how to print the *read.me* file to a logical printer device (pr1) using the *put* command.
read.me	*read.me* is a text file containing guidelines on manual integration as well as last-minute information not covered by this manual.
snmp/	A directory containing SNMP related files, see page 91.
axis.mib	The MIB. See Section 8: Network Management for more information.
status	*status* is the status file, also described later in this section.

sysv/	A directory containing files used in the integration process for System V UNIX systems, see page 54.
ftp_sysv	An interface program template for FTP printing.
makepros	The makefile for creating the PROS B driver.
prossysv.c	The source code for the PROS B driver.
vi.doc	A quick guide to the *vi* editor.

Access Privileges

You can always read and up-load files from the NPS print server regardless of your user privileges. There are two areas that require special privileges:

Editing the parameter list

Editing the parameter list involves down-loading of a modified *config* file, and this requires *root* privileges. If you try to down-load the *config* file as non-root, the command will be ignored and the messages ‘transfer failed’ and ‘NPS Not logged in for put of config’ will be displayed.

Interactive printing

The printer access privileges as non-root user is determined by parameter 008 *User Authority and Printer Access*. When this parameter is empty, all users have unrestricted printer access. If parameter 008 contains authority properties, no other users than the ones specified will have printing privileges. (An authority properties’ entry consists of a user id, password, and an access code specifying which logical printers the user may access. See *The Parameter List*, page 113 for further details).

Telnet Log-In

Use the command **telnet salesdept** to log in to the NPS print server (assuming that *salesdept* is the host name for your NPS print server). Below is a sample Telnet session that demonstrates the *help* command:

```
> telnet salesdept
Trying 192.36.253.96 ...
Connected to salesdept.
Escape character is '^]'.

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NPS network login: root
Password:  pass    (not visible)

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Root> help
Commands may be abbreviated:
logout       logout from TELNET
version      print current software version
help         print this list
status       show current printing status
account      show current account file
reset        master reset of NPS
hardreset    forced master reset of NPS
defaults     set default parameters in NPS
Root> logout
Goodbye!
Connection closed by foreign host.
>
```

Access Privileges

If you log in as non-root, you will only have access to the *status* and *account* files. It is not possible to reset the NPS print server or set factory defaults. These restrictions are reflected by the help command:

```
Telnet> help
Commands may be abbreviated:
logout       logout from TELNET
version      print current software version
help         print this list
status       show current printing status
account      show current account file
Telnet> logout
```

Note that the prompt is *Telnet>* instead of *Root>* for non-root users.

Accounting

The accounting file contents data concerning the ten last print jobs. It specifies an internal job number, the user that initiated the job, the protocol and logical printer that was used, current status (Completed, Offline, or Printing), number of bytes printed, elapsed time and off-line time. The accounting file can be accessed by TCP/IP using FTP or Telnet, and by Novell NetWare using AXCFG.

To read the *account* file using FTP, up-load the file to your workstation by the command **get account** (see *FTP Commands*, page 84). You can then view the file using a text editor.

If you don't need a local copy of the accounting file, a quicker way of viewing the account information is the Telnet **account** command shown below:

```
> telnet salesdept
Trying 192.36.253.96 ...
Connected to salesdept.
Escape character is '^]'.

NPS TELNET Printer Server V4.20 Jul 25 1994

NPS network login: root
Password:  pass    (not visible)

NPS TELNET Printer Server V4.20 Jul 25 1994

Root> account
Current account file:
JOB       USER    PROT     LPR  S   BYTES    ETIME   OTIME

 1        thomas  FTP      pr2  C   1885     2       0
 2        bengt   LPD      pr1  C   23074    4       0
 3        RICARD  NETWARE  pr2  C   43004    5       0
 4        MacUser APPLE    pr1  C   6717     2       0
 5        thomas FTP pr2 C   36955    3       0
 6        patrik  PROS     pr5  P   832081   9       0
Root>
```

- *JOB* is the job number; the last ten print jobs are listed.
- *USER* is the user ID that initiated the print job.
- *PROT* is the protocol used for the print job.
- *LPR* is the logical printer used for the print job
- *S* is the status of the print job (Completed, Off-line, or Printing).
- *BYTES* is the number of bytes printed.
- *ETIME* and *OTIME* is the elapsed time and off-line time for the print job.

Finally, the accounting file can also be viewed (and optionally saved and printed) using

AXCFG under Novell NetWare. Refer *Parameter Editing*, page 91 for a description of AXCFG.

Status Logging

The *status* file shows which printer port the logical printers are assigned to, and their current status. It can be accessed by TCP/IP using FTP or Telnet, and by Novell NetWare using AXCFG.

To read the *status* file using FTP, up-load the file to your workstation by the command **get status** (see *FTP Commands*, page 84). You can then view the file using a text editor.

If you don't need a local copy of the status file, a quicker way of viewing the status information is the Telnet **status** command shown below:

```
> telnet salesdept
Trying 192.36.253.96 ...
Connected to salesdept.
Escape character is '^]'.

NPS TELNET Printer Server V4.20 Jul 25 1994

NPS network login: root
Password:  pass    (not visible)

NPS TELNET Printer Server V4.20 Jul 25 1994

Root> status
Current printout status:
Printer    Port    Status      Bytes printed      Comments
pr1        LPT1    Occupied                       Ready
pr2        LPT2    Available                    Busy      Out
of paper
pr3        COM1    Available                      Busy
pr4        COM1    Available                      Busy
pr5        LPT1    Printing    20916              Ready
pr6        LPT2    Available                    Busy      Out
of paper
pr7        COM1    Available                      Busy
pr8        COM1    Available                      Busy

Root>
```

- *Printer* is the logical printer number (pr1 - pr8).
- *Port* is the printer port assigned to the logical printer. The port is LPT1.
- *Status* reflects the printer port status for each logical printer. *Available* means that the port is ready to receive a print job, *Printing* means that the port is currently in use, and *Occupied* means that the port is currently used by one of the other logical printers.
- *Bytes printed* shows the number of bytes sent to the printer.

- *Comments* reflect the current printer status of the logical printer. *Ready* means that the printer is ready to receive print data, and *Busy* means that the printer is out of paper, off-line, or not connected. The out of paper and off-line conditions are shown in the comments field, see example above. Note that out of paper is the normal condition for a parallel port such as LPT1 when it has no printer connected to it.

Finally, the status file can also be viewed (and optionally saved and printed) using AXCFG under Novell NetWare. Refer to *Parameter Editing*, page 91 for a description of AXCFG.

Note: The 'Bytes printed' number may differ between the status and accounting files. The accounting file reflects the number of bytes received from the network (before any filters have been invoked), and the status file shows the number of bytes sent to the printer.

SECTION 8

PARAMETER EDITING

The parameter list is stored in a file called *config* in the NPS print server. Editing the parameter list involves three steps: up-load the *config* file to your workstation, edit it using any text editor, and down-load it to the NPS print server. You may want to save a copy of the config file as backup, or to use when configuring additional NPS print servers later on.

The process of up-loading and down-loading the *config* file depends on the operating environment. Under TCP/IP, you log in to the NPS print server and use the *get config* and *put config* commands. For Novell NetWare and LAN Server/LAN Manager, we supply the AXCFG Configuration Utility that makes the transferring and editing extremely easy.

The parameters supported in this product are listed in the Network Print Server Administrator's Guides. Please refer to your Administrator's Guide for a description of the parameters.

Novell Netware

On the disk supplied with your NPS print server you will find the AXCFG Configuration Utility, which is a menu-driven package that performs the loading and editing tasks for you. It comes in both DOS and Windows versions, and contains extensive on-line help to guide you in the way. Together with the Novell PCONSOLE program, it provides an excellent tool for tailoring your NetWare printing environment.

Follow the instructions in the *read.me* file, which is also found on the supplied disk, to install AXCFG.

LAN Server/LAN Manager

On the disk supplied with your NPS print server you will find the AXCFG Configuration Utility, which is a menu-driven package that performs the loading and editing tasks for you. It comes in both DOS and Windows versions, and contains extensive on-line help to guide you in the way. Together with the supplied NPS Manager software, it provides an excellent tool for tailoring your LAN Server/LAN Manager printing environment.

Follow the instructions in the *read.me* file, which is also found on the supplied disk, to install AXCFG.

TCP/IP

The parameter list is stored in the file *config* located in the root directory of the NPS print server. Modifying the parameter list comprises the steps of up-loading, editing, and down-loading/saving the *config* file. Follow the instructions below:

1. Log in to the NPS print server by the command **ftp salesdept**. Enter **root** at the *user id* prompt as **pass** at the *password* prompt.
2. Up-load the parameter list by the command **get config**.

   Optionally print the parameter list by the command **put config pr1**.

   Optionally up-load the *vi* editor shortform by **get vi.doc**.
3. Log out from the NPS print server using the command **bye**, **quit** or **exit** depending on your FTP version.
4. Edit the parameter list using a text editor, e.g. **vi config**.
5. Log in again according to step 1.
6. Down-load the parameter list and save it permanently by the command **put config CONFIG**. The second argument (*CONFIG*) must be entered as capitals in order to save settings permanently.
7. Restart the NPS print server by the command **get hardreset**.
8. Log out from the NPS print server.

Notes:

1. The command *get config* creates a local copy of the parameter list in your current directory. If you want to create a copy at a different location use the command **get config /usr/mydir/myfile**.
2. The command *put config CONFIG* down-loads the local copy named *config* from your current directory. If you want to down-load the copy in */usr/mydir/myfile*, use the command **put /usr/mydir/myfile CONFIG**.

This is an extract from the *config* file, showing the beginning of the parameter list:

```
NPS Printer Server V4.20 Jul 25 1994

Parameter settings:

---  CONFIG MENU
001. INT_ADDR : 192 36 253 80
002. ETH_ADDR : 00 40 8C 01 05 70
003. DEF_ROUT : 0 0 0 0
004. NET_MASK : 0 0 0 0
007. ROOT_PWD : pass
008. USERS    :
010. PROS_PWD : netprinter
011. PROS_PRT : 35
013. TFTP_ENB : NO
016. TN_PORT  : 23
018. RTN_OPT  : YES
```

Each line beginning with a three-digit number immediately followed by a period is

interpreted as a *parameter entry.* All other lines are considered as comments, which are ignored by the NPS print server.

Parameter entry syntax:

<nnn>. <name> : <value>

- *nnn* is the three-digit parameter number. It must be immediately followed by a period (.).
- *name* is the parameter name abbreviation (e.g. INT_ADDR). It is ignored by the NPS print server.
- *value* is the parameter value; either of numerical, enumerated, boolean, hexadecimal string, or text string type. It must be preceded by a colon (:). Refer to Section 10 for the syntax of the individual parameters.

Syntax control:

The parameter list syntax check of the NPS print server is fairly limited – type mismatches (such as setting the internet address to YES) will be detected, but no validity or range check is performed on the parameter values.

If a syntax error is detected during the down-load operation, the following error message will be displayed:

```
Illegal configuration received, in parameter nnn
```

When this happens, all parameters preceding the faulty parameter entry will be updated, and the rest of the parameter entries (including the faulty) will be ignored.

Programming Hints

It is not necessary to down-load the complete parameter list. You can create customized files for different purposes, where each file contains only the parameters needed for a specific task.

Example:

You have a number of already configured print servers on your network, and want to change to letter page size without changing any other parameters.

Create a file letter containing the following lines:

```
File: letter
 Change page size to LETTER for PR1 - PR3

 095. PR1_SIZE : LETTER
 115. PR2_SIZE : LETTER
 135. PR3_SIZE : LETTER
```

Log in to each NPS print server and down-load the file by the command **put letter CONFIG**. This will update the page size for PR1, PR2 and PR3 without affecting any other parameter settings.

If you have a large number of print servers installed, you may want to automatize the process. This is done by creating a script that performs the following tasks:

1. Get the first host name from your system host table (*/etc/hosts*).
2. Log in to the host
3. Find out whether it is an NPS print server. If not, skip to step 5.
4. Down-load the file *letter.*
5. Log out.
6. Get the next host name from the system host table. If there are no more entries, exit the script.
7. Loop to step 2.

Factory Defaults

There are two ways of restoring the NPS print server to factory default settings: the Telnet *defaults* command, and the FTP file transfer method.

To use the Telnet *defaults* command, follow these steps:

1. Log in the NPS print server by the command **telnet salesdept**. Enter **root** at the *user id* prompt and **pass** at the *password* prompt.
2. Restore the parameters by the command **defaults**.
3. Restart *salesdept* by the command **hardreset** (this will also close the Telnet session).

To use the FTP file transfer method, follow these steps:

1. Log in the NPSprint server by the command **ftp salesdept**. Enter **root** at the *user id* prompt as **pass** at the *password* prompt.
2. Up-load the default parameter list by the command **get defaults**.
3. Down-load the parameter list and save it permanently by the command **put defaults CONFIG**.
4. Restart *salesdept* by the command **get hardreset** (this will also close the FTP session).

SECTION 9

SOLVING PROBLEMS

This section, which also appears in the *Administrator's Guide*, contains guidelines to help you to solve problems that might arise when installing and using your NPS print server. There are two major areas of difficulty:

- **Printer communication**
- **Network communication**

Use the check lists provided under each section to pinpoint the fault. If your problems should continue, please contact your IBM service representative. (Before doing so, please see *Reporting Problems*, page 99).

Before continuing with the communications trouble-shooting you should make sure that your NPS print server functions properly:

- The POWER indicator should be lit. Make sure that the power adaptor is properly connected and functional.
- The PACKET (Ethernet) or NETWORK (Token-ring) indicator is used for power-up self test flashing (lasting as long as 30 seconds). This indicator should stop flashing after the power-up self test, only occasionally flashing afterward as an indicator of network traffic. If the PACKET/NETWORK indicator continues to flash, an internal error has occurred (see *Error Messages*, page 99). Contact your IBM service representative. (Before doing so, please see *Reporting Problems*, page 99).
- The PACKET/NETWORK indicator should flash occasionally, reflecting the network traffic. Make sure that the NPS print server is properly connected to the network.

  Token-ring: Make sure that the RING SPEED switch (4/16 Mbit/s) is set in the correct position.

Printer Communication

Printer communication problems can result in either missing or corrupted printouts.

Missing Printouts

If you don't get any printouts, you should start with verifying the printer communication by printing the NPS print server test page. Press the TEST button on the NPS print server front panel until the PACKET/NETWORK indicator starts to flash. If no printout appears, check the following:

- Make sure that the printer is properly connected.
- Make sure that the printer is on-line (ready).

For PostScript printers:

- Sending ASCII data to a PostScript data may result in lost print jobs. You can use the ASCII-to-PostScript filter to convert your print data, see *ASCII to PostScript Conversion*, page 78. Note that the test page prints correctly on both ASCII and PostScript printers.

For parallel printers:

- The Centronics Interface Timing (parameters 020 or 040) may be set to a value not supported by your printer. Change to a slower mode and restart the NPS print server, then print the test page again.

If the test page prints correctly and you still don't get any network printouts, continue trouble-shooting with *Network Communication* below.

Corrupted Printouts

There are four major types of corrupted printouts:

- **PostScript data is printed:** You cannot print PostScript jobs on a ASCII printer using the NPS print server. Make your host application print in ASCII format, or use your PostScript printer.
- **Characters are missing or garbled:** The Centronics Interface Timing (parameters 020 or 040) may be set to a value not supported by your printer. Change to a slower mode and restart the NPS print server, then print the test page again.
- **'Staircase' printouts:** (the second line starts at the end of the first line rather than at the left margin) A UNIX New Line is interpreted as a Line Feed by ASCII printers. You can substitute UNIX New Lines with ASCII New Lines as described in Section 6 (this is default for logical printers PR5 - PR8).
- **Language-specific characters are printed incorrectly:** This happens when host uses a different character set than your printer. You can cure this by using a character set conversion filter as described on page 75.

Network Communication

The network communication trouble-shooting procedures depend on the network environment:

Novell NetWare

If Novell NetWare printing fails, check the following:

- Make sure that the NPS print server and the print queue are defined on the file server, that they are linked together, and that the NPS print server is attached to the file sever. Use PCONSOLE to verify this. Refer to the Novell NetWare section of your *Administrator's Guide* for details.
- Make sure that the NPS print server parameters concerning NetWare have the correct settings.
- If you have more than one printer connected to the NPS print server, make sure that the printer names end with !1, !2, etc.
- If your network contains sections using different frame types, you might have to disable the support for one or more of these types. See *Theory of Operation: The Frame Handler*, page 26
- Use the AXCFG Diagnose option to get further information about possible error causes.

LAN Server/ LAN Manager

If LAN Server/LAN Manager printing fails, check the following:

- Make sure that there is communication between the NPS print server and NPS Manager. NetBIOS must be activated, and the Requester service must be running.
- Make sure that the NPS print server ports appear in the NPS Manager list. Use the NPS Manager *Install* option to install the NPS print server.
- Make sure that NPS print server parameters concerning LAN Server/LAN Manager have the correct settings.
- Check the NPS Manager *Logfile*.

TCP/IP

If TCP/IP printing fails, start with verifying the communication by the **ping <unit>** or **telnet <unit>** command, where <*unit*> is the NPS print server Internet address or the alias specified in your host table. If you don't get a positive response from *ping*, or if the *Telnet* log in fails, check the following:

- Make sure that you have specified a unique NPS print server Internet address. See the TCP/IP section of your *Administrator's Guide* and *Network Printing: TCP/IP*, page 43, or consult your network manager. Note that down-loading the *config* file from another NPS print server changes the Internet address.
- If you are using an alias instead of the Internet address, make sure that your host table (*/etc/hosts*) and Yellow Pages (YP/NIS) are updated.
- If your network has routers, make sure that the NPS print server attached to the correct network segment, and that the *Default Router Address* (003) and *Net Mask* (004) parameters are set to proper values.

When communication is established, and printing in integrated mode still doesn't work, the next thing to do is try interactive printing using FTP. Log in to the NPS print server using FTP, and print a file by the **put <file> pr1** command. If this works, the NPS print server might not be properly integrated to the spooler. Verify the integration for your selected print method, see the *Network Printing: TCP/IP* section, page 43.

Apple EtherTalk

Because of the simple and straight-forward installation in the Apple EtherTalk environment, it is less likely that printing problems occur on the protocol level. There are however some application related areas that can cause problems:

- Enabling binary transfer mode (parameter 505) can cause problems in the following cases:
  - Your printer does not support binary mode.
  - Some non-Apple laser printers don't recognize the binary mode query from LaserWriter 8.
- Selecting a specific printer type in your application may cause problems since the NPS print server isn't aware of your printer's capabilities. Change to *Generic Printer* in your application to work around this (this applies to printing in spooler mode only, see *Network Printing: Apple EtherTalk*, page 70).

Reporting Problems

If you run into problems that you can't solve on your own, please make sure you read the *Customer Support* letter that was included with this product. If you need to contact your IBM service representative or Authorized IBM Reseller, please make sure the following information is available:

- The model and software revision of your NPS print server
- The type of network attachment you are using
- The operating environment (Novell NetWare, LAN Server/LAN Manager, TCP/IP or Apple EtherTalk)
- A printout of the parameter list (the *config* file)
- A detailed description of the problem
- A description of your network topology (preferably a diagram) including all relevant components such as network segments, routers, bridges, etc.

Additional information for Novell NetWare (when applicable):

- The PCONSOLE version
- The NetWare version
- A printout from AXCFG *Status* and *Account*
- The print method (CAPTURE, NPRINT) including all parameters

Additional information for LAN Server/LAN Manager (when applicable):

- The OS/2 version
- The LAN Server/LAN Manager version
- The printer driver and print method
- A printout from AXCFG *Diagnostics*, *Status* and *Account*
- A printout from the NPS Manager log file (NPSMAN.LOG)

Additional information for TCP/IP (when applicable):

- The host type/types, operating systems, and applications
- The print method (LPD, FTP, PROS, Reverse Telnet, etc.)

Additional information for Apple EtherTalk (when applicable):

- The printer driver type and version
- The print method (spooler mode, printer mode)
- The applications you are trying to print from

Error Messages

If the PACKET/NETWORK indicator continues to flash after the power-up self test, an internal error has occurred (with one exception, see below).

- Restart the NPS print server. If the problem doesn't appear again, the parameter list has been updated according to the default settings of your new software revision.
- If problem appears again after restarting, an error has occurred. Contact your IBM service representative.

Token-ring: If the NETWORK indicator continues to flash rapidly after the self test, an incorrect ring speed setting has been detected. Change the RING SPEED switch position and restart the print server.

Printed Messages

Error messages will be printed on the test page. See *INTERNAL PRINTOUTS*, page 101 on how to print the test page and a list of possible error messages.

APPENDIX A

INTERNAL PRINTOUTS

There are three different internal printouts that can be printed using the TEST button on the NPS front panel:

The Test Page

The test page (samples shown on the following pages) shows the software revision and the basic configuration of the NPS print server.

To print the test page, press the TEST button until the PACKET/NETWORK indicator starts to flash, then release the button.

The Parameter List

The parameter list (or the *config* file) shows the complete NPS print server configuration. See your *Administrator's Guide* for a list of parameters.

To print the parameter list, press the TEST button until the PACKET/NETWORK indicator starts to flash, release the button, and press it once.

The* read.me *File

The *read.me* file contains detailed instructions about how to integrate the NPS print server for different TCP/IP environments and print methods. It may contain last-minute information not covered by this manual, so you should always read this file before starting the integration (see also *Network Printing: TCP/IP*, page 43 and forward).

To print the *read.me* file, press the TEST button until the PACKET/NETWORK indicator starts to flash, release the button, and press it twice.

Note: If parameter 062, *Lock Test Button* is set to YES, only the test page can be printed using the test button. The parameter list and the *read.me* file are still available through FTP file transfer, see *FTP Log-In*, page 84, or the AXCFG *advanced functions* menu.

In the following sections, examples of print configurations are provided. These print configurations may not match this manual as those items may have been updated since this manual was published. Your actual printed page should look similar to these examples.

```
********************************************************************************
** NPS Printer Server V4.20 Jul 25 1994 S/N: 00408C100086        **
**                                                                            **
** THIS IS THE TEST PAGE                                                      **
**                                                                            **
** TCP/IP: enabled                                                            **
** Ethernet address  Internet address Default router  Net mask                **
** 00:40:8c:10:00:86 192.36.253.80    <automatic router sensing>              **
**                                                                            **
** NetWare: enabled                                                           **
** Print server name                                                          **
** AXIS100086                                                                 **
**                                                                            **
** LAN Server/LAN Manager: enabled                                            **
**  Printer name: AX100086.LP1      Port: LPT1                                **
**                AX100086.LP2            LPT2                                **
**                AX100086.CM1            COM1                                **
**                                                                            **
** Apple EtherTalk: enabled                                                   **
** Printer name              Printer type           Port  Mode                **
** AXIS100086_LPT1           LaserWriter            LPT1  Spooler             **
** AXIS100086_LPT2           LaserWriter            LPT2  Spooler             **
** AXIS100086_COM1           LaserWriter            COM1  Spooler             **
**                                                                            **
**                                                                            **
** Ripple test:                                                               **
**                                                                            **
**  !"#$%&´()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abc **
** $%&´()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefg **
** ()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijk **
** ,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno **
** 0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs **
** 456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvw **
** 89:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{ **
** <=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~  **
**                                                                            **
**                                                                            **
** For more information, use the TEST button:                                 **
** First press the TEST button until STATUS starts flashing,                  **
** release the button, then press once to print the parameter                 **
** list or twice to print the read.me file.                                   **
**                                                                            **
** For assistance, contact your local dealer/distributor.                     **
                                                                          ** **
**                                                                            **
********************************************************************************
END OF TEST PAGE
```

Example of the NPS Ethernet Test Page

```
**************************************************************************
** NPS Printer Server V4.20 Jul 25 1994 S/N: 000231C80061      **
**                                                                      **
** THIS IS THE TEST PAGE                                                **
**                                                                      **
** Token-Ring speed 16 Mbit/s, Inserted.  Accumulated err.counters:     **
** Line:    0           Internal: 0           Burst:      0             **
** A/C:     0           Abort:    0           Bcn xmits:  0             **
** Lost fr: 0           Rec con:  0           Fr copied:  0             **
** Freq:    0           Token:    0           Recoveries: 0             **
** Ring status: ok                                                      **
**                                                                      **
** TCP/IP: enabled                                                      **
**  Node address      Internet address Default router  Net mask         **
**  00:02:31:48:00:61 192.36.253.80    <automatic router sensing>       **
**                                                                      **
** NetWare: enabled                                                     **
**  Print server name: AXIS80061                                       **
**                                                                      **
** LAN Server/LAN Manager: enabled                                      **
**  Printer name: AX480061.LP1      Port: LPT1                          **
**                AX480061.LP2            LPT2                          **
**                AX480061.CM1            COM1                          **
**                                                                      **
**                                                                      **
** Ripple test:                                                         **
**                                                                      **
**  !"#$%&´()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abc **
** ()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijk **
** 0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs **
** 89:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{ **
**                                                                      **
**                                                                      **
** For more information, use the TEST button:                           **
** First press the TEST button until STATUS starts flashing,            **
** release the button, then press once to print the parameter           **
** list or twice to print the READ.ME file.                             **
**                                                                      **
** For assistance, contact your local dealer/distributor.               **
                                                                      ** **
**                                                                      **
**************************************************************************
END OF TEST PAGE
```

Example of the NPS Token-Ring Test Page

Error Messages

If the power-up self test fails, an error message is printed immediately below the "THIS IS THE TEST PAGE" header.

Example:

```
** THIS IS THE TEST PAGE
**
** NVRAM E4 : Updated parameter structure
**
**
```

The following error messages may be printed:

```
** NVRAM E1 : An NVRAM checksum error was detected
```

```
** NVRAM E2 : An NVRAM checksum error was detected
```

These messages does not necessarily indicate a permanent error condition. Restart the print server, and print the test page again. If the error condition remains, contact your dealer/distributor.

```
** NVRAM E3 : NVRAM hardware failure
```

This is a fatal error condition. Contact your dealer/distributor.

```
** NVRAM E4 : Updated parameter structure
```

This message is normal after a print server software upgrade. Restart the print server, and print the test page again. If the message appears again, contact your dealer/distributor.

```
** ETHER E6 : No factory default Ethernet address
```

The Ethernet address has been corrupted. Contact your dealer/distributor.

```
** ERROR E6 : No factory default node address
```

The Token Ring node address has been corrupted. Contact your dealer/distributor.

```
** COMM E8 : Communication hardware failure
```

This is a fatal error condition. Contact your dealer/distributor.

```
** COMM E9 : Wrong Token-Ring speed set
```

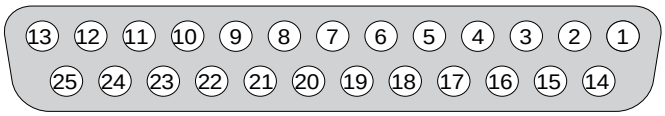
An incorrect ring speed setting has been detected. Change the RING SPEED switch position and restart the NPS print server.

APPENDIX B

PRINTER CONNECTOR PIN-OUTS

This appendix contains information on the parallel printer connector pin-outs and the parallel port timings for different modes. This section covers all models of the Network Print Server.

Parallel Port Pin-Outs



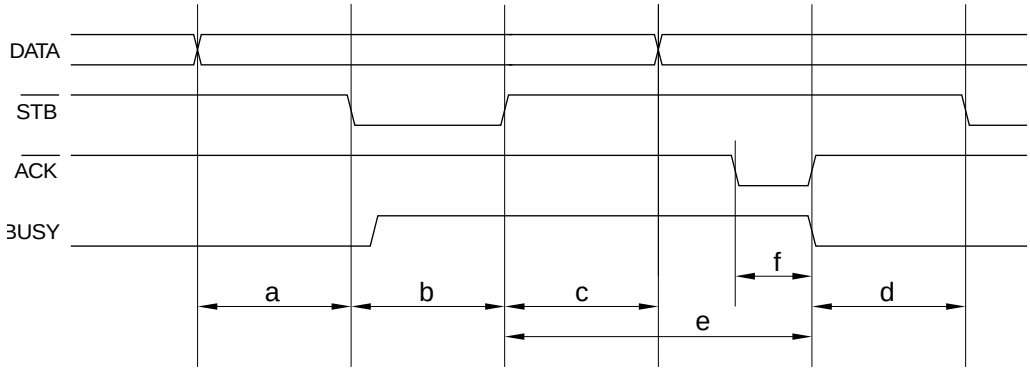
The following table shows the pin-out configuration of the NPS parallel printer port LPT, for all models.

Pin no.	Signal	Pin no.	Signal
1	Strobe	10	Acknowledge
2	Data 0	11	Busy
3	Data 1	12	Paper End
4	Data 2	13	Select
5	Data 3	14	Auto Feed
6	Data 4	15	Fault
7	Data 5	16	Init
8	Data 6	17	Select In
9	Data 7	19-25	Ground

(Pin 18 is reserved for future use)

Parallel Ports Timing

The following diagram illustrates the Centronics interface timing for the parallel ports LPT1. The table shows the values for the different Centronics modes (IBM PC, Standard, Fast).



Time	Description	IBM PC	Standard	Fast
a	Data Setup (latch enable)	5 µs	1.6 µs	0.8 µs
b	Strobe Active	5 µs	1.6 µs	0.8 µs
c	Data Hold	5 µs	3.2 µs	0.8 µs
d	Data Setup (printer ready)	5 µs	1.6 µs	0.8 µs
e	Printer Ready after Strobe Inactive	*	*	*
f	Acknowledge	Not used	0.2 µs (min.)	0.2 µs (min.)

* The ‘Printer Ready after Strobe Inactive’ time (e) depends on the attached printer.