IBM Network Station - RS/6000 Notebook

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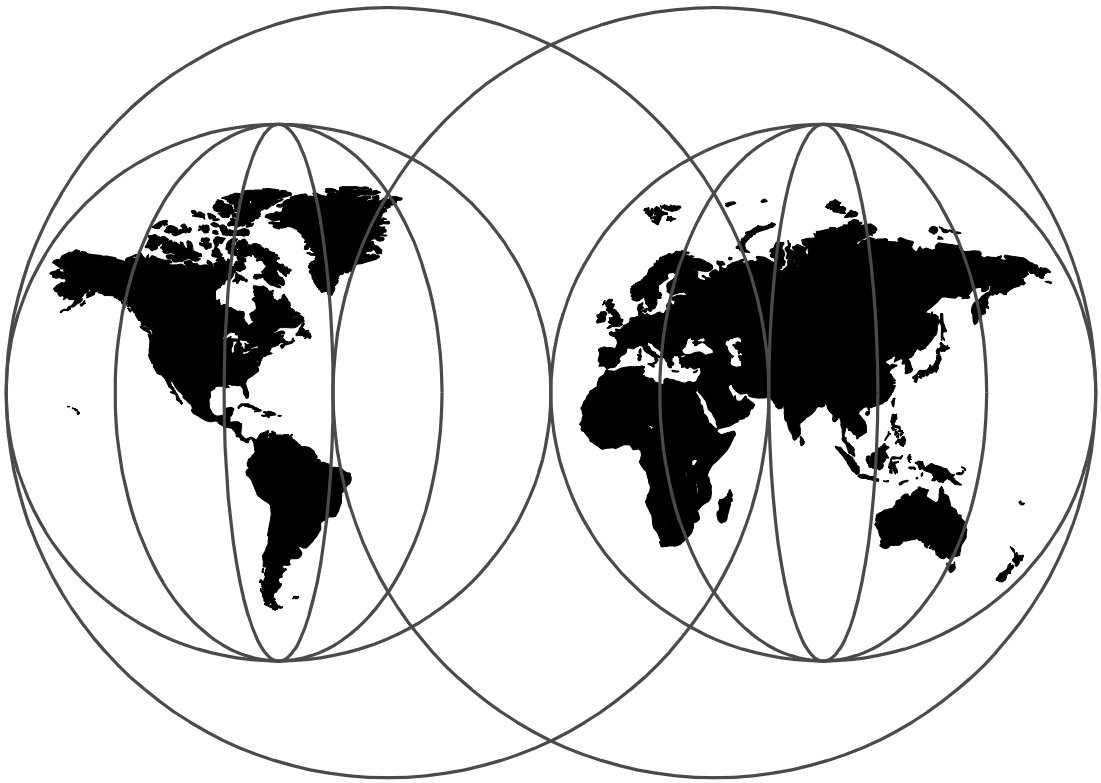

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IBM Network Station - RS/6000 Notebook

July 1998

Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix D, “Special Notices” on page 243.

Second Edition (July 1998)

This edition applies to the IBM Network Station Series 100, 200, and 1000, to IBM Network Station Manager Release 3, and to the AIX Version 4.3.1 operating system 5765-C34, and later releases, as a boot server running on RS/6000 hardware.

Note

This book is based on a pre-GA version of a product and may not apply when the product becomes generally available. We recommend that you consult the product documentation or follow-on versions of this redbook for more current information.

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Preface

This redbook helps you understand and enhance a network computing infrastructure using the IBM Network Station as an end-user workstation and an RS/6000 as a boot, configuration, application, and print server.

The IBM Network Station is the first of a new line of hardware devices targeted directly at the network computing initiative. The RS/6000 is IBM's most advanced network server combining state-of-the-art connectivity features with simple, accessible, system management in a reliable and affordable hardware/software bundle. Together, the IBM Network Station and the RS/6000 provide a powerful network computing solution.

With over 130 figures and tables, easy to follow scenarios, and a simple logical layout, this guide helps you:

- Understand the basics of network computing and learn about other new directions in computing
- Position the IBM Network Station with respect to its nearest competitors and learn exactly what it can do
- Learn the benefits of Java as a network-computing programming environment
- Quickly implement an IBM Network Station in a production environment with respect to IBM Network Station, network, server installation, setup, tuning, and end-user applications
- Debug problems if they occur and help prevent common mistakes
- Obtain answers to the difficult end-user questions that are asked only after installing new products

Network computing has reached all levels of the computing industry. That is why this publication is useful for system administrators, network specialists, users of the IBM Network Station, as well as anyone who needs to learn more about the IBM Network Station and RS/6000 integration.

The Team That Wrote This Redbook

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Chapter 1. Introduction

This chapter introduces the network computing concept followed by the IBM Network Station itself. You will find the basic background information required to understand the chapters that follow. After reading this chapter, you will be able to:

- Understand why network computing is such a powerful solution
- Position the IBM Network Station and IBM Network Station Manager with respect to the network computing model
- Define the basic components that comprise the IBM Network Station Manager
- Discuss the applications that come with the IBM Network Station Manager
- Implement new applications within the capability of the IBM Network Station using Java

1.1 Network Computing

Network computing is being hailed as the third major phase in the evolution of computing. Increasingly powerful networking technologies and the adoption of open standards are the gateway to allow the migration of applications, data, storage, and processing onto the network. The Internet represents the ultimate implementation of the network computing paradigm. Moreover, this evolution is market driven.

The first phase of computing was built around centralized resources, typically a mainframe serving numerous non-programmable terminals (NPTs). NPTs are simple, low-cost, and reliable, but limited in what they can do. Millions of them are still in use for data entry and other basic tasks. These systems are commonly known as *legacy systems* and are often thought of as outmoded, but their much predicted demise has not actually been witnessed. The huge amounts of data that are held on these systems and their stronghold in large corporate environments enforces their inclusion within the network computing model.

The second phase of computing was driven by the arrival of the microprocessor and its use within the personal computer (PC). Compared to NPTs, PCs offer tremendous flexibility, but are more complex and expensive to set up, connect and manage. Individual users have a wide choice of personal productivity applications, with windows and graphics that make them more interesting and easier to use. Users have control of their own data. They can connect to multiple servers, to remote computers, and to the Internet.

Figure 1 shows the evolution of the computing paradigms.

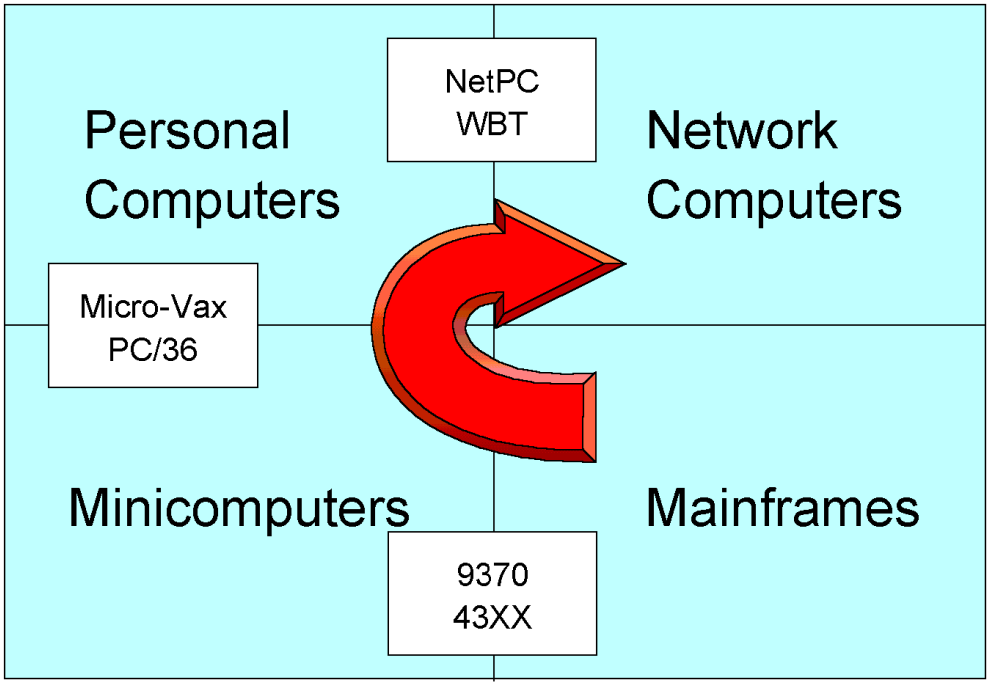

Figure 1. Generations of Computing

Network computing combines the best of both worlds and gives a solution that is able to meet the requirements of the user, administrator, and management in a corporate environment. Moreover, network computing is the core of IBM strategy under the name e-business. A simple definition of e-business is:

Combining systems that run core operations with the simplicity and reach of the Internet to transform business as we know it.

Figure 2 shows the evolution of the Network Computer (NC) as the advantages of both the NPT and the PC are combined.

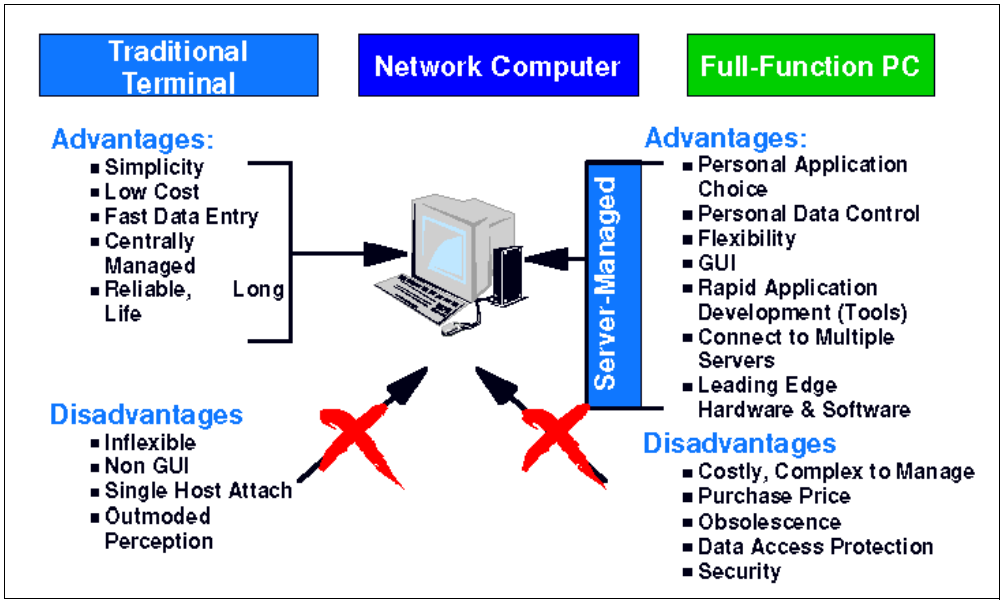

Figure 2. Evolution of the Network Computer

The key characteristic of network computing is that system resources are located on servers in the network. This centralized approach has the following advantages:

- Application installation and updates are done on the server, thus reducing the time required because of repetition and assuring version integrity. The IBM Network Station receives software updates directly from an application server.
- User data resides on the server, thus eliminating the need for the end user to back up files locally. The IBM Network Station does not contain a disk. It can be powered off at any time without loss of data.
- Security issues are simplified as data is not scattered across desktops throughout the enterprise. Since the IBM Network Station maintains data on the server, physical security is only a concern when the Network Station is left connected and unattended.
- Users can access their data from any desktop in the network. The IBM Network Station provides a uniform workplace that requires a minimum of training to operate.
- The system can be extended by adding more resources to the network. Adding new applications to the application server allows them to be immediately reached by all IBM Network Station users.

1.2 The Network Computer

Terminal and computer vendors may call almost anything a Network Computer (NC). The subset of NCs into which the IBM Network Station falls is commonly known as *thin clients*. These devices typically have minimal hardware, do not require a sophisticated operating system, are intended to be user friendly, and are easy to install and administer.

If you ask the customers for the reasons they are investing in thin computing, most of them will answer: "... multiple client types with a common application model."

Figure 3 shows the different classes of NC devices of today and of tomorrow.

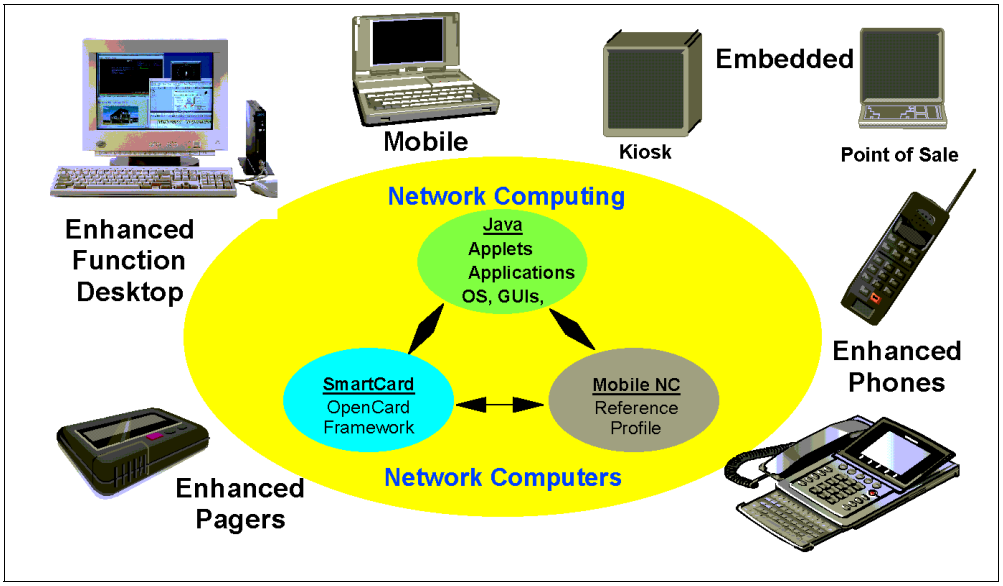

Figure 3. Network Computer Devices

Recent analyst reports from IDC, Zona Research, and the META Group continue to affirm the growing acceptance of NCs within the corporate sector and IBM's role as market leader. The following are examples of what they have said:

- In a NC survey, IDC stated that 73% of organizations who have implemented NCs had replaced PCs when rolling them out. In addition, 46% of respondents recognized IBM's Network Station as the leading NC brand.
- In a META Group survey, 87% of respondent organizations stated that they will implement NCs within three to five years. META Group also stated that the capital cost of a Network Computer is approximately 25% less than a PC.
- In its latest NC research, Zona group also found that IBM is best placed to lead the NC market, above and beyond competitive NC vendors.
- The Gartner Group has predicted that 40% of all enterprises will deploy Network Computers by 1999, and 60% will deploy them by 2001.

1.2.1 The Network Computer Reference Profile

To promote standardization, Apple, IBM, Netscape, Oracle, and Sun have introduced a Reference Profile for the NC. The Reference Profile (RP) is intended to provide a common denominator of popular and widely used features and functions across a broad range of scalable network computing devices, including personal computers. The specifications in the Reference Profile are intended to be open standards that anybody can implement. The RP encourages interoperability among various NCs and is designed to ease development of a broad application base to run on compliant devices. The RP also provides guidelines to content and service providers for designing and building

applications and other Internet content that will interoperate with profile-compliant devices.

The Reference Profile does not specify an implementation for an NC, nor does it preclude additional features and functions outside the scope of the RP. It is open, flexible, architecturally neutral, and is intended to help the growth of NCs while helping to protect investments made by customers and content, system, service, and application providers.

The original version of the Reference Profile can be seen on the Web at:

```
http://www.nc.ihost.com/nc_ref_profile.html
```

1.3 IBM Network Station Overview

The IBM Network Station is a simple, economical alternative to NPTs and under-utilized PCs. It extends access to network applications, intranets, and the Internet while it lowers total cost of ownership with significantly lessened support requirements.

Through its selectable network connections, the IBM Network Station attaches to any type of IBM server and is ideal for multi-platform computing environments. The IBM Network Station provides access to applications running on one server, many servers, to the worldwide resources of the Internet (or a private intranet), and to the fast-emerging world of Java applets and applications downloaded on demand from Internet or intranet servers.

The IBM Network Station is a simple, economical alternative that extends your access to information and applications, no matter where they reside.

For immediate productivity and investment protection, the IBM Network Station can display most of the legacy applications in use by customers today. Legacy applications execute on the application server machine and become available to the IBM Network Station user through a display connection to the application server. There is no limit (except memory constraints) to the number or combination of servers that the IBM Network Station can attach to concurrently.

For these reasons, IBM USA, and now IBM Europe, have chosen the IBM Network Station as the primary desktop device for its employees. In Europe, in 1998, 8,100 IBM Network Stations are installed in IBM locations in ten countries, making it the largest corporate installation of Network Computers (NCs) in Europe.

IBM is using the IBM Network Stations to replace older PCs and terminals and to provide its employees with access to the latest technology in a cost-effective way. IBM's family of Network Stations offers users the latest office productivity tools as well as access to existing applications and the Internet, intranets, and Java applications.

"Just like thousands of customers around the world, IBM Europe has chosen our Network Stations because they are easy to use and easy to manage," said Bob Dies general manager of IBM's Network Computer Division. "Our employees are similar to workers at many other companies, and IBM Network Stations provide the right solution for their work needs."

The IBM Network Station takes advantage of applications running on each of IBM's servers. Because these applications reside on the server (or another server in the network), they only need to be installed once and not hundreds or thousands of times on PCs throughout an enterprise. This dramatically reduces the ongoing cost of software installation and maintenance and system management.

The IBM Network Station is easy to install, use, and manage. Total long-term cost of ownership over time is only one-fourth to one-half that of a PC. Yet it delivers exciting new functions and flexibility.

The low-cost Network Computer is designed to operate without its own internal disk storage. It plugs right into a company's local area network. Supporting software and applications are stored in an associated server. This can be an IBM AS/400, PC Server, RS/6000, System/390, or compatible non-IBM system.

Central storage at the server makes security less of an issue, too, because a company's data is not scattered across desktops throughout the enterprise. Central storage also means you can sit down at any Network Computer connected to your server and have all your data available to you.

In short, IBM takes the most useful features of the 25-year-old NPT and adds much of what makes today's PCs appealing. The result: an inexpensive yet versatile new approach to bringing network computing to the desktop.

Figure 4 shows the available server types.

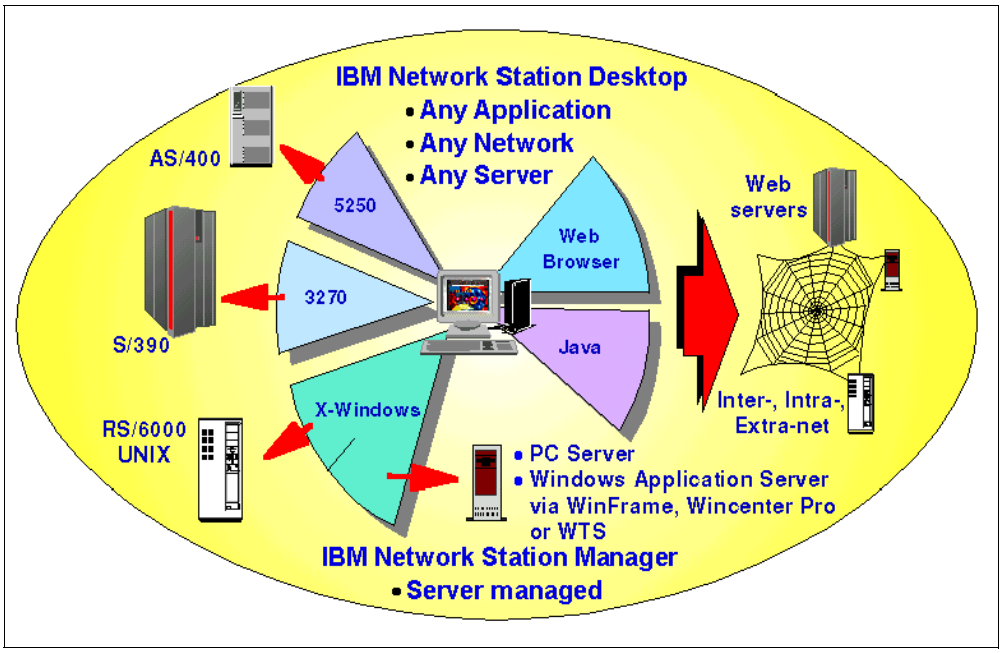

Figure 4. IBM Network Station Server Connectivity

Even if you are not surfing the Internet today, the IBM Network Station is ready when you are. It is also ready for Java, which enables the distribution of programs on demand.

Java makes it possible to deliver not only information but also software programs over the Internet or an intranet, as they are needed. And the IBM Network Station comes with support for industry-standard Java applications or applets that can be selected by users or by the system administrator.

The number of useful Java programs increases every day. Several developers have announced their intention to bring personal productivity applications based on Java to market in the very near future. Or, your company will be able to write its own applications. Either way, IBM Network Computer users will be ready to take advantage of them. See Section 1.9.1, “Java” on page 16, for more information about Java.

1.4 IBM Network Station Uses

The IBM Network Station is flexible in its use. It allows a variety of applications to be used simultaneously on the same or on different host systems running all kinds of operating systems, such as AIX, Microsoft Windows, OS/400, and VM. In addition, the IBM Network Station supports several functions to help you manage the way you work with those applications.

The hosts you are able to access and the applications you can use are determined by the network administrator. The administrator configures the IBM Network Station; so you do not have to worry about communication protocols, addresses, host names, and other details. Also, you will not have to worry about upgrading hardware and software or backing up your data. The data is securely kept on the hosts you will be working with; so you can concentrate on using the applications.

With the IBM Network Station, you can:

- Use it as an X-terminal. You can use the built-in Window Manager, or you may want to switch to a well-known Window Manager on your host system, such as the Common Desktop Environment (CDE) workspace manager on AIX. Using the built-in Window Manager allows access to all local or Windows applications at the same time because they all use the X or Independent Computing Architecture (ICA) protocol for displaying their data and receiving user input.
- Execute *native* Java applications. A native application executes on the IBM Network Station, but applications that run from an X-terminal session execute on a remote host system and you use the IBM Network Station X-server to communicate with the application.
- Use it as a line-mode terminal. Most hosts accept line-mode connections. These are called *telnet* sessions. You may have many telnet sessions at one time.
- Browse the World Wide Web using a native application, which may be either the NC Navigator or the HotJava browser included in eSuite.
- Use it to access remote PC applications. Those applications run on a Windows NT server, and you use the IBM Network Station as a display device the X11 or ICA protocol.
- Use it as a 3270 or 5250 terminal. Unlike many of these terminals, you are able to have more than just one host connection. Each connection, called a *session*, works as an independent terminal, enabling you to use several

applications simultaneously. Sessions are created and managed by a *terminal emulator* program running on the IBM Network Station.

1.5 IBM Network Station Hardware

The IBM Network Station consists of a system unit, display, keyboard, mouse, and power supply. The entry-level system unit measures only 20 cm by 25 cm by 3 cm (8" by 10" by 1 1/4") and weighs only 1.1kg (2 1/2 lbs). It can be placed on a desk or wall mounted.

The display, keyboard, and mouse follow industry standards. The mouse and keyboard are supplied, but the display must be obtained separately.

There are seven models of the IBM Network Station based on the network interface, processor speed, and base memory. They are grouped into series:

1. Series 100 (Base 8 MB, 33 MHz)
   - IBM Network Station Model 100 (61100*xx*) - Ethernet
   - IBM Network Station Model 200 (61200*xx*) - Token-Ring
2. Series 300 (Base 16 MB, 66 MHz)
   - IBM Network Station Model 110 (61110*xx*) - Ethernet
   - IBM Network Station Model 210 (61210*xx*) - Token-Ring
   - IBM Network Station Model 341 (61341*xx*) - Twinax

> **Take Note**
>
> The Model 341 will only be supported on AS/400 running OS/400 V4.2 and above, and will also require Release 3 on Network Station Manager. It may not be connected to a legacy AS/400 running V3R2 and V3R7.

3. Series 1000 (Base 32 MB or 64 MB, 200 MHz)
   - Base 32 MB
     - IBM Network Station Model A52 (62A52*xx*) - Ethernet
     - IBM Network Station Model A52 (62A22*xx*) - Token-Ring
   - Base 64 MB
     - IBM Network Station Model A52 (62A53*xx*) - Ethernet
     - IBM Network Station Model A52 (62A23*xx*) - Token-Ring

Where *xx* is the country designator - The following designators only (Table 1) are valid for the different series' models:

Table 1. Country Designators for IBM Network Station Series

BE	Belgium English	**PO**	Portugal
BF	Belgium French	**SA**	South Africa
DK	Denmark	**SE**	Switzerland UKE
FI	Finland	**SF**	Switzerland French

FR	France	**SG**	Switzerland German
GE	Germany	**SI**	Switzerland Italian
IL	Iceland	**SP**	Spain
IS	Israel	**SW**	Sweden
IT	Italy	**UK**	UK English
ND	Netherlands Dutch	**US**	US English
NO	Norway	**EU**	European

1.6 External View

The heart of the IBM Network Station is the system unit. It is compact (for the Series-100 and Series-300, a little smaller than the hardcopy version of this document), and it can stand on a desk or be attached to a flat surface with the built-in mounting points (except the Series-1000).

- Network Station Series-100 and Series-300

  The front of the system unit has a power on/off button, connectors for the mouse and keyboard, one PCMCIA slot, and two LED indicators. The top LED indicates the IBM Network Station is communicating over the network. The other LED is lit when the power is on. Figure 5 shows the front and back views of the Series 100 and 300.

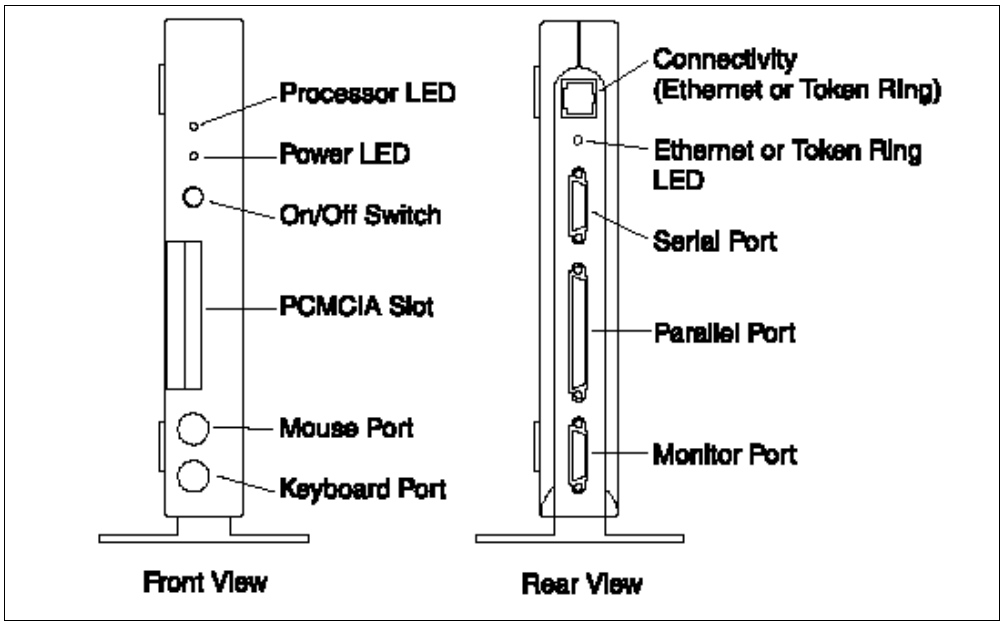

Figure 5. IBM Network Station Front and Rear Views (Series-100 and 300)

- Network Station Series-1000

  The front of the system unit has a power on/off button, connectors for the mouse, the keyboard, a headphone and a microphone, one SmartCard slot and two LED indicators. The top LED indicates the IBM Network Station is

communicating over the network. The other LED is lit when the power is on. Figure 6 shows the front and back view of a Series 1000.

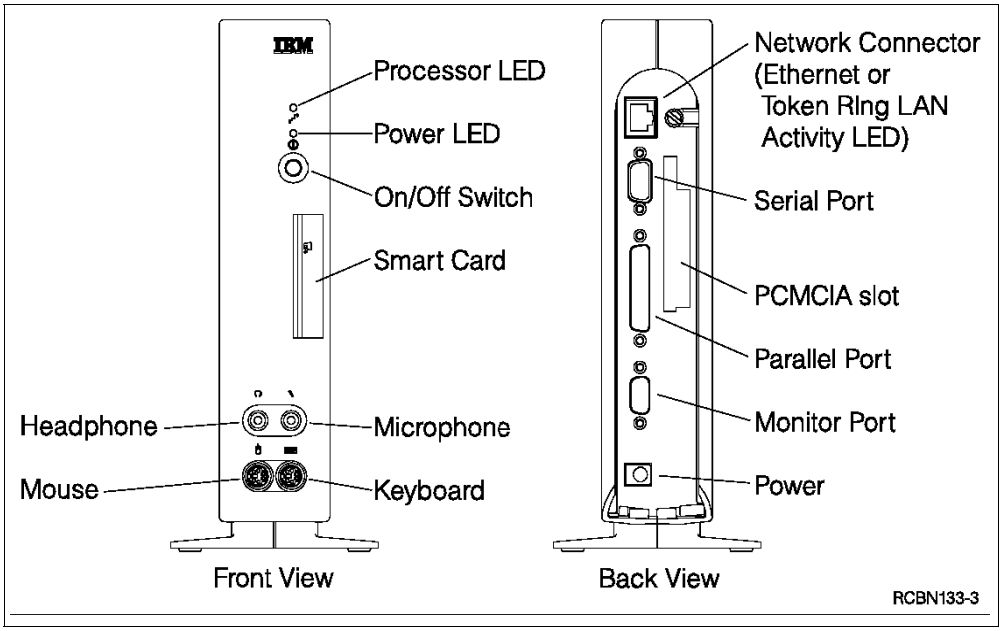

Figure 6. IBM Network Station Front and Rear Views (Series-1000)

There is no local hard disk or internal fan. This means that the IBM Network Station has just one moving part (power switch) and is completely silent in operation. This has resulted in a mean time before failure (MTBF) of 43 years and a very low power consumption of approximately ten watts. During periods of inactivity, power management reduces this value to eight watts. You must have a monitor that is Video Electronic Standards Association Display Power Management Signaling (VESA DPMS) compliant to activate this feature. With such a low power consumption, it is perfectly acceptable to leave the IBM Network Station powered on permanently. This will also help to reduce network traffic caused by excessive boot cycles.

The back of every system unit has connectors for the following:

LAN attachment Either token-ring, Ethernet, or Twinax connection (Twinax is only offered on the Series-300) is supported. A system unit may be ordered to support one or the other connection, but not both. Just below the LAN connector is an LED that indicates the status of the LAN connection. The Ethernet support operates at 10 MB for the Series-100 and 300 and at both 10 MB and 100 MB for the Series-1000.

Serial port This port allows the connection of a serial device.

Parallel port This port allows the connection of a printer.

Monitor port This port is used to connect the video monitor.

Moreover, the back of the IBM Network Station Series-1000 has:

PCMCIA slot At the time of writing, this feature is not activated on the Series-1000. Models produced in 1998 will not have this slot.

For the Series-100 and 300, the low-voltage power connector is at the bottom of the system unit, and the power cable leads out the back, under the monitor port. For the Series-1000, the low-voltage power connector is at the back of the system unit. The power module that converts normal line voltage for the IBM Network Station is attached to the power cord (line cord).

For more information on the details of the IBM Network Station, see *IBM Network Station Use*, SA41-0036.

1.7 Components and Subsystems

For every series and model, the system unit contains the following functional components:

Processor The IBM Network Station processor is based on the PowerPC technology developed by IBM and common to the RS/6000, AS/400, and some PC server platforms.

Bus The bus connects the various functional components. The effective bus width depends on the individual component.

PCMCIA The single PCMCIA slot is compatible with type 1 or 2 cards. Software support of these slots has not been formally announced. Newer Series 1000 IBM Network Stations do not have this feature.

Memory The system unit has two Single In-Line Memory Module (SIMM) sockets that accept industry standard 72-pin Extended Data Output (EDO) 60 nanosecond or faster memory. The IBM Network Station is shipped with one 8 MB SIMM (Series-100), one16 MB SIMM (Series-300) or one 32 - 64 MB (Series-1000) already installed. Based on the options chosen, up to 64 MB of memory may be installed with either 8, 16, or 32 MB SIMMs. The memory must to be installed in pairs only with the Series-1000. For the Series-100 or 300, a total memory size greater than 40 MB requires the removal of the factory-installed SIMM.

EPROM The erasable programmable read only memory (EPROM) contains the initial self-tests and boot monitor program for the IBM Network Station. The boot monitor program can be changed by the system administrator using the central systems management capabilities of the IBM Network Station Manager when it becomes available.

For more details on updating the boot monitor program in EPROM, see “Kernel File and Updating Boot Software” on page 115.

NVRAM The non-volatile random access memory (NVRAM) contains the configuration settings that the boot monitor program needs for contacting the boot server and for downloading the kernel. The configuration information can be changed locally or by the system administrator.

Graphics Subsystem The video subsystem includes video memory of 1 or 2 MB and supports VESA Video Graphics Array/Adapter (VGA) and Super Video Graphics Array/Adapter (SVGA) monitors. It is driven by a 64-bit dedicated graphics accelerator. The standard video memory of 1 MB is sufficient for the following combinations of video resolution options:

640 by 480, up to 256 colors
800 by 600, up to 256 colors
1024 by 768, up to 256 colors

A video memory of 2 MB allows the following combinations of video resolution options:

1280 by 1024, up to 256 colors
1360 by 1024, up to 256 colors
1600 by 1280, up to 256 colors

Note: The hardware is capable of handling up to 64000 colors, but the software only supports up to 256 colors.

I/O subsystem The I/O subsystem supports the RS232 serial port, the parallel port, the mouse, and the keyboard.

Audio subsystem 8-bit audio support with an internal speaker for the Series-100 and 300 and 16-bit audio support without internal speaker for the Series-1000.

Network interface The Ethernet logic in the IBM Network Station model 100/110/A52/A53 supports the RJ45 connector. The token-ring logic also uses an RJ45 connector. Pin assignment is different between the Ethernet and the token-ring models of the IBM Network Station.

Series-1000 specific:

SmartCard slot This device accepts standard SmartCards. The SmartCards may add functions such as personalized applications to the Network Station.

L2 Cache Optional 512 KB SRAM cache memory

Take Note

The IBM Network Station is shipped without any connection cable. Cable information is provided in the following paragraphs.

In terms of connection cables, be aware that:

- The IBM Network Station model 100 or 110 requires an Ethernet Telephone Twisted Pair (TTP) cable with an RJ-45 (8 positions) connector.
- The IBM Network Station model 200 or 210 requires a Token-Ring Telephone Twisted Pair (TTP) cable with an RJ-45 (8 positions) connector.
- The IBM Network Station model 341 requires a Twinax T-cable

Note: If you use a standard IBM Token-Ring cable (P/N 6339098) with an IBM Cabling System connector at one end and a 9-pin D shell connector at the other end, you will need to *add* a TTP RJ-45 STP cable (P/N 60G1066) to convert the 9-pin D shell connector end of the token-ring cable to the RJ-45 (8 pin) connector required on the IBM Network Station.

For more information, see *IBM Network Station Use*, SA41-0036.

1.8 IBM Network Station Software

It is important to understand that the IBM Network Station is not only a hardware device but a solution which allows you, at the same time, to decrease drastically your total cost of ownership and to increase the productivity of your teams. To complete these tasks, IBM offers with its Network Station the IBM Network Station Manager (NSM) software, which contains all of the software the IBM Network Station needs.

The IBM Network Station Manager is the keystone of your global IBM Network Station architecture. With this software, the administrator is not only able to manage every IBM Network Station but also every user or group of users' profile from any terminal on your network that can run a JavaScript-enabled browser, but each user can adapt their own desktop environment.

Figure 7 shows the basic functions of NSM.

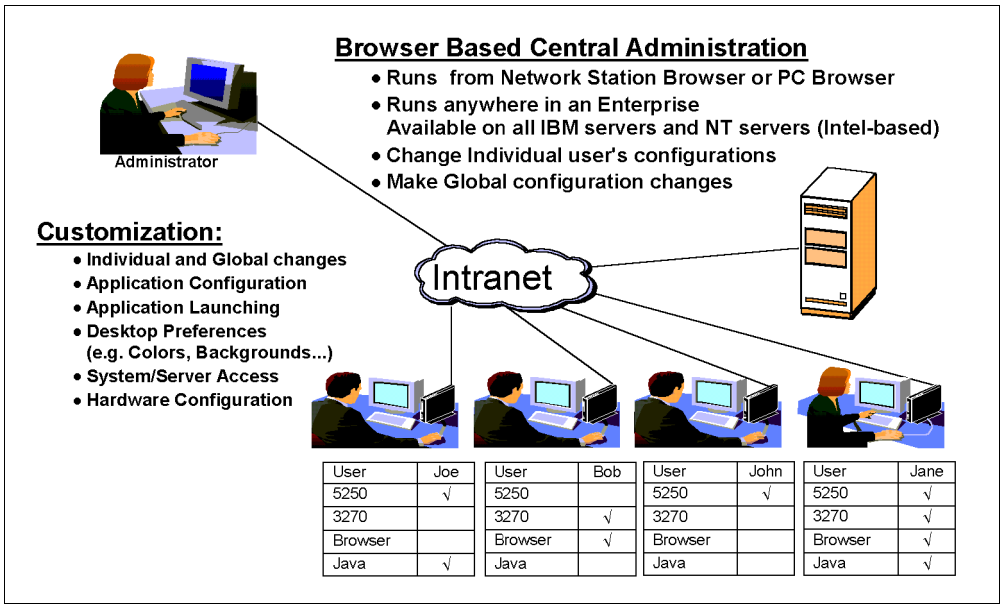

Figure 7. Overview of NSM

Moreover, the IBM Network Station Manager Release 3, as with previous releases, is a no charge product.

The IBM Network Station Manager, which supports a multi-server architecture (for example one base code server and one configuration server), consists of two main subsets:

Server-dependent subset

This subset contains the Network Station Manager program, including the login server, CGI applications, and user and groups of users management (every IBM Network Station user or group of users has to be defined on the server), to name a few. Moreover, this server-side software uses specific resources available on the server where it resides.

IBM Network Station subset

This subset contains every executable, configuration, and environment file which is downloaded or can be downloaded on demand into the IBM Network Station. This subset is server independent and includes the kernel, the local clients, and the fonts used by the IBM Network Station, to name a few.

The IBM Network Station kernel is a cut-down version of the Berkeley UNIX operating system that fits into less than 2 MB for NSM Release 2. With NSM Release 3, mainly due to the full NLS support, the size of the kernel increases to 4 MB. But, by default, the IBM Network Station downloads from the server a compressed 2 MB version of this kernel before decompressing it locally. This kernel provides the operating system and hardware access for the application software.

Figure 8 shows a logical view of the major hardware and software building blocks belonging to the client.

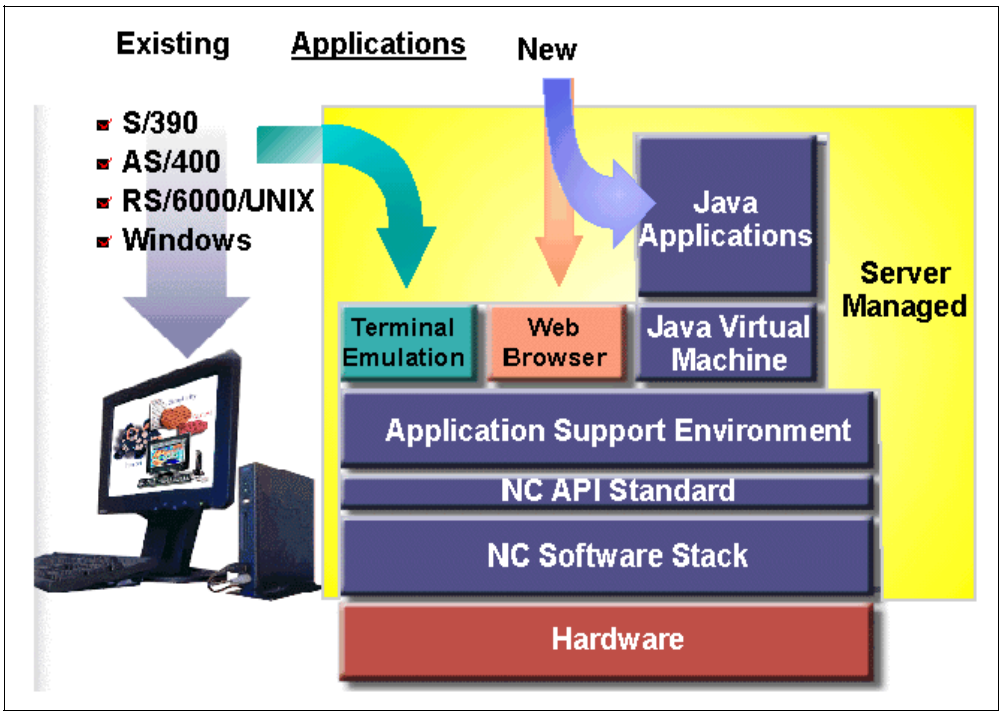

Figure 8. The IBM Network Station Software Architecture

Figure 9 shows the main components of the IBM Network Station Manager software belonging to the server.

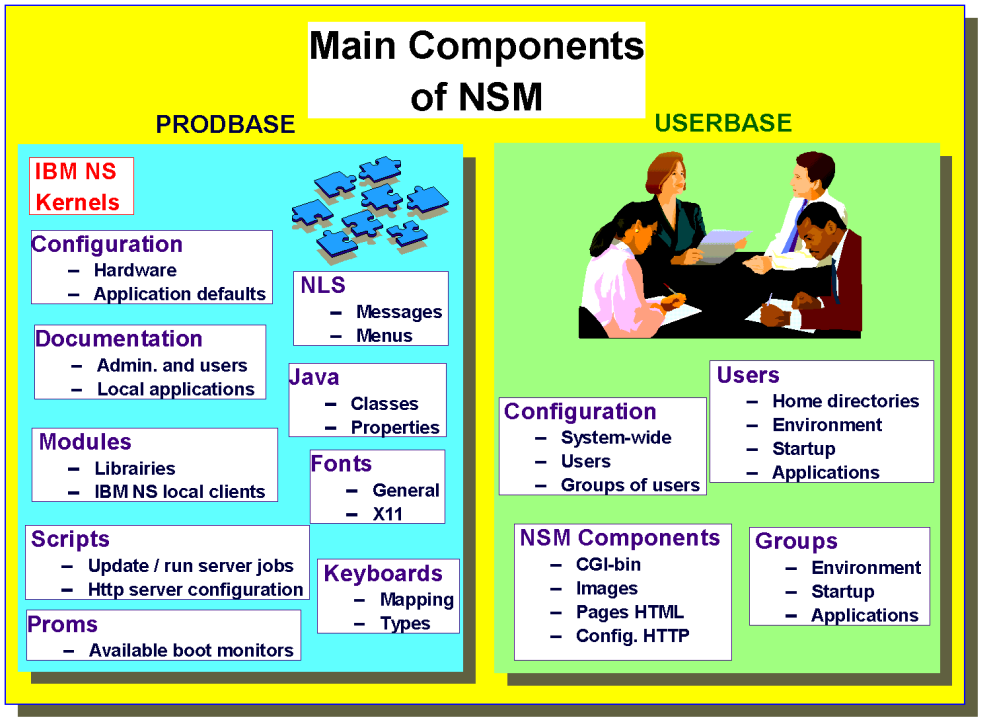

Figure 9. Main Components of IBM Network Station Manager

The PRODBASE group is shipped with the installation process and never modified through IBM Network Station Manager program. In contrast, all the settings defined by using the IBM Network Station Manager program (depending on your environment) are stored in the USERBASE group.

1.8.1 Local Clients

Local (or *native*) clients are applications that execute on the IBM Network Station itself. The following is a list of the currently available applications:

Window Manager Provides window management in environments where a remote Window Manager is not available and can also reduce network traffic and server load.

Login Provides an X Display Manager Control Protocol (XDMCP) chooser for selecting a login server.

3270 emulator Provides a multi-session terminal emulator for access to OS/390, VSE, VM, or TPF.

5250 emulator Provides a multi-session terminal emulator for access to OS/400.

Terminal Provides a VT320 terminal emulator.

Web browser Provides access to the Internet and the World Wide Web. It also provides an environment for running Java script and Java applets and may incorporate an e-mail and news applications. The specifications of this browser are detailed in Appendix A, “NC Navigator” on page 221.

Java Virtual Machine	Provides an environment for running Java applications and also an applet viewer.
X Server	Provides an environment to run remote X clients and Microsoft Windows applications.
Windows ICA client	Provides an environment to run remote Microsoft Windows applications using the Independent Computing Architecture (ICA) protocol.

1.9 Application Development

New applications developed to run locally on the IBM Network Station must be programmed in Java because there is no documented API for the IBM Network Station kernel. The IBM Network Station is intended to be a black box, and the software architecture is likely to change in the future. Programming in Java will ensure application compatibility in this event.

1.9.1 Java

One of the key elements of the Reference Profile is the provision of a Java application environment. Java is a programming language developed by Sun Microsystems. Java consists of a programming environment, a portable run-time environment (the Java Virtual Machine), and a standard set of class libraries. These class libraries include a single, standard graphical user interface API. The Java authors have written a white paper that defines the following eleven goals:

Simple	Java is an offspring of C++.
Object oriented	Everything in Java is an object.
Distributed	Java includes extensive networking classes.
Robust	The Java compiler and run-time make extensive checks for possible problems.
Architecture neutral	Java is a cross-platform language. The Java compiler compiles Java source code into intermediate bytecodes. These bytecodes are then interpreted by a Java Virtual Machine that is written for the processor architecture on the executing system.
Portable	There are no implementation-dependent aspects.
Interpreted	Java bytecodes can be executed directly on any machine to which the Java Virtual Machine has been ported.
High performance	Just-in-time compilers can boost performance by a factor of 10 or more.
Secure	Java was designed from the outset to operate in a networked environment and has extensive security features built in.
Multithreaded	Better interactive response and real-time behavior is provided using threading.

Dynamic The Java run-time automatically loads the required classes. If these classes are not part of the standard class libraries, they can be downloaded transparently across the network. This ensures that the code is always the latest code and eliminates the normal software distribution complexities.

The full text of the Java white paper can be found at:

```
http://java.sun.com/nav/read/whitepapers.html
```

Java can be used to build both stand-alone applications and applets. Applets are small, self-contained programs that run within a Web browser or using an applet viewer.

Figure 10 shows the steps involved in generating and executing a Java application.

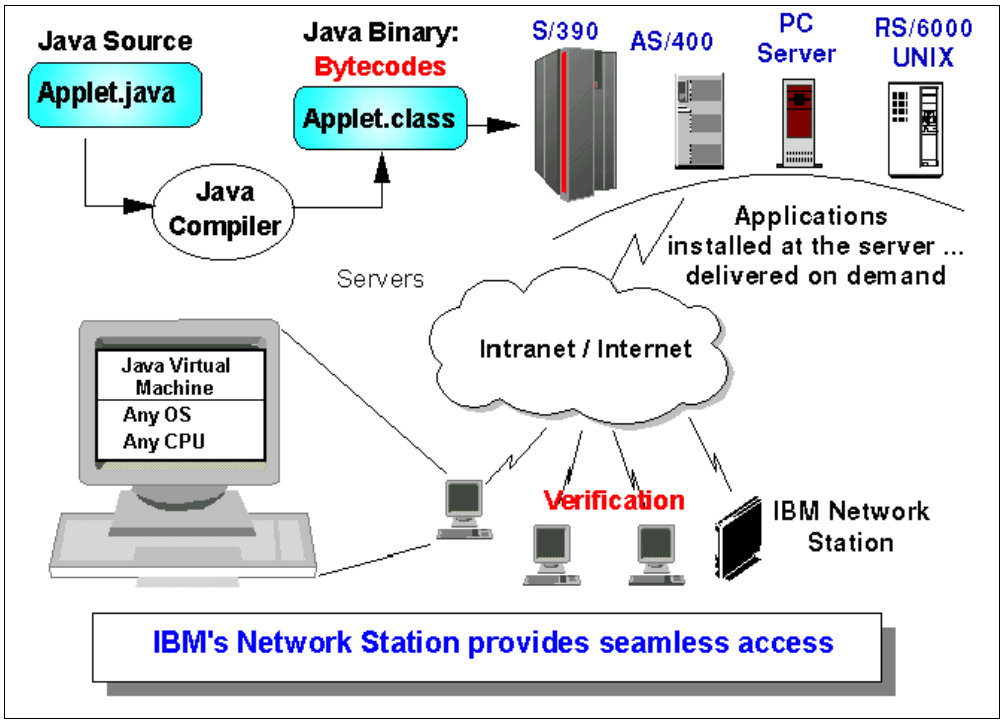

Figure 10. The Java Application Cycle

1.9.2 JVM 1.0 and 1.1, the Differences

In 1998, an improved version of Java, Version 1.1.4, was released. This version supports the API introduced with Version 1.1 and all available bug-fixes applied. It has several improvements in function, quality, and security and should be used for future development. Additional features, like internationalization and JAR (Java archive), are also added since the Version 1.1.1. This new version is fully compatible with older versions; so no software modifications have to be made.

The IBM Network Station currently supports software written in JVM 1.1. For more information, see:

```
http://java.sun.com/products/jdk/1.1/compatibility.html
```

1.9.3 One JVM Application but Multiple Applets

The current IBM Network Station is only able to run one Java application at a time. If you want to run another one, the IBM Network Station will sound a warning and the error message "`Too many copies already running: java`" will appear in the message area of the Console Window.

Using the IBM Network Station browser, you are able to run as many Java applets as memory allows. See 5.8.1, “Browsers and Java Applets” on page 138 for more information about the different options you have to run Java applets with the IBM Network Station.

1.9.4 Lotus eSuite

eSuite is the name for a new technology being developed by Lotus to address the emergence of the network computing. The eSuite product family consists of a desktop and a set of productivity applets, both coded in Java and therefore able to run on top of any JVM.

The desktop provides a fully configurable, task-oriented workspace to include the following:

- HTML browsing
- File management
- Electronic mail
- Enterprise data access
- Personal information management

The user interface is designed around a concept known as InfoCenter, which is easy to learn but also conforms to common software conventions.

The applets are written to Sun's JavaBeans specification with the intent that they be used as the building blocks for the rapid development of business solutions. The applets exchange data using a set of Java interfaces known as InfoBus. The family includes the following applets:

- Spreadsheet
- Chart
- Word processor
- Presentation graphics
- File Manager
- Calendar and to-do
- Project scheduler
- E-mail client

Figure 11 shows a screen of the eSuite WorkPlace Desktop.

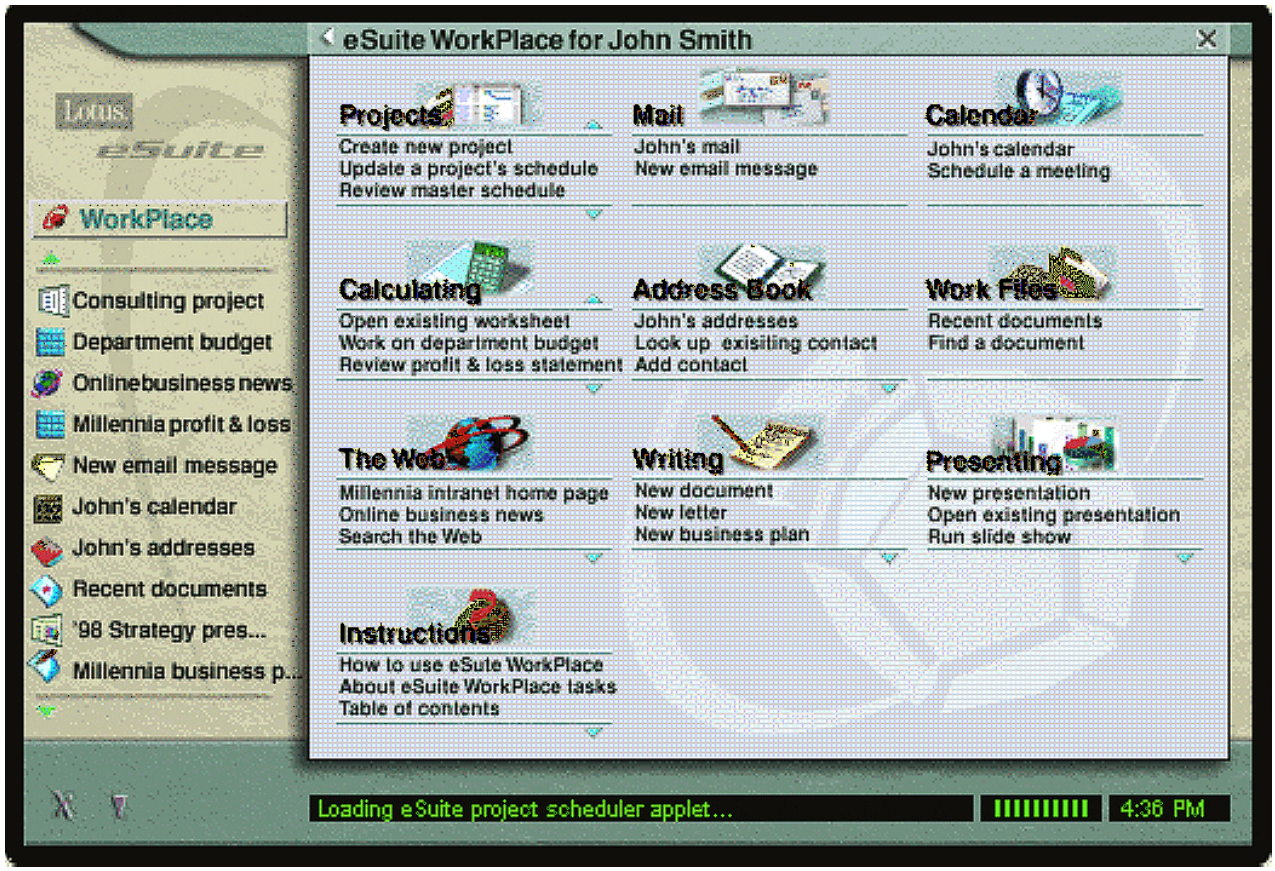

Figure 11. eSuite WorkPlace Desktop

To access an eSuite demonstration and other eSuite-related information, refer to the following URL:

```
http://esuite.lotus.com/
```

1.9.5 Memory Requirements

The IBM Network Station has no virtual memory capabilities. All programs that run on the IBM Network Station must remain in real memory for the entire duration of their execution. Therefore, when estimating the RAM requirements for an IBM Network Station, you should specify more RAM than is actually required by the executing programs.

Table 2 summarizes the memory requirements of the IBM Network Station based on the software loaded with an early version of NSM Release 3. Since the software loaded onto the IBM Network Station is common across all boot servers, these figures are valid in all environments.

Table 2. IBM Network Station Software Memory Requirements for NSM Release 3

Component	SBCS	Extended fonts SBCS	DBCS
Base support required by all applications	7.2 MB	7.4 MB	14.5 MB

Component	SBCS	Extended fonts SBCS	DBCS
ICA access to Windows applications	3.4 MB	3.4 MB	3.4 MB
Access to Java applet / application: Minimum buffer size specified Recommended buffer size specified Minimum buffer size specified eSuite Recommended buffer size specified eSuite If JITC is selected, add	 5.0 MB 7.0 MB 14.0 MB 18.0 MB 18.0 MB	 5.0 MB 7.0 MB 14.0 MB 18.0 MB 18.0 MB	 5.0 MB 7.0 MB 14.0 MB 18.0 MB 18.0 MB
3270 emulator first session Each additional 3270 session Each additional 5250 session	2.4 MB 0.26 MB 2.7 MB	7.9 MB 4.8 MB 7.3 MB	9.2 MB 1.7 MB 4.2 MB
5250 emulator first session Each additional 5250 session Each additional 3270 session	3.0 MB 0.3 MB 2.1 MB	8.6 MB 5.0 MB 6.5 MB	9.2 MB 2.8 MB 7.8 MB
NC Navigator	6.8 MB	9.9 MB	8.4 MB
X-terminal Client first session Each additional session	0.3 MB 0.12 MB	0.34 MB 0.15 MB	1.1 MB 0.03 MB
VTxxx emulator first session Each additional session	0.34 MB 0.15 MB	0.34 MB 0.14 MB	0.6 MB 0.2 MB
eSuite WorkPlace Desktop (U.S. English) Browser 2.4 MB Calendar Mailbox Address Work files Instructions Word Processor Spreadsheet Presentation	4.6 MB 2.4 MB 3.0 MB 2.2 MB 1.4 MB 0.9 MB 0.3 MB 1.9 MB 1.1 MB 1.8 MB	4.6 MB 2.4 MB 3.0 MB 2.2 MB 1.4 MB 0.9 MB 0.3 MB 1.9 MB 1.1 MB 1.8 MB	4.6 MB 2.4 MB 3.0 MB 2.2 MB 1.4 MB 0.9 MB 0.3 MB 1.9 MB 1.1 MB 1.8 MB

Note: X-clients and Microsoft Windows applications do not run on the IBM Network Station itself, but use it as a display device; therefore it is on the application server that the memory requirements must be fulfilled.

The Series-100 IBM Network Station contains 8 MB of RAM in the default configuration. This is not enough to run anything else than the base system with NSM Release 3. Therefore it is strongly recommended to increase the RAM to 16 MB or more, depending on your applications.

1.9.6 Additional Java Memory Requirements

As listed in Table 2, you need more than 8 MB for running Java applications because the IBM Network Station needs about 8 MB for the base system (including the Window Manager) and another 5 MB for the JVM. These memory requirements are just for loading the JVM and its core classes. If you want to run commercial Java applications, you will need additional memory because the application needs memory for internal storage as well.

For using simple Java programs or Java applets, at least 32 MB is recommended if you plan to execute commercial applications. Other local applications, such as

3270 emulators, also need memory; so be careful when deciding how much memory is required in the IBM Network Station.

Running the HotJava browser, for example, will need about 42 MB of memory. Loading applets or visually rich HTML pages with HotJava requires even more.

1.10 IBM Network Station Boot Server

One of the key characteristics of the IBM Network Station is that all software required is stored on a server in the network. Having the software stored on a server makes it easy to manage and update. Only the code required to initiate the network boot is held locally in EPROM, and this code itself can be updated over the network. All configuration and administration can be managed by the server. The IBM Network Station needs only to know its physical network address.

1.10.1 Boot Server Platform

The IBM Network Station Manager is available on a variety of software platforms. The current platforms are:

- AIX
- OS/390, VSE, VM, and TPF
- OS/400
- Windows NT

So, the IBM Network Station is manageable with every server supporting the operating system listed previously. Moreover, the IBM Network Station can boot from any platform that is capable of supporting the following required TCP/IP protocols:

- BOOTP or Dynamic Host Configuration Protocol (DHCP) for IP address and boot configuration information
- TFTP or NFS for file transfer

Note: It is possible to operate without either BOOTP or DHCP, but this increases the administration overhead for each individual IBM Network Station.

1.10.2 Using AIX As a Boot Server

AIX can offer the following advantages as a boot server:

- Proven X-station management technology
- The latest NFS and TFTP technologies
- Journaled file system
- A native X11 font server
- Systems and network management tools
- Multi-user support
- Graphical desktop environment

1.11 The IBM Network Station Value

There are compelling arguments both for and against the Network Computer (NC), and the situation is never likely to be conclusively resolved; however, during the last year, the market has openly embraced the NC. For a more complete discussion, there are many references available on the World Wide Web. A good starting point is:

```
http://www.ibm.com/nc
```

Several of arguments that fully support the IBM Network Station are discussed in the following sections.

1.11.1 Total Cost of Ownership

Total cost of ownership is the fundamental economic argument for the NC, and it is important to differentiate this from an initial capital outlay. On a 50-user network over a 5-year period, you could expect to save between 30% and 50% when compared with a PC-based network. This value takes into account the cost involved in supporting such a system.

Cost of Ownership tools are available on the CD-ROM orderable as an IBM Publication, *IBM Network Station Evaluation Software,* SK3T-2028.

1.11.2 Strategic Use

The Network Computer will not replace the PC. In fact, the PC is fully compliant with the NC reference profile. There are also certain applications for which the NC (in its current state of development) will not be suitable. The primary targets for the IBM Network Station are:

- NPT replacement (ASCII, 3270, 5250)
- Under-utilized PC replacement
- Corporate intranet applications
- Internet access
- Full Java environment

For a comparison between the IBM Network Station and its nearest competitors, see Appendix B, “Thin Client Product Comparison” on page 231.

Chapter 2. IBM Network Station Manager Software Installation

This chapter describes the installation process of the IBM Network Station Manager software and post-installation configuration.

2.1 Overview

The IBM Network Station Server software contains all of the program files necessary to execute the local clients on the IBM Network Station from boot. It also contains the browser interface for managing IBM Network Station customization and user profiles. The software is packaged according to the server target platform. On AIX, the installation follows the procedure as for any Licensed Program Product (LPP). This allows use of the standard AIX tools for fileset-level tracking and update management (apply/commit/reject).

2.2 Obtaining the Software

The product codes for the IBM Network Station server software for the IBM Network Station Runtime Environment for RS/6000 are listed in Table 3. There is currently no charge, but in the future, there may be changes to the way the software is packaged and priced. Select either the International or the 128-Bit North American version. The Omron CD contains additional Japanese input methods. Lotus eSuite is bundled on its own CD.

Table 3. IBM Network Station Software Order Numbers

Platform	International 5648-C05	128-Bit NA 5648-C20	Omron 5648-OMR	eSuite 5648-KN2
RS/6000	SK3T-3022	SK3T-3036	SK3T-3037	SK3T-3048

In general, the software becomes available electronically before it is available on installation media. Beta code may become available from time to time, but this is purely for demonstration and evaluation purposes only. Business Partner Evaluation CD-ROMs, orderable under the reference SK3T-2028, are considered as evaluation only.

2.2.1 General Availability Release

The IBM Network Station Server software General Availability (GA) release is may also be downloaded electronically from the Internet using a Web browser. At the time of publication, the URL for the IBM Network Station Server software on all platforms is:

```
http://service.boulder.ibm.com/nc
```

2.2.2 Obtaining Product Temporary Fixes

Product Temporary Fixes (PTFs) may be obtained electronically or through the normal AIX support channels. Electronically, fixes may be obtained from your browser at the following URL, as shown in Figure 12:

```
http://service.software.ibm.com/aix.us/aixfixes
```

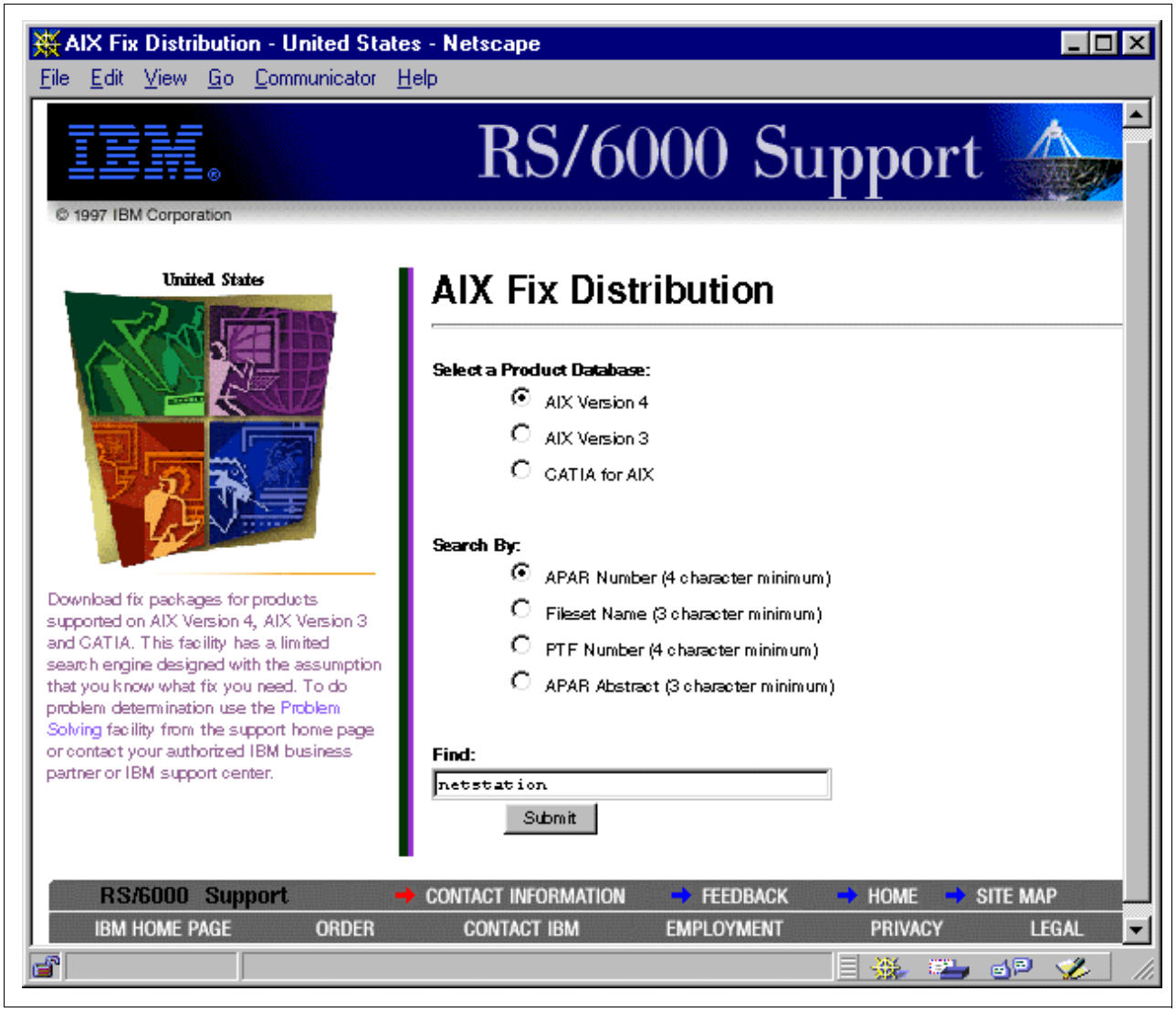

Figure 12. AIX Fix Distribution Web Site

The FixDist utility for obtaining fixes with anonymous FTP may be obtained from:

```
ftp://aix.boulder.ibm.com/fixdist_client_code/fd.tar.Z
  (198.17.57.66)
```

If Internet FTP access is available, the simplest method is to download fixes using the AIX FixDist tool.

2.2.3 Electronic Packaging

If the product has been downloaded electronically, then it could be in *tar* format. It is first necessary to extract the tar file into LPP packages. At the command line, enter:

```
tar xvf netstation.tar
```

Note: The file name may be different depending on the version of AIX. Note that `tar` is a UNIX command that does not require, but allows, a minus sign immediately before the option flags.

2.3 AIX Software Requirements

The IBM Network Station Manager software is supported on AIX 4.2.1 and above. This is because of LPP packaging requirement, not technical issues.

2.3.1 Required AIX Filesets

In this section, the required AIX filesets are given.

Take Note

These filesets are not LPP prerequisites of the IBM Network Station Server software and should be installed or verified before installation of the IBM Network Station server software itself if automatic initial configuration is required.

Table 4 shows the prerequisite filesets needed to support various functions on the server.

Table 4. Required AIX Filesets

Function	Fileset
To support the Network Station Manager itself (IBM Network Station management software):	
Domino GO Webserver	internet_server_base_httpd.4.6.2.2
To support the boot protocols and file access protocols are required:	
BOOTP	bos.net.tcp.client
DHCP	bos.net.tcp.server
TFTP	bos.net.tcp.client
NFS	bos.net.nfs.client
To support the graphical desktop login environments:	
Common Desktop Environment (CDE)	X11.Drt.rte (NSM R2.5 only)
X Display Manager (XDM)	X11.apps.xdm (NSM R2.5 only)
If one of the graphical desktop environments is to be used or any X applications are to be used:	
X11 Font Server	X11.fnt.fontServer

Notes:

1. The Domino GO Webserver is included in the RS/6000 AIX 4.2.1 or later bonus pack CD-ROM. However, if you want to install the latest level, you can download it from:

   `http://www.ics.raleigh.ibm.com/icserver`

   This is only a trial copy of the secure mode of the software, but the non-secure function will not be disabled after the trial period expires.

2. Installing the Network Station Manager licensed program automatically configures the Domino GO Webserver by running the nsm_icsconf script as

described in Appendix 2.7.2, “Nsm_icsconf Script Step by Step” on page 34. Setup is complete after running this step.

3. The CDE and XDM display managers on the IBM Network Station are only supported using NSM Release 2.5. A detailed discussion can be found in the IBM Network Station Advanced User Information located at the following Web site:

   `http://www.ibm.com/nc/pubs`

4. It is not possible to run CDE and XDM concurrently on the same server. Refer to Chapter 3.7, “X Display Control Manager Protocol” on page 58, for more details.

2.3.2 Required AIX PTFs

To install a Network Station server environment on an RS/6000, the following software must be installed before you install Network Station Manager filesets, as listed in Table 5.

Table 5. Required AIX PTFs

AIX	APAR	PTF	Minimal Fileset Level	Comments
4.2.1	NONE	U448475	bos.rte.4.2.1	Included in AIX 4.2.1
	NONE	U448428	bos.net.tcp.server.4.2.1.0	If DHCP is used on this server Included in AIX 4.2.1
4.3	NONE	NONE	bos.rte.4.3.0.0	Included in AIX 4.3.0
	NONE	NONE	bos.net.tcp.server.4.3.0.0	If DHCP is used on this server Included in AIX 4.3.0

2.4 Software File Systems

The IBM Network Station Server software is placed in the /usr/netstation directory. At the time of publication, the total size of the IBM Network Station Server product is approximately 270 MB. It may be desirable to install the software in a separate file system to prevent expansion of the /usr file system. Refer to your AIX documentation for instructions on creating file systems.

Accurate sizing of the file system at this stage is not important as the AIX installation process will automatically expand the file system as required if unallocated physical disk storage is available.

Moreover, the installation process creates a new file system, whose size is approximately 4 MB, and exports it:

- /usr/netstation/nsm

2.5 IBM Network Station Server Filesets

The IBM Network Station Manager Release 3 software is composed of the following filesets:

- netstation.base.rte

- netstation.msg.*lang*.base
- netstation.msg.*lang*.nsm

where *lang* is the language variable; for English, *lang* is EN_EN.

2.6 Software Installation on AIX

The following sections describe the possible installation methods on AIX. You must have root privileges for this software installation.

Before You Start

Installing the software enables BOOTP, TFTP, and NFS on your AIX server by running the nsconf script as described in 2.7, “Alternate Installation” on page 32.

Moreover, the installation creates two new files systems /usr/netstation/nsm/users and /usr/netstation/nsm/groups and adds them in the exports list, /etc/exports.

2.6.1 Installation Using the System Management Interface Tool

To install the IBM Network Station Server software on AIX, use the following procedure:

1. Use the fastpath shortcut to start the System Management Interface Tool (SMIT) and open the **Install/Update from all Available Software** menu:

   ```
   smit install_selectable_all
   ```

2. Type the INPUT Device/Directory in the text field or select **List** to choose from a list. Select **OK** or press **Enter** to confirm the action.
3. Select **List** against **SOFTWARE to install** to display a list of available software. Select **Find** and type `netstation` in the text field. Select **OK** or press **Enter** to confirm the action. Then highlight the following filesets and **Select** (F7 key) to install them:
   - netstation.base.rte
   - netstation.msg.*lang*.base
   - netstation.msg.*lang*.nsm

   Take Note

   For the data set netstation.msg.*lang*.nsm, *lang* must be all uppercase characters. You must use uppercase to support Unicode.

4. Select **OK** or press **Enter** to confirm the action. Figure 13 shows how a typical screen should look at this point.

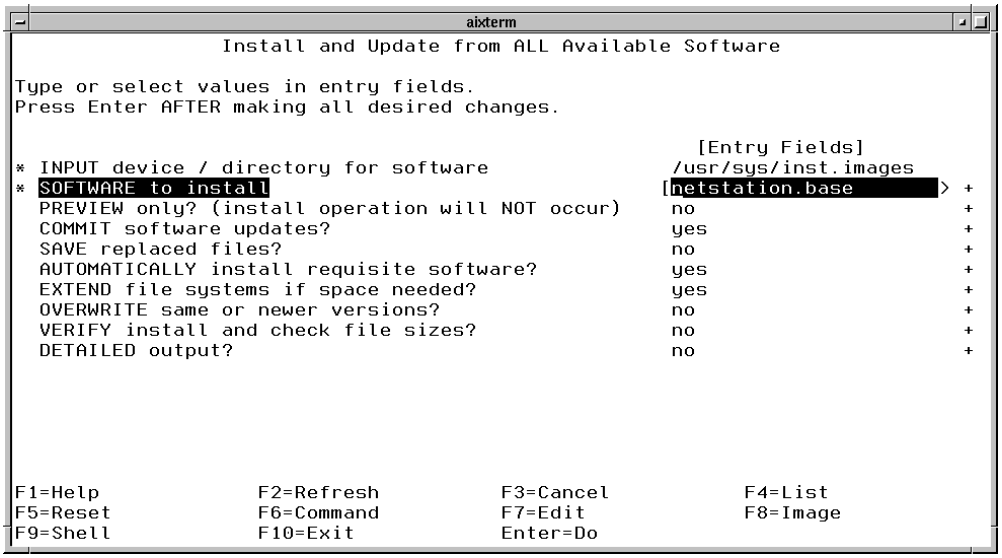

Figure 13. IBM Network Station Server Software Installation SMIT Panel

5. Select **OK** or press **Enter** to begin the software installation.

Take Note

You do not have to reboot the AIX system if only the netstation filesets were installed.

To use the text-based SMIT when in a graphical environment, run:

```
smitty install_selectable_all
```

2.6.2 Installation Using Web-Based System Manager

The Web-based System Manager is a new Java interface available with AIX 4.3.0 or later.

Before You Start

Installing the software enables BOOTP, TFTP, and NFS on your AIX server by running the nsconf script as described in 2.7, “Alternate Installation” on page 32.

Moreover, the installation creates a new file system /usr/netstation/nsm/ and adds it to the exports list.

To install the IBM Network Station Server software on AIX, use the following procedure:

1. Start the Web-Based System Manager software:

```
wsm
```

Figure 14 shows how the initial window should look at this point.

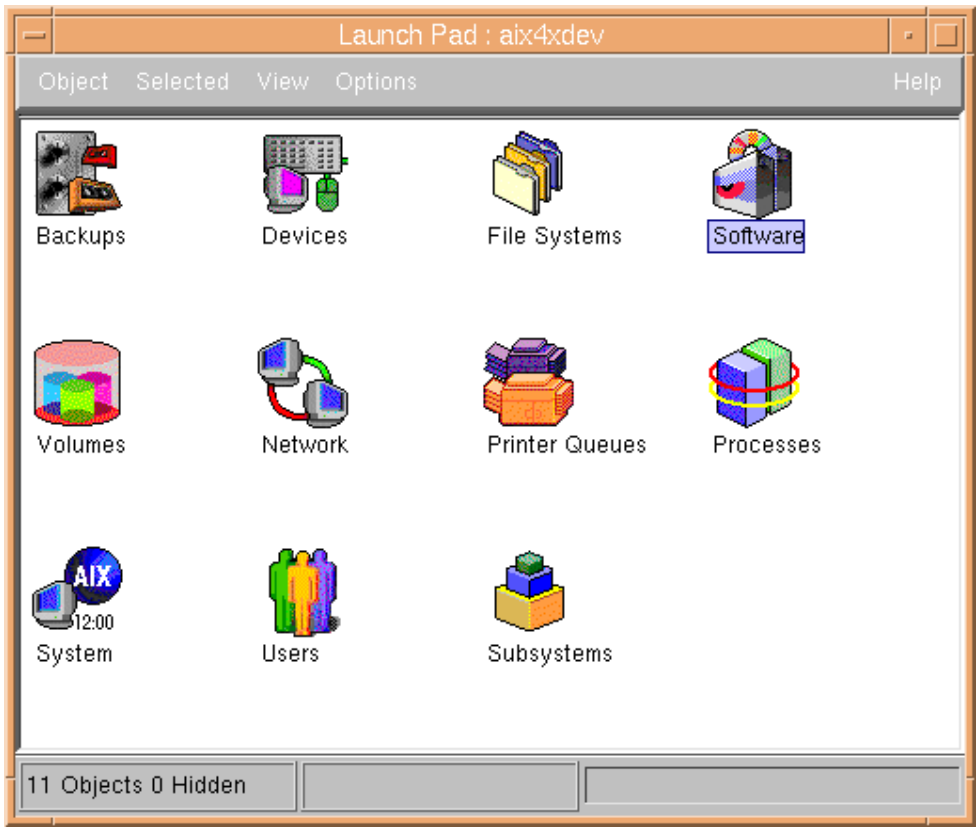

Figure 14. Web-Based System Manager: Initial Window

2. Double click on the **Software** icon and in the resulting window select the window-popup-menu **Software** -> **New Software (Install/Update)** -> **Install Additional Software (Custom)...** as indicated in the Figure 15:

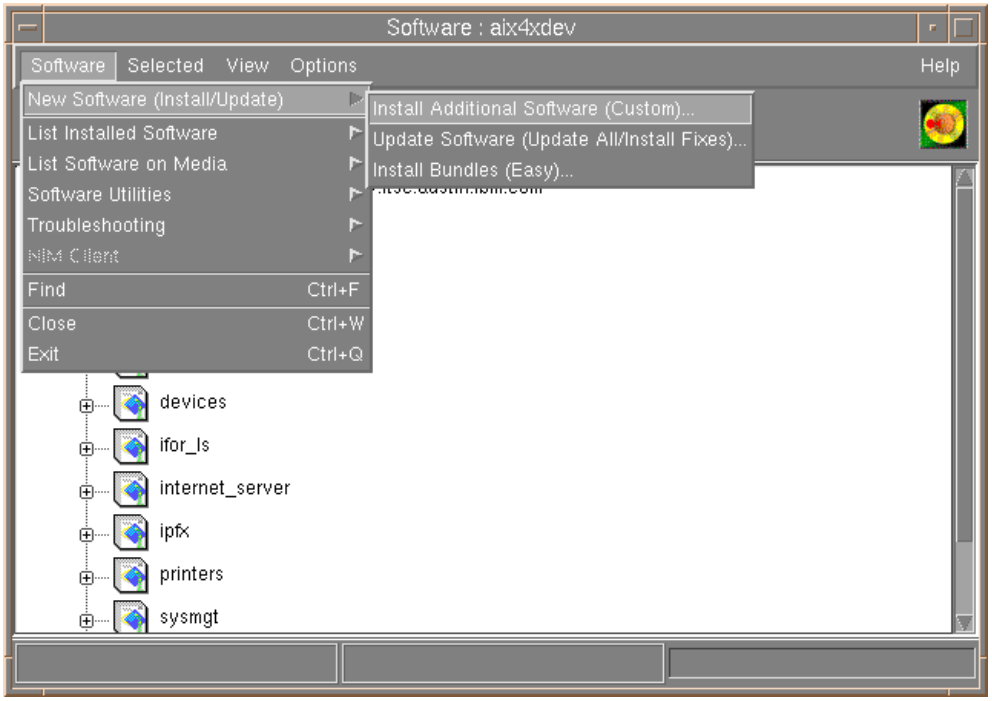

Figure 15. Web-Based System Manager: Install New Software

3. In the Specify or select a software source field, type the name of the directory where the software is or select a predefined software source. In the panel Specify or select software to install panel, select the line **Install specific software from source**. Click on the button **Advanced...**, deselect the option **Filter out language filesets and previous versions of installed software** and click on **OK**. Finally click on the **Browse** button and select the netstation filesets as indicated in the Figure 16:

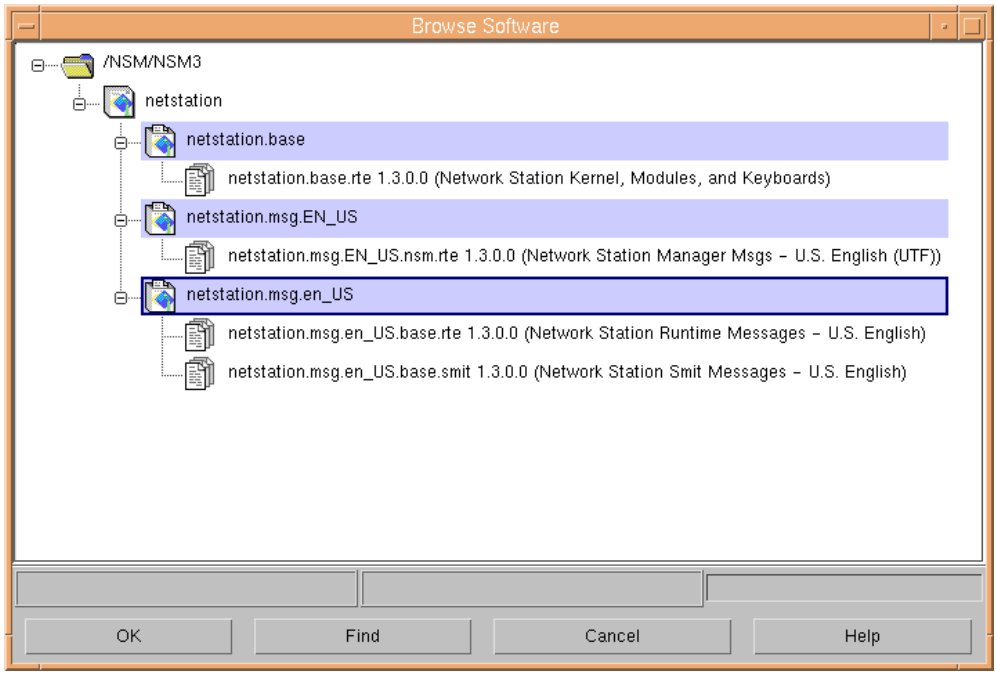

Figure 16. Web-Based System Manager: Filesets to Install

4. Click on **OK** to start the installation.

2.6.3 Installation Using the Command Line

UNIX loyalists may prefer the command line for installation. This section describes this installation method.

Before You Start

Installing the software enables BOOTP, TFTP, and NFS on your AIX server by running the nsconf script as described in 2.7, “Alternate Installation” on page 32.

Moreover, the installation creates a new files system /usr/netstation/nsm and adds it to the exports list.

To install the IBM Network Station Server software on AIX, use the following command:

```
installp -acgX -d device netstation.base
```

where *device* is the input device/directory containing the software install images. Repeat the command for the other software packages as required.

2.6.4 Installation Using Network Install Manager

The IBM Network Station Server software is a standard AIX LPP and may be incorporated into the Network Installation Manager (NIM) environment. This installation method is suitable if you have multiple servers to install or update. Refer to your AIX documentation for further details.

2.7 Alternate Installation

You do not need to run the nsconf and nsm_icsconf scripts. They are run automatically by the AIX installation process. This section is for informational purposes only.

2.7.1 Nsconf Script Step by Step

The nsconf script examines the software on the server and makes changes to the IBM Network Station default configuration files based on its findings. It also enables and configures certain subsystems on AIX if the relevant software is installed. The following steps are taken:

- BOOTP - IBM Network Station devices in /etc/bootptab are enabled. An IBM Network Station device, as far as BOOTP is concerned, is an entry that has a bootfile directory `hd=/usr/netstation`. It is disabled by prefixing it with a pound sign (#).

  It is enabled by removing this prefix. The BOOTP daemon is run under the control of the Internet Super-Server (inetd). If present, the preceding # is removed from the BOOTP entry in /etc/inetd.conf, and the inetd daemon is refreshed by running:

  ```
  refresh -s inetd
  ```

- TFTP - The following is a sample of the records that are added to /etc/tftpaccess.ctl so that the IBM Network Station Server software directories are accessible using TFTP. See Appendix C, “TFTP Directories” on page 239 for a complete list.

  ```
  allow:/usr/netstation
  allow:/usr/netstation/configs
  allow:/usr/netstation/StationConfig
  allow:/usr/netstation/nsm/StationConfig
  allow:/usr/netstation/mods
  allow:/usr/netstation/fonts/pcf/100dpi
  allow:/usr/netstation/fonts/pcf/dw100dpi
  allow:/usr/netstation/fonts/misc
  allow:/usr/netstation/fonts/ns3270
  allow:/usr/netstation/fonts/pcf/java

  The TFTP daemon is run under the control of the Internet Super-Server
  (inetd). If present, the preceding # is removed from the TFTP entry in
  /etc/inetd.conf, and the inetd daemon is refreshed by running:
  refresh -s inetd
  ```

- NFS - The following entry is added to /etc/exports:

  ```
  /usr/netstation -ro
  ```

  All file systems are then exported by running:

  ```
  /usr/sbin/exportfs -a
  ```

  It is verified that /usr/netstation is exported by running:

  ```
  /usr/bin/showmount -e localhost
  ```

If /usr/netstation is not exported, then assume that NFS is not enabled, and the NFS daemons are started by running:

```
/usr/sbin/mknfs -B
```

Note: If you require the IBM Network Stations to be able to save configuration files on the server in the /usr/netstation/nsm/StationConfig directory, then you must remove the `-ro` option from the /etc/exports file and rerun the command `/usr/etc/exportfs -a`

- Domain Name Service (DNS) - If /etc/resolv.conf exists on the boot server, then the IBM Network Station is configured to use DNS by adding the following to /usr/netstation/nsm/StationConfig/defaults.dft:

```
set tcpip-name-server-protocol = dns
set tcpip-name-servers[-1] = {
"name_server" }
```

where *name_server* is the IP address of the first name server as listed in /etc/resolv.conf. The `tcpip_name_servers` line is repeated for all subsequent name servers.

- CDE - Note that the use of CDE or XDM as a display manager for the Network Station is limited to NSM Release 2.5 only. To enable setting user preferences in the IBM Network Station at login the following is added to /etc/dt/config/Xconfig:

```
Dtlogin.IBM-8361-100.startup: /usr/netstation/bin/Xstartup.ibm8361
Dtlogin.IBM-8361-200.startup: /usr/netstation/bin/Xstartup.ibm8361
Dtlogin.IBM-8361-100.reset: /usr/netstation/bin/Xreset.ibm8361
Dtlogin.IBM-8361-200.reset: /usr/netstation/bin/Xreset.ibm8361
Dtlogin.IBM-8361-110.startup: /usr/netstation/bin/Xstartup.ibm8361
Dtlogin.IBM-8361-210.startup: /usr/netstation/bin/Xstartup.ibm8361
Dtlogin.IBM-8361-110.reset: /usr/netstation/bin/Xreset.ibm8361
Dtlogin.IBM-8361-210.reset: /usr/netstation/bin/Xreset.ibm8361
Dtlogin.IBM-8362-A50.startup: /usr/netstation/bin/Xstartup.ibm8361
Dtlogin.IBM-8362-A50.reset: /usr/netstation/bin/Xreset.ibm8361
Dtlogin.IBM-8362-A20.startup: /usr/netstation/bin/Xstartup.ibm8361
Dtlogin.IBM-8362-A20.reset: /usr/netstation/bin/Xreset.ibm8361
```

Refer to Chapter 3.7.6, “User Customization” on page 63, for more details. The dtlogin process is restarted by running:

```
/usr/dt/bin/dtconfig -reset
```

XDM - To enable setting user preferences at login, the following is added to /usr/lib/X11/xdm/xdm-config:

```
DisplayManager.IBM-8361-100.startup:/usr/netstation/bin/GiveConsole.ibm8361
DisplayManager.IBM-8361-200.startup:/usr/netstation/bin/GiveConsole.ibm8361
DisplayManager.IBM-8361-100.reset: /usr/netstation/bin/TakeConsole.ibm8361
DisplayManager.IBM-8361-200.reset: /usr/netstation/bin/TakeConsole.ibm8361
DisplayManager.IBM-8361-110.startup:/usr/netstation/bin/GiveConsole.ibm8361
DisplayManager.IBM-8361-210.startup:/usr/netstation/bin/GiveConsole.ibm8361
DisplayManager.IBM-8361-110.reset: /usr/netstation/bin/TakeConsole.ibm8361
DisplayManager.IBM-8361-210.reset: /usr/netstation/bin/TakeConsole.ibm8361
DisplayManager.IBM-8362-A50.startup:/usr/netstation/bin/GiveConsole.ibm8361
DisplayManager.IBM-8362-A50.reset: /usr/netstation/bin/TakeConsole.ibm8361
DisplayManager.IBM-8362-A20.startup:/usr/netstation/bin/GiveConsole.ibm8361
DisplayManager.IBM-8362-A20.reset: /usr/netstation/bin/TakeConsole.ibm8361
```

Refer to Chapter 3.7.6, “User Customization” on page 63, for more details. The xdm process is restarted by running:

```
/bin/kill -1 $(cat /usr/lib/X11/xdm/xdm-pid)
```

- Authorization - Access to the IBM Network Station configuration daemon is enabled, and the configuration read/write password is set to the machine ID of the boot server by adding the following to /usr/netstation/nsm/StationConfig/defaults.dft

  ```
  set config-access-control-enabled = false
  set config-read-write-password = XXXXXXXXXXXX
  ```

  where *XXXXXXXXXXXX* is the `uname -m` of the boot server.

  The **Setup** menu option on the IBM Network Station User Services Console is disabled by adding the following to the file /usr/netstation/nsm/StationConfig/defaults.dft:

  ```
  set exec-disabled-commands[-1] = {"setup"}
  ```

- Environment variables - The main environment variables are set up by adding the following to /usr/netstation/nsm/StationConfig/defaults.dft (if they do not already exist):

  ```
  echo "set pref-environment[-1] = { \"MRI_PATH\" \"MRI2924\" }" >>
  /usr/netstation/nsm/StationConfig/defaults.dft
  echo "set pref-environment[-1] = { \"NSM_PROD_SYSDEFAULTS\"
  \"/usr/netstation/SysDefaults\" }" >>
  /usr/netstation/nsm/StationConfig/defaults.dft
  echo "set pref-environment[-1] = { \"NSM_ADMIN_SYSDEFAULTS\"
  \"/usr/netstation/nsm/SysDefaults\" }" >>
  /usr/netstation/nsm/StationConfig/defaults.dft
  echo "set pref-environment[-1] = { \"BOOTHOST\" \"$BOOTHOST\" }" >>
  /usr/netstation/nsm/StationConfig/defaults.dft
  echo "set pref-environment[-1] = { \"BOOTPATH\" \"/usr/netstation/\" }" >>
  /usr/netstation/nsm/StationConfig/defaults.dft
  echo "set pref-environment[-1] = { \"DESKTOPLAUNCHER_CLASSPATH\"
  \"/usr/netstation/mods/NAV/navio.zip:/usr/netstation/mods/NSB/nsb.zip:/usr/
  netstation/java/nwspackg.zip:/usr/netstation/java/classes.zip\" }" >>
  /usr/netstation/nsm/StationConfig/defaults.dft
  set exec-disabled-commands[-1] = { "setup" }
  ```

Note: Subsequent configuration may undo changes made by the `nsconf` script, or the user may install additional filesets. It may be necessary later to run the nsconf command manually in this event.

Moreover, if you need to disable the server code, enter the following command:

```
/usr/netstation/bin/nsconf -d
```

Running the nsconf script with the `-d` flag comments out references to the Network Station in the /etc/bootptab file, which keeps them from booting using BOOTP protocol. Configuration information is not erased from the system, and the server code can be reactivated by running the `nsconf` again with no flags.

Running `nsconf -d` does not turn off BOOTP, TFTP and NFS. These processes must be shut down manually.

2.7.2 Nsm_icsconf Script Step by Step

The nsm_icsconf script examines the configuration of Domino GO Webserver and adapts it for the IBM Network Station Manager software. The following steps are taken:

- During the installation process, this script is run with the flag `-C`

  ```
  nsm_icsconf -C
  ```

  To remove this specific customization, run the script with the flag `-U`

  ```
  nsm_icsconf -U
  ```

- Backups the existing configuration file of the httpd server, /etc/httpd.conf:

  ```
  /bin/cp /etc/httpd.conf /etc/httpd.conf.sav
  ```

- Changes the httpd user ID to *root* and the httpd group ID to *system:*

  ```
  s/UserId/#UserId/
  /UserId/{a\
  UserId root
  }
  s/GroupId/#GroupId/
  /GroupId/{a\
  GroupId system
  }
  ```

- Adds the NSM cgi-bin configs in the file /etc/httpd.conf. The paths defined with NSM R2.x have been changed with the Release 3 of NSM:

  `/NetworkStation/Admin` is replaced to `/networkstation/admin`

- Adds the basic authentication API program in the file /etc/httpd.conf with the line:

  ```
  Authentication BASIC
  /usr/netstation/nsm/httpd/basicsec.so:basic_authentication
  ```

- Stops and restarts the http daemon using the following commands:

  ```
  /bin/stopsrc -s httpd
  /bin/startscr -s httpd
  ```

2.8 Software Installation on Non-AIX Platforms

It is possible to install the IBM Network Station Server software on any software platform that will support the boot protocols listed in Chapter 1.10, “IBM Network Station Boot Server” on page 21 (a non-AIX platform also includes unsupported AIX levels). If the software platform is capable, IBM Network Station Server software install images can be used directly; otherwise the software must first be installed on an AIX server.

Take Note

This is a non-trivial procedure, and you should be confident of your ability to complete this task unaided. IBM will offer no official support and is not responsible for any damage to your system caused by following these instructions.

Moreover, the Network Station Manager software itself (the management software on the AIX server) is not available on other UNIX systems.

2.9 File System Structure

All of the IBM Network Station Server base software is stored in the /usr/netstation file system. Figure 17 shows a one-level directory tree of that file system immediately after installation.

The installation process creates one new file system, namely:

```
/usr/netstation/nsm
```

This structure may not match the directories used in all IBM Network Station servers. The use of directory aliases or links may allow compatibility between conflicting file system topologies.

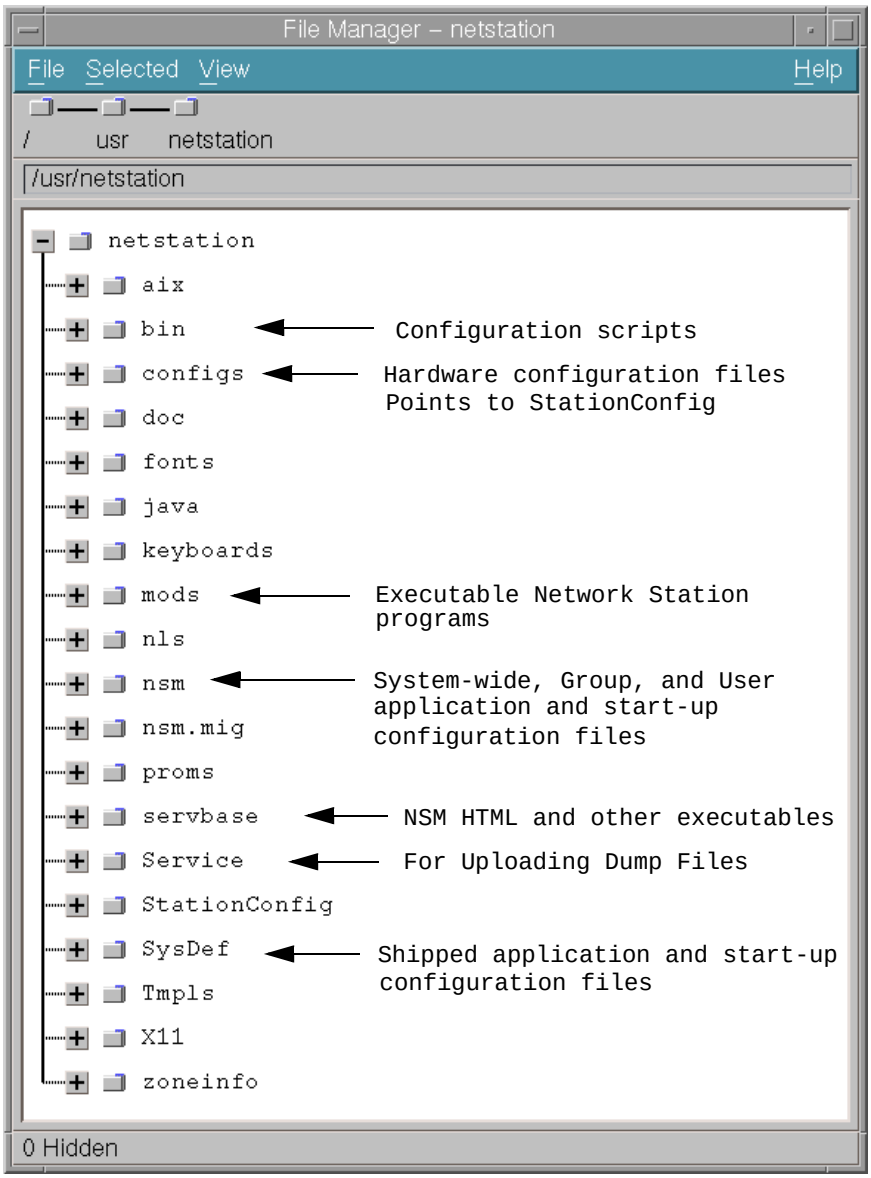

Figure 17. IBM Network Station Server Software Directory Tree

Chapter 3. AIX Server Configuration

This chapter discusses how to configure AIX for both the lowest administration overhead and the maximum IBM Network Station end-user benefit. Topics include DHCP, BOOTP, DHCP, DDNS, NFS, security, CDE, and XDM.

For a detailed look at the IBM Network Station configuration files themselves, see Chapter 4, “Configuration Files” on page 67.

3.1 Overview

After completion of the Network Station software installation, the server is ready to communicate with the Network Station using the default protocol settings.

The following steps are already completed by the `nsconf` command. They are included to provide a summary of the configuration changes that were automatically performed by the installation script. Refer to Chapter 2.7, “Alternate Installation” on page 32, for further information.

The AIX-specific configuration performed by the IBM Network Station installation are as follows:

- The bootpd BOOTP daemon is enabled and controlled by inetd, the Internet super daemon. This service is used to assign a valid IP address to the Network Station and define some other boot information.
- The tftpd TFTP daemon is enabled and controlled by inetd. This service is used as low-level solution for retrieving files from the boot server if NFS is not available.
- The TFTP daemon is allowed to export the directories needed by the Network Station. This is configured in the file /etc/tftpaccess.ctl. By default, these are /usr/netstation and subsequent directories.
- The NFS daemon is activated and will be started automatically at boot time instead of using TFTP. This service is used as high-level solution for retrieving files from the boot server.
- The Network Station is able to mount the directory /usr/netstation which is used to store its boot files.
- The CDE and XDM processes are configured to allow the Network Station to act as X-terminal for the boot server.
- The configuration files of the IBM Network Station are updated so it will use, by default, the same name server that the boot server uses and access the directory with the boot files using NFS for faster access.

How to configure each of these services is discussed in the following sections.

3.2 DHCP versus BOOTP

For participating in a TCP/IP network, the Network Station must have a unique IP address, which is used for the correct delivery of network packets between the server and the IBM Network Station. To avoid manual configuration on each Network Station, all information needed for its booting process must be available

in the local network. This includes the IP address of each IBM Network Station. Although it is possible to set this address manually, the Boot Monitor process of the Network Station attempts to get a valid IP address from the network by default.

A logical view of the request for information exchanged during the boot phase is shown in Figure 18. The arrows represent the progression of time throughout a typical session.

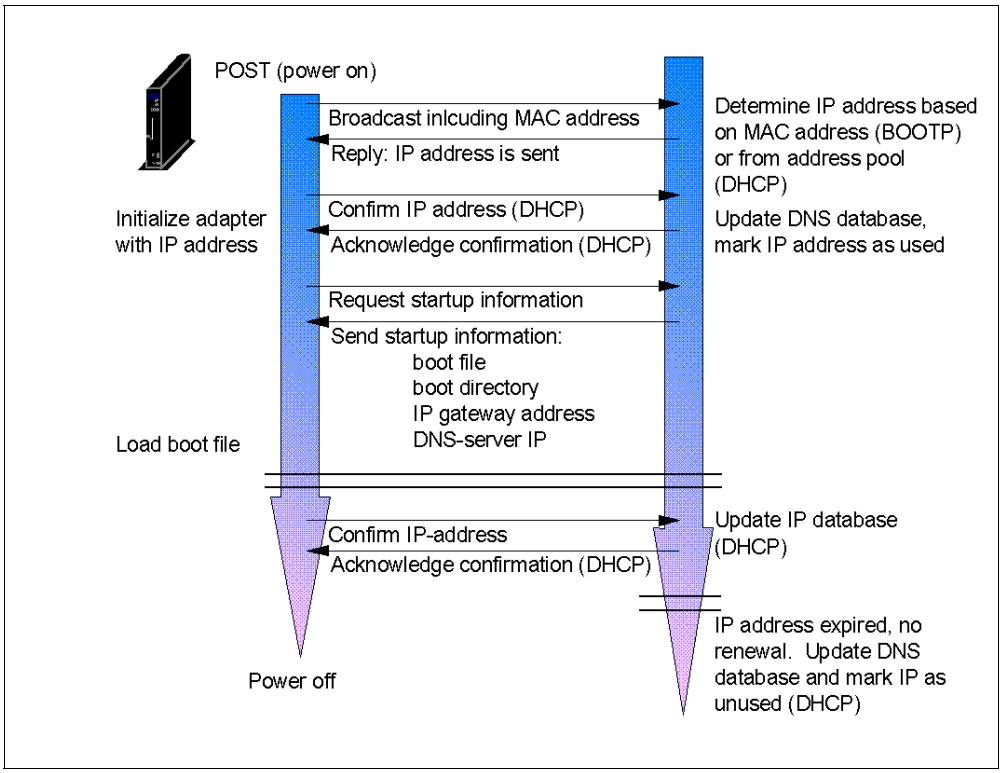

Figure 18. Request IP Address and Start-Up Information

To distribute a unique IP address to each IBM Network Station, there must be a service available in the local network that assigns a valid IP address for each IBM Network Station. This task is done by either the bootstrap protocol (BOOTP) or by the dynamic host configuration protocol (DHCP). Both the DHCP and BOOTP daemons support different features. Daemons are background applications running on the server that provide a service used by other programs, either local or distributed.

The way you use your IBM Network Station determines the best way to assign an IP address to it. Which service and which order they will be tried can be customized in the Network Parameters Panel of the IBM Network Station. If you just want to use a few IBM Network Stations in a small network, BOOTP will be sufficient. For large networks with many IBM Network Stations, DHCP will ease the maintenance. The following sections describe the major differences.

3.2.1 Dynamic IP Address Allocation

In expansive network environments, it is important to have a mechanism assigning IP addresses to IBM Network Stations automatically. DHCP is designed

to solve this problem. It can assign either a permanent IP address or a dynamic IP address for every host or IBM Network Station within a range of predetermined IP addresses.

The static assignment is similar to BOOTP. You must register the MAC address of every Network Station with DHCP. A MAC address is a hard-coded, unique identifier in the network adapter of the IBM Network Station. This address is used to communicate with the adapter in the local network. The MAC address of your IBM Network Station is displayed during the power-on phase or is available using the built-in utilities.

For dynamic assignment, the DHCP server will lease an IP address out of a pool of free addresses to every client requesting an address. At certain time intervals, the client has to renew this lease. Thus you are able to connect as many IBM Network Stations as you want to your network, and DHCP will assign everyone a unique IP address without having to record the MAC addresses of each client.

With BOOTP, you can use only the static assignment and thus have to register every IBM Network Station's MAC. In large networks, this registration can be a time-intensive task. In addition, you must keep track of the assigned IP addresses because you are not allowed to assign an IP address twice.

To make matters easier, the MAC addresses are printed on the external carton of the IBM Network Station.

The IBM Network Station is able to use either DHCP or BOOTP for retrieving an IP address. You can specify the order that these protocols should be queried.

3.2.2 IP Address Reuse

Because the DHCP daemon only leases IP addresses to its clients for a configurable time interval, DHCP can collect expired IP addresses and add them back into the pool of free addresses. Powering-off one IBM Network Station will cause its IP address to fail renewal; so it can be eventually assigned to an other DHCP client by the server.

This allows you to connect more than 253 IBM Network Stations to your local subnet if only a maximum of 253 are active at the same time. Vacations, sickness, flexible work schedules, and other events can be used in your favor. There are only 253 available IP addresses in a subnet. The numbers 0 and 255 have special meanings, and you need one address for your boot server as well.

3.2.3 Setting Up BOOTP

To use BOOTP to assign an IP address to the IBM Network Station, there are two steps to be performed. It is important to know that you cannot connect a IBM Network Station to the local network and assume it will get the correct IP address from BOOTP without first configuring BOOTP to do so.

You must have root privileges to perform the following tasks.

The first step is to start BOOTP if there are incoming requests from the network. This is performed automatically by the IBM Network Station installation program. Normally, BOOTP is started by inetd, the Internet super daemon. Therefore, you must remove the comment (#) from the correct line in /etc/inetd.conf and refresh inetd so it will re-read the configuration file. This can be done with the command:

```
refresh -s inetd
```

Registering the IBM Network Stations with the BOOTP daemon must be done for every IBM Network Station separately. There is a SMIT panel available to provide an interface for this task. The command for the text-based version is:

```
smitty bootp
```

For using SMIT, refer to the *AIX Version 4 System Administration Guide*.

The resulting SMIT panel offers the following choices:

- **List All BOOTP Devices:**

  This will list all currently defined entries with host name, MAC address, and IP address.

- **Add a new BOOTP Device:**

  This will add a new IBM Network Station to BOOTP, as described in the text that follows.

- **Change / Show Characteristics of a BOOTP Device:**

  This allows you to select an existing entry and either make changes or see all of the parameters.

- **Duplicate a new BOOTP Device from an existing Device:**

  You can select an existing device that has almost all required parameters and just change some of them according to the new IBM Network Station. The panel is the same as when adding a new device.

- **Remove a BOOTP Device:**

  A list is presented that allows you to select the one you want to remove from BOOTP.

Configuring, changing, or duplicating entries will show you the screen shown in Figure 19.

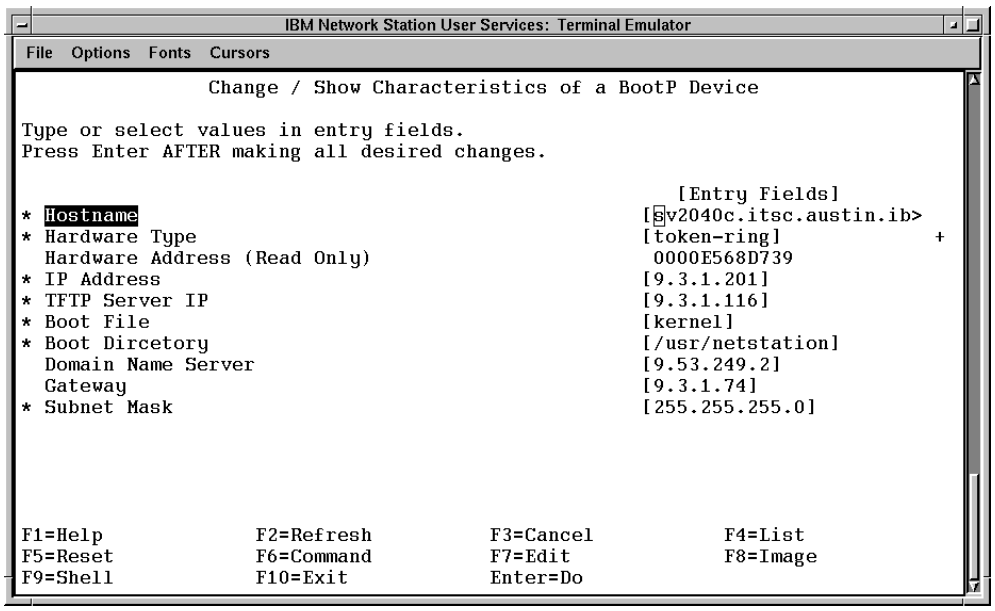

Figure 19. Adding New BOOTP Device

In this panel, enter the host name of the IBM Network Station, including the domain name followed by the hardware type and hardware address, which is the type of network adapter used and the corresponding MAC address of the adapter. The MAC address will be visible during the boot process of the IBM Network Station. Then enter the IP address of the IBM Network Station, the IP address of the server where it can load the configuration files from, the name of the file storing the kernel, and the directory storing it. The last step is to enter the IP address of your domain name server, the IP address of the gateway handling IP traffic outside the local network, and the subnet mask of you local network. You can omit the fields for the domain name server and the gateway if you do not use these services.

Commit the updates by pressing **Enter**. The configuration will be added to the BOOTP configuration file /etc/bootptab, and the BOOTP daemon will provide this information to your IBM Network Station during boot.

Remember: This procedure must be repeated for every IBM Network Station added to your network if you want to use BOOTP.

3.2.4 Setting Up DHCP

DHCP is able to handle both assigning and reusing IP addresses. It will lease the addresses for a configurable time to its clients. Once the time expires, the clients have to renew the lease to keep the address. This allows DHCP to reuse IP addresses no longer used by clients. DHCP tries to allocate the same IP address for the same machine, but this may not always be possible.

In contrast to BOOTP, where every MAC address must be assigned to an IP address, DHCP is able to handle this task automatically. Therefore, if you want to

add a new Network Station to your network, you just have to connect it to your network, and the DHCP daemon will assign a free IP address to it.

DHCP and BOOTP cannot run on the same machine at the same time because they both use the same protocol and the same UDP port. Designed to replace BOOTP, DHCP is supports all features of BOOTP. There is no need to run both daemons on the same machine.

It is also possible just to set up a relay DHCP daemon. This server will forward DHCP request to an other DHCP server. Use this relay feature if you want to use a DHCP server in an other network because the broadcast requests from an IBM Network Station will not cross subnets.

3.2.4.1 DHCP Configuration

DHCP configuration is more advanced than BOOTP since there are no SMIT panels available for this task.

If you already have a running BOOTP configuration, you can convert all entries from /etc/bootptab into the file /etc/dhcpsd.cnf automatically with the program /usr/sbin/bootptodhcp. This will append the proper client entries to the DHCP configuration file. Further information can also be found within the file /etc/dhcpsd.cnf and in the *AIX Version 4 System Administration Guide*.

To help you visualize the parameters involved, the network layout for this configuration can be seen in Figure 20 and the configuration file that follows:

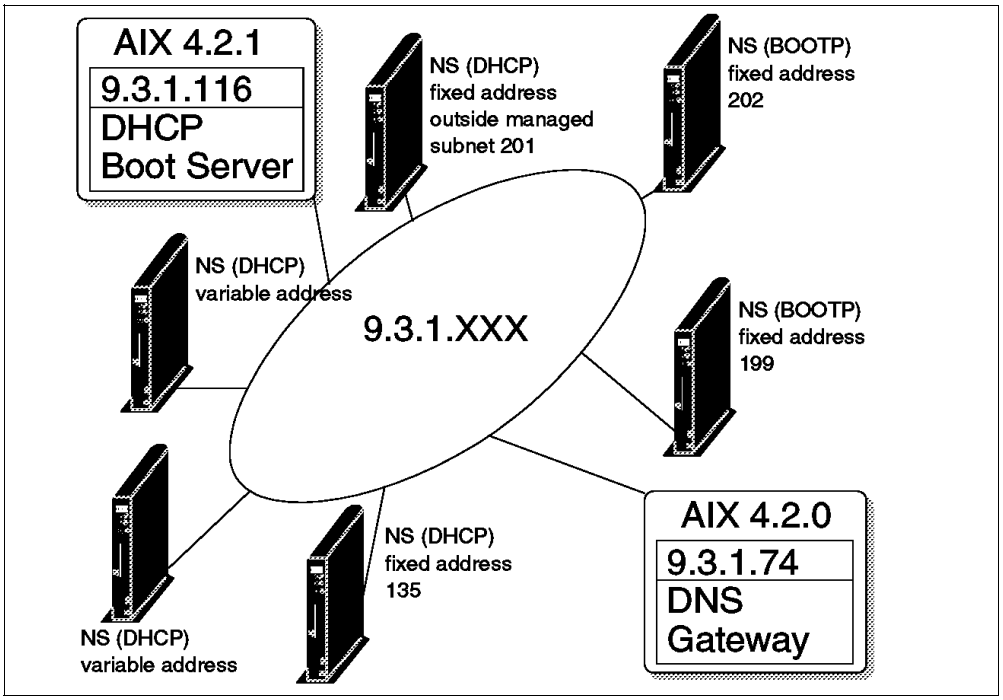

Figure 20. Sample Network Layout

```
#global declaration of the log files
1   numLogFiles 4
      logFileSize 100
      logFileName /tmp/dhcp.log
2   logItem SYSERR
      logItem OBJERR
      logItem PROTERR
      logItem WARNING
      logItem EVENT
      logItem ACTION
      logItem INFO
      logItem ACNTING
      logItem TRACE

      #how long is IP address valid
3   leaseTimeDefault      30 minutes
      leaseExpireInterval   10 minutes

      #BOOTP should be supported
4   supportBOOTP yes

      #All clients will be served
5   supportUnlistedClients yes

      #declare global options
6   option 28 9.3.1.255                # broadcast address
      option 3  9.3.1.74                 # default gateway
      option 6  9.3.1.74                 # domain name server
      option 15 itsc.austin.ibm.com      # Domain name

      #special BOOTP options
7   option sa 9.3.1.116                #boot server
      option hd "/usr/netstation"        #boot directory
      option bf "kernel"                 #kernel file

      #our network with subnetmask
      #this must be first statement
8   network 9.0.0.0 255.255.255.0
      {
        #BOOTP clients
9     client 6 0000E568D75E 9.3.1.199
        client 6 0000E5E8EC76 9.3.1.202

        #DHCP clients outside managed subnet
10    client 6 0000E568D739 9.3.1.201
        {
          option 51 0xffffffff           # infinite address lease time
        }
#subnet with variable IP addresses
11    subnet 9.3.1.0     9.3.1.135-9.3.1.139
        {
          #hosts with variable IP addresses
          #need not to be mentioned explicit, since
          #supportUnlistedClients=yes

          #hosts with fixed IP addresses within managed subnet
12      client 6 0000e568f5f0 9.3.1.135

          #hosts with variable IP address, but fixed host name
          #this needs DDNS enabled (last two lines)
13      client 6 0000e568f5ee "any"
          {
            option 12 "sv2040b" #hostname
          }
        } #end subnet
      } #end network

14  #Actions for updating DNS
      updateDNS
      "/usr/sbin/dhcpaction '%s' '%s' '%s' '%s' PTR NONIM>>/tmp/rmdns.out 2>&1"

      removeDNS
      "/usr/sbin/dhcpremove '%s' PTR NONIM >>/tmp/rmdns.out 2>&1"
```

This example shows entries for a variety of configurations.

- Variable IP address, variable host name
- Variable IP address, static host name
- Static IP address inside managed IP range
- Static IP address outside managed IP range
- BOOTP address records

The following notes further describe the records with annotations:

1 The declaration of the log files. DHCP should use four log files with a 100 KB maximum file size and base name /tmp/dhcp.log. These log files are important and the only source of information for error messages and debugging.

2 The events to be logged by DHCP. During setup, you should enable all events. Once DHCP is running, you can decrease the amount of logging.

3 Declaration of the lease time interval. After 30 minutes, the client has to renew the lease interval. In the case where the IP address cannot be renewed because the DHCP server cannot be contacted, the IP will expire in 10 minutes.

4 This DHCP server should answer BOOTP requests.

5 If set to no, you must declare all MAC addresses of your clients in the configuration file to serve them by DHCP. If set to yes, DHCP will serve any incoming requests.

6 These are global options that will be transmitted to the client when it requests the start up information. You should (at a minimum) declare these four, if available. For additional options, refer to the comments in the original file /etc/dhcpsd.cnf of AIX.

7 Special options for BOOTP. These options will be used by the IBM Network Station to load the kernel file and configuration files. The IBM Network Station will read these options even when using the DHCP protocol.

8 Here is the declaration of the network. You must adhere to the TCP/IP network conventions. Be sure to use the right network address and mask.

9 These lines declare the BOOTP clients. As with the BOOTP setup, you must register every client with its MAC address and the corresponding IP address. If you want to specify different BOOTP options for a client, you must put these options into brackets right after the client statement.

10 Here is an example for a DHCP client outside the subnet managed by DHCP. This looks similar to the BOOTP client definition. Because DHCP cannot renew any IP addresses outside its managed range, you must specify an infinite lease time for these clients. This results in the same behavior as BOOTP clients. They will get an IP address assigned and do not have to renew it.

11 This is the declaration of the subnet managed by DHCP and the range of the IP addresses for the address pool of DHCP. Unless otherwise

specified, any client requesting an IP address from DHCP will get an address out of this pool, if possible. Because the option `supportUnlistedClients` is set to `yes`, you do not have to specify any MAC addresses of your clients.

12 With statements similar to this, you can assign fixed IP addresses to special clients in cases where the software depends on a fixed address.

13 If you use DDNS (see Section 3.2.5, “Setting Up DDNS” on page 45), the IP address of your host can vary, but it will always have the same host name. To specify the host name, you must assign a host name with `option 12` to this client.

14 These are the commands used to update the DNS database if DHCP assigns or releases IP addresses. See Section 3.2.5, “Setting Up DDNS” on page 45, for further information.

It is likely that your configuration file will be less complex since this file contains many possibilities of how DHCP can assign IP addresses or host names.

3.2.4.2 Starting DHCP

To start the DHCP server, you have first to disable the start of BOOTP in the /etc/inetd.conf file by placing a comment (#) in the first column of the bootps line. Then make inetd re-read the configuration by using the following command:

```
refresh -s inetd
```

Check for any active BOOTP daemons with:

```
ps -eaf|grep bootp
```

If any BOOTP processes are running, stop them with:

```
kill -9 PID
```

where `PID` is the process ID of the BOOTP process listed by the `ps` command.

Start DHCP by using `smitty dhcpsd`, or start it directly with:

```
startsrc -s dhcpsd
```

Be sure to check your log files the first time you start DHCP to find errors in your server configuration or client configuration. It will be good idea to enable all events for logging in the beginning.

3.2.5 Setting Up DDNS

The dynamic domain name system (DDNS) is needed in correlation with DHCP. Because the IP address of an IBM Network Station may vary if you use the Dynamic Host Configuration Protocol (DHCP), you must be certain that the DNS host name and IP resolution tables will be updated correctly. DDNS keeps track of the used IP addresses and the corresponding host names.

DDNS should be configured before updating DNS database from DHCP. To update DNS dynamically, you need to add dynamic controlled to the entries in named.boot. Our example of named.boot is the following:

```
;
; type   domain                 source file or host
;
domain  itsc.austin.ibm.com
primary itsc.austin.ibm.com   /etc/named.date dynamic controlled
primary 1.3.9.in-addr.arpa    /etc/named.rev dynamic controlled
```

If DHCP just maintains a pool of IP addresses for the IBM Network Stations and you do not require fixed host names, you do not need to use DDNS.

In AIX, the dynamic DNS update is handled by using special parameters in the DHCP configuration file. The parameter `updateDNS` specifies a program that will be called every time DHCP assigns a new IP address. It has to update the DNS database and refresh the DNS daemon to set this change into effect.

The program receives the following parameters from DHCP:

hostname The host name of the assigned or released IP address

domainname The domain name of the assigned or released IP address

ipaddress The IP address of the host

leasetime The number of seconds this IP address will be valid

With AIX, you can use the program /usr/sbin/dhcpaction for this task. It has the following calling syntax:

```
/usr/sbin/dhcpaction hostname domainnaim ipaddress leasetime REC NIM
```

The first four parameters are provided by DHCP. The next one, `REC`, specifies the action to be done by the program. The following parameters are valid:

A Update just the A records of the DNS database.

PTR Update just the PTR records of the DNS database.

BOTH Update A and PTR records of the DNS database.

NONE Do not update any records.

The last parameter specifies if NIM is used. Valid options are:

NIM NIM is used.

NONIM NIM is not used.

If DHCP frees a previously assigned IP address, the program specified with the parameter `removeDNS` will be called. The program provided with AIX has the following syntax:

```
/usr/sbin/dhcpremove ipaddress REC NIM
```

where `REC` and `NIM` are the same parameters and have the same options as `dhcpaction`.

3.2.6 NVRAM Settings

You can use both BOOTP and DHCP with the IBM Network Station. You can choose which of these services should be used by the IBM Network Station and in which order. This allows you to select the desired protocol depending on your network setup. Because the order which the IBM Network Station should try the

protocols can be specified, you can still have an additional BOOTP server running as backup solution.

3.3 Control of a Multiple Server Environment with DHCP

It may be desirable to have multiple servers to separate the load when a large number of IBM Network Stations power on simultaneously. And also, you may want to have configuration information (IP addresses of the IBM Network Stations, which server should a IBM Network Station boots from, the DNS server of clients, and so on) in a specific machine to maintain it easily. This section describes the method to control a multiple server environment with DHCP.

3.3.1 Role of Multiple Servers

Servers, as defined by the IBM Network Station Manager, fit into three roles, and you can distribute these roles to multiple servers. A brief description of each server role follows:

- Terminal Configuration Server

  The IBM Network Station Manager program on this server provides terminal-based configuration settings. An example of items to configure on this server are a printer that is attached to the Network Station or the IBM Network Station's keyboard language. These configuration files correspond to the shipped configuration files, the system-wide configuration files, and the individual IBM Network Station configuration files in the hardware configuration files. See 4.4.3, "User Preferences" on page 97, for more information of these files. By specifying the IP address of the terminal configuration server and the path name of the configuration file in the DHCP configuration file or NVRAM, the IBM Network Station reads the specified configuration from the terminal configuration server.

- Base Code Server

  This server provides the kernel and the application programs that are downloaded to the IBM Network Stations. You need to have the kernel and the application programs on this server. On this server, you need to configure the NFS and also the TFTP server if you use the TFTP protocol during boot sequence. These configurations are run automatically if you install the IBM Network Station on this server. See 2.7.1, "Nsconf Script Step by Step" on page 32, for more information about configuration of NFS and TFTP.

  At the time of writing, the base code server must have at least the following directories and files under the directories:

  - /usr/netstation directory

    kernel files

    XKeysymDB file

    rgb.txt file

    boot.nsl

  - /usr/netstation/mods directory

    All subdirectories and files

  - /usr/netstation/SysDef directory

All subdirectories and files

- /usr/netstation/java directory

  All subdirectories and files

- /usr/netstation/keyboards directory

  All subdirectories and files

By checking diagnostic messages on the console, you will obtain the files that the IBM Network Station fails to read. If a file does not exist on the base code server, you must copy the file to your base code server.

- Authentication Server

  The IBM Network Station Manager program on this server provides user authentication and user-based configuration settings. The IBM Network Station Manager program manages these settings. Examples of what you might configure on this server are user's startup programs or environment variables. These setting are read in the login sequence. See 4.3.7, "Configuration File Download Sequence" on page 83, for more information of the login sequence. You can select the authentication server by selecting the server with the **Roam** button on the login dialog.

3.3.2 DHCP Configuration: Example of Multiple Server Environment

A test environment is shown in Figure 21. There are two base code servers in this environment. Also, each server has another role, one works as the terminal configuration server, the other works as the authentication server.

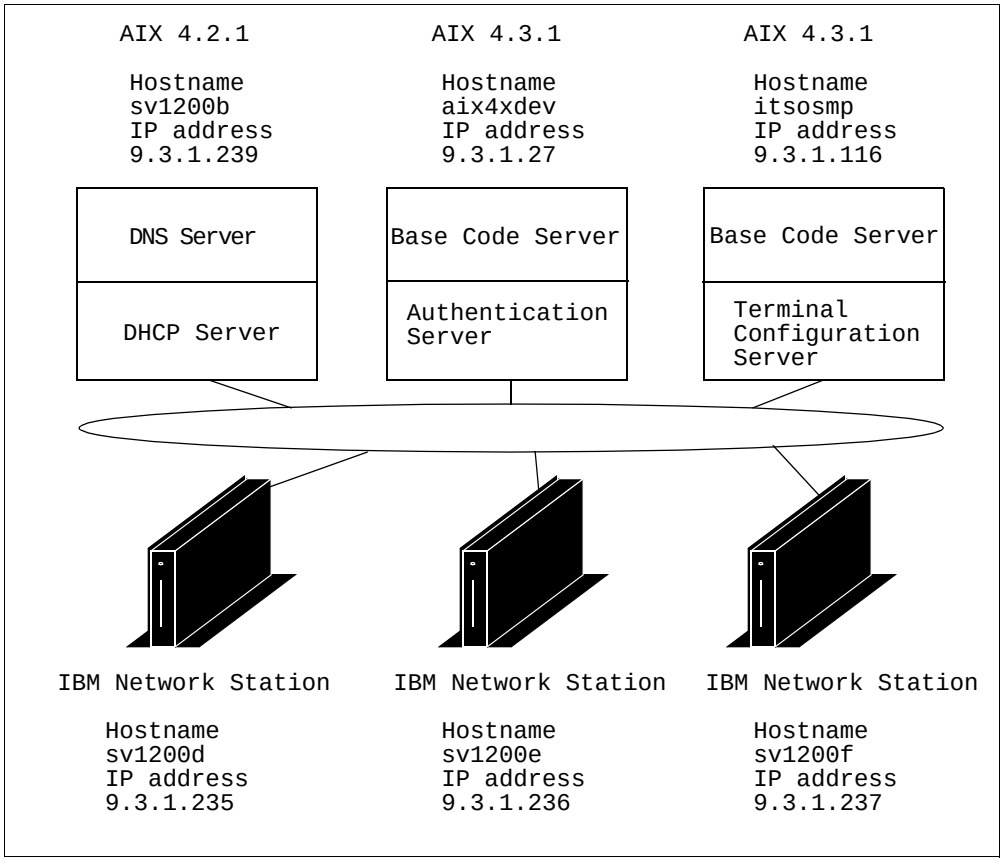

Figure 21. Multiple Server Environment Example

In this environment, the three IBM Network Stations have no network configuration on their NVRAM. The three IBM Network Stations boot by using DHCP protocol.

The DHCP server controls and distributes the following information:

- The DHCP server gives a static IP address and hostname to each IBM Network Station. These names have to be consistent with the name resolution of DNS.
- The IBM Network Stations sv1200d and sv1200f use aix4xdev as the base code server. The kernel and the application programs are downloaded from aix4xdev for sv1200d and sv1200f.
- The IBM Network Station sv1200e connects to itsosmp as the base code server. The kernel and the application programs are downloaded from itsosmp for sv1200e.
- All IBM Network Stations use aix4xdev as the terminal configuration server. All IBM Network Stations read configuration files from the specified path and the specified server by the DHCP server.
- The NFS protocol is used for downloading base code and configuration files.

To specify the download protocols and the terminal configuration server, you need to use the following site specific options in DHCP. If you don't use these

options, the IBM Network Station reads the terminal configuration from the base code server.

- Option 211

  This option specifies the protocol to use for downloading the base code from the base code server. Possible values are nfs or rfs/400.

- Option 212

  This option specifies IP address of the terminal configuration server. Up to two addresses separated by blank can be specified.

- Option 213

  This option specifies the configuration files path name. Up to two paths separated by a blank can be specified.

- Option 214

  Protocol to use for reading the terminal configuration files. Possible values are tftp, nfs, or rfs/400. Up to two values separated by a blank can be specified.

The following example listing is the /etc/dhcpsd.cnf file we used to specify the above configuration with DHCP options.

```
numLogFiles   4
logFileSize 100
logFileName /usr/tmp/dhcpsd.log
logItem   SYSERR
logItem   OBJERR
logItem   PROTERR
logItem   WARNING
logItem   EVENT
logItem   ACTION
logItem   INFO
logItem   ACNTING
logItem   TRACE

leaseTimeDefault    10 minutes
leaseExpireInterval  3 minutes

option 1 255.255.255.0
option 3 9.3.1.74
option 6 9.3.1.239
option hd "/usr/netstation"
option bf "kernel.63Z"

network 9.0.0.0 255.255.255.0
{
 subnet 9.3.1.0 9.3.1.235-9.3.1.237
 {
  # BOOTP CLIENT: sv1200f
  client 6 0000E5D421D9 9.3.1.237
  {
   option sa 9.3.1.116
   option 12 "sv1200f"
  }

  # BOOTP CLIENT: sv1200e
  client 6 0000E5D4222F 9.3.1.236
```

```
  {
   option sa 9.3.1.27
   option 12 "sv1200e"
   option 211 "nfs"
   option 212 "9.3.1.116"
   option 213 "/usr/netstation/configs/ \
               /usr/netstation/nsm/StationConfig/"
   option 214 "nfs"
  }

  # BOOTP CLIENT: sv1200d
  client 6 0000E5D42221 9.3.1.235
  {
   option sa 9.3.1.116
   option 12 "sv1200d"
  }
 }
}
```

The proceeding configuration example includes the following information:

- The DHCP server gives a specific IP address to each IBM Network Station by reference of MAC address. And also, the DHCP server gives a specific hostname with `option 12`.
- The DHCP server specifies the IP address of the base code server with `option sa`. Therefore the base code server for sv1200f and sv1200d is 9.3.1.116, and the base code server for sv1200e is 9.3.1.27.
- To change the terminal configuration server for sv1200e, `option 212` and `option 213` are specified. sv1200e searches the terminal configuration file in the directories specified with `option 213` on the machine that is specified with `option 212`.
- The protocol for downloading is specified with `option 211` and `option 214`.

Note: You cannot specify the IP address of the authentication server with DHCP. To change the authentication server for the IBM Network Station, you need to specify the authentication server after pushing the **Roam** button on the login dialog.

3.3.3 Using DHCP Classes to Isolate Option Conflicts

In a DHCP environment, it is possible for options 211, 212, 213, and 214 to be used for a variety of purposes other than the IBM Network Station use for multiple servers. Because of this, it is recommended that IP address ranges are restricted to IBM Network Station classes.

In the following example, the class IBMNSM 1.0.0 is applied to two addresses in the subnet.

```
class "IBMNSM 1.0.0"  9.53.150.34-9.53.150.35
{
option 66 "9.53.150.219" #Network Station Class Boot Server IP Address
option 67 "/usr/netstation/kernel" #Boot Image file
option 211 "nfs" #Boot servr tcpip access protocol
```

```
option 212 "9.53.150.222" #Terminal Configuration Server IP Address
option 213 "/usr/netstation/configs" #Configuration files directory
option 214 "nfs" #Terminal Config server tcpip access protocol
}
```

Valid classes for IBM Network Stations are shown inTable 6.

Table 6. DHCP Classses for IBM Network Stations

IBM Network Station Model	DHCP Class
8361-100	"IBMNSM 2.0.0"
8361-110	"IBMNSM 2.1.0"
8361-200	"IBMNSM 1.0.0"
8361-210	"IBMNSM 1.1.0"
8361-341	"IBMNSM 3.4.1"
8362-A22	"IBMNSM A.2.0"
8362-A23	"IBMNSM A.2.0"
8362-A52	"IBMNSM A.5.0"
8362-A53	"IBMNSM A.5.0"

3.4 NFS versus TFTP Downloads

To download the kernel and the configuration files, the IBM Network Station has to access the directories on the boot server storing these files. There are two different possibilities to achieve this task. The IBM Network Station can download the files using the Network File System (NFS), the same mechanism used to share data between UNIX workstations, or with the trivial file transfer protocol (TFTP), a simple protocol for downloading files that is supported by almost every operating system.

3.4.1 Performance

In its current state of development, TFTP is slower than NFS. It will take about two times longer to download the kernel with TFTP than with NFS. For more performance information, see 8.2.1, “Boot Performance” on page 184. We recommend you should use NFS whenever possible.

Because some servers do not support NFS, TFTP is provided for compatibility.

In AIX Version 4.3.1, TFTP daemons do not shutdown when they are idle. This allows negotiation of block sizes up to 8K with the IBM Network Station. This enhancement improves performance of TFTP file transfers significantly. Make sure the latest AIX 4.3.1 service is loaded before using this feature.

3.4.2 Setting Up TFTP

For preparing your server to provide the TFTP service to your Network Station, there are a couple of steps:

- Specifying the directories that should by accessed with TFTP

- Starting TFTP

You must have root authority to perform these tasks.

Take Note

The setup program for the IBM Network Station software has already set up TFTP for you. You do not have to execute these steps manually. This section is for information only. See 2.7, “Alternate Installation” on page 32, for information about the setup.

The TFTP daemon requires a list of all directories that should be accessible by its clients. This list is provided in the file /etc/tftpaccess.ctl.

To make all directories needed by the IBM Network Station available, you must add several lines to the /etc/tftpacess.ctl file, see Appendix C, “TFTP Directories” on page 239 for a complete list:

```
allow:/usr/netstation
allow:/usr/netstation/configs
allow:/usr/netstation/mods
allow:/usr/netstation/fonts/pcf/100dpi
allow:/usr/netstation/fonts/pcf/dw100dpi
allow:/usr/netstation/fonts/pcf/misc
allow:/usr/netstation/fonts/pcf/ns3270
allow:/usr/netstation/fonts/pcf/java
```

After configuring the directory list, activate the TFTP daemon. Like BOOTP, TFTP should be started from inetd. Therefore you must uncomment (remove the #) in the configuration file /etc/inetd.conf and refresh the daemon to re-read the configuration file with the command:

```
refresh -s inetd
```

After finishing these steps, TFTP is configured and will be started by inetd with the first TFTP request received.

3.4.3 Setting Up NFS

For preparing your server to provide the NFS service to your IBM Network Station, there are a couple of steps:

- Specifying the directory that should by accessed using NFS
- Making sure the NFS daemon is up and running

You must have root authority to perform these tasks.

Take Note

The setup program for the IBM Network Station software has already done this step for you. You do not have to execute these steps manually. This section is for information only. See 2.7, “Alternate Installation” on page 32, for information about the setup.

The NFS daemon requires a list of all directories that could be accessed from its clients. Add the directory storing the files for the IBM Network Station to the *NFS export list*. There is a SMIT panel provided for this task. The command for the text based version is as follows:

```
smitty nfs
```

Select **Network File System (NFS)**, and you will see the panel in Figure 22.

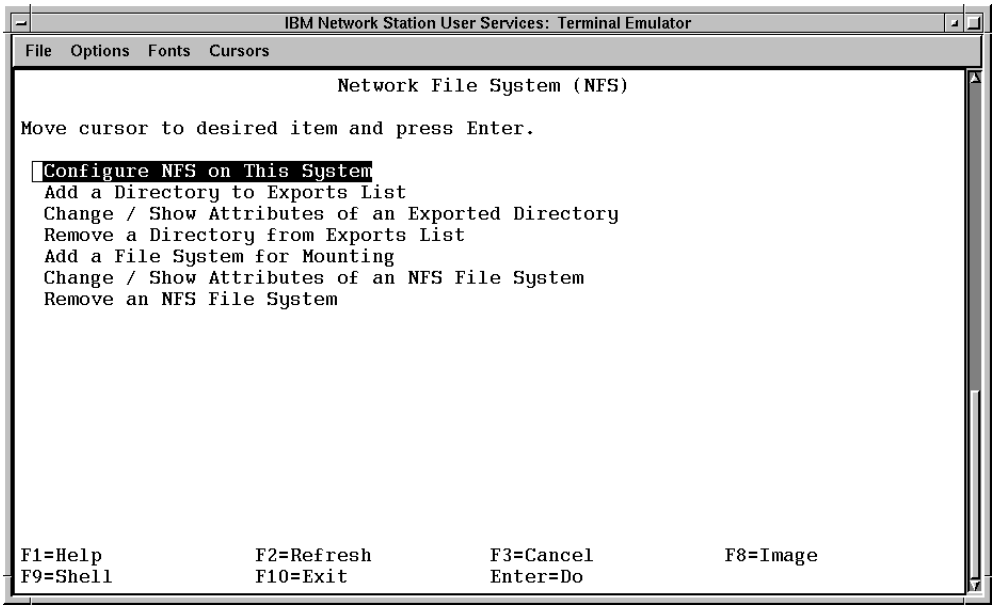

Figure 22. SMIT Network File System (NFS) Panel

In this panel, you can choose one of the following items to manipulate the list of exported directories:

- **Add a Directory to Exports List**

  This will show a new screen where you can specify which directory you want to export.

- **Change / Show Attributes of an Exported Directory**

  You can change attributes of an exported directory.

- **Remove a Directory from Exports List**

  This allows you to remove a directory from the existing export list.

The selection of the first two items will display another panel where you can additionally tailor the exported directory (see Figure 23).

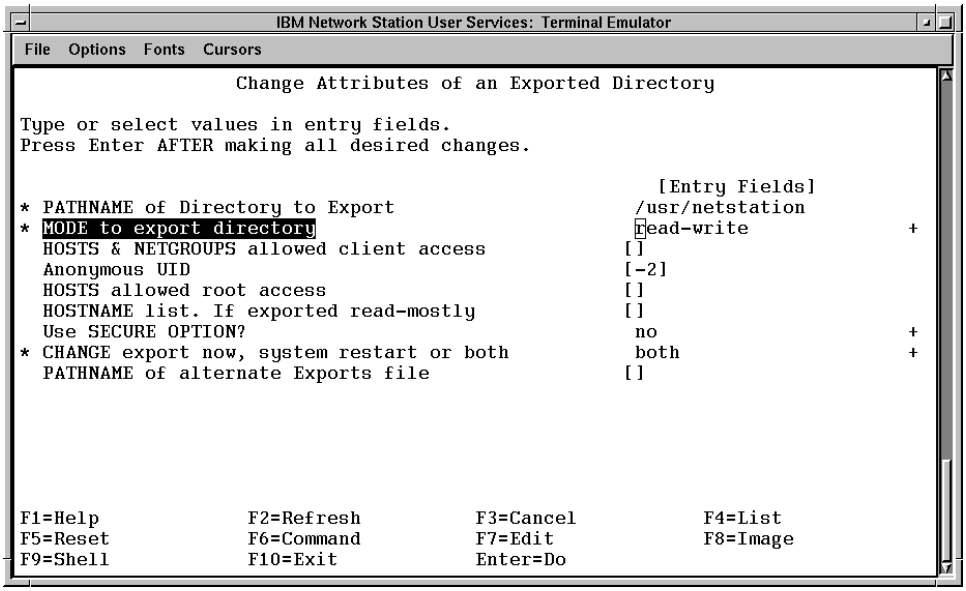

Figure 23. SMIT: Changing Attributes of an Exported Directory

You must export the base directory with the IBM Network Station files. NFS provides access to the whole directory contents beginning at this starting point. By entering the base directory, /usr/netstation, for example, the rest of the parameters can be left to default. After committing the action by pressing **Enter**, the directory will be added to the export list, and the NFS daemon will be refreshed.

Repeat the above operation for the directorie /usr/netstation/nsm/. Indeed, the installation process creates a new file system mounted at this directory.

As the last step, check to see if the NFS daemon is active and will be started at boot time. This can be done by selecting the item **Configure NFS on This System** in the panel shown in Figure 22. Another panel will appear with the first item labeled **Start NFS**. After this selection, you can choose if you want to start the NFS daemon now, at next system restart, or both. The best option is both, so you do not have to restart your server manually.

After finishing these tasks, the IBM Network Station can mount these two directories from the server and access the kernel, configuration files, users and groups directories using NFS.

Remember: The tasks described above are automatically executed by the IBM Network Station software setup program. The explanation is provided in case further configuration is needed.

3.5 X-Font Server

If the IBM Network Station is not able to find a font requested by a X program in its own font directories, especially when using the IBM Network Station as an X-terminal, it can query the font server of AIX and download it, if available. However, modifications must be made in the IBM Network Station configuration

files. For more information on how to use the IBM Network Station as an X-terminal, see 5.4, “Remotely Starting Native Applications” on page 120.

The font server is enabled and started on the AIX server by the following steps:

1. Check whether the font server fileset is already installed on your AIX server by running the following command on the AIX server:

   ```
   lslpp -l X11.fnt.fontServer
   ```

   If you get a blank result, install this fileset with SMIT.

2. Check the font server is running by typing the command:

   ```
   ps -ef | grep fs
   ```

   If the result is:

   `/usr/bin/X11/fs` or `/usr/bin/X11/xfs`
   or
   `/usr/bin/lpp/X11/fs` or `/usr/bin/lpp/X11/xfs`

   the font server is running; if not, you must start it either at boot-time by the command:

   ```
   /usr/lpp/X11/bin/fsconf
   ```

   or immediately by the command:

   ```
   # AIX 4.3.0 or later:
   startsrc -s xfs
   #AIX 4.2.1:
   startsrc -s fs
   ```

3.6 Security - Restricting Access

The default IBM Network Station installation places all the configuration files in two subdirectories. If these directories are given write access, it will allow remote maintenance, but could allow tampering.

To avoid these problems, the network administrator should pay special attention to securing files used by the IBM Network Station and the way they are accessed. The following sections discuss the security mechanisms provided.

3.6.1 X Access

Most of the time, you will use the IBM Network Station as X-server for applications on other servers. An X-server allows access to all input devices without a user knowing this. It is easy to write a program that will collect all keystrokes made by a user and write them into a remote file.

To allow the clients to use your IBM Network Station as an X-server, you have two possibilities:

- Allow all hosts to use the X-server
- Specify which hosts may use the X-server

The first possibility is the easiest one because you are not restricted in your choice of hosts you want to work with. But this allows access to your X-server by everyone.

The second possibility is more secure. You need to determine which hosts will be used and list them in the configuration files, but normally this list does not change very often. Access is only allowed by host names, not user IDs. This could be a major problem because if you work on a host to which many users have access, all these users can access your X-server.

How you can restrict X access and increase the security of your data is described in 4.5.6, “X Client Access Control” on page 105.

3.6.2 File Permissions

To avoid tampering of the files from the directory the IBM Network Station is booting from, the permissions of these files should be selected carefully. Both NFS and TFTP access these files as user *nobody* by default; so you must be sure this user cannot replace or update the files.

To change the configuration files of the IBM Network Station using the setup utility of the IBM Network Station, the file /usr/netstation/configs/standard.nsm.stp (or the one specified in the configuration files) must be writable by the Network Station.

This could be done by changing the user ID used by the IBM Network Station to mount the directory storing the boot files. All other IBM Network Station are unable to write to the configuration files because they still access the files as user *nobody*. This method requires a special configuration for your IBM Network Station. With TFTP, there is no such option. You can only change the user running TFTP in the file /etc/inetd.conf, but this will affect all downloads with TFTP from this host.

To minimize the any security exposure, export the boot directory of the IBM Network Station read only and disable TFTP in /etc/inetd.conf. It is sufficient to allow downloads using only NFS. TFTP does not provide a mechanism to authenticate the user; so everyone can manipulate files accessible for the user nobody. NFS is more secure because security authentication is at the user level.

3.6.3 NFS Export Permissions

There are several possibilities to secure NFS. First, you can secure the files by setting the correct permissions so only authorized persons can write to them. Next, you can control how NFS handles accesses to these files within the file /etc/exports. This file not only controls which directories should be exported by NFS but also controls the export permissions. You have the following possibilities:

- Allow read-only access to this directory
- Allow read-write access without root access
- Allow access for certain hosts only
- Allow root access for specific hosts

All these settings can easy be made with the SMIT panel introduced in 3.4.3, “Setting Up NFS” on page 53.

If you want to have a maximum of security, export the IBM Network Station directory read-only so no one can change files in it. In addition, you must set the

correct permissions on the files; otherwise a user can edit the files directly on the host (not through NFS).

If you want to have write access from your IBM Network Station to use the built-in setup utility, you must export the directory read write. Check that the files cannot be changed by any user other than root or a special administration user. The Network Station will access the files as user *nobody* by default and should not be able to change these files. To change the user your IBM Network Station will use, you must create a special configuration for your Network Station and set the parameters `file-nfs-uid` and `file-nfs-gid` in your IBM Network Station configuration files. Do not use root as the NFS user to mount your files because you will have to export the directory with root access allowed, opening additional security exposures.

3.7 X Display Control Manager Protocol

The X Display Manager Control Protocol (XDMCP) provides a mechanism for a remote display to request a login session on a server. In an environment with multiple servers, the protocol allows for the remote display to select a server from a list. To locate a server, the remote display can use one of the following methods:

- Direct query - The remote display asks a specific server.
- Indirect query - The remote display asks a primary server to forward the request to a specific list of hosts or to generate a remote chooser list.
- Broadcast query - The remote display asks all hosts on local subnet and generates a local chooser list.

The login server must be running a *display manager* daemon to accept login requests. The display manager handles user authentication and session start up.

The XDMCP protocol specifies the use of a device class to allow the display manager to determine the type of device that is requesting a login session. Table 7 shows the IBM Network Station device classes used by the different models

Table 7. IBM Network Station Device Classes

Device	Device Class
IBM Network Station Model 100, 110	IBM-8361-100
IBM Network Station Model 200, 210	IBM-8361-200
IBM Network Station Model A22, A23	IBM-8362-A20
IBM Network Station Model A52, A53	IBM-8362-A50

On AIX, there are two display manager environments available, the Common Desktop Environment (CDE) and the X Display Manager (XDM). You cannot run CDE and XDM concurrently on the same login server, but the filesets do not conflict, and it is possible to switch between them. You should consider the following points when deciding whether to use CDE or XDM:

- Choose CDE if you need to use the bundled applications listed in 3.7.1, “Common Desktop Environment” on page 59.

- Choose XDM if you will use mainly the IBM Network Station native applications.
- CDE is more resource intensive on the IBM Network Station and on the server.

Take Note

The use of CDE or XDM as a display manager for the IBM Network Station is limited to NSM Release 2.5 only. The following discussions are, therefore, only supported when used with that release.

3.7.1 Common Desktop Environment

The CDE desktop is an interactive graphical user interface jointly developed by IBM, HP, Sun, and Novell for open systems. The desktop has a rich and intuitive user interface based on X11 Release 5 and OSF/Motif 1.2. It is designed for enterprise computing and scales across a variety of platforms; thus it is appealing to a wide range of users, from novice to expert.

The scope of the desktop is pretty broad, and it encompasses core services and productivity tools and applications. The base support covers areas such as window management, file management, customization, and on-line help. Advanced programming services for inter-application communication include messaging, drag/drop, data interchange, and session and workspace management are included. Along with the Display Manager, CDE includes the following applications:

- Mail application
- Multi-user calendar
- Text editor
- Calculator
- Icon editor
- Window Manager (incorporating the front panel)
- File Manager
- Application Manager
- Print Manager

Figure 24 shows the CDE front panel.

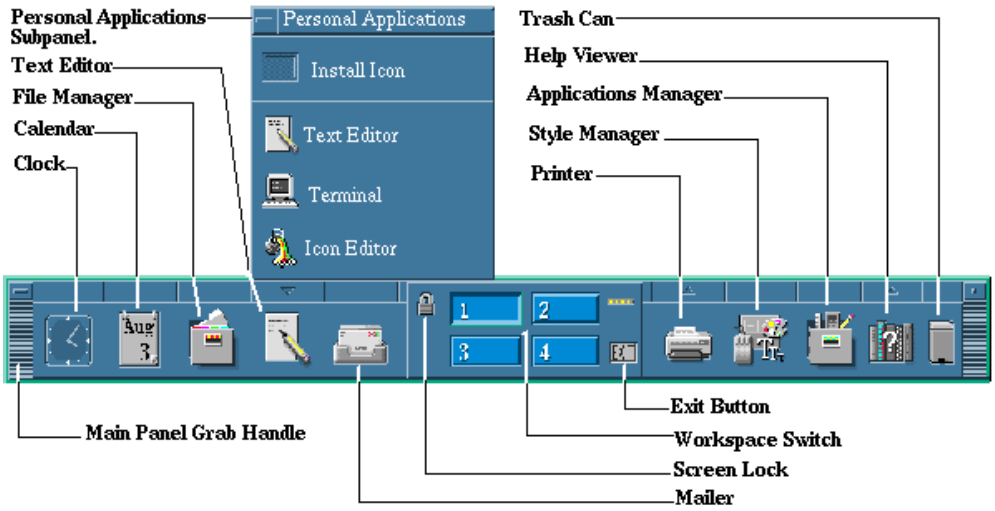

Figure 24. CDE Front Panel

3.7.2 X Display Manager

XDM provides only the graphical server selection and user authentication services as defined by the XDMCP protocol. It does not include any productivity applications itself, but uses those packaged with the standard X distribution. This allows for a high degree of customization based on individual preferences. Generally, at least the Motif Window Manager and a terminal emulator are started at login time. Further applications are commonly launched from the mwm pop-up menu. XDM is the industry standard Display Manager, and much of the CDE Display Manager is based on XDM.

3.7.3 Configuring CDE

To configure CDE as the Display Manager, use the following procedure:

1. Install the required filesets as described in 2.3.1, “Required AIX Filesets” on page 25.
2. To have CDE start automatically at reboot from SMIT, use the following procedure:
    1. Use the Fastpath shortcut to start SMIT and open the Select System User Interface menu:

        ```
        smit dtconfig
        ```

    2. Select **List** to display a list of user interfaces.
    3. Select **AIX CDE 1.0** or **AIX CDE 1.0 (without graphical boot)**. The only difference between these options is that the first option displays a graphical progress indicator on the console during bootup. Figure 25 shows how a typical screen should look at this point.

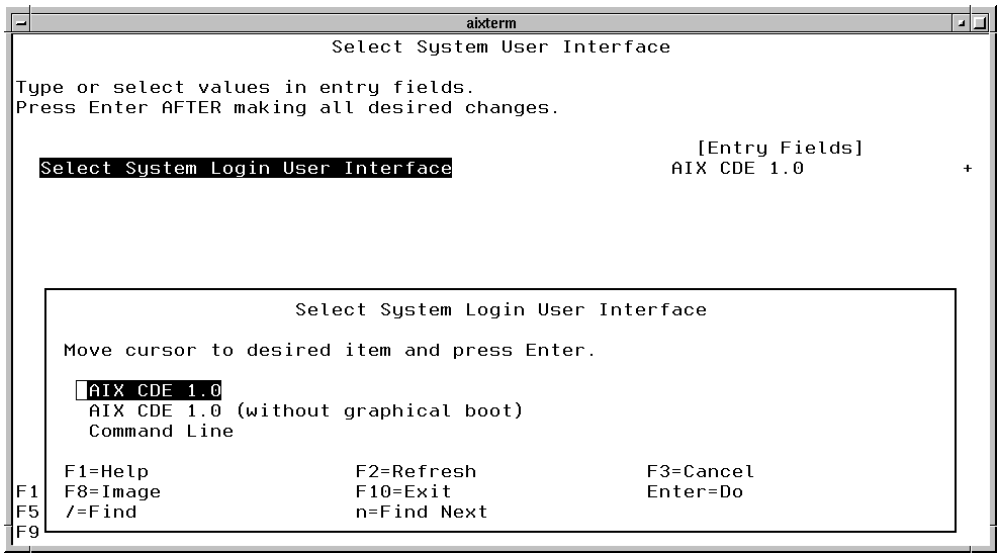

Figure 25. Select System User Interface SMIT Panels

4. Select **OK** or press **Enter** to confirm the action.

   To have CDE start automatically at bootup from the command line, use either of the following commands:

   - `/usr/dt/bin/dtconfig -e`
   - `/usr/dt/bin/dtconfig -enograph` (without graphical boot)

3. If the server does not have a local graphics display, then edit the file /etc/dt/config/Xservers and comment out (with a `#`) the line that defines the local display (if you have a default configuration; then this is the only active line). If the file /etc/dt/config/Xservers does not exist, then make a copy of the system supplied default file using the following commands:

   ```
   mkdir -p /etc/dt/config
   cp /usr/dt/config/Xservers /etc/dt/config/Xservers
   ```

4. Reboot the server.

To unconfigure CDE from starting automatically at bootup, run the following command:

```
/usr/dt/bin/dtconfig -d
```

Note: If XDM is configured, then `dtconfig` will disable it.

3.7.4 Configuring XDM

To configure XDM as the Display Manager, use the following procedure:

1. Install the required filesets as described in 2.3.1, “Required AIX Filesets” on page 25.
2. If CDE is the current Display Manager, then it must be disabled as described in 3.7.3, “Configuring CDE” on page 60.
3. To have XDM start automatically at bootup, use the following command:

   ```
   /usr/lib/X11/xdmconf
   ```

4. If the server does not have a local graphics display, then edit the file /usr/lib/X11/Xservers and comment out (with a #) the line that defines the local display (if you have a default configuration then this is the only active line).
5. Start XDM by using the following command:

```
startsrc -s xdm
```

To unconfigure XDM from starting automatically at bootup, use the following command:

```
/usr/lib/X11/xdmconf -d
```

3.7.5 Window Managers

It is an inherent restriction of the X design that only one Window Manager may be running a time. Therefore, in normal operation, if the built-in Window Manager is running, it must be stopped before invoking an XDMCP login. However, it is possible to configure both CDE and XDM to use an alternative Window Manager should it be necessary. Regarding CDE, this may not be a good idea as some of the function of CDE is incorporated into the CDE Window Manager. In particular, the following items would not be available:

- Front panel
- Graphical workspace manager

If it is required to use the built-in Window Manager throughout the login session, then XDM is a better choice.

When using XDM, there are many files that could be used for options when the Window Manager is started. Typically, it will be $HOME/.xsession but could also be any of the following:

- $HOME/.xinit
- $HOME/.Xinit
- $HOME/.xinitrc
- $HOME/.Xinitrc
- $HOME/.xsession
- /usr/lpp/X11/defaults/xinitrc

If you are unsure, then run the following command while logged in to XDM and check for matches with the above list:

```
ps -ef | grep $LOGNAME
```

If there are no matches, then create a new startup script. A sample startup script follows:

```
xclock -geometry -0+0 &
xsetroot -solid grey60
aixterm =80x25+0-0 &
exec mwm -multiscreen -xrm "ShowFeedback: -quit"
```

On AIX, the Window Manager is usually the Motif Window Manager (mwm) and is usually placed on the last line of the script. It is important that this script does not exit; otherwise the session will end. You cannot simply replace the `mwm` command with `rsh wm` command because the `rsh` command returns immediately. Therefore,

the last line in the script should execute a program in the foreground as in the following example:

```
A=‘echo $DISPLAY | awk -F’:’ ’{print $1}’‘
rsh $A wm
exec aixterm =80x25+0-0
```

Note: If `aixterm` is closed, then the session will end.

3.7.6 User Customization

The IBM Network Station makes use of the Display Manager startup and reset scripts for modifying user preferences within the IBM Network Station at login. Configuration of the Display Manager to execute these scripts is done by the nsconf script as described in 2.7, “Alternate Installation” on page 32. The file names of the scripts are:

- CDE
  - Startup script - /usr/netstation/bin/Xstartup.ibm8361
  - Reset script - /usr/netstation/bin/Xreset.ibm8361
- XDM
  - Startup script - /usr/netstation/bin/TakeConsole.ibm8361
  - Reset script - /usr/netstation/bin/GiveConsole.ibm8361

The default configuration daemon password is set to the `uname -m` of the boot server. If the login server is not the boot server, then the password sent by the startup and reset scripts will be the `uname -m` of the login server and will not match. This will cause delays logging in to CDE, but can easily be found by examining the message log. You would expect to see the following statements in the message log:

```
%NETSRV-I-ACCEPT, accepting CONFIGD connection from server
%CONFIGD-I-OKPASSWD, correct read-write password entered
```

where *server* is the host name of your login server. This sequence is repeated four times.

To simplify password management across multiple IBM Network Stations accessing multiple login servers and boot servers, you should select a global configuration password. Edit the startup and reset scripts and insert your chosen password into the following line:

```
PSW=XXXXXXXXXXXX
```

where `XXXXXXXXXXXX` is the old password generated from `uname -m` of the login server. This is not a security issue because these files are readable only by root.

User preferences are stored in the file $HOME/.netstationrc. These resources are downloaded to the IBM Network Station configuration daemon at login. This allows active customization of the IBM Network Station for each user. Only configuration parameters that begin with `pref` are downloaded. This prevents a user from making non-user related configuration changes by editing their preferences file.

The changes either override the default configuration files or the settings made by XDM/CDE. Take note that any non-standard modifications may cause

migration concerns as the software implementations used for the IBM Network Station evolve.

To allow users to customize their own preferences, set the configuration parameter, `config-auto-save-file-name`, to `$HOME/.netstationrc`. To enable this edit, use the userenvironment subroutine in the startup script as follows:

```
userenvironment()
{
echo $PSW
sleep 1
echo "set pref-environment[-1] = { \"HOME\" \"$HOME\" }"
echo "set config-auto-save-file-name = $PRF"
echo apply
echo quit
}
```

To enable user-specific application preference files, the environment variable NSM_USER_PREFS should point to the user's home directory, for example `$HOME/.SysDefaults` To enable this, edit the startup script as follows:

```
userenvironment()
{
echo $PSW
sleep 1
echo "set pref-environment[-1] = { \"HOME\" \"$HOME\" }
echo "set pref-environment[-1] = { \"NSM_USER_PREFS\" \"$HOME/.SysDefaults\"
}"
echo apply
echo quit
}
```

Note: The startup script supplied is very inefficient. It makes four connections to the IBM Network Station and sleeps for one second during each.

3.7.7 Display Manager Access Control

You may control access to the Display Manager using a configuration file. This file is also used to control behavior in response to an XDMCP indirect request. Both CDE and XDM support this type of file with identical syntax. In CDE, the file name is /etc/dt/config/Xaccess. In XDM, the file name is /usr/lib/X11/xdm/Xaccess. Details of the format for this file can be found in the file itself. The default configuration allows access from all remote displays and to generate a remote chooser list by broadcast:

```
*                       # grant service from all remote displays
* CHOOSER BROADCAST     # any indirect host can get a chooser
```

To restrict access to the Display Manager, comment out the `grant service from all remote displays` line and add lines for the remote displays that you wish to allow access:

```
# *                       # grant service from all remote displays
*.austin.ibm.com        # grant service from all remote displays
# in austin.ibm.com domain
!sv2040a.austin.ibm.com # refuse service to remote display
# sv2040a.austin.ibm.com
```

To control the list of hosts that a remote display can access using an indirect request, use a host list or macro after the remote display or domain. To generate a remote chooser list, the second field should be the keyword CHOOSER:

```
sv2040a.itsc.austin.ibm.com aix4xdev.itsc.austin.ibm.com
%hostlist aix4xdev.itsc.austin.ibm.com itsorus.austin.ibm.com
sv2040b.itsc.austin.ibm.com %hotlist
sv2040c.itsc.austin.ibm.com  CHOOSER %hostlist
```

Figure 26 shows the CDE remote chooser application.

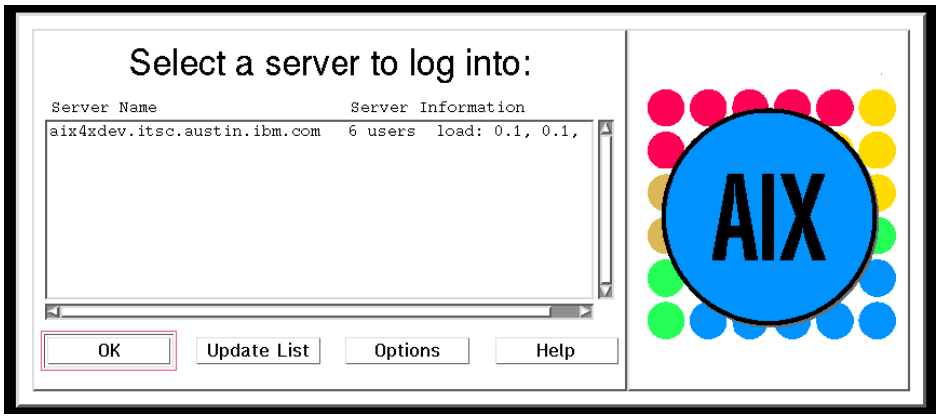

Figure 26. CDE Remote Chooser Application

3.7.8 Running an XDM-Style Session from the CDE Login

For situations where a single login server is required to serve both CDE and XDM style sessions, the server should be configured as a CDE server. CDE can then be configured to run an XDM-style session by adding the following to $HOME/.dtprofile:

```
SESSIONTYPE=xdm
```

To check if a particular session is running on an IBM Network Station and only change to an XDM style session in that instance, the following example could be used:

```
xrdb -symbols | grep EXT_NCD_SETUP > /dev/null 2>&1
if [ $? -eq 0 ]
then
SESSIONTYPE=xdm
fi
```

This will run the first found of the following commands:

- $HOME/.xsession
- /usr/lib/X11/xdm/Xsession
- xterm -geometry 80x24+10+10 -ls

It is desirable to run `/usr/lib/X11/xdm/Xsession` because this will set up the complete XDM environment. Therefore, if a $HOME/.xsession file exists, it should be renamed to $HOME/.xinit. This will prevent it from being used by CDE but not by /usr/lib/X11/xdm/Xsession itself and XDM in general.

3.7.9 Switching between CDE and XDM

When testing different environments, it may be desirable to switch between the CDE Display Manager and the XDM Display Manager on the same server. Table 8 shows the management commands for the Display Managers.

Table 8. Display Manager Management Commands

Operation	CDE	XDM
Enable	dtconfig -e (or -enograph)	xdmconf
Disable	dtconfig -d	xdmconf -d
Stop	dtconfig -kill	stropsrc -s xdm
Start	sh /etc/rc.dt (or reboot if on console)	startsrc -s adm
Reset	dtrconfig -reset	kill -1 cat /usr/lib/X11/xdm/xdm-pid

To switch from CDE to XDM, use the following procedure:

```
PATH=$PATH:/usr/dt/bin:/usr/lib/X11/xdm
dtconfig -kill
dtconfig -d
xdmconf
startsrc -s xdm
```

To switch from XDM to CDE, use the following procedure:

```
stopsrc -s xdm
xdmconf -d (optional as this is done by dtconfig -e)
dtconfig -e (or -enograph)
sh /etc/rc.dt (or reboot if on console)
```

3.7.10 NCDRunWM Utility

The ncdrunwm program is a utility to remotely manage a second application pop-up menu in the built-in Window Manager. Commands generated by selecting the menu items are not run locally, but are communicated back to the ncdrunwm program, which then executes them on the remote host. The pop-up menu is configured in exactly the same way as the Motif Window Manager (mwm), and the mwm configuration files themselves can be used without modification. However, the configuration file $HOME/.launchrc will be used first, if it exists. A sample startup script to enable this feature follows:

```
xclock -geometry -0+0 &
xsetroot -solid grey60
aixterm =80x25+0-0 &
exec ncdrunwm -k
```

The `-k` flag sends *keepalive* packets from the ncdrunwm program to the built-in Window Manager.

Chapter 4. Configuration Files

Configuration files enable you to specify parameters for the setup and control of the IBM Network Station. This chapter discusses how to maintain the configuration files and explains some of the most commonly used parameters.

4.1 Overview

Take Note

This information is intended for advanced users that understand the consequences of directly editing configuration files. The IBM Network Station Manager program is the preferred method to change configuration parameters. These parameters are subject to change at any time. IBM provides program support for configuration files automatically edited through ordinary use of the IBM Network Station Manager program and for those manually edited configuration files specifically designated as type EDIT in this chapter.

4.1.1 Basic Principles

There are over 600 IBM Network Station parameters, most of which can be set by the Network Station Manager program. Other parameters can only be set through the use of editable configuration files. To help manage this complexity, they are organized into groups. Each group is further divided into subgroups.

Be aware that not all parameters have the same effect on the IBM Network Station configuration:

Immediate effect This type of parameter results in a change as the IBM Network Station reads it.

Effect at boot The IBM Network Station has to reboot to realize the change from this type of parameter.

Moreover, some parameters are stored in the nonvolatile random access memory (NVRAM) of the IBM Network Station and some others are not. See 4.5, “Configuration Parameters Examples” on page 99, for some examples.

Using the file imbed capability, some configuration files can refer to other files in a multilevel structure. For instance, the file standard.nsm indicates, which other configuration files the IBM Network Station have to read by default during its initial setting. Some configuration files contain statements tailored to a particular group or individual IBM Network Station. If a parameter is specified more than once, it is the last instance of the parameter that takes precedence. This makes it possible to override the IBM supplied defaults without modifying the original configuration files and to use different levels of configuration. The general levels at which the files are read are:

1. Product configuration files (application files only)
2. Shipped configuration files
3. System-wide configuration files
4. Individual configuration files (hardware files only)

5. Group configuration files
6. Individual user configuration files

Moreover, there are three main groups of configuration files, each group including the preceding levels:

Hardware files Hardware and kernel settings

Application files X-resources for applications run by the users

Startup files Startup applications, environment variables, and menu bar settings

Within these groups, there are three types of configuration files as defined in Table 9.

Table 9. Different Types of IBM Network Station Configuration Files

Type	Description
INST	This type of file is shipped from IBM and is installed or replaced by the installation program.
NSM	This type of file is created through the use of the IBM Network Station Manager program and is migrated from release to release. These files are not replaced by the installation program.
EDIT	This type of file can be edited by the user. This type of file is not migrated from release to release and is not replaced by the installation program.

Take Note

Do not edit any files whose type is INST or NSM. If you edit these files, your changes may be overwritten by the IBM Network Station Manager program, and they may not be migrated in future releases.

4.1.2 IBM Network Station Manager Program Setup Tasks

Table 10 shows which configuration files are affected by setting preferences in the Setup Tasks menu of the IBM Network Station Manager program.

Table 10. IBM Network Station Manager: Setup Tasks

Files	Setup Tasks
Hardware Files	Hardware -> Workstations Hardware -> Printers Internet -> Applet Viewer
Application Files	Desktop -> Standard Desktop 5250 3270 Internet -> NC Navigator

Files	Setup Tasks
Startup Files	Startup -> Programs Startup -> Menus Startup -> Environment Variables Internet -> Network Language Select User's Group

4.2 Groups of IBM Network Station Users

It is a matter of time before you identify users who all share the same configuration requirements, but whose collective requirements differ from the default settings. This user environment can be managed by a group.

4.2.1 Overview

Groups are new in IBM Network Station Manager Release 3. With previous releases of IBM Network Station Manager, the administrator had to set every user environment individually. For a large company, this customization could be costly.

With IBM Network Station Manager Release 3, group support provides tailored management of IBM Network Station functions to a specific number of IBM Network Station users (the group). Group support fills the void between having to work with all users or individual users. Using group support, an administrator can set specific settings for a group rather than specify the same settings one user at a time.

From the Select User's Group panel, you can work with the For which user do you want to select a group? field. Then, you can enter any existing user ID in this field. Or, you can click the **Browse** button to see a list of all user IDs on the system. The panel for this is shown in Figure 27.

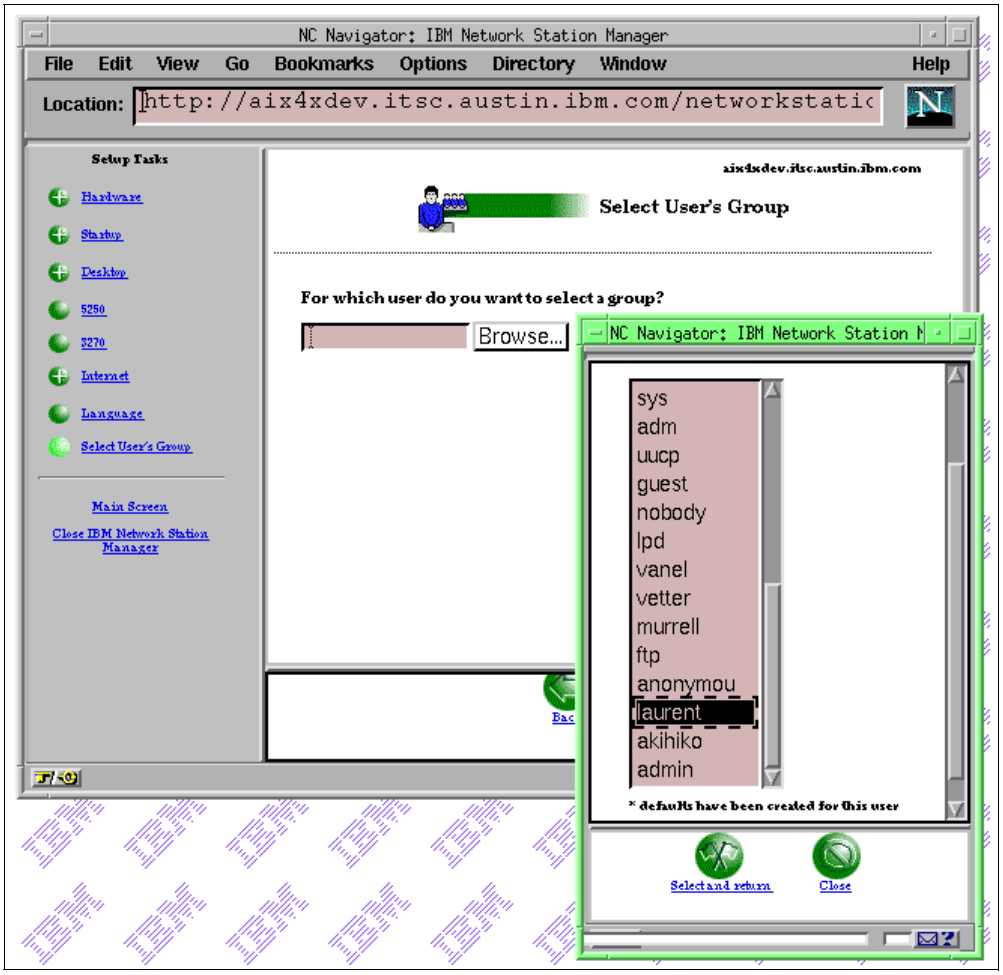

Figure 27. IBM Network Station Manager: Select User's Group Panel

4.2.2 Working with the Groups of IBM Network Station Users

User IDs and group IDs must be created or already exist on the host before group support can be used. Once the group has been created (on the host), you can work with that group to assign IBM Network Station settings to that group. For example, you could use the Startup function and configure a 5250 session and a NC Navigator browser session for a group. Users must belong to groups on the host system. Once a user is in a group, the IBM Network Station Manager program is used to specify from which group users can inherit settings. The default is the user's main group, and the user inherits the settings specified for that group.

All the groups that a user is a member of appear in the Group to use dialog. It defaults when that user ID is specified on the Select User's Group panel. However, the AIX server defines which group is a user's main or primary group. If you select the group you want to associate that user with, that group's IBM Network Station settings are then assigned to that user.

A user can have only one set of IBM Network Station settings. Therefore, although all the groups that the user belongs to appear in the selection list, you can only specify one group per user. If job requirements change, you could

associate the user with a group that has more appropriate IBM Network Station settings.

Take Note

Group settings are not cumulative with user and system settings except in the case of the startup programs and menus tasks.

4.3 IBM Network Station Configuration Files

The IBM Network Station configuration files reside on a host system and are read and interpreted by the kernel program as part of the IBM Network Station initialization procedure, as described in 5.2.1, “Reading the Configuration Files” on page 117. With Network Station Manager Release 3, the files can reside on a host other than the host where the kernel is read from. See 3.3.1, “Role of Multiple Servers” on page 47, for an example of multiple server environment.

4.3.1 Overview of the Configuration File Syntax

The configuration files contain:

- Comments and blank lines

  Comments are lines whose first non-blank character is a `#`. Comments and blank lines are ignored by the kernel. Document your changes.

- Read directives

  These directives allow you to specify other files, which are imbedded at the point of the `read` statement, and replace them.

- Parameter statements

  Values are assigned to parameters using the `set` statement. Parameters that have more than one entry use braces to group the entries. Entries that have more than one field use braces to group the fields and a blank space as the field delimiter. To add an entry to an existing table, use an index of -1. The following example shows these techniques:

```
set modules-load-policy = {
        { "libx2" at-boot }
        { "libxt" at-boot }
        { "libxm" at-boot }
}
set exec-disabled-commands[-1] = { "setup" }
```

  Note: The `set` is optional and may be omitted.

4.3.2 Hardware Configuration Files

The tables in this section list the hardware configuration files that are shipped with the IBM Network Station Manager program. The tables indicate which files can be edited and which files should not be edited. Hardware configuration files contain hardware and kernel settings, such as keyboard language and printers.

A description of the hardware configuration parameters can be found on your AIX server, in the files:

`/usr/netstation/StationConfig/configd.doc`

`/usr/netstation/doc/configd.doc.info`

The configd.doc.info file contains the most detailed information and is intended for informational purposes only.

4.3.2.1 Shipped Configuration Files

The settings in the files shown inTable 11 are the basic shipped settings. These settings apply to all IBM Network Stations and are never modified by the IBM Network Station Manager program.

These files are located at /usr/netstation/StationConfigs/

Table 11. Hardware Configuration Files: Shipped Configuration Files

File Name	Type	Edit	File Format	Description
standard.nsm	INST	No	ASCII	This is the master file that controls the other configuration files downloaded by the IBM Network Station.
required.nsm	INST	No	ASCII	This file contains the settings for base IBM Network Station functions. These settings are not configurable through the IBM Network Station Manager program.
control.nsm	INST	No	ASCII	This file contains the default settings in the IBM Network Station Manager program.

It is possible to change the name of the master file, if required, using the `config-custom-file` parameter.

4.3.2.2 System-Wide Configuration Files

The settings in the system-wide files are the basic system-wide settings. These parameters apply to all IBM Network Stations and are set through the IBM Network Station Manager program. The settings in these files take precedence over control.nsm.

The files listed in Table 12 are located at /usr/netstation/nsm/StationConfig/

Table 12. Hardware Configuration Files: System-Wide Configuration Files

File Name	Type	Edit	File Format	Description
hosts.nsm	NSM	No	ASCII	This file contains TCP/IP settings set through the IBM Network Station Manager program.
defaults.nsm	NSM	No	ASCII	This file contains the settings set through the IBM Network Station Manager program.
defaults.dft	EDIT	Yes	ASCII	This file may be created if it does not exist. Configuration settings added to this file take precedence over settings defined in required.nsm, control.nsm, and defaults.nsm. IBM Network Station Manager program does not read or write this file.

4.3.2.3 Individual IBM Network Station Configuration Files

Individual IBM Network Station configuration files are specific to a particular IBM Network Station. The settings in these files take precedence over the shipped and system-wide configuration files.

The files listed in Table 13 are located at /usr/netstation/nsm/StationConfig/

Table 13. Hardware Configuration Files: Individual IBM Network Station Configuration

File Name	Type	Edit	File Format	Description
NS_name	NSM	No	ASCII	This is the master file that controls the other configuration files called *NS_name, w*here *NS_name* is the TCP/IP host name, IP address (dotted decimal), or MAC address (lower case, no colons) of the IBM Network Station. The host name must match what the IBM Network Station is told that its name is by DHCP or BOOTP.
NS_name.nst	NSM	No	ASCII	This file contains the settings that are set through the IBM Network Station Manager program for the IBM Network Station called *NS_name*.
NS_name.trm	EDIT	Yes	ASCII	This file cannot be edited until it is created by the IBM Network Station Manager program. The IBM Network Station Manager program creates this file when the IBM Network Station is configured. Settings added to this file take precedence over settings in the *NS_name*.nst file. The IBM Network Station Manager program does not read or write this file.

Take Note

If *NS_name* is the TCP/IP name of the IBM Network Station, creating these files using the IBM Network Station Manager program does not mean that they are enabled or that they will be read at boot time by the IBM Network Station. Other configuration parameters must be set manually to indicate that these individual IBM Network Station files should be used, as described in the following section.

In order for the host name of an IBM Network Station to be used as a configuration file name for that station, you have to change the initial configuration file in the NVRAM of the IBM Network Station, or the unit name of the IBM Network Station must be set in the DHCP configuration. With the second option, if you are using a Domain Name Server (DNS), the IBM Network Station can obtain *NS_name* (its TCP/IP host name) from the DNS server by supplying the DNS server with an IP address and getting a name back. This is called a RARP or Reverse Address Resolution Protocol. To activate this feature, set the following parameter in /usr/netstation/nsm/StationConfig/defaults.dft:

```
set unit-query-for-name-at-boot = tcpip
```

The first statement causes the IBM Network Station to do a RARP and to then use its name as the name of the initial configuration file to read (instead of the normal standard.nsm).

Moreover, because the *NS_name* file is located in the /usr/netstation/nsm/StationConfig and not in /usr/netstation/StationConfig as a standard.nsm file, you have to set another parameter depending on your IBM Network Station configuration:

- If you are using a NVRAM configuration, modify the NVRAM dynamically, as described in 4.6, “Dynamic IBM Network Station Configuration” on page 109, or through the setup menu of the IBM Network Station. In the panel F5 = Set Configuration Parameters, add:

  ```
  Configuration File ..............  NS_name
  Configuration Directory:
  first ........................ /usr/netstation/StationConfig/
  Second ....................... /usr/netstation/nsm/StationConfig/
  ```

  It is recommended that you use two configuration directories because if you want to work again with the default configuration file, you will have only to replace *NS_name* to standard.nsm.

- If you are using a DHCP server, use the DHCP option 213 to indicate the configuration directory. Use the following setting in the /etc/dhcpsd.cnf file:

  ```
  option 213 "/usr/netstation/configs/ /usr/netstation/nsm /StationConfig/"
  ```

  See 3.2.4, “Setting Up DHCP” on page 41, for more information on the DHCP configuration.

NS_name contains the following lines:

```
read standard.nsm
read NS_name.nst
read NS_name.trm
```

Since the administrator may indicate only /usr/netstation/nsm/StationConfig as the configuration directory, a link to the standard.nsm file in /usr/netstation/StationConfig must exist in /usr/netstation/nsm/StationConfig for the other IBM Network Stations without an Individual configuration.

The unit name may also have the domain name added. If this is required, set the following parameter in /usr/netstation/nsm/StationConfig/defaults.dft:

```
set config-add-domain-to-unit-name-as-filename = true
```

4.3.2.4 Group Configuration Files

Table 14 lists files that are specific to a particular group of IBM Network Station users. The settings in these files take precedence over the shipped and system-wide files.

These files are located at /usr/netstation/nsm/groups/*groupname*

Table 14. Hardware Configuration Files: Group Configuration Files

File Name	Type	Edit	File Format	Description
groupname.nsg	NSM	No	ASCII	This file contains the settings that are set through the IBM Network Station Manager program for the IBM Network Station group of users called *groupname*.
groupname.grp	EDIT	Yes	ASCII	This file cannot be edited until it is created by the IBM Network Station Manager program. The IBM Network Station Manager program creates this file when the IBM Network Station group of users is configured. Settings added to this file take precedence over settings in the *groupname*.nsg. The IBM Network Station Manager program does not read or write this file.

4.3.2.5 Individual User Configuration Files

Table 15 lists files that are specific to a particular IBM Network Station user. The settings in these files take precedence over the shipped, system-wide and group files.

These files are located at /usr/netstation/nsm/users/*username*

Table 15. Individual User Configuration Files

File Name	Type	Edit	File Format	Description
*username.*nsu	NSM	No	ASCII	This file contains the settings that are set through the IBM Network Station Manager program for the IBM Network Station user called *username.*
*username.*usr	EDIT	Yes	ASCII	This file cannot be edited until it is created by the IBM Network Station Manager program. The IBM Network Station Manager program creates this file when the IBM Network Station user is configured. Settings added to this file take precedence over settings in the *username*.nsu. The IBM Network Station Manager program does not read or write this file.

4.3.3 Application Configuration Files

The following tables list the application files. There are four different applications that can be configured for the IBM Network Station. Application configuration files contain X-resources for applications that are run by the user, such as the 3270 and 5250 emulators, NC Navigator, and the Desktop (X-Windows) Manager.

4.3.3.1 Product Configuration Files

The settings listed in Table 16 are shipped with the applications. They are not configurable through the IBM Network Station Manager program.

Table 16. Applications Files: Product Configuration Files

File Name	Type	Edit	File Format	Description
pref	INST	No	ASCII	This file contains the settings for the base NC Navigator functions. Location: /usr/netstation/mods/NAV.
resources.nsl	INST	No	ASCII	This file contains the settings for the base IBM Network Station Login functions. Location: /usr/netstation/StationConfig.
Login	INST	No	Unicode	This file contains the base translated settings for IBM Network Station Login. Location: /usr/netstation/nls/*lang*/MRI.
boot.nsl	INST	No	ASCII	This file is used by IBM Network Station Login to indicate the file service protocol to use to the boot server. Location: /usr/netstation.
nsl.dft	EDIT	Yes	ASCII or Unicode	This file may be created if it does not exist. The settings in this file allow IBM Network Station Login to be customized. For example, the login dialog and user's task bar can be customized. The configuration settings added to this file take precedence over the settings in resources.nsl, boot.nsl, and Login. Location: /usr/netstation/StationConfig.
kiosks.nsl	EDIT	Yes	Encrypted ASCII	This file may be created if it does not exist. The settings in this file may be used to suppress the IBM Network Station login screen. See 5.7.6, "Suppressed Login" on page 136, for more information about how to create and edit this file. Location: /usr/netstation/nsm/StationConfig.

4.3.3.2 Shipped Configuration Files

The settings in the files listed in Table 17 are the application configuration defaults in the IBM Network Station Manager program. These settings are applied to all IBM Network Station users for the appropriate application.

These configuration files are located at /usr/netstation/SysDef/*app-name*/

Table 17. Application Files: Shipped Configuration Files

File Name	Type	Edit	File Format	Description
pref (Nav)	INST	No	Unicode	This file contains the default settings for the NC Navigator. This file overrides the NC Navigator pref product file.

File Name	Type	Edit	File Format	Description
pref (NCDwm)	INST	No	Unicode	This file contains the default settings for the X-Window manager. For Release 3, the Motif Window Manager (mwm) is used. Although the directory is NCDwm, this file actually contains the mwm resources.
pref (NS3270)	INST	No	Unicode	This file contains the default settings for the 3270 emulator.
pref (NS5250)	INST	No	Unicode	This file contains the default settings for the 5250 emulator.

4.3.4 System-Wide Configuration Files

The settings in the files listed in Table 18 are the basic system-wide settings. These settings override the shipped files and apply to all IBM Network Stations.

All of the configuration files except pref.dft are located at /usr/netstation/nsm/SysDef/*app-name*/. The pref.dft configuration file is located at /usr/netstation/nsm/SysDef, and the pref.dft (Nav) configuration file is at /usr/netstation/nsm/SysDef/Nav

Table 18. Application Configuration Files: System-Wide Configuration Files

File Name	Type	Edit	File Format	Description
pref (Nav)	NSM	No	Unicode	This file contains the system-wide settings for the NC Navigator that are set through the IBM Network Station Manager program.
pref (NCDwm)	NSM	No	Unicode	This file contains the system-wide settings for the X-Window manger that are set through the IBM Network Station Manager program. For Release 3, the Motif Window Manager (mwm) is used. Although the directory is NCDwm, this file actually contains mwm resources.
pref (NS3270)	NSM	No	Unicode	This file contains the system-wide settings for the 3270 emulator that are set through the IBM Network Station Manager program.
pref (NS5250)	NSM	No	Unicode	This file contains the system-wide settings for the 5250 emulator that are set through the IBM Network Station Manager program.
pref.dft	EDIT	Yes	ASCII or Unicode	This file may be created if it does not exist. Settings may be added to this file to customize any application, except NC Navigator. For the Window Manager, mwm resources should be used, not NCDwm. The configuration settings added to this file take precedence over the pref files at all levels.

File Name	Type	Edit	File Format	Description
pref.dft (Nav)	EDIT	Yes	ASCII or Unicode	This file may be created if it does not exist. The settings in this file allow the NC Navigator to be customized. The configuration settings added to this file take precedence over the settings in the system-wide file.

4.3.4.1 Group Configuration Files

Table 19 lists the files that are specific to a particular group of IBM Network Station users. These settings take precedence over the system-wide files.

These files are located at /usr/netstation/nsm/groups/*groupname/app-name/*

Table 19. Application Configuration Files: Group Configuration Files

File Name	Type	Edit	File Format	Description
pref (Nav)	NSM	No	Unicode	This file contains the group settings for the NC Navigator that are set through the IBM Network Station Manager program.
pref (NCDwm)	NSM	No	Unicode	This file contains the group settings for the X-Window manger that are set through the IBM Network Station Manager program. For Release 3, the Motif Window Manager (mwm) is used. Although the directory is NCDwm, this file actually contains mwm resources.
pref (NS3270)	NSM	No	Unicode	This file contains the group settings for the 3270 emulator that are set through the IBM Network Station Manager program.
pref (NS5250)	NSM	No	Unicode	This file contains the group settings for the 5250 emulator that are set through the IBM Network Station Manager program.

4.3.4.2 Individual User Configuration Files

Table 20 lists the files that are specific to a particular IBM Network Station user. The settings in these files take precedence over the group files.

These files are located at /usr/netstation/nsm/users/*username/app-name/*

Table 20. Application Configuration Files: Individual User Configuration Files

File Name	Type	Edit	File Format	Description
pref (Nav)	NSM	No	Unicode	This file contains the group settings for the NC Navigator, that are set through the IBM Network Station Manager program.

File Name	Type	Edit	File Format	Description
pref (NCDwm)	NSM	No	Unicode	This file contains the group settings for the X-Window manger that are set through the IBM Network Station Manager program. For Release 3, the Motif Window Manager (mwm) is used. Although the directory is NCDwm, this file actually contains mwm resources.
pref (NS3270)	NSM	No	Unicode	This file contains the group settings for the 3270 emulator that are set through the IBM Network Station Manager program.
pref (NS5250)	NSM	No	Unicode	This file contains the group settings for the 5250 emulator that are set through the IBM Network Station Manager program.
pref (NCDterm)	NSM	No	Unicode	This file contains changes made inside the VTxxx terminal emulator by the user on the Network Station. This file is not managed by the IBM Network Station Manager program.
pref (Login)	NSM	No	Unicode	This file contains the Network Station user's last selection on the menu bar for Hide, Top/Bottom, and Lock. This file is not managed by the IBM Network Station Manager program.

4.3.5 Startup Configuration Files

The following tables list the startup files. Startup configuration files contain settings such as: which applications are launched for the user, environment variables, and the list of menu bar buttons.

These files, except startup.dft, are modified only through the IBM Network Station Manager program. In the menu Startup, you are able to add applications in your menu bar or started at login. If you want that these programs appear in an icon, add the flag `-iconic` in the parameters field.

4.3.5.1 Shipped Startup Configuration Files

The settings in these files are the defaults in the IBM Network Station Manager program for startup. They contain default menu bar buttons, X-Window manager launching, and mandatory environment variables. These settings apply to all IBM Network Stations, and the IBM Network Station Manager program does not modify these files.

Table 21 lists the files that are located at /usr/netstation/SysDef

Table 21. Startup Configuration Files: Shipped Configuration Files

File Name	Type	Edit	File Format	Description
startup.nsm	NSM	No	Unicode	This file contains the settings for environment variables, which programs are automatically run at login, and what menu bar buttons are displayed.
envvars.nsm	NSM	No	Unicode	This file contains environment variable substitutions.

4.3.5.2 System-Wide Configuration Files

The files listed in Table 22 are basic system-wide settings that are made through the IBM Network Station Manager program. Settings in these files apply to all IBM Network Station users.

These files are located at /usr/netstation/nsm/SysDef

Table 22. Startup Configuration Files: System-Wide Configuration Files

File Name	Type	Edit	File Format	Description
startup.nsm	NSM	No	Unicode	This file contains the settings for environment variables, which programs are automatically run at login, and what menu bar buttons are displayed.
envvars.nsm	NSM	No	Unicode	This file contains environment variable substitutions.

startup.dft	EDIT	Yes	ASCII	This file may be created if it does not exist. If this file exists, it is the only startup file read by the IBM Network Station. This file may be used to set environment variables, launch applications, and add menu bar buttons. This file must contain the following five mandatory environment variable statements:
				`SET NSM_NAV_PREF_VERSION R3M0`
				`SET NSM_MWM_PREF_VERSION R3M0`
				`SET NSM_NCDMW_PREF_VERSION R3M0`
				`SET NSM_NS5250_PREF_VERSION R3M0`
				`SET NSM_NS3270_PREF_VERSION R3M0`

4.3.5.3 Group Startup Files

The files listed in Table 23 are specific to a particular group of IBM Network Station users. Settings in these files are made through the IBM Network Station Manager program.

These files are located at /usr/netstation/nsm/groups/*groupname*

Table 23. Startup Configuration Files: Group Configuration Files

File Name	Type	Edit	File Format	Description
startup.nsm	NSM	No	Unicode	This file contains the settings for environment variables, which programs are automatically run at login, and what menu bar buttons are displayed.
envvars.nsm	NSM	No	Unicode	This file contains environment variable substitutions.

4.3.5.4 Individual User Startup Files

The files listed in Table 24 are specific to a particular IBM Network Station user. Settings in these files are made through the IBM Network Station Manager program.

These files are located at /usr/netstation/nsm/users/*username*

Table 24. Startup Configuration Files: Individual User Configuration Files

File Name	Type	Edit	File Format	Description
startup.nsm	NSM	No	Unicode	This file contains the settings for environment variables, which programs are automatically run at login, and what menu bar buttons are displayed.
envvars.nsm	NSM	No	Unicode	This file contains environment variable substitutions.

4.3.6 Files Systems Structure

As described in the above sections, the Network Station Manager Release 3 is composed of a large number of configuration files that are shared out among several directories under /usr/netstation. The following lists show the content of each directory including a subset of these configurations files; the links are not mentioned.

You will find in each directory shown below the above detailed configuration files. Indeed, you may have some other files in these directories on your AIX server.

- **/usr/netstation:**
  - boot.nsl
- **/usr/netstation/StationConfig:**
  - control.nsm
  - required.nsm
  - resources.nsl
  - standard.nsm
- **/usr/netstation/mods:**
  - NAV/pref
- **/usr/netstation/SysDef:**
  - NAV/pref

    - NCDwm/pref
    - NS3270/pref
    - NS5250/pref
    - envvars.nsm
    - startup.nsm
- **/usr/netstation/nls/*lang*/MRI:**
    - Login
- **/usr/netstation/nsm/StationConfig:**
    - defaults.dft
    - defaults.nsm
    - hosts.nsm
    - kiosks.nsl
    - nsl.dft
    - *NS_name*
    - *NS_name*.nst
    - *NS_name*.trm
- **/usr/netstation/nsm/SysDef:**
    - NAV/pref
    - NAV/pref.dft
    - NCDwm/pref
    - NS3270/pref
    - NS5250/pref
    - envvars.nsm
    - pref.dft
    - startup.nsm
    - startup.dft
- **/usr/netstation/nsm/groups:**
    - *groupname*/NAV/pref
    - *groupname*/NCDwm/pref
    - *groupname*/NS3270/pref
    - *groupname*/NS5250/pref
    - *groupname*/envvars.nsm
    - *groupname*/*groupname*.grp
    - *groupname*/*groupname*.nsg
    - *groupname*/startup.nsm
- **/usr/netstation/nsm/users:**
    - *username*/*username*.nsu
    - *username*/*username*.usr

- *username*/Login/pref
- *username*/NAV/pref
- *username*/NCDterm/pref
- *username*/NCDwm/pref
- *username*/NS3270/pref
- *username*/NS5250/pref
- *username*/envvars.nsm
- *username*/startup.nsm

4.3.7 Configuration File Download Sequence

The sequence in which the configuration files are downloaded and read is important. In the case of conflicting parameters appearing in two files, the last file that is downloaded sets the parameter. The exception to this are the startup files. The first startup file that is found, runs. In general:

- A parameter set in an individual user configuration file overrides (replaces) the same parameter in a group configuration file.
- A parameter set in a group configuration file overrides the same parameter set in a system-wide configuration file.
- A parameter set in an individual IBM Network Station configuration file overrides the same parameter set in a system-wide configuration file.
- A parameter set in a system-wide configuration file overrides the same parameter set in a shipped (Type INST) configuration file.

There are exceptions for parameters that are additive. If the same additive parameter is in more than one file, all instances of these parameters are aggregated. Examples of additive parameters are:

- `Printers`, under `Hardware`
- `Menus`, under `Startup`
- `Programs`, under `Startup`

Notes:

1. Some files may *source* (cause the IBM Network Station to read) other files. Generally, the sourcing statement, `SOURCE`, is the first line in the file.
2. In this document, all of the files that could exist on the server are shown, but not all files must exist. For example, the individual Network Station, individual user, group, and system-wide configuration files do not have to exist on the server.

From this section and those that follow, PRODBASE and USERBASE will be used to designate place holders for the following path names:

PRODBASE -> /usr/netstation
USERBASE -> /usr/netstation/nsm

The configuration files are downloaded from the server to the IBM Network Station in the order described below.

4.3.7.1 Boot Sequence (Pre-Login):

First, the Network Station is powered-on. Then, the kernel is downloaded, and afterwards, during the IBM Network Station boot sequence**,** the kernel downloads the files shown in Figure 28:

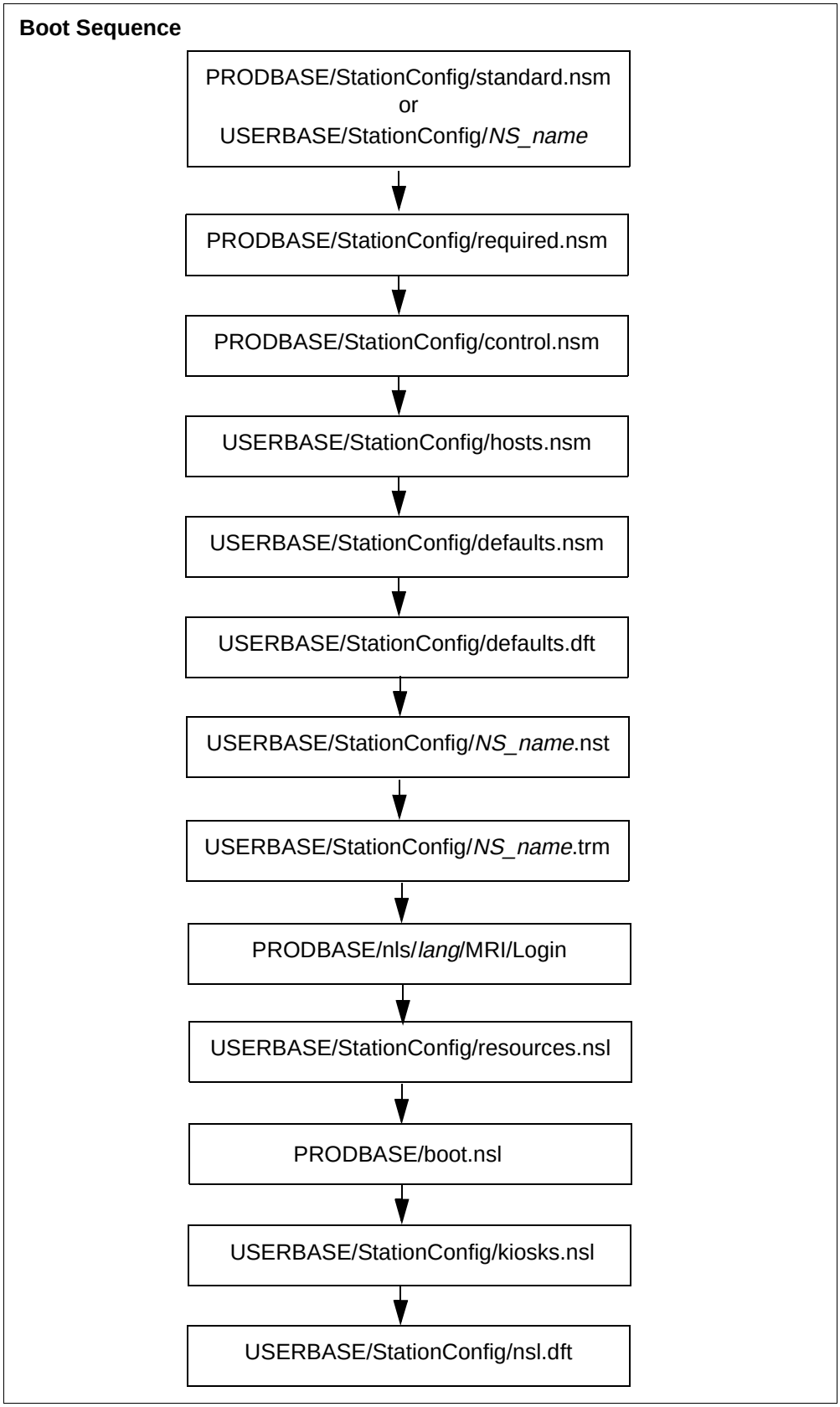

Figure 28. IBM Network Station Boot Sequence

Note: *NS_names* is a master file and sources standard.nsm, *NS_name*.nst, and *NS_name*.trm files.

4.3.7.2 Login Sequence

The IBM Network Station Login program shows the login screen. When the user logs in, the login program does the following, as shown in Figure 29, Figure 30, Figure 31, and Figure 32:

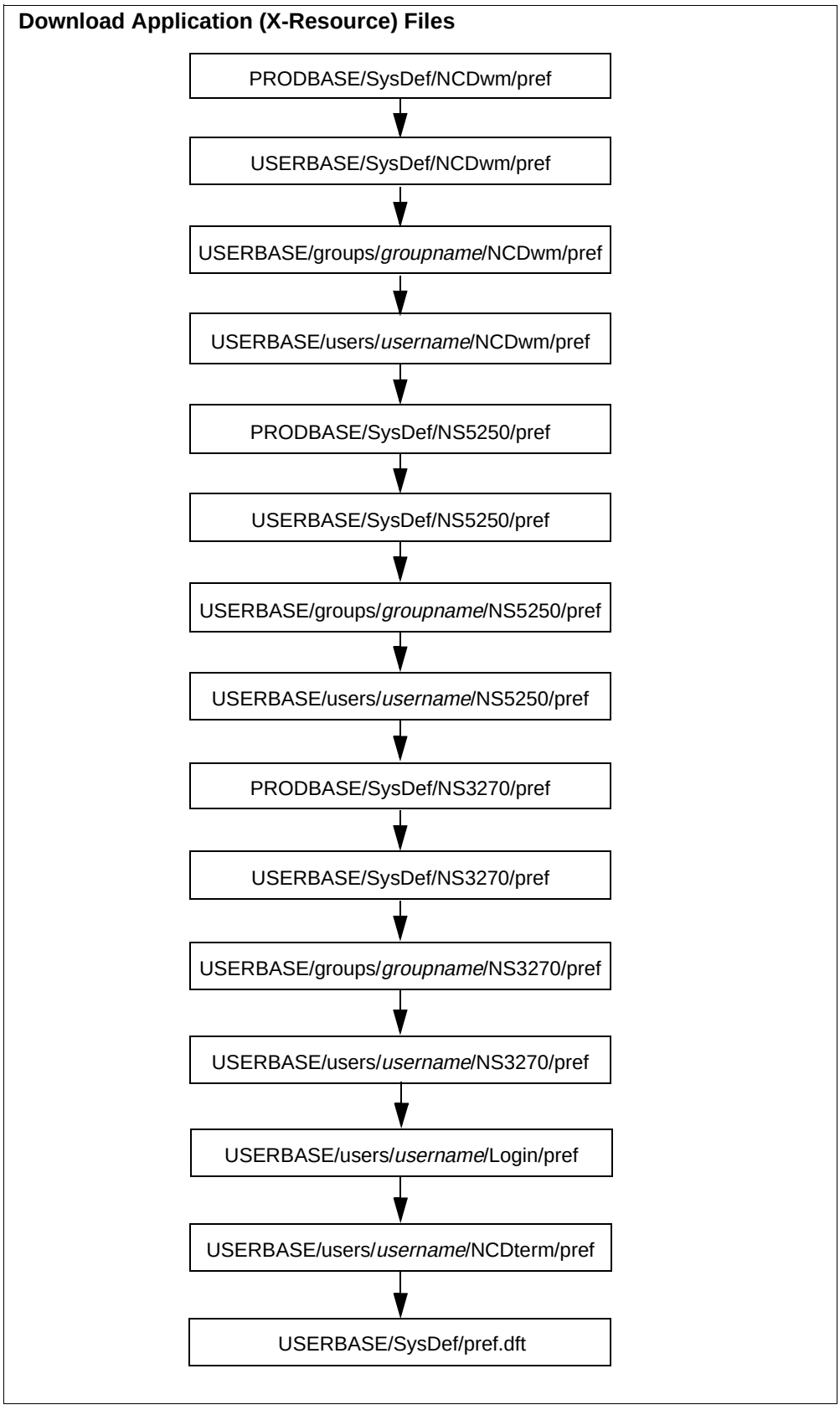

Figure 29. IBM Network Station Login Sequence: Application Files

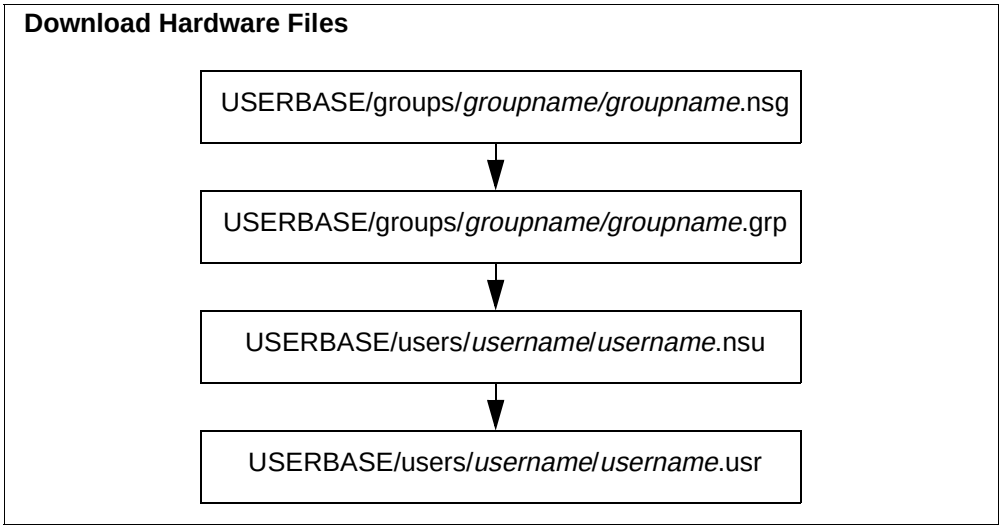

Figure 30. IBM Network Station Login Sequence: Hardware Files

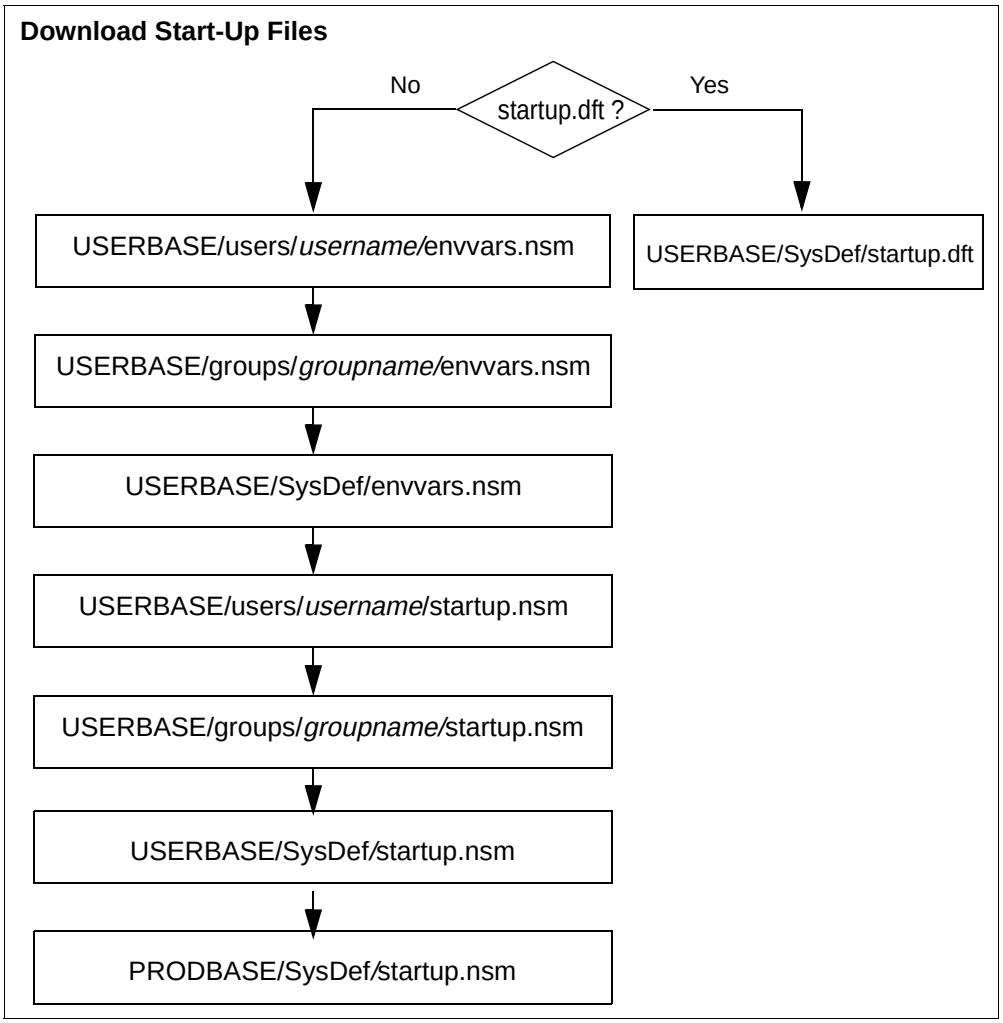

Figure 31. IBM Network Station Login Sequence: Startup Files

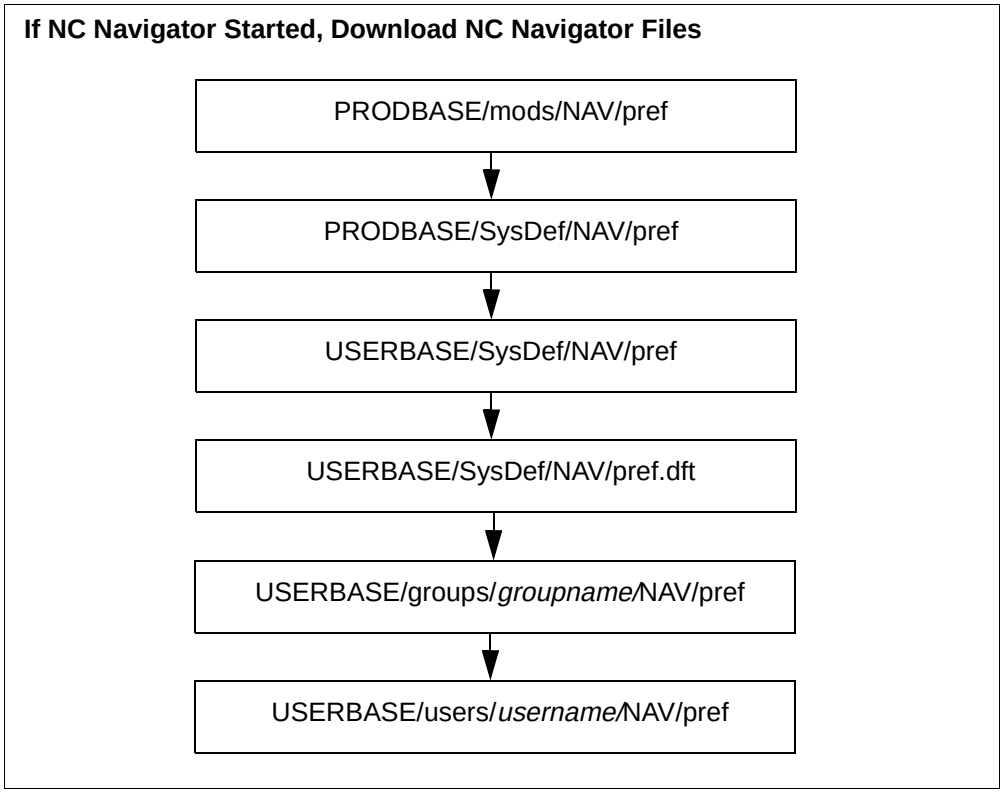

Figure 32. IBM Network Station Login Sequence: NC Navigator Files

4.3.8 Editing Configuration Files

The configuration files that are marked Yes in the Edit column (see the tables in 4.3, “IBM Network Station Configuration Files” on page 71) are ASCII files in UNIX format. This means that lines must end with a line feed, not a carriage return line feed. The text editor that you use must not insert carriage returns. The exceptions are start up files, which may contain carriage returns; so any editor may be used for these files.

Take Note

Before you begin editing, make a copy of the original file.

Moreover, the files marked ASCII in the file format column must only contain invariant (ISO 8859-1) characters. Generally, you are not required to edit Unicode (UCS-2) files, and all of these files that are marked Yes in the Edit column may be ASCII files. You would create Unicode files only if you need to enter UCS-2 characters (for example, Chinese). Unicode files must contain big endian UCS-2 characters; the first 2-bytes must contain the byte order mark (BOM). The BOM must be X’FEFF’ (big endian).

If you work on a platform other than an RS/6000, it is recommended that you edit the files by using one of the following editors to avoid unintended modification of the contents of the files:

- **PC:**
  - Microsoft WordPad
  - IBM EPM
- **AS/400:**
  - Using Client Access to access the files
- **S/390 platform:**
  - aedit editor
- **VM/ESA platform:**
  - ASCXED editor to edit files in the client mode

In order to edit *name*.trm and *username*.usr files, you must first create these files by using the IBM Network Station Manager program. For example, to create the bob.usr file, you first need to create a user preference for Bob (such as a mouse setting) using the IBM Network Station Manager program. The IBM Network Station Manager program creates these files with the proper permissions and links.

4.3.9 Access to Server Directories

This section describes the file system that is created on the IBM Network Station. The file system is a set of mount points for directories accessible by the IBM Network Station. Each directory has a local mount point and a remote mount point. The local mount point is visible to applications on the IBM Network Station. The corresponding remote mount point is the directory that is exported by the server. This is not visible to applications. For Release 3, the local mount points follow a naming convention that is independent of the directory that is exported by the server. Therefore, for most servers, the local mount point for a directory does not equal the remote mount point.

The file service table (a configuration table on the IBM Network Station) lists the mount points and the server they go to. For Release 3, the IBM Network Station can access separate servers for boot data (kernel, fonts, and so forth), terminal configuration data (attached printers, and so forth), and user configuration data (NS5250 preferences, and so forth). Mount points to the boot and terminal configuration servers are controlled by DHCP or the NVRAM setup. Mount points to user configuration data are controlled by the IBM Network Station login daemon (NSLD) running on the login server. The NSLD communicates with login daemon on the IBM Network Station to set these user mount points.

The file service table may be viewed on the IBM Network Station by pressing **Alt-Shift-Home** to bring up the Console. Then **Setup-> Change Setup Parameters -> File Service** should be selected.

Environment variables that contain paths are set to the local directories on the IBM Network Station.

The kernel initializes the file service table with the values shown in Table 25 before Login is called:

Table 25. File Service Table before Login

Local Directory	Remote Directory	On RS/6000
/netstation/prodbase/	*directory_on_boot_server*	/usr/netstation/
directory_on_boot_server	*directory_on_boot_server*	/usr/netstation/
/netstation/prodbase/configs/	*directory_on_1st_ configuration_server*	/usr/netstation/StationConfig/
directory_on_1st_ configuration_server	*directory_on_1st_ configuration_server*	/usr/netstation/StationConfig/
/netstation/prodbase/configs/	*directory_on_2nd_ configuration_server*	/usr/netstation/StationConfig/
directory_on_2nd_ configuration_server	*directory_on_2nd_ configuration_server*	/usr/netstation/StationConfig/

The kernel sets the following path environment variables:

```
set BOOTPATH /netstation/prodbase/
set PATH /netstation/prodbase/mods
```

`/netstation/prodbase/` is the boot directory where the IBM Network Station found the kernel. It has all the subdirectories, such as mods/, proms/, and fonts/. All subdirectories except StationConfig/ are on the boot server.

When the user logs on, Login appends the following (Table 26) to the file services table:

Table 26. File Service Table after Login

Local Directory	Remote Directory	On RS/6000
/netstation/userbase/	/USERBASE/ on the login server	/usr/netstation/nsm/
/netstation/prodbase/SysDef/	/PRODBASE/SysDef/ on the login server	/usr/netstation/SysDef/
/netstation/homebase/users/*username*/	*user's_home* on the login server	/usr/netstation/nsm/users/*username*/

Login sets the following path environment variables:

```
#User hardware preferences, application preferences, and startup:
set NSM_USER_PREFS /netstation/userbase/users/username/
#Group hardware prefences, application preferences, and startup:
set NSM_GROUP_PREFS /netstation/userbase/groups/groupname/
#All-users application preferences and startup:
set NSM_ADMIN_SYSDEFAULTS /netstation/userbase/SysDef/
#Shipped application preferences and startup)
set NSM_PROD_SYSDEFAULTS /netstation/prodbase/SysDef/
#User home directory:
set HOME /netstation/homebase/users/username/
```

All of the mount points and environment variables are set under the direction of the IBM Network Station login server (NSLD).

4.3.10 Migrating to Release 3

If you have changed configuration files in your Release 2.5 and are now migrating to Release 3, refer to Table 27. However, IBM does not guarantee that your changes will successfully migrate to Release 3. It is possible that your changes will conflict with statements IBM changed or added for Release 3. If you are in doubt about the impact of your changes on Release 3, view (but do not save or update in any way) the shipped configuration files.

Use the following steps if you have to migrate from Release 2 to Release 3:

1. Save your hand edited Release 2.5 configuration files before installing Release 3.
2. To avoid errors during the installation of Release 3, remove all changed statements from Release 2.5 in USERBASE/ files that you hand edited.
3. Install Release 3. This replaces all PRODBASE/ files.
4. Move only the added or changed statements from the files saved in step 1. to the files shown in the table below.

Do not copy the contents of the changed files to the editable files. This may cause unpredictable results. Move only the new or changed information to the editable files.

Table 27. Correcting Configuration Files

In Release 2.5, if you changed:	**For Release 3, move your modifications to:**
standard.nsm, required.nsm, control.nsm, hosts.nsm, or defaults.nsm	/USERBASE/StationConfig/defaults.dft
NS_name or *NS_name*.nst	/USERBASE/StationConfig/*NS_name*.trm
username.nsu	/USERBASE/users/*username*/*username*.usr
/PRODBASE/mods/Login/MRI2924/Login	/USERBASE/StationConfig/nsl.dft
/PRODBASE/SysDefaults/NCDwm/pref /USERBASE/SysDefaults/NCDwm/pref /USERBASE/users/*username*/NCDwm/pref	/USERBASE/SysDef/pref.dft
/PRODBASE/SysDefaults/NS3270/pref /USERBASE/SysDefaults/NS3270/pref /USERBASE/users/*username*/NS3270/pref	/USERBASE/SysDef/pref.dft
/PRODBASE/SysDefaults/NS5250/pref /USERBASE/SysDefaults/NS5250/pref /USERBASE/users/*username*/NS5250/pref	/USERBASE/SysDef/pref.dft
/PRODBASE/mods/NAV/pref /PRODBASE/SysDefaults/NAV/pref /USERBASE/SysDefaults/NAV/pref /USERBASE/users/*username*/NAV/pref	/USERBASE/SysDef/NAV/pref.dft
/PRODBASE/SysDefaults/startup.nsmf /USERBASE/SysDefaults/startup.nsm /USERBASE/users/*username*/startup.nsm	/USERBASE/SysDef/startup.dft

4.4 The Console Setup Utilities

The Console Setup utilities consist of a set of programs that allow you to tailor the configuration parameters using a graphical application directly on the IBM Network Station. As indicated in 4.1, “Overview” on page 67, some parameter changes take effect immediately; others require a reboot.

When properly authorized, the Console Setup utilities save the changed parameter information in a single file on the server. The name of this file is stored in the `config-auto-save-file-name` parameter. By default, it is the name of the initial configuration file with a `.stp` suffix. The IBM Network Station must have permission to write the file back on the server.

Take Note

You must use a single configuration file for all the parameters so that the setup utilities effectively work as specialized file editors. But the IBM Network Station Manager implements a multilevel configuration file structure, whereas the setup utilities have no knowledge of your multilevel structure, and a file save creates a single file. This is the reason why, by default, IBM disables the **Setup** menu of the IBM Network Station User Services Console window.

Therefore, use the Console Setup utilities only as a tool to visualize the configuration parameters at an IBM Network Station.

To use the Console Setup utilities, you must first add the following lines in /usr/netstation/nsm/StationConfig in order to enable this menu:

```
set exec-disabled-commands = { {} }
set xserver-initial-x-resources = "ncdconsole.disableSetupMenu: false"
```

See 4.5.7, “Disabling Command Usage” on page 106, for more information about these parameters.

Then, select **Setup** on the IBM Network Station User Services Console window menu, and select one of the pull-down menu choices shown in Figure 33.

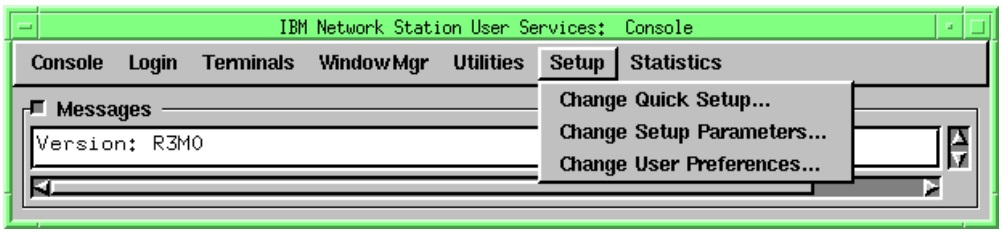

Figure 33. Services Console Window

Three broad groups are defined:

- Quick Setup
- Setup Parameters
- User Preferences

4.4.1 Quick Setup Utility

This group of parameters is especially useful when testing the environment. It is recommended that the corresponding menu option be disabled or password protected so that users do not have access to it. See 4.5.11, “Protecting by Password the IBM Network Station Configuration” on page 108, for more information.

Figure 34 shows a list of the subgroups available in this menu.

Figure 34. Quick Setup Parameters Window

A short description of each subgroup follows.

Subgroup	Description
Booting	Allows specifying a boot protocol and one server.
Files	Covers file service primary and backup protocols and servers, initial configuration file specifications, and the loadable modules directory. It is a subset of the parameters available in the Setup subgroups Configuration, File Service, and Loadable Modules.
Fonts	Allows specifying default font paths at reboot time. It is a subset of the parameters available in the Setup subgroup Fonts.
Network	Allows specifying the minimum IP information needed for booting when not using BOOTP or DHCP. It is a subset of the parameters available in the Setup subgroups IP and TCP/IP Name Service.
Session	Allows tailoring an entry in the exec-startup-commands list. This entry is either an XDMCP login session or a telnet session.

The pushbuttons visible in Figure 34 perform the following functions:

Button	Function Description
Apply	Commits to memory all the changed parameter values. If the `config-auto-save-nvram` option is in effect, parameters that are kept in memory are also written to NVRAM.
Restart	Disregard all changes that have not been applied.
Defaults	Reprocess the configuration files used at boot time.

Cancel Exit the Setup Services utility without applying any changes.

Apart from the pushbuttons, the *File* dialog allows you to selectively read from and save to a file and to read from and save to NVRAM. Both the pushbuttons and the File dialog are available and perform the same function in the other Console Setup utility programs.

4.4.2 Setup Parameters Utility

This group of setup parameters includes many subgroups that allow you to tailor almost every parameter. As is the case with Quick Setup, it is recommended that this menu option be disabled or password protected so that users do not have access to it. See 4.5.11, “Protecting by Password the IBM Network Station Configuration” on page 108, for more information.

Figure 35 on page 95 shows a list of all the subgroups available in this option group.

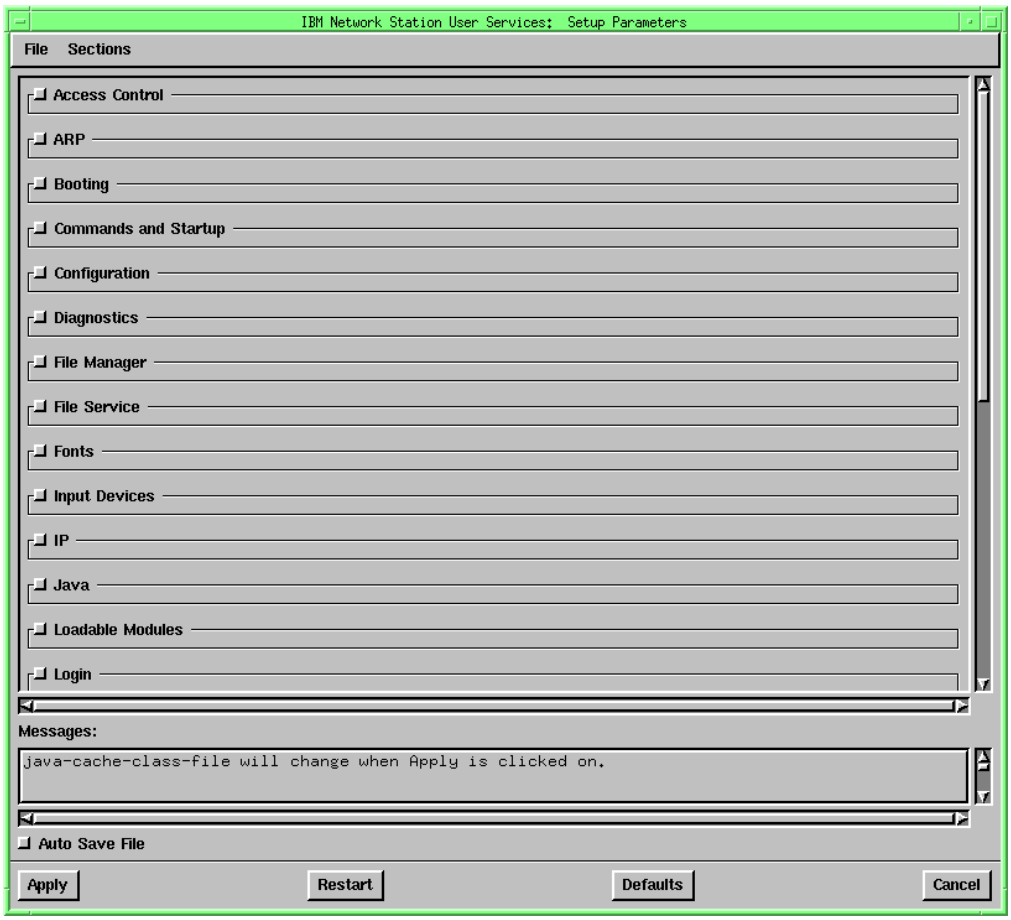

Figure 35. Setup Parameters Window

A short description of each subgroup follows:

Subgroup	Description
Access Control	Allows the specification of security-related parameters, including the hardware password (also called unit global password), configuration access

	and modification, file manager access, NFS access (allowing remote execution using the RSH daemon), use of the X-Windows server, and SNMP controls.
ARP	Covers data for use with Address Resolution Protocol (ARP). This data is for information only and may be useful for troubleshooting purposes. You should not change these parameters in normal operation.
Booting	Allows the specification of primary and backup boot servers' IP addresses, boot protocols, and boot file naming choices.
Commands and Startup	Allows the configuration of special lists of commands. Covered in detail in 4.5.1, "Configuring the Local Host Name Cache" on page 100, 4.5.2, "Configuring the Initial Applications List" on page 100, and 4.5.3, "Configuring the Applications Pop-Up Menu" on page 101.
Configuration	Covers parameters related to the initial configuration file name, location, protocols to be used, and search options. It also includes parameters that will be used by the NSM.
Diagnostics	Parameters in this subgroup are related to remote diagnosis of the IBM Network Station. You should not change these parameters in normal operation.
File Manager	Specifies IP information on the IBM Network Station file manager service. You should not change these parameters in normal operation.
File Service	Includes directories to be mounted on file-serving hosts. See 4.3.9, "Access to Server Directories" on page 90, and 4.5.4, "Configuring the Local File System" on page 103.
Fonts	Includes default font names, caching information, and the paths from which to obtain the fonts.
Input Devices	Includes the keyboard and mouse definitions.
IP	This subgroup includes the IBM Network Station's, gateway and broadcast IP addresses, subnet mask, and routing table. These parameters are set automatically, and you should not change them in normal operation.
Java	The Java parameters define the home directory for the Java support code and the command used to start the Java AppletViewer application.
Loadable Modules	Specifies the path to the directory containing the modules to be loaded by the kernel and the policy for module loading.
Login	Parameters in this subgroup are related to the use of the IBM Network Station when using XDMCP.

Network Interfaces	Parameters in this subgroup are related to the LAN physical interface.
Parallel	You can use the parallel interface to drive a printer. See Chapter 6, “Printing” on page 145.
PPP and SLIP	At the time of publication, support for these parameters is not available.
Serial	At the time of publication, support for this parameter is not available.
TCP	Covers TCP buffer sizes and several time intervals. You should not need to change these parameters unless you are experiencing network problems.
TCP/IP Name Service	Specifies information needed for local name resolution and for using domain name servers. Some of these parameters are discussed further in 4.5.1, “Configuring the Local Host Name Cache” on page 100.
Time	Allows the user to define a time server and local time information, such as the time zone.
Unit	Includes the unit name and location, as well as the name of a contact person.
VT320 Terminal Emulation	Parameters in this subgroup cover the telnet capabilities of the IBM Network Station, see 4.5.5, “Configuring the Telnet Host Chooser” on page 104.
WinCenter	This subgroup is related to the WinCenter product.
X and Graphics	Includes file paths for the color and key definitions files and some default X-Windows resources.

4.4.3 User Preferences

Allowing the end user to tailor the preferences is not a recommendation. Without using IBM Network Station Manager program, the user is required to have detailed knowledge of the available choices and may inadvertently overwrite the preferences of other users or the administrator. See 4.5.11, “Protecting by Password the IBM Network Station Configuration” on page 108, for more information. However, if you are using CDE or XDM, it is possible to have user preferences stored in a user-specific file that will allow customization of user preferences at login as described in Chapter 2.7, “Alternate Installation” on page 32. Figure 36 on page 98 shows the groups of preferences a user may change.

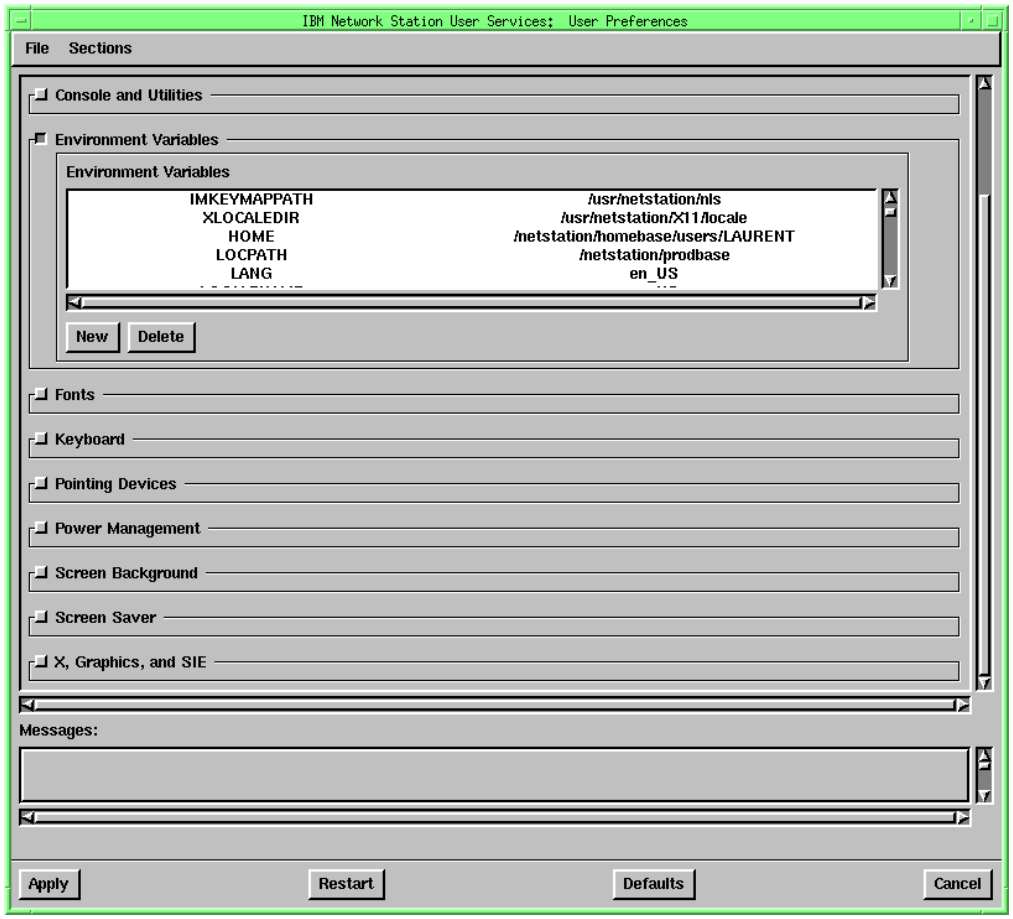

Figure 36. User Preferences Window

A description of these subgroups follows.

Subgroup	Description
Audio	This parameter allows you to set the maximum volume of an audio client.
Bell	This parameter allows you to tailor the bell volume, frequency, and duration.
Compatibility	This parameter allows you to set specific compatibilities with other vendors' X-Windows implementations.
Console and Utilities	Preferences in this subgroup include the key combination to show or hide the Console Window, automatic logout, and screen locking.
Environment Variables	This parameter is actually a list of environment variables. These may be useful for the Java Virtual Machine and Internet browser.
Fonts	This is a table of host paths from which to obtain the fonts.
Keyboard	Parameters in this subgroup include function key style and use of the keyboard's light indicators.

Pointing Devices These parameters are related to the use of the mouse and input extension devices. For example, a left- or right-handed mouse may be specified.

Power Management The parameters here allow you to specify display power management times. These parameters are automatically set.
Note: Forcing the use of the power management features on a display that does not have the necessary support may permanently damage the display.

Screen Background These parameters allow you to select a color or bitmap for the screen background.

Screen Saver These parameters allow you to select a color or bitmap for the screen saver, as well as the activation time.

X, Graphics, and SIE These parameters allow you to specify graphics optimizations. These parameters are automatically set. You should not need to change these parameters in normal operation.

4.4.4 Editing Parameter Tables

Many of the configuration parameters are actually tables. Editing these tables must be done line by line and field by field. You may also add new lines or delete existing lines by pressing the **New** and **Delete** buttons, respectively. To edit a field on a newly created or existing line, select it with the mouse button 1. A text entry field, containing the field's current value, is created under the table text area, shown in Figure 37. Change the text in the text entry field and press **Enter**.

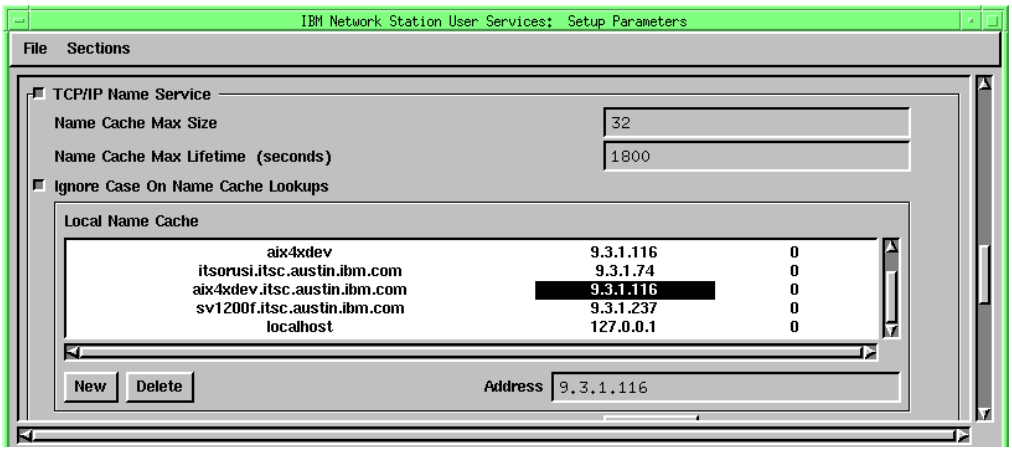

Figure 37. Editing Parameter Tables

4.5 Configuration Parameters Examples

This section presents selected examples of the configuration file parameters that are not managed by the IBM Network Station Manager program. Remember, it is strongly recommended to edit only the configuration files with a .dft extension. See 4.3, "IBM Network Station Configuration Files" on page 71 for more information on the structure of the IBM Network Station configuration file.

4.5.1 Configuring the Local Host Name Cache

Configuring the local host name cache is only useful in situations where IP addresses are statically allocated and there is no DNS or any other means of name resolution. You can the following table in /usr/netstation/nsm/StationConfig/defaults.dft. When directly editing this configuration file, the `tcpip-name-local-cache` parameter has the following syntax:

```
set tcpip-name-local-cache = {
        { "aix4xdev"   "9.3.1.116"   0 }
        { "itsosmp"    "9.3.1.27"    0 }
}
```

Each entry has three fields, as follows:

1. A symbolic name

   This name is case-sensitive and can be subsequently used in other configuration parameters.

2. An IP address in dotted-decimal notation

3. Lifetime for the entry

   The time, relative to the unit boot time in seconds, when the entry will become unusable. A value of zero (0) indicates an infinite lifetime.

Note: Host names are case-sensitive.

4.5.2 Configuring the Initial Applications List

As part of the initialization process, the kernel program will load and start executing the applications listed in the `exec-startup-commands` parameter.

These applications should be the most frequently used ones or those necessary to initiate a user login. The IBM Network Station is a real memory system; so you should be careful to avoid exceeding the capacity of the installed memory. If there is not enough memory to load a newly requested application, an appropriate message is issued; and the request is not honored.

For an estimate of the memory requirements for downloaded software, see Figure 1.9.5 on page 19.

Take Note

If you are using a full-screen solution with your IBM Network Station with only one application such as a 3270 or 5250 emulator, Windows desktop, CDE or XDM, NC Navigator, refer to 5.7, “Full-Screen Solutions with the IBM Network Station” on page 132.

Moreover, the information given in this section is informational only, and it is recommended not to modify the initial applications list outside the IBM Network Station Manager program.

If you want to add your own initial applications list, add the following table in one these files, depending your environment:

- **/usr/netstation/nsm/StationConfig/defaults.dft**
  In this case, every IBM Network Station will start these initial applications
- **/usr/netstation/nsm/StationConfig/*NS_name*.trm**
  In this case, only the IBM Network Station whose TCP/IP name is *NS_name* will start these initial applications.

When directly editing the configuration file, the `exec-startup-commands` parameter has the following syntax:

```
set exec-startup-commands = {
        { "mcuis" }
        { "actlogin" }
}
```

Important: Removing the `actlogin` statement bypasses the IBM Network Station login phase. Therefore, no user or group settings are received by the IBM Network Station.

Each entry has a full command line composed of the command name and its parameters.

Note: Command names and parameters are case-sensitive.

It may also be desirable to load some of the library modules at boot to reduce subsequent application startup time. This will increase the initialization time, but may result in a more responsive system. Modules may be loaded according to one of the following policies:

`on-demand` The module is loaded when needed; it is the default.

`at-boot` The module is loaded when the unit is booted.

`disable` The module is never loaded.

When directly editing the configuration files, the `modules-load-policy` parameter has syntax as in the following example:

```
set modules-load-policy = {
     { "libx2" "at-boot" }
     { "libxt" "at-boot" }
     { "libxm" "at-boot" }
}
```

4.5.3 Configuring the Applications Pop-Up Menu

The pop-up menu is a list that may be an alternative or a complement to the IBM Network Station menu bar. It allows you to hide some applications which would not be included in this menu.

Take Note

The applications pop-up menu is part of the built-in Window Manager and Motif Window Manager provided with IBM Network Station Manager Release 3 and can only be used to start native applications. It will not work under CDE or XDM if you are using another Window Manager. Refer to 3.7.5, “Window Managers” on page 62, for more information.

The list, also known as the *Local Clients* list, can be created by tailoring the exec-command-menu parameter of the Network Station configuration files. Typically, you may include this settings in one of the following configuration files:

- **/usr/netstation/nsm/StationConfig/defaults.dft**
  In this case, every IBM Network Station user will be able to use this pop-up menu.
- **/usr/netstation/nsm/StationConfig/*NS_name*.trm**
  In this case, only the users working on the IBM Network Station whose TCP/IP name is *NS_name* will be able to use this pop-up menu.
- **/usr/netstation/nsm/groups/*groupname*/*groupname*.grp**
  In this case, only the IBM Network Station user member of the *groupname* group will be able to use this pop-up menu.
- **/usr/netstation/nsm/groups/*username*/*username*.usr**
  In this case, only the IBM Network Station user whose name is *username* will be able to use this pop-up menu.

The list is displayed as a pop-up menu and is invoked by the following key combination:

Left Shift + Left Alt + Right Mouse Button

When directly editing the configuration file, the exec-command-menu parameter has the following syntax:

```
set exec-command-menu = {
        { "Lock Screen"      "lock" }
        { "Show Console"     "console" }
        { "WTSCPOK"          "ns3270 WTSCPOK -graphics -title 'ITSO
Poughkeepsie'" }
        { "Navio Browser"    "loadb navio" }
        { "VT 320 on aix4xdev"   "telnet -tn vt320 aix4xdev" }
        { "Show Version"     "show version" }
        { "Show Memory"      "show memory" }
}
```

Every entry has two parameters: a short description used in the pop-up menu window and the actual command to be issued. For the commands that you may specify, see 4.5.2, “Configuring the Initial Applications List” on page 100. The resulting pop-up menu is shown in Figure 38.

Note: Command names and parameters are case-sensitive.

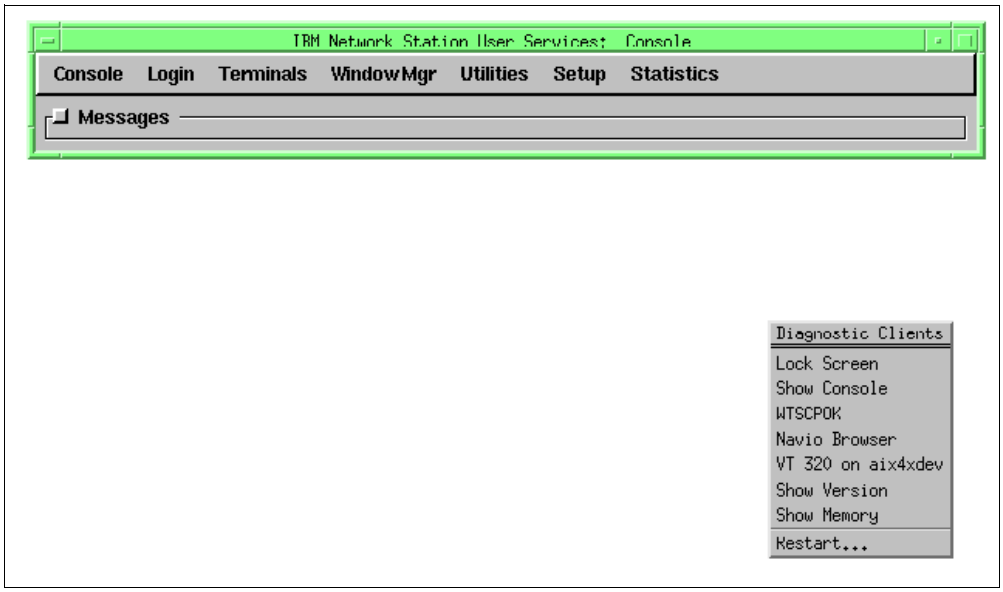

Figure 38. Local Clients List

4.5.4 Configuring the Local File System

The kernel running in the IBM Network Station needs a file system structure from which to serve applications file requests. This structure is known as the local file system and effectively consists of mounts of other hosts directories.

The directories for basic operation are automatically mounted during the initialization process. See 4.3.9, “Access to Server Directories” on page 90 for more information on the automatically mounted directory during the initialization process.

The `file-service-table` parameter allows you to specify any number of additional directories from any hosts that are to be mounted on the local file structure.

The `file-service-table` parameter works differently from all other parameters; its contents are added at the end of the list of automatically mounted directories. However, if the `file-service-table` parameter is specified more than once, then the contents of the *last* specification are added to that list.

You can add such a table in the same configuration files detailed in 4.5.3, “Configuring the Applications Pop-Up Menu” on page 101.

Each entry in the list is composed of the following fields:

Field	Description
local-unix-mount-point	Specifies the unit's UNIX-style local name for this file service access point.

local-vms-mount-point	This value should always be specified as *nil*.
server	This is the symbolic name or the IP address of a host.
protocol	Specify either tftp or nfs here.
server-mount-point	Specifies the name of the file service access point on the file server.
file-name-type	Specifies the type of file names used by the file server. This is not used with NFS file servers. Always specify unix.
retransmission-timeout	Specifies the amount of time (in seconds) between successive transmissions of a file service request.
transaction-timeout	Specifies the amount of time (in seconds) to attempt a file service request before a failure situation is declared.
read-size	Specifies the amount of data (in bytes) to be requested in a single read request. If you experience problems writing files across gateways, try decreasing this parameter to 1024 for NFS or 512 for TFTP.
write-size	Specifies the amount of data (in bytes) to be requested in a single write request. If you experience problems writing files across gateways, try decreasing this parameter to 1024 for NFS or 512 for TFTP.

The `file-service-table` parameter has the following syntax:

```
set file-service-table = {
        { "/javademo/"  nil  9.3.1.116  nfs \
          "/usr/lpp/netstation/javademo/"  unix  3 30  8192 8192 }
}
```

Note: Parameters are case-sensitive.

4.5.5 Configuring the Telnet Host Chooser

If the user needs telnet sessions, you may provide a list of them. Also, the user may be restricted to use only the listed sessions.

You can add such a list in the same configuration files detailed in 4.5.3, “Configuring the Applications Pop-Up Menu” on page 101.

When directly editing the configuration file, use the `term-default-hosts` parameter with the following syntax:

```
set term-default-hosts = {
        { telnet "aix4xdev" "AIX V4.3 Development" }
        { telnet "itsosmp" "AIX V4.3 SMP" }
        { telnet "sv1200b" "AIX V4.2" }
}
```

Each entry has three parameters:

1. Protocol to use
2. Symbolic host name
3. Description

Note: Command names and parameters are case-sensitive.

To see the results of this example, select **Terminals** from the Console Window; next select **New Telnet**. The window shown in Figure 39 is displayed.

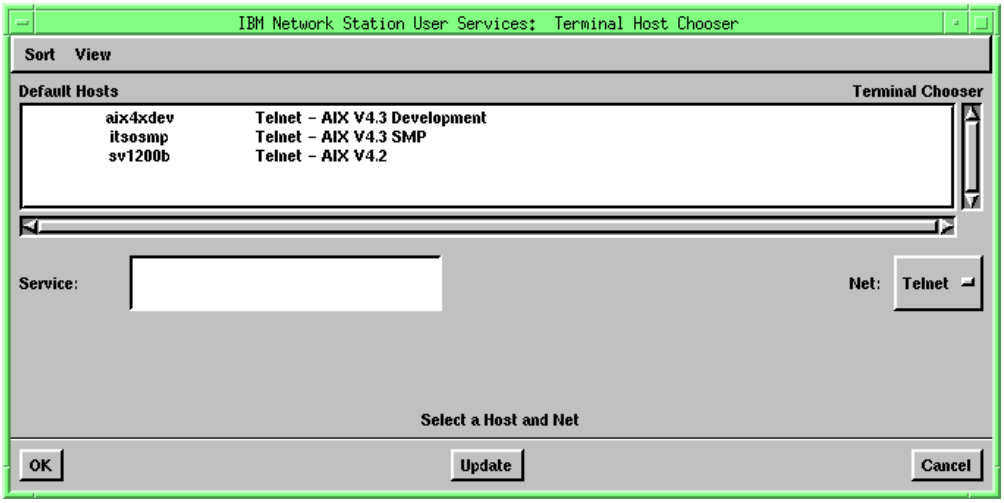

Figure 39. Telnet Host Chooser

To restrict the user's choices to the hosts specified on the list and exclude entering a host address in the Service: entry text field, specify in the same configuration file the parameter:

```
term-restrict-host-choices= true
```

4.5.6 X Client Access Control

To enable the IBM Network Station to interact with an X-Windows client running on another host, the client application must be authorized to use the X-Windows server on the IBM Network Station.

Depending if you want use this setting for one specific, or for all, IBM Network Stations, you will add the following lines in one of this both configuration files:

- /usr/netstation/nsm/StationConfig/defaults.dft
- /usr/netstation/nsm/StationConfig/*NS_name*.trm

To give universal access authorization, specify the following:

To selectively allow access, specify:

```
set xserver-access-control-enabled = true
set xserver-access-control-list = {
        { hostname family }
}
```

where:

`hostname` Is the symbolic name or the IP address of a host.

`family` Is always tcpip.

Note: Parameters are case-sensitive.

4.5.7 Disabling Command Usage

As discussed earlier, some commands are not intended for end users, and it is probably better that they be disabled. Also, some menu options on the Console window may be disabled. If a command can be invoked from the Console window, disabling it also disables the respective menu option on the Console window.

To disable commands, use the `exec-disabled-commands` parameter and create a list as in the following example:

```
set exec-disabled-commands = {
        { quicksetup }
        { setup }
}
```

The same parameter used with an empty list enables all previously disabled commands:

```
set exec-disabled-commands = { {} }
```

The commands that can be entered in this list are described in 4.5.2, “Configuring the Initial Applications List” on page 100.

Note: Command names and parameters are case-sensitive.

To disable other menu options on the Console window, use the X-resource database as in the following example:

```
set xserver-initial-x-resources = "

 ! Resource definitions for other applications

        ncdconsole.disableReboot: true\n\
        ncdconsole.disableLoginMenu: true\n\

 ! Resource definitions for other applications

"
```

IBM disables some commands and menus by inserting these above lines in the file /usr/netstation/StationConfig/required.nsm.

Manually, you can add such a lines in one of the configuration detailed in 4.5.3, “Configuring the Applications Pop-Up Menu” on page 101.

The resulting Console window is shown in Figure 40.

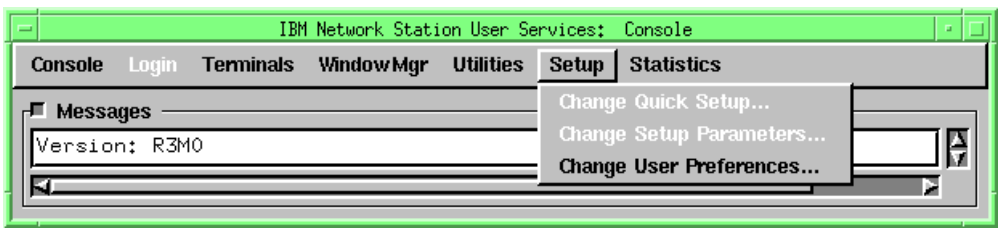

Figure 40. Console Window with Disabled Commands

4.5.8 Forcing the IBM Network Station Configuration from NVRAM

If you have a DHCP or BOOTP server on your network, the IBM Network Station will choose, by default, the Network mode to download its configuration information.

It could be useful, in some specific situations, to force one or several IBM Network Stations to download this information from NVRAM. To obtain such a result, you have to add `set ip-use-address-discovery = false` in /usr/netstation/nsm/StationConfig/defaults.dft for every IBM Network Station that must be configured with NVRAM.

Make this setting in /usr/netstation/nsm/StationConfig/*NS_name*.trm, if only the IBM Network Station whose TCP/IP name is *NS_name* has to use its NVRAM configuration.

4.5.9 Generating an Error Log

If you want to fix a specific problem on the IBM Network Station, you may find these hints and tips helpful:

1. Enable the verbose parameter and generate an error log by adding in the defaults.dft file the following lines:

```
#Display information regarding the files that the IBM Network Station is attempting to
access:
set file-extended-diagnostics = true
#All the information that is displayed on the IBM Network Station console screen is also
logged into the console.log file:
set diag-log-file = /usr/netstation/console.log
```

   The console.log file must be an NFS mounted file, and therefore must be in an exported directory.

2. Get a listing of all configurable parameters and their values by adding in the defaults.dft file the following lines:

```
#All the configuration parameters and their values are stored back on the server:
set config-auto-saved-info = all-info
#Setup the file name under which all the configuration parameters and their values are
stored to allcfg.nsm:
set config-auto-save-file-name =
/usr/netstation/nsm/StationConfig/allcfg.nsm
```

4.5.10 Setting the ARP Timing

If you have base code servers specified as backup, the IBM Network Station tries automatically to use the primary, then the secondary backup server after a timeout defined in its NVRAM if the default base code server is unreachable. By default, this timeout is set to twenty minutes. Therefore if your main base code server is unavailable, the IBM Network Station expects twenty minutes before trying the back-up server.

In order to optimize your environment, add the following line in /usr/netstation/nsm/StationConfig/defaults.dft:

```
set tcpip-arp-complete-entry-timeout = 1
```

This parameter specifies how long (in minutes) a completed ARP table entry should be allowed to exist without being used before it is automatically deleted.

4.5.11 Protecting by Password the IBM Network Station Configuration

As mentioned in 4.4, “The Console Setup Utilities” on page 93 it is recommended to protect by password access to the IBM Network Station. You find in this section the main options to complete this task.

Every parameter detailed in this section may be added in /usr/netstation/nsm/StationConfig/defaults.dft.

4.5.11.1 Protecting the Setup Menu

During the boot sequence, every user can press the **Esc** key to display and to modify the NVRAM configuration of the IBM Network Station. It is recommended to protect this access by adding the line:

```
set unit-global-password = password
```

The administrator global password is saved in NVRAM during the next IBM Network Station reboot and will be required to modify every parameter included in the setup menu.

4.5.11.2 Protecting the Telnet Access

For more information on the use of telnet to visualize or to set the IBM Network Station configuration, see 4.6, “Dynamic IBM Network Station Configuration” on page 109.

By default, everyone can get the diagnostic messages displayed in the IBM Network Station console window. However if you want to protect this information, add the following line:

```
diag-access-control-enabled = true
```

With this statement, it will be impossible to view the diagnostic messages from remote access. You will get the following message if you try a connection:

```
Trying ...
Connected to NS_name
Escape character is '^T'.
Connection closed.
```

To allow some IBM Network Stations this access, add the following list:

```
diag-access-control-list = {
{ "NS_name_1" tcpip }
{ "NS_name_2" tcpip }
...
}
```

The remote access allows the administrator to read and write every configuration parameter and eventually to store them into the IBM Network Station NVRAM. However, this capability is password protected, and you have to set this password by adding the following line:

```
config-read-write-password = password
```

4.5.11.3 Protecting the Console Window Menus

Table 28 summarizes the different available parameters:

Table 28. Protecting the Console Window Menus

Statement to add	Description
`set config-enforce-password-locally = true`	Specify that a password is required to configuration information at the IBM Network Station.
`set config-read-only-password =` *password*	Specifies the password required to obtain read-only access to the user preference information.
`set config-read-write-password =` *password*	Specifies the password required to obtain read-write access to the user preferences information.
`set config-pref-read-only-password =` *password*	Specifies the password required to obtain read-only access to the user preference information.
`set config-pref-read-write-password =` *password*	Specifies the password required to obtain read-write access to the user preferences information

4.6 Dynamic IBM Network Station Configuration

As indicated in 4.5.11.2, “Protecting the Telnet Access” on page 108, you can access a IBM Network Station by using the `telnet` command on some specific ports.

4.6.1 Remote Configuration

Some configuration changes have an immediate effect, some do not; refer to 4.1, “Overview” on page 67, for more information about the different types of configuration parameters. It is possible to telnet to an IBM Network Station into port 5999 (default) if you have defined a password, as explained in 4.5.11.2, “Protecting the Telnet Access” on page 108, and make a configuration change.

After running the command `telnet` *NS_name* `5999`, you will obtain the following messages:

```
Trying...
Connected to sv1200f.itsc.austin.ibm.com.
Escape character is '^]'.
*** NCD X Terminal Configuration ***
Password:
```

Enter the password (which will not appear on the screen), and you will get a > prompt. You will be able to use the many commands whose principals are:

get *param* or *group* To obtain the actual value of one parameter or of every parameter in a specific group

set *param* = *value* To set a parameter with a specific value

apply To apply the previous set commands

write nvram To write to the IBM Network Station NVRAM the previous settings which will be apply during the next IBM Network Station boot

Moreover, you can write some scripts in order to optimize your administration. Figure 41 and Figure 42 show two scripts that allow you to reboot a IBM Network Station after warning the user.

Copy the two files (nsreboot, msg-reboot) into the same directory and run the main script with the command:

```
nsreboot NS_name boot_delay_in_sec
```

```
#!/bin/ksh
#########################################################################
# NS - Remote Boot : nsreboot
#########################################################################
export TERM
TERM=dumb
#Write below your read-write password:
PSW=xxxx
NS=$1
(( T=$2*60+6 ))
#########################################################################
# Modification of parameter boot-custom-file
#########################################################################
boot()
{
echo $PSW
sleep $T
echo "set unit-administrative-status = unit-reset"
echo apply
}
#########################################################################
# main
#########################################################################
aixterm -display $NS:0 -T ALERTE -geometry 60x3+400+50 -e ./msg-rebooot \
$2 > /dev/null 2>&1 &
echo "       Alert sent to the NS $NS"
boot | /usr/bin/telnet $NS 5999 > /dev/null 2>&1
exit 0
```

Figure 41. Remote Boot: nsreboot Script

```
#!/bin/ksh
#########################################################################
# NS - Remote Boot : msg-reboot
#########################################################################
(( T=$1*60 ))
echo "Please, save your data and log out,"
echo "your NS is going to reboot in $T minute(s)."
exit 0
```

Figure 42. Remote Boot: msg-reboot Script

You can adapt the nsreboot `script` to reboot a group of IBM Network Stations by reading a file containing the list of stations.

4.6.2 Remote Diagnostic Access

If you have to get the diagnostic messages displayed in the console window from another station on the network, you can use the `telnet` command and port 5998 (default). See 4.5.11.2, “Protecting the Telnet Access” on page 108, if you have some permission problems.

Enter the following command to use telnet for remote diagnostic access:

```
telnet NS_name 5998
```

You will receive every line sent to the console window on the remote IBM Network Station in your telnet session window. If you are using a UNIX machine, it is recommended to use the `tee` command to save these diagnostics in a file as shown below:

```
telnet NS_name 5998 | tee TRACES
```

This will create the file `TRACES` containing all the diagnostic messages.

Press **Ctrl-T** to terminate the session, and enter `quit` to end telnet.

4.7 Configuring the Java Environment

The JVM requires the location of the Java class files and must be able to access those files. The `java-directory` parameter specifies the location of the standard class files. The default for this parameter is /usr/netstation/java. The location of any other class files must be specified in the `-classpath` parameter to the Java application and may require additions to the virtual file system as described in 4.5.4, “Configuring the Local File System” on page 103.

The AppletViewer application is a special invocation of the JVM to run a Java applet from within an HTML wrapper file. The AppletViewer application will also search for class files in the directory that contains the HTML wrapper file. The actual command line for the AppletViewer application is specified by the `java-appletviewer-command` parameter. The default for this parameter is `java ncd.applet.NCDAppletViewer`.

4.7.1 Color Preferences

Several applications allow setting color preferences by using an RGB value. Some of those values are listed in Table 29. When entering a value, you must specify the leading " \#" characters. The back slash "\" acts as an escape character to prevent the number sign "#" from being interpreted as the start of a comment. The file named /usr/netstation/rgb.txt contains an extensive list of RGB values and their symbolic names.

Table 29. RGB Color Values

Value	Description
#000000	Black
#0000FF	Blue
#69B9CD	Light blue
#00FFFF	Cyan
#CCCCCC	Grey

Value	Description
#00FF00	Green
#BC8F8F	Pink
#FF0000	Red
#ADEAEA	Turquoise
#FFFFFF	White
#FFFF00	Yellow
#A62A2A	Brown
#4F2F4F	Violet
#9F9F5F	Khaki
#FF7F00	Orange

Chapter 5. Advanced Network Station Initialization and Use

This chapter is for the IBM Network Station user or administrator who would like to acquire expert skills. Several useful hints and tips are provided to clarify the concepts.

For more information about the Network Station initialization and setup, see *IBM Network Station Manager - Installation and Use,* SG41-0664.

5.1 Booting

The booting phase objective is to load all necessary software into the memory of the Network Station and set the configuration according to the settings in the configuration files.

5.1.1 Locating the Host System

To load the boot file, the address of a host system must be available to the Network Station Boot Monitor program. Up to three addresses may be configured and stored in NVRAM. However, instead of using NVRAM addresses, it is recommended to use a boot protocol, such as BOOTP or DHCP, which allows a centralized administration of network addresses.

The process of locating a host to boot from is illustrated in Figure 43 and in Figure 44.

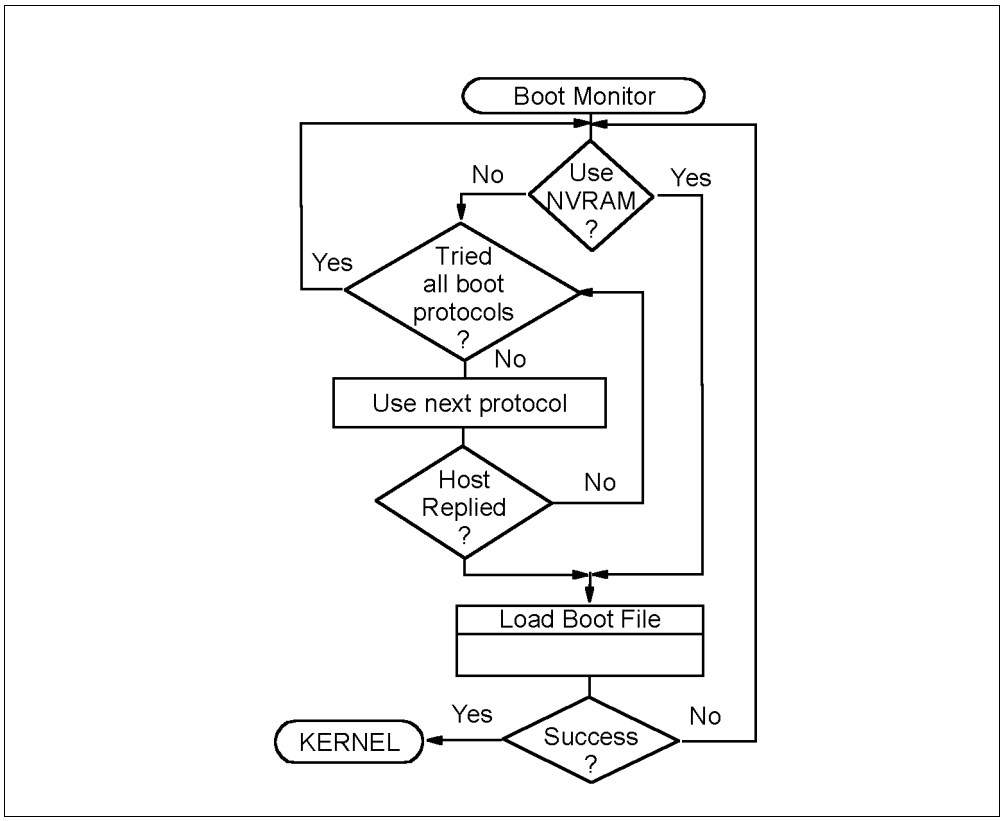

Figure 43. Locate a Host Algorithm (Part 1)

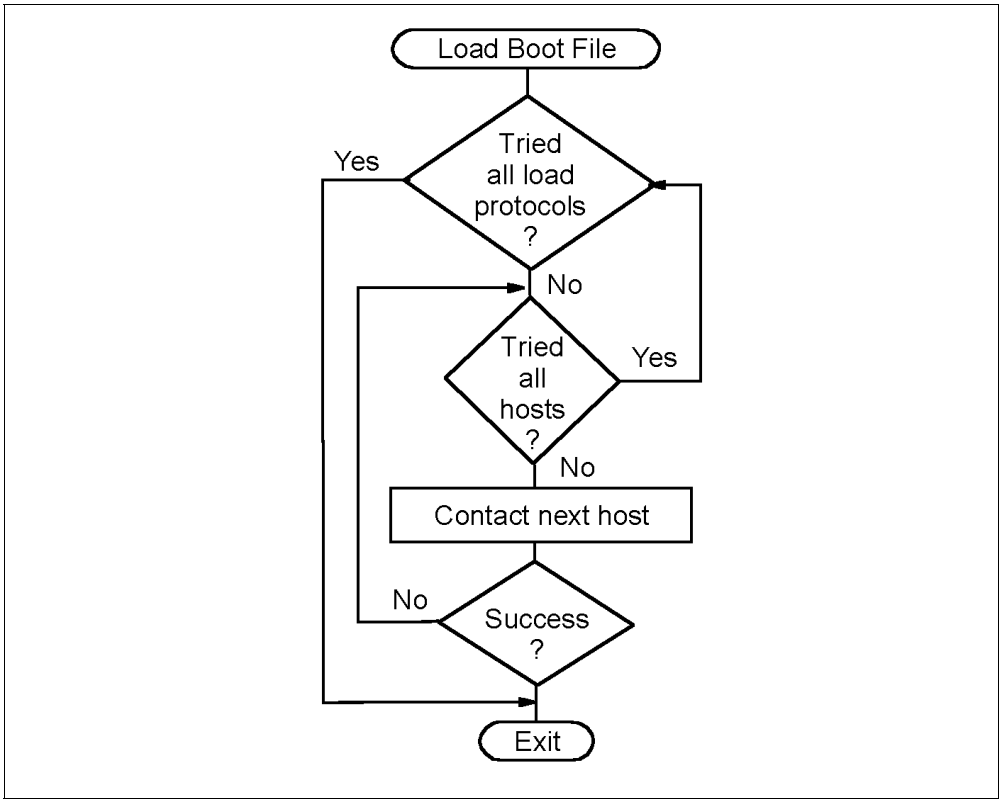

Figure 44. Locate a Host Algorithm (Part 2)

The order of the protocols or the IP-addresses of the host systems can be changed in the Boot Menu panel of the Network Station. When the option selected in the **IP Address from** field is **NVRAM**, the Boot Monitor checks the IP addresses:

- If any non-zero address is found, the Network Station tries to load the kernel from the host with the given address.
- If all addresses are zero (`0.0.0.0`), the Boot Monitor acts as if **Network** had been selected.

When the option selected in the **IP Addressed from** field is **Network**, the Boot Monitor attempts to use the first boot protocol in the priority list. If no reply is received after a specific interval, the monitor attempts to use the second protocol, and so on. When contact is made, IP addresses for both the host system and the Network Station are received. The Boot Monitor then requests the boot file from the host.

5.1.1.1 Loading the Boot File

The Network Station offers two different protocols for accessing data over the network:

- The trivial file transfer protocol (TFTP) is a simple protocol for transferring files. Because of its small block size, it is inefficient and slow, but it is available for almost every operating system. This allows many systems to act as a boot server.

- Network File System (NFS) is the same protocol used to share files between UNIX hosts. There is some additional configuration to be made by the network administrator to use NFS, but it is more manageable and reliable than TFTP and should be used when possible.

The desired protocol is chosen in the Boot Menu panel.

When more than one load protocol is enabled (for example, NFS and TFTP), the Boot Monitor attempts to use each one, in the established priority order. For each protocol, the Boot Monitor requests the boot file from the first (or only, as happens when BOOTP or DHCP are used) host, and displays the message `NS0520 Requesting start up information...` If the request fails, the next host on the list is used, if available. When the end of the hosts list is reached, the Boot Monitor restarts with the next available protocol. If all load protocols and hosts fail, the Boot Monitor restarts with the first protocol and host. This algorithm is shown in the Load Boot File routine of Figure 43.

If the request is successful, the message `NS0530 Loading start up information..` is displayed. The boot file is about 4 MB in size, but a compressed version of this kernel, about 2 MB, is downloaded by default then decompressed by the IBM Network Station. The downloading and decompressing phases take a few seconds. Decompression time depends on the model of your IBM Network Station. During the downloading process, the size of the downloaded kernel is displayed, and during the decompressing process, a progress-indicator is shown.

If the name and directory for the boot file is returned within the BOOTP or DHCP protocol, this setting will be used. Otherwise, the path stored in the NVRAM using the Network Parameter Panel will be used. If no boot file name or directory is returned, the default NVRAM parameters will be used.

5.1.1.2 Kernel File and Updating Boot Software

After the Boot Monitor has successfully downloaded the kernel, the kernel will be executed. The first task of the kernel is to set up the environment of the Network Station as stored in the configuration files. The configuration files will be loaded from the configuration server which can be the same as the host that the Network Station received the kernel. For more information on the configuration file download sequence, see 4.3.7, “Configuration File Download Sequence” on page 83. Once the kernel has finished loading the environment and starting the actlogin program (the default startup program), the IBM Network Station will be ready for use.

Take Note

Do not edit any *xxx*.nsm configuration files if you want to keep your specific customization by updating the Network Station Manager software. If you have to add some new lines in your system-wide configuration files, use the /usr/netstation/nsm/StationConfig/defaults.dft file.

To keep maintenance costs low, the network administrator needs simple facilities to update the software used for the IBM Network Station.

Updating the kernel and other modules loaded from the boot server is simple because you only have to replace the old files on the boot server with the updated

software. At the next boot, every Network Station using this server will load and use the updated software.

Updating the Boot Monitor program is more difficult because it is stored in a separate part of memory inside the IBM Network Station (NVRAM) to be available right after power on. However, there is a feature to update this file automatically.

After server installation, the following lines are in the configuration file /usr/netstation/StationConfig/control.nsm:

```
set boot-prom-update-file = nil
set boot-token-ring-update-file = nil
```

If you want to automatically update the boot monitor of your Network Station, run the Network Station Manager software and choose **Hardware->Workstations.** Then choose the **Update** option in the combo box Update to boot monitor installed on the boot server combo box. Figure 45 shows this Network Station Manager window.

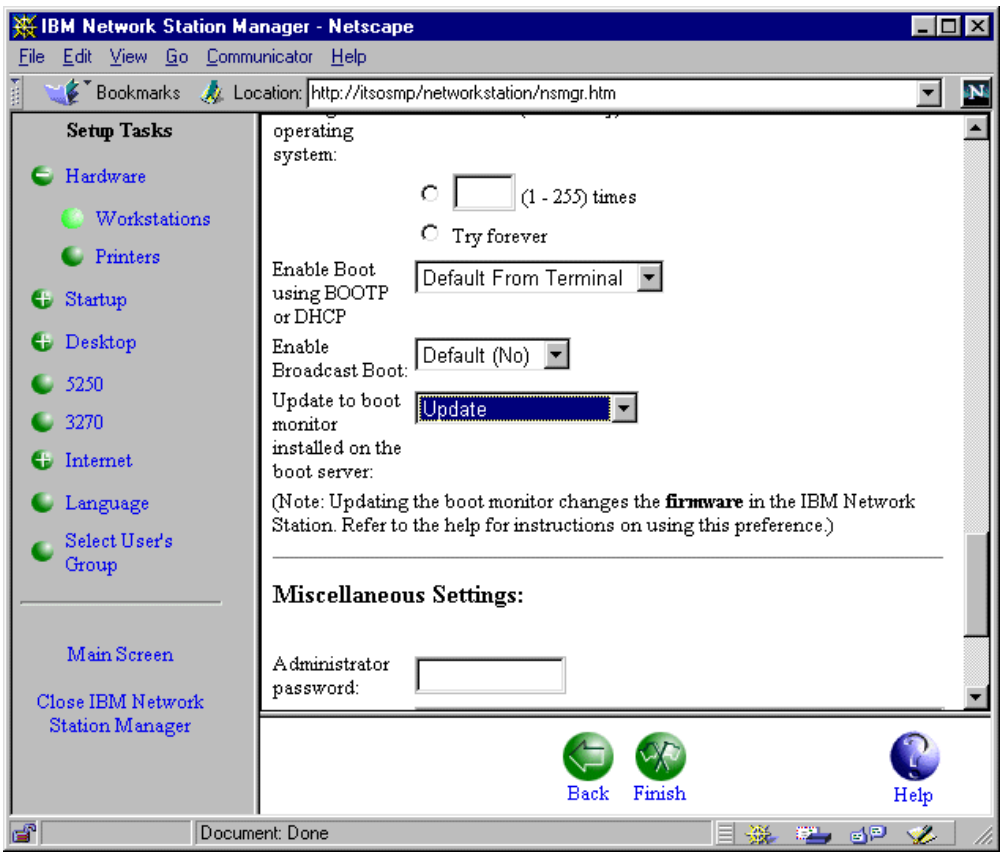

Figure 45. Network Station Manager: Boot Panel

After the update, a new line will be added in the configuration file defaults.nsm:

```
set boot-prom-update-file = "/netstation/prodbase/proms/bootflash"
set boot-token-ring-update-file = "/netstation/prodbase/proms/bootflash"
```

bootflash is the name of the newest boot monitor level found in the /netstation/prodbase/proms directory. If the kernel encounters one of these

parameters, it will verify the software level of the Boot Monitor stored in the Network Station against the value of this parameter. If they are not at the same level, the kernel will load this file and update the EPROM of the Network Station with the new Boot Monitor. In order for the changes to take effect, it will automatically reboot the machine after updating.

You need to copy the new versions of the Boot Monitor in the /netstation/prodbase/proms directory, and the Network Station will automatically update its Boot Monitor at the next reboot.

Take Note

During the update of the Boot Monitor, you must never power off the Network Station. If you do so, the Boot Monitor will become unusable. This is an unrecoverable situation, and the EPROM must be removed and reprogrammed. For an in-depth look at server installation, see Chapter 2, “IBM Network Station Manager Software Installation” on page 23.

5.2 Environment Set Up

After the IBM Network Station kernel is started it will initialize the user environment. This consists of defining preferences, such as the background color and cursor speed, and starting the default applications in the following order:

1. Reading the initial configuration file
2. Reading all other files pointed to by the initial configuration file
3. Establishing the operating characteristics including display foreground and background colors, character fonts, mounted file systems, configuration and file access passwords, enabled and disabled commands, and protected options
4. Loading initial applications

These steps are discussed in detail in the following sections.

5.2.1 Reading the Configuration Files

The name and directory of the initial configuration file may be kept in NVRAM or the Network Station can get this information from the server during the IP address request using BOOTP or DHCP, see 3.2, “DHCP versus BOOTP” on page 37. If no configuration file name or directory is available, default values, /usr/netstation/StationConfig/standard.nsm, are used. A clever system administrator will adapt the server to use these defaults, as well as server-specific paths.

The kernel requests the configuration files from one server which is not necessary the same host the boot file was loaded from. See 3.3, “Control of a Multiple Server Environment with DHCP” on page 47, if you want an example of multiple server environment. In addition, the configuration files will be accessed with any protocol chosen between the following, independently of the one used to load the kernel file:

- TFTP
- NFS

- RFS/400 (if your configuration server is a AS/400)
- Local (if use of a flash memory)

The initial file may contain pointers to other files containing additional configuration information. For more information about the contents of the configuration files, see Chapter 4, “Configuration Files” on page 67.

The Network Station Manager software allows you to change most of the aspects of the configuration files.

5.2.2 Establishing Operational Characteristics

After reading the configuration files, which may override several or all of the IBM-supplied defaults, the kernel reads files such as:

- The color names file (rgb.txt)
- The keyboard definition file
- The numerous font files from several directories under the general fonts directory

Although the names of these files cannot be changed, the directories they reside in can be changed in the configuration file.

A background color and bitmap is established, and the kernel starts loading the initial application.

5.2.3 Loading Initial Applications

The configuration file has a parameter named `exec-startup-commands`. The kernel executes all the commands defined in that section, effectively building the user's initial working environment. Each command causes the download of a binary file (a module) from a special directory whose default name is /usr/netstation/mods. This directory may be changed within the configuration files.

After finishing this task, the Network Station is ready for use.

5.2.4 Mouse Issues, 3-Button Enablement, Handedness

The IBM Network Station is delivered with a standard PC keyboard and a 2-button mouse. Normally, the paste function is handled on an X-compliant server using the center mouse button on a 3-button mouse. If you want to use cut-and-paste, the paste operation is accomplished on the 2-button mouse using **Shift + right mouse button**, where the right mouse button is the secondary mouse button (left-handed mice will be the opposite). However, depending of your Network Station configuration, this capability could fail. In this case, add the following lines in the /usr/netstation/nsm/StationConfig/defaults.dft file:

```
set xserver-initial-x-resources[-1] = "*Translation:#override\
Shift <Btn2Down>: insert-selection(PRIMARY,CUT_BUFFER0)"
```

Even though not explicitly noted in the documentation, the Network Station provides support for a 3-button mouse. You can use such a mouse if you are uncomfortable with the 2-button model. You only have to plug in the 3-button mouse into the Network Station, and it will work without further configuration.

If you are left-handed and need to change your mouse button layout, you can do this with the Network Station Manager software.

5.3 Special Keys and Key Combinations

The following keys and key combinations listed in Table 30 have a special function:

Table 30. Special Key Combinations

Key	Context	Action	Special
Esc	Boot Time	Stops download of kernel and invokes Network Station Setup utility main menu.	
Left Alt + Left Ctrl + Left Shift + F1	Network Station Setup utility	This will jump into the Boot Monitor program.	Only 101.102 keyboard
Left Alt + Left Shift + F1	Network Station Setup utility	This will jump into the Boot Monitor program.	Only 5250/3270 keyboards
F1	Boot monitor program	Switch to the Network Station Setup utility main menu.	
Left Alt + Left Shift + Home	Window Manager	Acts as a toggle to show or hide the Console window	
Left Shift + Left Alt + Right Mouse Button	Window Manager	Opens the local Command Window (if defined).	
Left Alt + Caps Lock + Pause	Window Manager	Keys must be pressed in this exact sequence. Network Station will jump into Boot Monitor program.	Do not use this combination unless instructed to do so! All applications are immediately terminated, and there is no chance to switch back. There will be no warning before switching!

Notes:

1. The U.S. English and Japanese keyboards have been tested.
2. The Alt, Ctrl, and Shift keys located on the *left* side of the keyboard must be used.

5.4 Remotely Starting Native Applications

If your Network Station is suitably configured, you may start applications that execute locally on the Network Station from a remote system. This means that, without changing the configuration parameters, it is possible to execute an application that is not started at initialization time or included in your menu bar.

To remotely start an application, you must first have access to a system that supports the *remote shell* protocol. From your Network Station, the easiest way is to start a telnet session and log into a remote system. Next, issue a remote shell command with the following syntax:

```
rsh IP-address command parameters
```

The *IP-address* is the IP address of the Network Station. You are instructing the remote system to send the *command* and its *parameters* to the designated IP address.

For example, to start a 3270 emulator session on the Network Station with the IP-address 9.12.14.235, to the WTSCPOK system, you would issue:

```
rsh 9.12.14.235 ns3270 WTSCPOK
```

This feature can have security implications as access control is host based. Therefore, anyone logged in to an enabled host can remotely start programs on the Network Station. So it is possible to disable access completely. See 3.6, “Security - Restricting Access” on page 56, for further information

5.5 Terminal/Telnet Session

The IBM Network Station provides a terminal emulation client named nsterm. Accepted terminal types are xterms, xterm, vt320, vt300, vt220, vt200, vt102, vt100, and ansi. With this terminal emulation client, you can telnet to remote hosts. This section describes the setup of the terminal emulator.

5.5.1 Adding the Telnet Session Terminal to Startup Menus

The terminal session can be added to the startup menu by using the IBM Network Station Manager program. By adding the terminal session to the menu, you can easily start telnet session to a remote host from the menu button. To add to the startup menu, perform the following tasks:

1. Start the IBM Network Station Manager program.
2. Select **Menus** under **Startup.**
3. Select **System defaults** for all users, **Group defaults** for a single group, or **User defaults** for a single user.
4. Click on the **Next** button at the bottom of the screen. This will bring you to a screen labeled Menu Contents.
5. Scroll to the section **Terminal Menu Items**. You can see the Terminal Menu Items screen shown inTable 46.

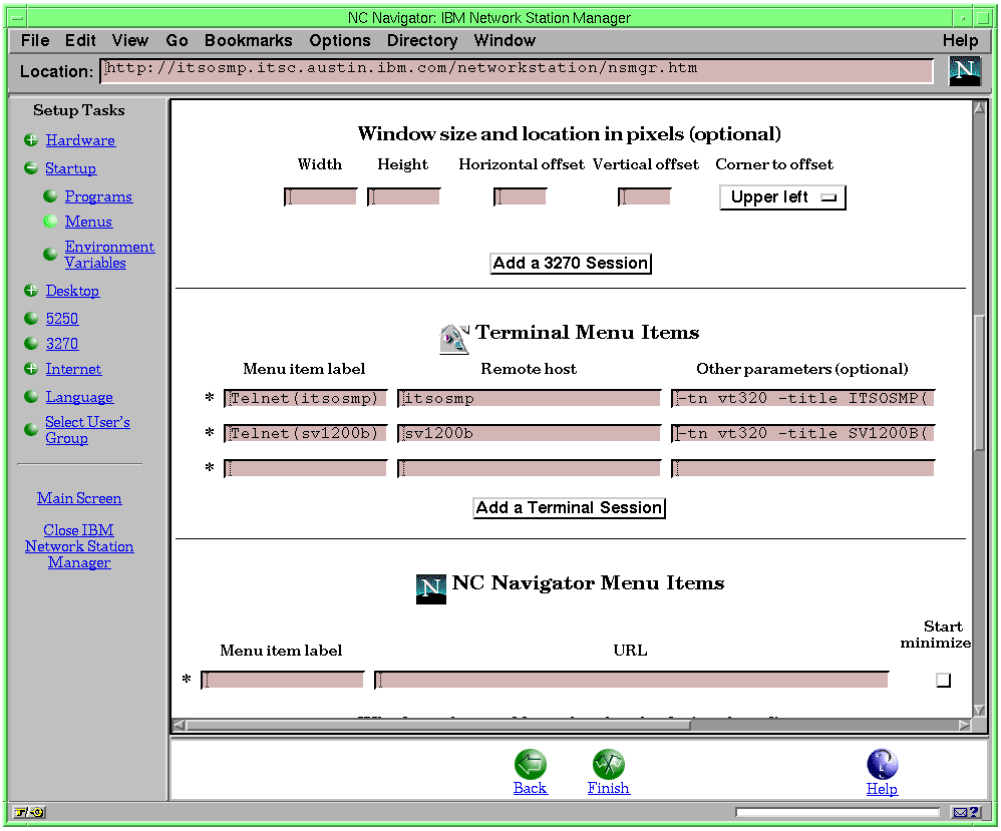

Figure 46. Terminal Menu Iterms

6. Fill out the text boxes; the following is the brief description of the each items:

   - **Menu item label**

     The label that appears on the menu bar.

     In Figure 46, you can see our examples; `telnet(itsosmp), telnet(sv1200b)`

   - **Remote host**

     The name of the remote host to which you connect with the terminal session. The name can be the IP address or the IP hostname.

     In Figure 46, we specified as the IP hostname; `itsosmp, sv1200b`

   - **Other parameters(optional)**

     Parameters for the terminal session client. You can see the parameters that can be input in the box on the help document by pushing the **Help** button.

     In Figure 46, we specified the terminal type and the title on the title bar:

     ```
     -tn vt320 -title ITSOSMP(VT320)
     -tn vt320 -title SV1200B(VT320)
     ```

7. Click on **Add a Terminal Session**.
8. Click on **Finish** button at the bottom of the screen and **Close IBM Network Station Manager.**

The next time you log in, you can see the terminal menu you added on the menu bar. And by pushing the button, you can open the telnet session to the remote host. By the setting shown in Figure 46, the resulting menu and the terminal window is shown in Figure 47.

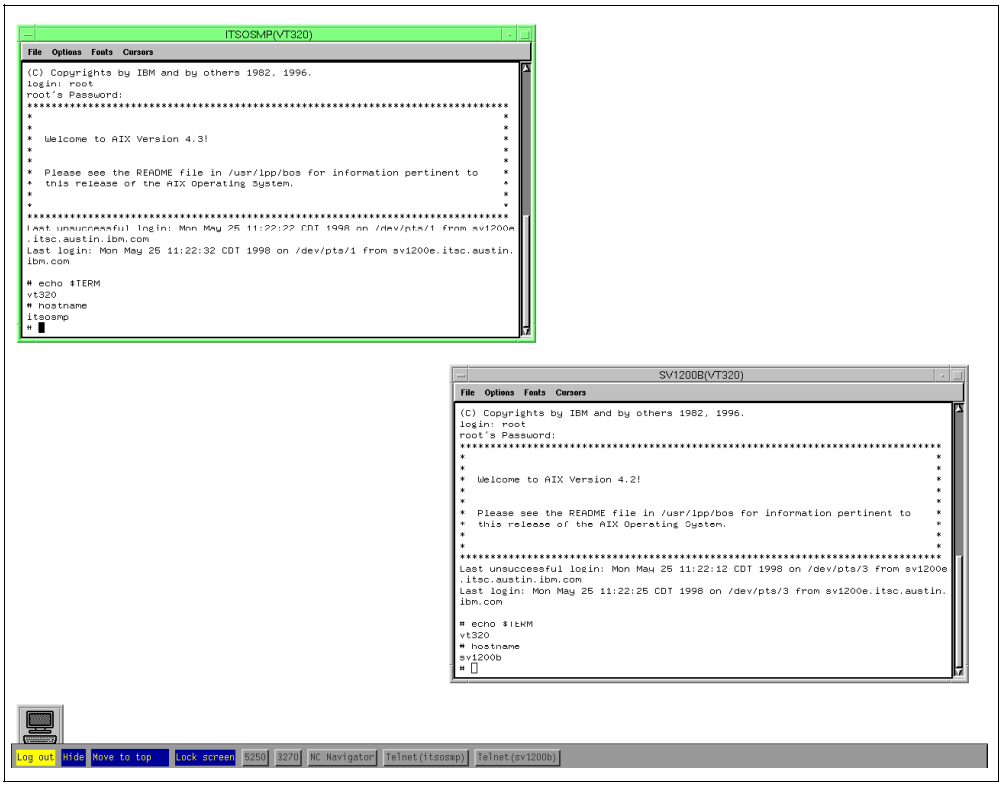

Figure 47. The Menu and the Window for the Terminal Session

5.5.2 Other Method to Start the Terminal Emulation

Since the terminal session is a local Network Station client, it can be started in the normal way that most other local clients are started, such as:

- Using the `rsh` command from an AIX window.
- As an auto start program when set up in the IBM Network Station Manager program.

5.5.2.1 Staring the Terminal Emulation with rsh

Terminal emulation can be started from an AIX window or shell by using the `rsh` command. The following show examples of starting terminal emulation with `rsh`:

```
rsh ns_host ncdterm -ctype telnet aix_host
rsh ns_host telnet aix_host
rsh ns_host telnet 9.19.129.12 -title TN_TO_REDWING
```

In this command example, *ns_host* refers to the host name of the IBM Network Station, and *aix_host* refers to the host name of the remote host being accessed. This does not have to be an AIX host, but any server accepting telnet connections.

Note: To enable the command execution from remote host with the `rsh` command, the remote host must be authorized to execute on the IBM Network Station. To give the access authorization, specify the following in defaults.dft file:

```
set exec-access-control-list = {
     { localhost tcpip }
     { aix_host tcpip }
}
```

5.5.2.2 Starting the Terminal Emulation as an Autostart Program

You can start the terminal emulation as autostart program during login process. To start the terminal emulation as autostart program, perform the following tasks:

1. Start the IBM Network Station Manager program.
2. Select **Programs** under **Startup**
3. Select **System defaults** for all users, **Group defaults** for a single group, or **User defaults** for a single user.
4. Click on the **Next** button at the button of the screen. This will bring you to a screen labeled Program Settings.
5. Scroll to the section **Terminal Sessions to AutoStart**.
6. Fill out the text boxes; the following is the brief description of the each items:
   - **Remote host**

     The name of the remote host to which you connect with the terminal session. The name can be the IP address or the IP hostname.
   - **Other parameters (optional)**

     Parameters for the terminal session client. You can see the parameters that can be input in the box on the help document by pushing the **Help** button.
7. Click on **Add a Terminal Session**.
8. Click on **Finish** button at the bottom of the screen and close the IBM Network Station Manager

5.5.3 Using Cut and Paste

Sections of text on the term window may be selected with the left mouse button similar to standard X-Window cut and paste. You may select a word with a double-click, or hold the left-mouse button down and drag to select a portion of the text. Clicking the center mouse button will paste the text at the new cursor position. This may include a position in a second term window.

In addition, rectangular sections may be marked and copied. These are selected with left shift + left-mouse button. When using a three-button mouse, the paste can be completed with the center mouse button.

5.5.4 Fixing Function Keys

There are a number of keys that generate key sequences that are different from the key sequence expected by AIX and other UNIX operating systems. You can see this condition when you use smitty in the vt100 or vt320 terminal emulator.

5.5.4.1 Knowing Function Key Definitions

Function keys in UNIX systems are defined by a library called termcap or one called terminfo. In AIX, terminfo is used, and the terminal definitions are stored in /usr/lib/terminfo directory. DEC emulation function key definitions in AIX are defined in /usr/lib/terminfo/dec.ti. You can see what escape sequence should be generated by function keys on a terminal type in this file.

You can find out what sequence is stored in the terminfo database on AIX for a particular key by using `tput` and `od` command.

For example, to know the definition of F1 key, use the `tput` command as follows:

```
tput kf1 | od -a
```

The output of the commands is the following:

```
00000000 esc O P
```

This output means that AIX is expecting the key to generate Escape O P.

5.5.4.2 Keyboard Map Testing

To check what the key is actually generating, use the following procedure:

1. Enter the following commands:

   ```
   stty -echo; od -c; stty echo
   ```

2. Press each function key. There will be no display to the screen at this time.
3. Press **Ctrl-D** two times until the command line prompt returns.

The sequence will then display showing you what the keys generated. For example, pressing **F1**, **F2**, **F3** creates the following:

```
0000000 033 [ 1 1 ~ 033 [ 1 2 ~ 033 [ 1 3 ~
0000020
```

From this, you can see that the F1 key generated the sequence Escape [11 ~the F2 key generated Escape [1 2 ~ , and Escape [1 3 ~ for the F3 key.

5.5.4.3 The Definition and the Actual Output on the Terminal Session

There are some keys that generate key sequences that are different from the key sequence expected by AIX and other UNIX operating systems. Table 31 shows the differences on the nsterm emulator for the terminal type xterms, xterm, and VT320:

Table 31. The Definition and the Actual Key Sequence for the Terminal Session

Keys		**xterms/xterm**		**vt320**	
Key Label	Keysym	Actual	Defined	Actual	Defined
F1	F1	\E[11\176	\E[11\176	\E[11~	\EOP
F2	F2	\E[12\176	\E[12\176	\E[12~	\EOQ
F3	F3	\E[13\176	\E[13\176	\E[13~	\EOR
F4	F4	\E[14\176	\E[14\176	\E[14~	\EOS
F5	F5	\E[15\176	\E[15\176	\E[15~	NA
F6	F6	\E[17\176	\E[17\176	\E[17~	\E[17~
F7	F7	\E[18\176	\E[18\176	\E[18~	\E[18~
F8	F8	\E[19\176	\E[19\176	\E[19~	\E[19~
F9	F9	\E[20\176	\E[20\176	\E[20~	\E[20~
F10	F10	\E[21\176	\E[21\176	\E[21~	\E[21~

Keys		xterms/xterm		vt320	
Key Label	Keysym	Actual	Defined	Actual	Defined
F11	F11	\E[23\176	\E[23\176	\E[23~	\E[23~
F12	F12	\E[24\176	\E[24\176	\E[24~	\E[24~
Shift-F1	F13	\E[11\176	\E[25\176	\E[11~	\E[25~
Shift-F2	F14	\E[12\176	\E[26\176	\E[12~	\E[26~
Shift-F3	F15	\E[13\176	NA	\E[13~	NA
Shift-F4	F16	\E[14\176		\E[14~	NA
Shift-F5	F17	\E[15\176	\E[31\176	\E[15~	\E[31~
Shift-F6	F18	\E[17\176	\E[32\176	\E[17~	\E[32~
Shift-F7	F19	\E[18\176	\E[33\176	\E[18~	\E[33~
Shift-F8	F20	\E[19\176	\E[34\176	\E[19~	\E[34~
Shift-F9	NA	\E[20\176	NA	\E[20~	NA
Shift-F10	NA	\E[21\176	NA	\E[21~	NA
Shift-F11	NA	\E[23\176	NA	\E[23~	NA
Shift-F12	NA	\E[24\176	NA	\E[24~	NA

Actual: Key sequence generated by pressing the key
Defined: AIX terminfo key sequence definition
NA: Not assigned by terminfo
Keysym: Indicates allowed keysyms on the IBM Network Station

5.5.4.4 Making a New Keyboard Map

To remove difference between Actual and Defined of xterms/xterm in Table 31, you can use the method described in this section.

If you only use the xterms/xterm terminal definition, then the most direct way to add the shifted function keys is to add the key symbols to the appropriate keyboard file in /usr/netstation/keyboards directory. The correct keyboard file to modify depends on the language of the keyboard being used. To add function keys F13 through F20 for xterms/xterm, add these definitions in the shift column after the function keys F1 to F8 as follows:

```
keycode 15 = F2         F14
keycode 16 = F1         F13
keycode 23 = F3         F15
keycode 31 = F4         F16
keycode 39 = F5         F17
keycode 47 = F6         F18
keycode 55 = F7         F19
keycode 63 = F8         F20
```

Remember that F15 and F16 are not defined in terminfo, but keysym will still generate a sequence. Adding keysyms F21 and above will not generate an error, but no key sequence will be generated either.

5.5.4.5 Making a New Keyboard Translation Table

If you need true vt320 function keys, then the most direct way is to use X-style translation tables for the nsterm emulator. By setting up a translation table, it is simple to correct the discrepancies between the key sequence generated by the emulator and that expected by the program. The translation table can be defined as a simple ASCII text file. The following entries illustrates the lines in the /usr/netstation/vt320.trans file:

```
Shift<Key>F1 : string(0x1b) string("[25~")
<Key>F1 : string(0x1b) string("OP")
Shift<Key>F2 : string(0x1b) string("[26~")
<Key>F2 : string(0x1b) string("OQ")
<Key>F3 : string(0x1b) string("OR")
<Key>F4 : string(0x1b) string("OS")
Shift<Key>F5 : string(0x1b) string("[31~")
Shift<Key>F6 : string(0x1b) string("[32~")
Shift<Key>F7 : string(0x1b) string("[33~")
Shift<Key>F8 : string(0x1b) string("[34~")
Shift<Key>F11 : string(0x1b) string("[29~")
Shift<Key>F12 : string(0x1b) string("[28~")
```

Notes:

- Make sure the last line is not blank or you will get an error.
- You must specify the modifier key translations before the unmodified key translations.
- Each entry must start with a leading white space (either a space or a tab).
- You cannot remap a key that is used as an accelerator in the Window Manager (For example, Alt-F4) or a key that is used to bring up the console.

After making a new keyboard translation table, use one of the following methods to get the keyboard to take effect:

- Add lines in one of configuration files to specify the X resources. The following is the example in the defaults.dft entry:

  ```
  set xserver-initial-x-resources = "\n\
          NCDterm*transfile: /usr/netstation/vt320.trans\n\
  "
  ```

- Call nsterm client with resource flags. You can specify these flags in the **Other parameters (optional) box** shown in Figure 46 on page 121. The following is the example of the flag:

  ```
  -xrm NCDterm*transfile:/usr/netstation/vt320.trans
  ```

5.5.5 Additional Configurations for the Terminal Emulation

This section describes additional settings possible when using terminal emulation.

5.5.5.1 Function Key Timing

Functions keys on terminals usually generate a sequence of characters beginning with the escape character. When using terminals and telnet sessions over a network, the delay between the escape character and the next character in a function key definition can be long enough so that the escape character is treated as a single character and not as a part of the defined function key sequence.

Fortunately, AIX has a method for defining the length of time to wait after the escape character to determine if the next character is a part of the sequence. The method of setting the delay is by setting the environment variable ESCDELAY. By default, this value is quite short, and some networked applications may get premature termination from some function keys. This can be even more of a problem when using X translation tables. You might see this problem occur with the IBM Network Station ASCII terminal emulation program.

When the function key is pressed, if the escape character is interpreted separately, and the rest of the sequence is printed to the screen, then you may have this problem.

To solve this problem, increase the value of ESCDELAY by about 500 until the keys work.

```
export ESCDELAY=500
```

Retest the function keys. If this does not solve the problem, try to increase the value:

```
export ESCDELAY=1000
```

Repeat these steps until the function keys work.

5.5.5.2 Accepting 8-Bit Characters

The default setting for the terminal emulator is to use 7-bits. Therefore, the character codes which are greater than 127 decimal are not displayed correctly. You might see this problem when using a UK keyboard and pressing the keys to generate the sterling or broken-bar symbols. The solution to this problem is to change the input activity to 8 bits. You can change this activity with the following X resources:

```
NCDterm*eightBitInput:true
```

5.5.5.3 Command Line Options

When starting the terminal emulation client, options can be specified that will modify the actions or appearance of the telnet client. Some of these options were shown in the examples above. The list of allowable options is shown in Table 32.

Table 32. Command Line Options for the Term Client

Flag	Parameter	Description
-/+132	NA	Enable/disable 132 column mode switching.
-b	margin (pixels)	Specifies the size of the inner margin. The distance between the window and the outer edge of the characters.
-bd	color	Specifies the color of the border.
-bg	color	Specifies the background color.
-bw	border_width (pixels)	Specifies the width of the border surrounding the window.
-cr	color	Specifies the color for the text cursor.
-ctype	telnet | cterm | serial	Connection type to start.

Flag	Parameter	Description
-cu, +cu	NA	Use this to work around curses xenl problem.
-fg	color	Specifies the color for the text characters.
-fn	font name	Specifies the font to use for displaying the normal text. The foundry, family name, and point size from the specified font are used to override the corresponding resource values. Proportional fonts are not supported.
-geometry	[col]x[row] +/-[xoff]+/-[yoff]	Startup size and location. The default is 80x24.
-help	NA	Print the help text to the console message window.
-host	host name	Host system to connect to. Use this option only with -ctype.
-iconic	NA	Start in iconic form.
-j,+j	NA	Use jump scrolling. This may improve performance on long test scrolls.
-mb,+mb	NA	Determines if margin bell should ring at end of typing line.
-ms	color	Specifies the color of the pointer.
-n	icon_title	Specifies the text that will appear under the icon.
-name	X class name	Class name for X resources. The default is NCDterm.
-nb	number	The number of characters from the right end of the line at which the margin bell will ring when enabled.
-ph	host:port	Specifies the remote printer host and TCP/IP port for printing.

5.5.5.4 X Resources for the Terminal Emulation Client

X resources can be set in the `xserver-initial-x-resources` configuration variable. The resources that were discovered during our investigations include those shown in Table 33:

Table 33. X Resources for Term Client

Resource Name	Description
NCDterm.title	Specifies the application title to be displayed by the Window Manager. The default is NCD User Services: Terminal Emulator

Resource Name	Description
NCDterm.termName	Specifies a blank separated list of terminal types to be offered during telnet negotiation. The following terminfo entries are offered in this order: xterms, xterm, VT320, VT300, VT220, VT200, VT102, V5100, and ansi using the telnet terminal type option defined in RFC1091.
NCDterm.iconName	Specifies the text string appearing under the icon if the term session is iconified. The default is NCDterm.
NCDterm.defaultPrintMode	Specifies the default mode for printing. Values are Serial, Parallel, and Remote. A value of Parallel indicates that the print request will go to the parallel port. For remote sessions, the printerHost resource value must also be set.
NCDterm.printer.Timeout	Time-out period for connecting to print connection.
NCDterm.printerFormFeed	Add a form feed at the end of the print file to flush the printer buffer. The default is true.
NCDterm.printerHost	Host name and port number of a print server for remote printing from the terminal session.
NCDterm.printerInit	Specifies a string to be sent to initialize the printer. This usually specifies an escape sequence that the printer understands.
NCDterm.printerPort	Specifies serial/parallel port 1 or 2. For the current models, the default of 1 is the only valid entry.
NCDterm.disablePrinting	Specifies in the Print-related menu entries in the File menu should be disabled. The default is False.
NCDterm.Translations	Key translation tables.
NCDterm.transfile	Specifies the file to be used to obtain an initial set of keyboard translations.
NCDterm.defaultHost	Host name of host that will be logged into if autoConnect is set to true.
NCDterm.autoConnect	Start a session automatically to be the defaultHost when the term client is started.
NCDterm.autoReconnect	If set to true, the terminal emulator reconnects on exiting the current session. The default is true.
NCDterm.exitOnDisconnect	If exitOnDiscconnect is set to true, the emulator exits after disconnecting. The default is true.

5.6 Remote X-Windows Applications

Any graphical application that executes on the Network Station is an X-Windows application, except the NT applications which can be accessed with the X11 or ICA protocol. This is because these applications use a set of commands, known as X-Windows commands, to communicate with the user. Other host systems (like most UNIX systems) also supply several X-Windows applications, and in that

case, you are able to use the Network Station as server for displaying and interacting with these applications.

To achieve this result, all you have to do is to instruct the other system to route the graphical commands issued by an application to your Network Station display and then start the application. The remainder of this section provides examples of this technique.

As with the `rsh` command, it could be a security risk to allow everyone to have access to the X-server of your Network Station. The X protocol allows an application to intercept every keystroke or other action you do on your Network Station without you recognizing it. This could be used to get the password of your account, for example. To avoid this, access to the X-server of the Network Station could be allowed access only to some special hosts, where your applications should run. See 3.6.1, “X Access” on page 56, and 4.5.6, “X Client Access Control” on page 105, for further information.

5.6.1 Using a Remote Internet Browser

As an example, you can run the Netscape browser on a AIX server but still use the Network Station display and keyboard to interact with the application. To do this, execute the following tasks:

1. Start a telnet session on the AIX server.
2. Set the `DISPLAY` variable to route the X-Window commands to your Network Station, so all X applications now started will use the display of your Network Station. This is done by the following command:

   ```
   export DISPLAY=sv1200f:0
   ```

   You have to replace the hostname `sv1200f` with the hostname or the IP address of your Network Station.
3. Assuming the Netscape browser is installed on your system, you can now start it with the command:

   ```
   netscape
   ```

The results are shown on Figure 48 on page 131.

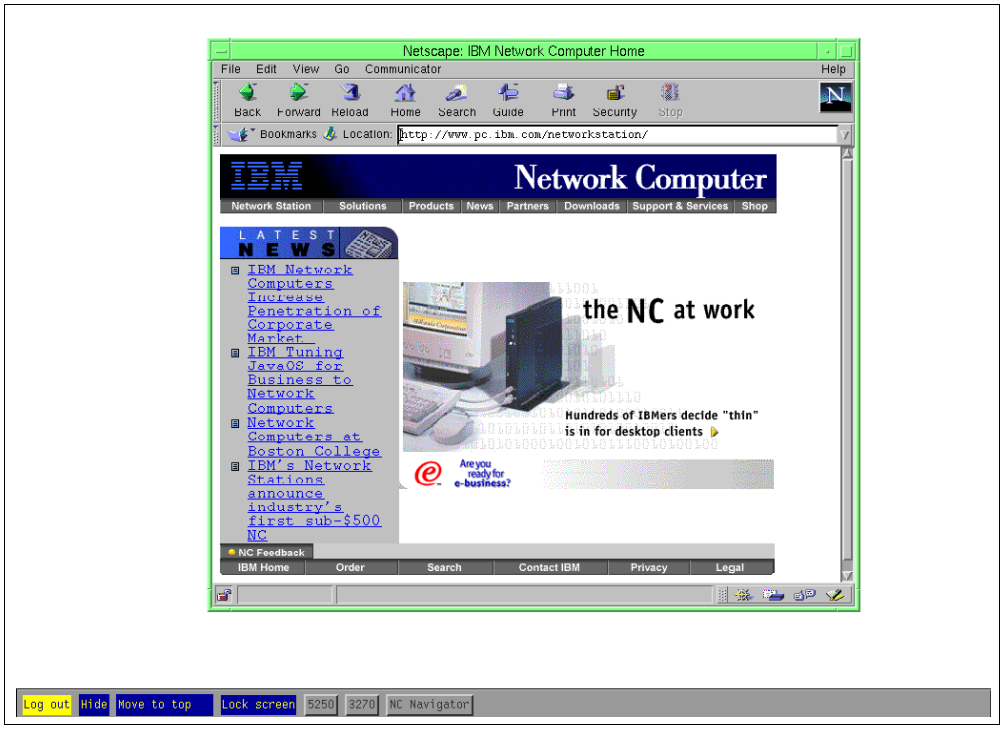

Figure 48. Using an AIX Browser on the IBM Network Station

5.6.2 Using the AIX XClock Application

In this example, the AIX graphical clock (`xclock`) on the IBM Network Station is shown in Figure 49 on page 132.

If you want to launch this application, execute the following steps:

1. Start a telnet session on the AIX server. At the remote system, issue the following commands:

   ```
   xclock -display sv2100f:0 &
   ```

   Opposite to the previous example, this command uses the special parameter `-display` to redirect the X-Window commands. By ending the `xclock` command with an `&`, the program is started in the background, freeing the telnet shell session to interpret other commands.

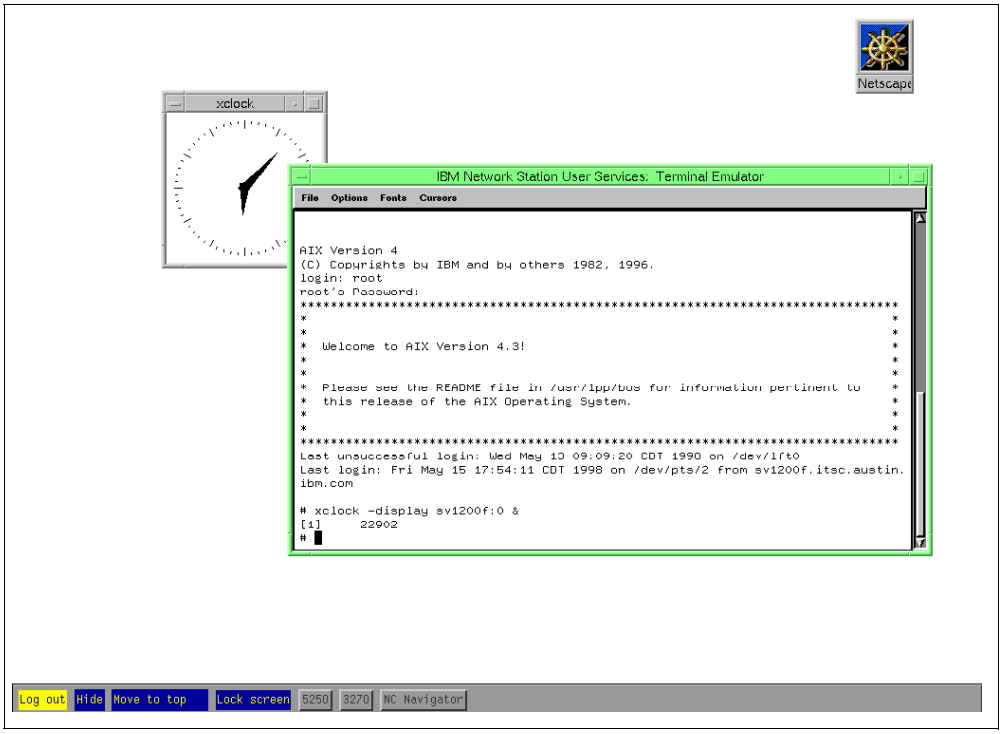

Figure 49. Starting the AIX xclock from the IBM Network Station

5.7 Full-Screen Solutions with the IBM Network Station

The following examples provide a way to enable full-screen applications:

- Suppress the login screen
- Suppress the X-Window Manager
- Suppress the menu bar
- Autostart a full screen application

Performing the previous steps with Network Station Manager Release 2.5 requires the login to be bypassed. This prevents many setup functions from taking place. In Release 3, the login can be suppressed, rather than bypassed. This allows the setup functions to take place.

In order to suppress the login, a special kiosk user ID must be created on your server, and the login screen is not shown to this user.

For each particular appearance of a full screen application, you must create a user ID. That user ID is configured using the IBM Network Station Manager program. If you have more than one user ID, you may want to create a user group for these IDs. Each Network Station that you associate with the user ID, can log in and automatically start a full screen application. These special kiosk user IDs and passwords (along with the Network Station host name or IP address that you want to associate) must be added to a special kiosk file that is encrypted and saved on your server. If the session hangs or the configuration changes, the Network Station must be rebooted to restart the session.

In this section we refer to PRODASE/ for /usr/netstation and USERBASE/ for /usr/netstation/nsm.

5.7.1 3270 Emulator

The following steps allow an IBM Network Station to behave like a non-programmable 3270 terminal:

1. Create a user ID on your server that can be used for the kiosk ID.
2. Create the kiosks.nsl file. See Chapter 5.7.6, “Suppressed Login” on page 136, for more information.
3. Use the IBM Network Station Manager to configure a kiosk ID using the following steps:
    1. Disable the Window Manager. Select **Startup->Environment Variables->User defaults**. Set **RUNWM** to **NO**.
    2. Remove the menu bar. Select **Startup->Menus->User defaults**. Select **Standard desktop without menu bar**.
    3. Autostart a 3270 session. Select **Startup->Programs->User defaults**. Under **3270 Sessions to AutoStart**:
        1. Enter the name or address of the 3270 server.
        2. Set the **Width** and **Height** to match the monitor resolution of the IBM Network Station.
        3. Set the **Horizontal offset** and **Vertical offset** to **0**.
        4. All other fields may be left as defaults. Make sure that no other programs are configured to autostart for this user on the user, group, or system levels.
    4. Set the background color to **black**. Select **Hardware->Workstations->User defaults**. Set the **Desktop background** to **black**.
4. You may want to set other options, for example:
    - Remove 3270 drop-down menus. Select **3270->User defaults**.
    - Set language. Select **Languages->User defaults**.

5.7.2 5250 Emulator

This example allows an IBM Network Station to behave like a non-programmable 5250 terminal. The following steps outline the required setup:

1. Create a user ID on your server that can be used for the kiosk ID.
2. Create the kiosks.nsl file. See Chapter 5.7.6, “Suppressed Login” on page 136, for more information.
3. Use the IBM Network Station Manager to configure a kiosk ID for the following:
    1. Disable the window manager. Select **Startup->Environment Variables->User defaults**. Set **RUNWM** to **NO**.
    2. Remove the menu bar. Select **Startup->Menus->User defaults**. Select **Standard desktop without menu bar**.

3. Autostart a 5250 session. Select **Startup->Programs->User defaults**. Under **5250 Sessions to AutoStart**:
    1. Enter the name or address of the AS/400 system.
    2. Set the **Width** and **Height** to match the monitor resolution of the IBM Network Station.
    3. Set the **Horizontal offset** and **Vertical offset** to **0**.
    4. All other fields may be left as defaults. Make sure that no other programs are configured to autostart for this user on the user, group, or system levels.
4. Set the background color to **black**. Select **Hardware->Workstations->User defaults**. Set the **Desktop background** to **black**.

You may want to set other options, for example:

- Remove 5250 drop-down menus. Select **5250->User defaults**.
- Set language. Select **Languages->User defaults**.

5.7.3 WinCenter or Winframe

These steps allow an IBM Network Station to behave like a Windows PC desktop:

1. Create a user ID on your server that can be used for the kiosk ID.
2. Create the kiosks.nsl file. See Chapter 5.7.6, “Suppressed Login” on page 136, for more information.
3. Use the IBM Network Station Manager to configure a kiosk ID for the following:
    1. Disable the window manager. Select Startup->**Environment Variables->User defaults**. Set **RUNWM** to **NO**.
    2. Remove the menu bar. Select **Startup->Menus->User defaults**. Select **Standard desktop without menu bar**.
    3. Autostart a WinCenter session. Select **Startup->Programs->User defaults**. Under **Remote Programs to AutoStart**:
        1. Enter the name or address of the Remote host (WinCenter server).
        2. Set the Program to run to `Wincenter`.
        3. Set the **Optional parameters** to `-display ${IP}:0 -depth 4 -resolution fullscreen -noaudio`.
        4. Make sure that no other programs are configured to autostart for this user on the user, group, or system levels.
    4. Set the background color to **black**. Select **Hardware->Workstations->User defaults**. Set the **Desktop background** to **black**.

If you want to use a Winframe server, change 3. to:

- Autostart a Winframe session. Select **Startup->Programs->User defaults**. Under **Local Programs to AutoStart**:
    1. Enter **Program to run** to `icaclnt`
    2. Set **Parameters** to `-h` *Winframe_server*.

Winframe_server is the hostname or the IP address of the Winframe server.

3. Make sure that no other programs are configured to autostart for this user on the user, group, or system levels.

5.7.4 UNIX Common Desktop Environment

This example allows a Network Station to behave like a X-terminal. But keep in mind that running the Common Desktop Environment (CDE) on the IBM Network Station generates a noticeable increase to the network load.

Complete the following steps:

1. Validate the configuration of CDE or XDM on your AIX server. Your AIX server must be setup to allow the CDE or XDM remote sessions. See 3.7, “X Display Control Manager Protocol” on page 58, for enhanced information.
2. Create a user ID on your server that can be used for the kiosk ID.
3. Create the kiosks.nsl file. See Chapter 5.7.6, “Suppressed Login” on page 136, for more information.
4. Use the IBM Network Station Manager to configure a kiosk ID for the following:
    1. Disable the window manager. Select **Startup->Environment Variables->User defaults**. Set **RUNWM** to **NO**.
    2. Remove the menu bar. Select **Startup->Menus->User defaults**. Select **Standard desktop without menu bar**.
    3. Autostart an X session. Select **Startup->Programs->User defaults**. Under **Local Programs to AutoStart**:
        1. Enter the Program to run as `login`.
        2. Enter the Parameters as the name or IP address of the X session server.
        3. Make sure that no other programs are configured to autostart for this user on the user, group, or system levels.
    4. Set the background color to **black**. Select **Hardware->Workstations->User defaults**. Set the **Desktop background** to **black**.
5. Edit the userbase/configs/defaults.dft file. This file can be created if it does not exist. Add the following line to the file:

    ```
    set exec-disabled-commands = {{ }}
    ```

    This line guarantees that the X login program is allowed to run on the Network Station.
6. Enable the font server on AIX. See 3.5, “X-Font Server” on page 55, for more information.
7. Modify your IBM Network Station configuration to add the font server by adding the following line in /usr/netstation/nsm/StationConfig/defaults.dft:

    ```
    #For AIX 4.3.0 or newer:
    set xserver-default-font-path[-1] =  {"tcp/<IP_Address>:7100"
    #For AIX 4.2.1:
    set xserver-default-font-path[-1] =  {"tcp/<IP_Address>:7500"}
    ```

5.7.4.1 Decreasing the Network Traffic Generated by Dtterm

The increase of network traffic by dtterm is caused by the blinking cursor that is set as the default. The default cursor is a box cursor that blinks every 250 milliseconds. This means that four times a second a request is sent from the RS/6000, and a response from the Network Station.

You can improve the situation in two ways:

- Switch to aixterm as the standard window.
- Change the cursor in dtterm to a non-blinking cursor.

To change the dtterm cursor for the current window, select **Options** from the menu bar at the top of the dtterm window. From the submenu, select **Global**. In the Global Options window change the **Blinking Cursor** selection box to **Disabled**. You can also leave the cursor blinking and change the rate of blink from this screen.

5.7.5 NC Navigator

This following steps allow a Network Station to display a full screen NC Navigator session:

1. Create a user ID on your server that can be used for the kiosk ID.
2. Create the kiosks.nsl file. See Chapter 5.7.6, “Suppressed Login” on page 136, for more information.
3. Use the IBM Network Station Manager to configure a kiosk ID for the following:
    1. Disable the window manager. Select **Startup->Environment Variables->User defaults**. Set **RUNWM** to **NO**.
    2. Remove the menu bar. Select **Startup->Menus->User defaults**. Select **Standard desktop without menu bar**.
    3. Autostart a NC Navigator session. Select **Startup->Programs->User defaults**. Under **NC Navigator Sessions to AutoStart**:
        1. Enter the URL that you want to be the home page.
        2. Set the **Width** and **Height** to match the monitor resolution of the IBM Network Station.
        3. Set the **Horizontal offset** and **Vertical offset** to **0**.
        4. All other fields may be left as defaults. Make sure that no other programs are configured to autostart for this user on the user, group, or system levels.
    4. Set the background color to **black**. Select **Hardware->Workstations->User defaults**. Set the **Desktop background** to **black**.

5.7.6 Suppressed Login

Before implementing suppressed login, make note of the following restrictions:

- The unencoded file contains the unencoded passwords of the kiosk userids. It should only be accessible by the system administrator.
- The encoding program should only be accessible by the system administrator.

- The kiosk userids associated with suppression of login should have very limited authority Userids should be created similar to guest userids.
- The kiosks.nsl file should only be writeable by a system administrator.
- If the file system cannot prevent a general user from creating the file, an empty file should be created and protected by the system administrator.

In order to keep the login window from being displayed, perform the following steps. Remember that the user you are going to create will automatically log in without password; so these users must have very limited authority.

1. Create a file that is named kiosks.nsl in a non-NFS (private) directory.
2. Edit the file to add the Network Station IP address or host name, user ID, and password. The values should be separated by one or more spaces. For example:

   ```
   10.9.99.99 userid1 password1
   kiosk      userid2 password2
   ```

   You can use wildcards (matching patterns) to specify the IP address or hostname.

Pattern	Description
[string]	Matches any characters specified by the string variable within the square brackets.
^	Signifies the beginning of the IP address.
$	Signifies the end of the IP address.
.	Signifies any one character.
*	Signifies zero or more of preceding character.

   For example:

Wildcard	Examples of IP addresses that match
kiosk	kiosk01, mykiosk, akioskbc
^kiosk$	kiosk
kiosk[3-8]	kiosk3, mykiosk4, akiosk5b
^kiosk	kiosk01, kiosk, kiosk
kiosk$	mykiosk, kiosk, 3kiosk
kiosk...	kiosk123, mykioskabc, akiosk09bcd
kiosk*1	kiosk01, mykios01, akiosk21abc
^kiosk0..	kiosk001, kiosk099, kiosk0abcd
^kiosk0..$	kiosk001, kiosk099
^kiosk0[0-5].$	kiosk001, kiosk059

3. Run the `createKIOSKS kiosk.nsl` command.
4. Copy the kiosks.nsl file to the /prodbase/configs directory.

5.8 Running Java on the IBM Network Station

The Java programming language is one of the major enablers of the new network computing paradigm and related technologies. However, saying that an application is written in Java is no guarantee that it will run in a particular environment. There are so many different Java Virtual Machine levels, operating systems, and variables that is it worthwhile to spend some time looking at the Network Station's Java environment.

Take Note

Although every IBM network Station has the same functions, IBM recommends to use the IBM Network Station Series-1000 for Java applications and the IBM Network Stations Series-300 or 1000 for Java applets.

The Network Station Manager Release 3 includes level 1.1.4 of the Java Virtual Machine. Java levels are frequently updated.

5.8.1 Browsers and Java Applets

The Network Station Manager currently includes the NC Navigator which is Java and JavaScript capable browser, but it doesn't contain a Java Virtual Machine, unlike the other traditional browsers. The HotJava browser from JavaSoft, which is written in pure Java, also runs on a Network Station Series-1000. Moreover, the browser in Lotus eSuite is based on this product. As explained before, running Java applets from these browsers can vary quite a bit.

5.8.1.1 NC Navigator

When NC Navigator has to run a Java applet, it communicates with the desktop launcher who manages the relation between the browser and JVM. But before running Java applets on NC Navigator, check the **Java Enabled** setting, whose default is **No**. So you have to switch this setting to **Yes** by using Network Station Manager as shown in the Figure 50.

It is useful to fine-tune the appletviewer command if you want to run large applets. Since the the IBM Network Station's JVM is used by the appletviewer, modifications here will help as well. A good procedure would be to fine tune the applet viewer, then the JVM to run larger applets.

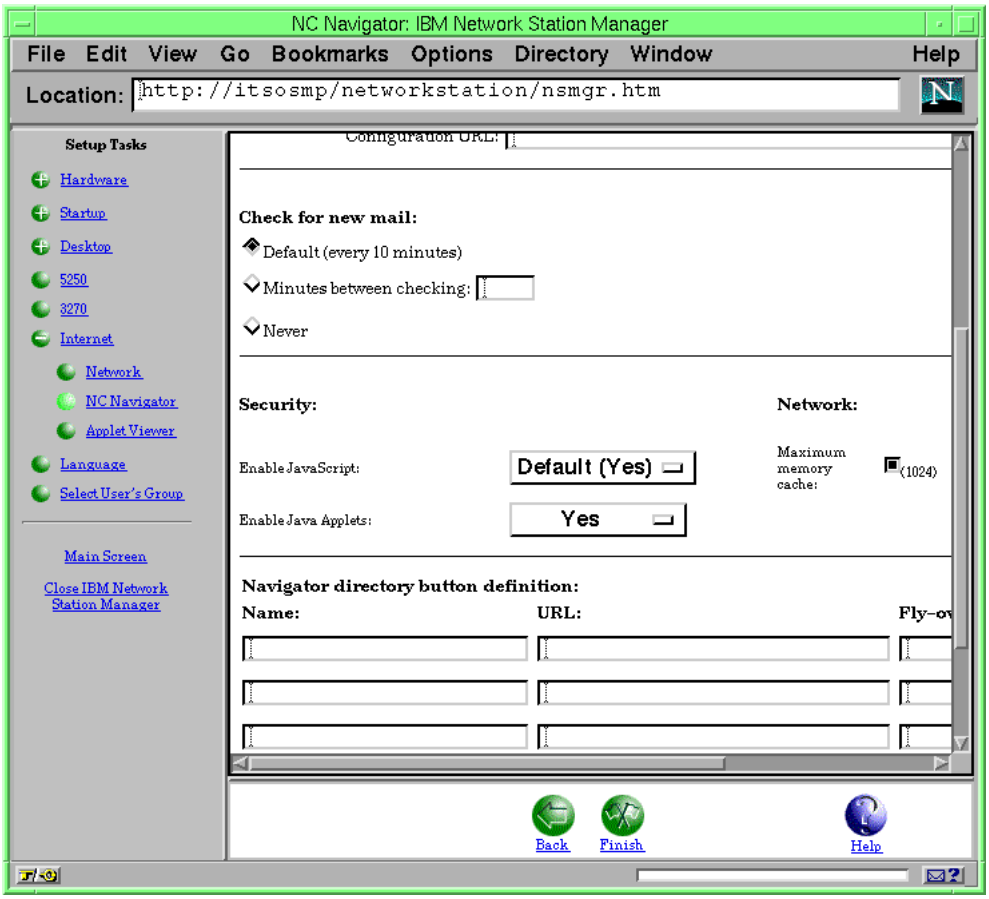

Figure 50. Network Station Manager: NC Navigator Setup

5.8.1.2 Commercial Applet - CATweb

Dassault Systems, editor of Catia, well known for CAD CAM software, has developed the CATweb product that allows every authorized user using a Java-enabled browser to log in to a Catia server and to visualize their Catia models in two or three dimensions.

On the Catia server, the following prerequisites must be met:

- Catia.COM
- CATweb module
- HTTP server

From a IBM Network Station, a Series-1000 is recommended, you can use the NC Navigator included in IBM Network Station Manager Release 3 to access to the Catia server. However, as indicated in 5.8.1.1, “NC Navigator” on page 138, you have to increase the default Java heap size of the AppletViewer through the IBM Network Station Manager in order to work with most of the Catia models.

After entering the URL of your Catia server, you are presented the IBM Network CATweb home page including a dialog where you must enter your user ID and password. If the authentication phase is successful, you are able to select and visualize, print the available Catia models.

Figure 51 shows the home page of CATweb Version 1.

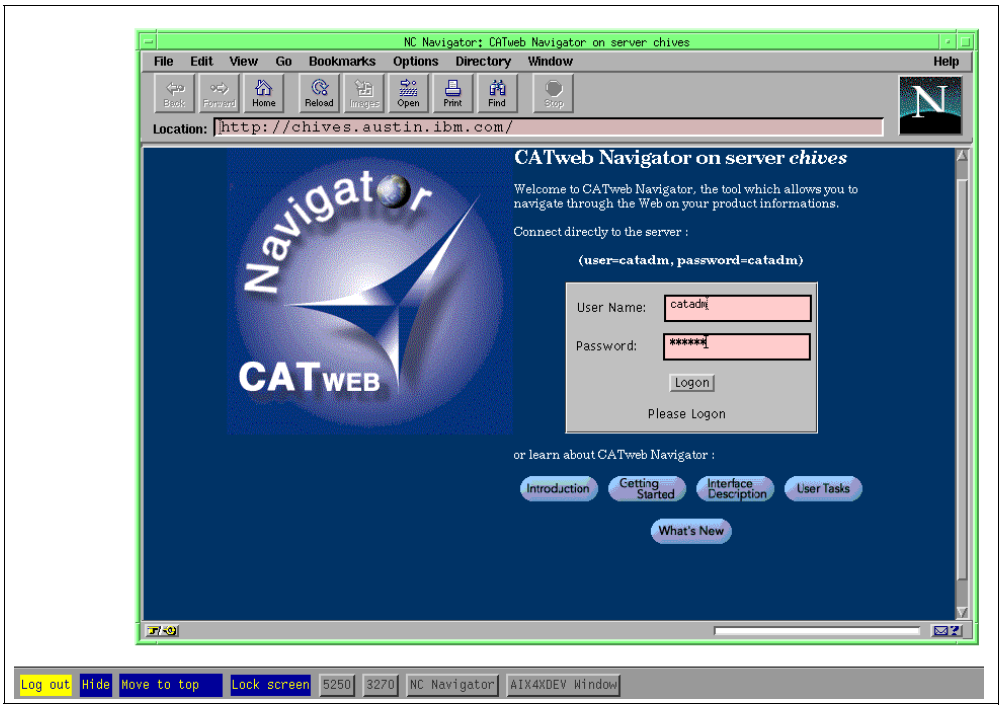

Figure 51. CATweb with NC Navigator

5.8.1.3 HotJava

This browser does not ship with the IBM Network Station, and it is a JavaSoft product, therefore it is not supported by IBM. Versions 1.1.2 and 1.0 are written in pure Java but are not JavaScript enabled. HotJava browser is a Java application, and as such, does not contain a Java Virtual Machine.

Installing HotJava on the IBM Network Station

Here are the steps to use HotJava with IBM Network Station Series-1000:

1. Download the software from the Web site:

   `http://java.sun.com:80/products/hotjava/1.1.2/index.html`

2. Extract the HotJava archive under the directory */MyApplications*/hotjava on your AIX server.

3. Export by NFS the directory */MyApplications* if it is not already mounted by the IBM Network Station.

4. Update the file-service-table of your IBM Network Station by adding in the configuration file /usr/netstation/nsm/StationConfig/defaults.dft the line:

   `file-service-table[-1]= { "`*`/MyApplications`*`" nil `*`aix_server`*` nfs "`*`/MyApplications`*`" unix 3 30 8192 8192 }`

5. Start HotJava with the following command:

   `rsh `*`NS_name`*` java -classpath netstation/java/classes.zip:`*`/MyApplications`*`/hotjava/lib -ms4m -mx32m -Dhotjava.home=`*`/MyApplications/`*`hotjava -Djava.home=/usr/netstation/java sunw.hotjava.Main -nosplash`

It is important to use the classes supplied with HotJava because there are special extensions in the Sun package. You will get error messages if you use the classes provided with the IBM Network Station.

You can add a button in your menu bar to start directly your HotJava browser from the IBM Network Station desktop.

Take Note

You need more then 48 MB of memory installed on your IBM Network Station to run HotJava, or you will get an **out of memory** error.

5.8.1.4 AppletViewer

Although running applets from within a browser is the most common method, if you don't need a browser interface, AppletViewer is simpler and therefore a recommended approach.

Take Note

The AppletViewer command does not interpret any of the HTML syntax that may be embedded in your HTML file. The AppletViewer command will only look for the <applet>....</applet> constructs, instantiate the applet that is defined, and ignore all other statements.

With the AppletViewer program, the Java applet can run outside of a browser using a command such as:

```
appletviewer MyApplet.html
```

Running your applet using the AppletViewer command is one of the first things you should try if you encounter trouble running your applet from inside a browser. Even if you do not want to ultimately run your applet from AppletViewer, it is still a worthwhile diagnostic exercise.

The `java-appletviewer-command` specifies the Java command line that should be used to start up the AppletViewer. It defaults to:

```
java ncd.applet.NCDAppletViewer
```

To execute an applet, the command can be one of either of the following commands:

```
appletviewer /Demo/Test.html
java -classpath /netstation/java/classes.zip:/Demo
ncd.applet.NCDAppletViewer /Demo/Test.html
```

Sometimes, the latter syntax is preferred if you need to pass lengthy parameters like classpath or properties. The sun.applet.AppletViewer class may also be used. You may run into cases where the Sun AppletViewer produces better results than the NCD version, and vice versa.

The Network Station Manager software allows you either to associate a button in your menu bar with a specific Java applet or to run one or several Java applets as a starting program. Figure 52 shows the **Java Applet to AutoStart** menu.

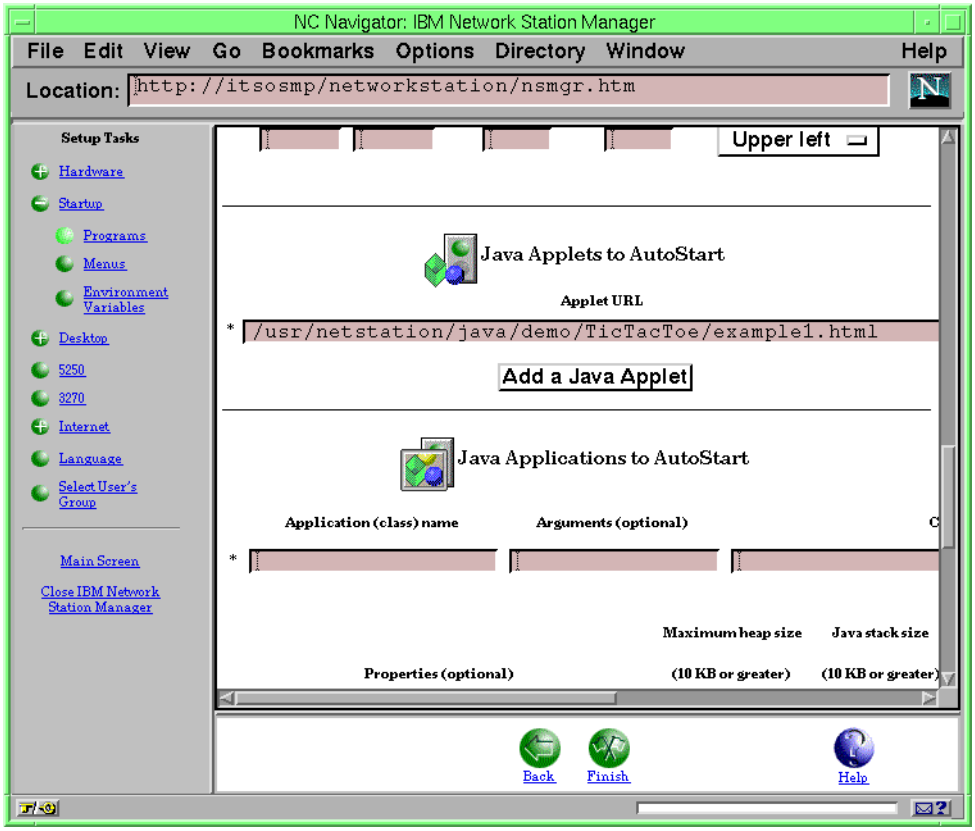

Figure 52. Java Applet to AutoStart menu in Network Station Manager

When running the AppletViewer, you may encounter a variety of errors relating to security issues. Often these can be fixed by setting the following parameter in your appletviewer.properties file, which is located in the /usr/netstation/java/lib directory on the AIX server:

```
appletviewer.security.mode=unrestricted
```

Please review a good Java book for a complete understanding of AppletViewer properties and the implications of changing the security mode. *Java In a Nutshell* has a discussion of this (Flanagan, ISBN 1-56592-262-X).

5.8.1.5 Sample Applet - TicTacToe

To run the sample TicTacToe applet local on the IBM Network Station, you can use the AppletViewer provided by the IBM Network Station. You have to execute the following steps to run TicTacToe:

1. Since all demonstration programs in the Java Development Toolkit come in source code only, you first have to compile TicTacToe. If you are in the directory storing the TicTacToe source code, TicTacToe.java, execute the following command:

   ```
   javac TicTacToe.java
   ```

   This will generate the class file TicTacToe.class, which will be called by the AppletViewer. If the path with the Java applications is not in your search path, use the full path name for calling javac, the Java compiler.

2. Make sure the directory with the TicTacToe files is readable by the Network Station or move the files to a proper location. For this example, all files needed for TicTacToe reside in /usr/netstation/java/demo/TicTacToe.

3. To start this applet, either insert the command in your IBM Network Station menu bar or use the following single `rsh` command:

```
rsh NS_name java -classpath
/usr/netstation/java/classes.zip:/usr/netstation/java/classes
ncd.applet.NCDAppletViewer
usr/netstation/java/demo/TicTacToe/example1.html"
```

   You can replace the command `ncd.applet.NCDAppletViewer` with `sun.applet.AppletViewer`, as explained in Chapter 5.8.1.4, “AppletViewer” on page 141. Figure 53 shows the result of the command and the successful defensive the IBM Network Station provides.

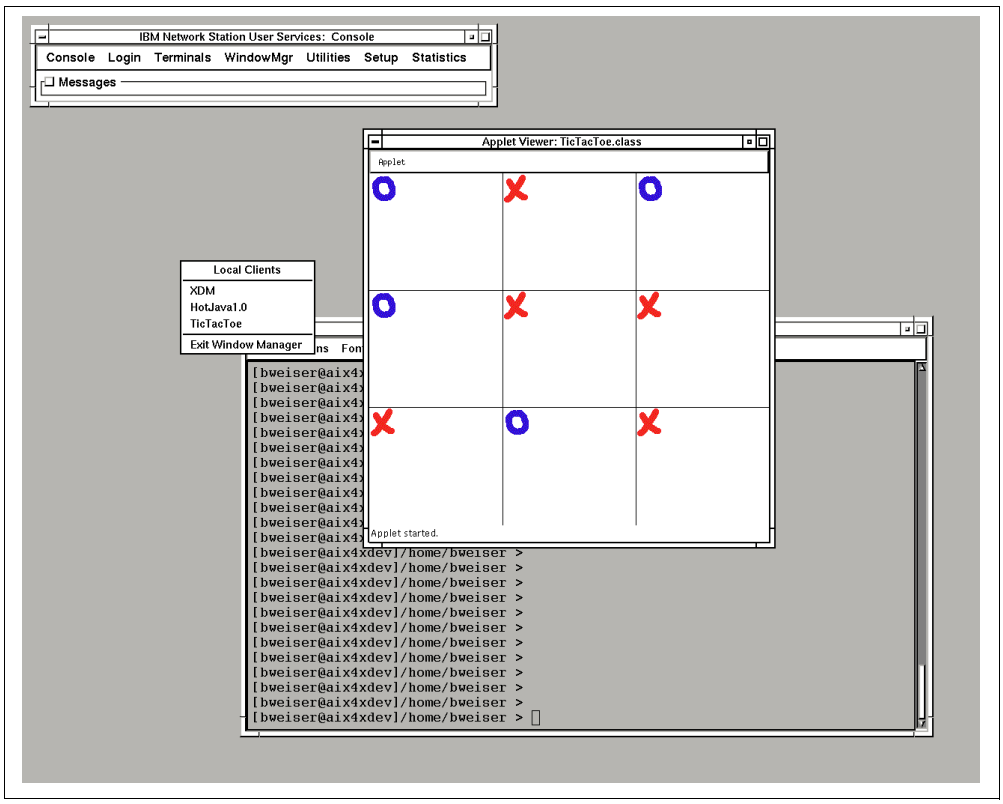

Figure 53. Java Applet Running on the IBM Network Station

5.8.2 Java Applications

The same explanations used to describe the IBM Network Station using Java Applets can be applied in this section with the exception that Java applications cannot be run from within browsers.

Only one Java application can run at one time on the IBM Network Station, and if some applets are already run, you will not be able to start a Java application on your IBM Network Station.

5.8.2.1 Java Application Example

Many Java applications are now available, and their numbers are increasing daily. The following examples are the subject of this discussion:

- The HotJava browser, described previously, is a good example of a Java application.
- eSuite from Lotus is a comprehensive groupware application written in pure Java. See 1.9.4, “Lotus eSuite” on page 18, for an overview of eSuite product and 1.9.5, “Memory Requirements” on page 19, to know the memory requirements with the IBM Network Station and visit the following site for more information:

  `http://www.esuite.lotus.com`

- Java ICA client: The ICA protocol, from Citrix, is used to access a multi-user Windows NT server. The Network Station Manager Release 3 provides a native ICA client and can be started by adding in your menu bar the command:

  `icaclnt -h` *NT_server*

  NT_server is the name or the IP address of the NT server you want to access to.

  However, you can use this same ICA protocol with a Java applet or a Java application. For further information and downloading these programs, go to:

  `http://www.citrix.com`

Each of these Java applications can be inserted in your IBM Network Station menu bar or run at login time as a startup program. Figure 54 shows the Network Station Manager screen for adding a Java application in your menu bar:

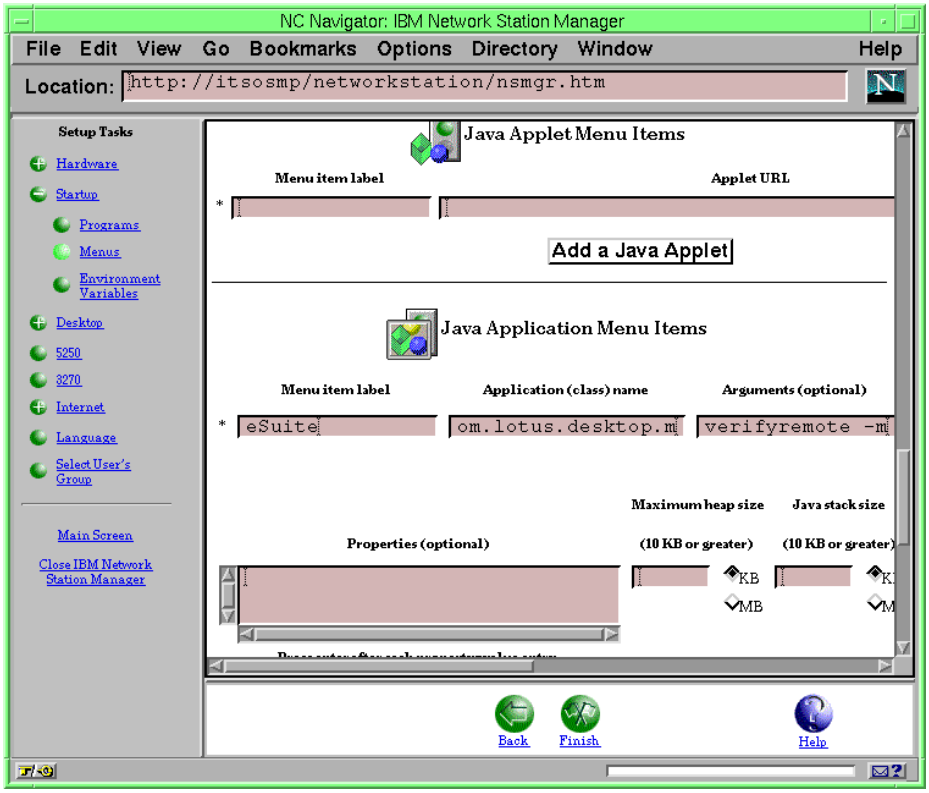

Figure 54. Java Application Menu Items in Network Station Manager

Chapter 6. Printing

This chapter discusses the printing environment of the IBM Network Station Manager Release 3 and subsequent releases.

The IBM Network Station provides support for the TCP/IP LPR/LPD protocol (RFC 1179). This allows the IBM Network Station to send print output to remote systems through LPRD and to receive a printing request through LPD as print server.

In addition to the support of LPR/LPD, the operating system on the IBM Network Station provides a mechanism for printing directly to the parallel or serial ports, either from a local application or from a remote system. VTxxx applications use this method for screen printing.

A variety of printers can be attached to the IBM Network Station and used for printing. They can support different types of print data streams, such as ASCII, HP PCL, and PostScript.

This chapter provides the information needed when using the printing capability of the IBM Network Station from local applications and remote applications. This chapter mainly focuses the relationship between the IBM Network Station printing capability and the AIX printing subsystem.

6.1 The Print Components of the IBM Network Station

This section describes the major print components to you understand how printing works on the IBM Network Station. Figure 55 shows the major print components and the print flow. A discussion of this figure follows.

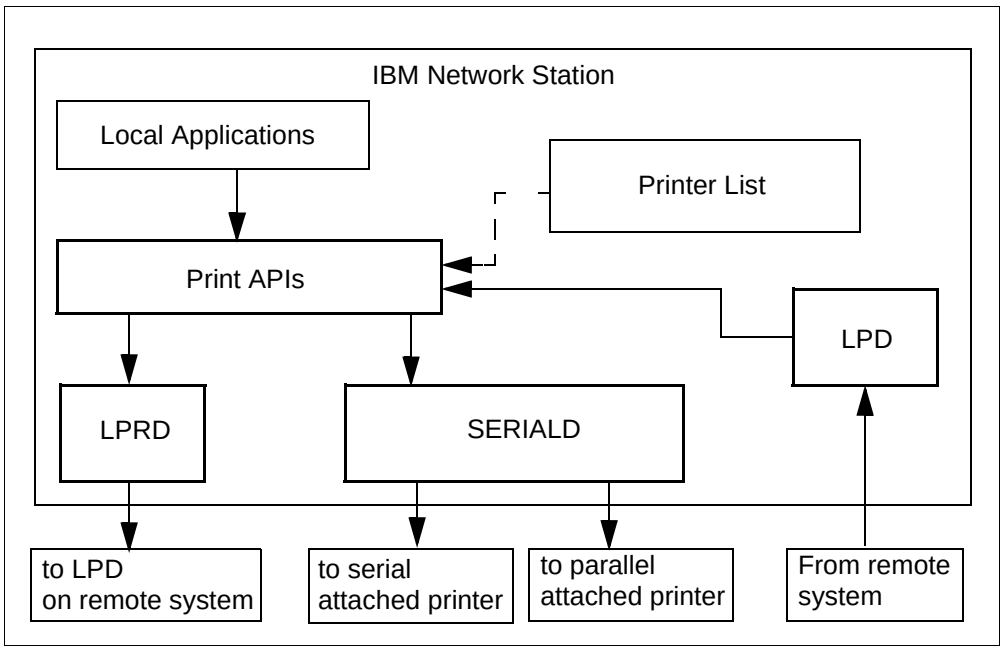

Figure 55. The Major Print Components and the Print Flow

The printing subsystem consists of four major components, SERIALD, Print APIs, LPRD, and LPD. The functions of each component are explained as follows:

- SERIALD

  SERIALD is a daemon responsible for controlling the serial and parallel interfaces. SERIALD is misleadingly named because it controls both the serial and parallel port. Sometimes, it is referred to as PARALLELD, but internally to the IBM Network Station PARALLELD is just an alias for SERIALD. SERIALD has its own IP ports which can be accessed directly by remote systems. The serial interface uses port 87 or 6461. Parallel interface uses port 5964 or 6464. In local applications (non-networked), a VT*xxx* application sends print data directly to SERIALD and not to the port. VT*xxx* printing method is discussed in 6.5, “Terminal Emulator VTxxx Printing” on page 158.

- Print APIs

  Local applications go through the print APIs whenever they print, whether it is to a local printer or to a remote printer. The print APIs provide the routing of application print output to either the locally-attached printer or to a remote printer. The print APIs provide an interface for local applications to specify the desired printer as a list of available printers and an indication of a default printer. The user is presented with that information, and after the user selects a target printer, the print API forwards the print request to the SERIALD daemon or LPRD.

  The list of available printers is configured by the administrator using the Network Station Manager program. After the administrator configures printers by using the Network Station Manager program, the `print-lpr-servers` parameter is added to either the defaults.nsm, *username*.nsm, or *groupname*.nsm (depending on administrator choice) read by the IBM Network Station at boot time.

- LPRD

  LPRD is the line printer requester daemon, used by the sending machine to communicate with the LPD, which resides on the receiving machine. If a remote printer is selected, a connect request is sent to LPRD from the print APIs. Once the connection is established, the print API passes the application print data to LPRD. Implementation of LPRD is described in 6.2, “How the IBM Network Station Implements LPR/LPD” on page 146.

- LPD

  The line printer daemon (LPD) handles incoming print requests by listening on TCP/IP port 515 which is the well-known port for LPD across most platforms. When LPD receives print requests from remote systems, it uses the print API to send the data to the local printers using the SERIALD. The LPD on the IBM Network Station only sends data to the local parallel or serial-attached printers. It is not possible to configure the IBM Network Station to take a print job request that is received by the LPD and to forward it on to the LPRD component in order to reroute it to a remote printer. The detailed information on the implementation of LPR/LPD is discussed in the following section.

6.2 How the IBM Network Station Implements LPR/LPD

There are three characteristics regarding the IBM Network Station:

- It does not have any local disk storage and therefore cannot do any spooling on a disk.
- It has a limited amount of RAM and operates as a real memory system, and therefore only has a limited print buffer capability.
- It does not use any printer drivers; so it must receive printer-ready data streams.

6.2.1 LPR/LPD

LPR/LPD is a TCP/IP-based printing facility. LPR is the line printer requester used by the sending machine to communicate over IP with the line printer daemon (LPD), which resides on the receiving machine and handles incoming print requests by listening on TCP/IP port 515.

When sending a spool file using LPR, the sending system creates and sends two parts to the receiving system:

- A control file

  The control file contains details about the print job such as the number of copies requested, the type of formatting, the user ID of the print job, job name, banner request or forced banner, and so forth.

- A print file

  This is the actual print data.

The order which file is sent first is determined by the negotiation between the LPR on the sending machine and LPD on the receiving machine, and it depends on the implementation of streaming mode on each machines. Streaming mode is discussed in 6.2.2, “Streaming Mode LPR/LPD” on page 147.

When the print request is received by LPD on the receiving machine, the printer output is placed onto a printer queue on the system. LPD itself does not do any data stream conversion. It sends whatever it receives to the printer. It is the responsibility of the sending machine to ensure that the data is suitable for the target printer.

6.2.2 Streaming Mode LPR/LPD

Streaming mode LPR/LPD is a facility that allows the LPR on a sending system to begin sending data before the system has finished creating the spool file. On a receiving system, streaming mode allows LPD to begin sending the data to the printer before the entire file has been received.

Therefore, streaming mode is useful for thin clients and systems with limited storage capabilities, such as the IBM Network Station. So the IBM Network Station supports streaming mode.

But the streaming is not part of the original specification for RFC 1179 and therefore is not supported by all LPR/LPD implementations. So if the LPD on remote system does not support streaming mode, LPR has to finish creating the control file and data file on local storage before sending data.

6.2.3 The LPRD on the IBM Network Station

The LPRD uses select a remote printer from the Printer Selector on the IBM Network Station. The Printer Selection lists available printers. On that list, when the user selects a printer that is attached to the remote system, the LPRD function is used to route the request to the remote printer.

Because there is no local disk storage on the IBM Network Station to use for spooling and the restricted amount of memory available, LPRD tries to use streaming mode first. But in case LPD on the remote system does not support streaming mode, LPRD tries to send print data by non-streaming mode. So there are two situations, one where the target LPD node does not support streaming mode and one where the target LPD node does support streaming mode.

The simplified process is as follows:

- The target LPD node does not support streaming mode.
  1. LPRD contacts the target LPD and attempts to use streaming mode to find out if the target LPD supports streaming.
  2. Because the LPD does not support streaming mode, it either closes the connection or returns an error message, or simply waits.
  3. That causes the sending LPRD to recognize that the LPD target does not support streaming mode, and it then switches to non-streaming mode. It accepts data from the application and builds the control file and data file in free RAM.
  4. If the entire data file does not fit into the available print buffer in RAM, the job fails.

     Note: There is a buffer size value on the IBM Network Station which defines how much memory is used when spooling a file. By default, this is 10% of the free memory at the time the print was requested. This percentage can be adjustable as maximum LPRD buffer size by using the Network Station Manager program. This free memory can vary greatly depending on the number of active applications at the time that the print request is submitted.
  5. If the print buffer is sufficient to hold the entire data file and control file, then LPRD sends a data file and a control file.
- The target LPD node supports streaming mode.
  1. LPRD contacts the target LPD and attempts to use streaming mode to find out if the target LPD supports streaming.
  2. The LPD accepts to use streaming mode, receives the control file, and stores it in the print buffer.
  3. The LPRD starts sending the data file as it is still being generated by the application with unspecified length.
  4. The LPD can then start printing the data file as it is received.

6.2.4 The LPD on the IBM Network Station

The LPD on the IBM Network Station receives print requests from remote systems, and it uses the print APIs to send the data to the local printers.

The only two printer queues that can be accessed by an incoming LPR request are:

- PARALLEL1 - This uses LPD passthrough to the parallel port printer.
- SERIAL1 - This uses LPD passthrough to the serial port printer.

Access to these local printers is controlled through configuration options in the Network Station Manager program. If print access control has been enabled on the IBM Network Station, it verifies whether the sending system is authorized to print on the IBM Network Station.

On the receive side, the LPD on the IBM Network Station is slightly different from LPD implementations on other platforms. The IBM Network Station has a maximum LPD buffer size which can be configured to hold incoming print requests. By default this is also 10% of the free memory at the time that request is received.

If the received data file exceeds the available buffer size, then the IBM Network Station has the ability to begin emptying the data onto the printer before the entire file is received. Even if non-streaming mode receive is used by the LPD, it still has the ability to begin printing the data file when the entire print file or control file has not been received.

If starting printing when the print buffer is exceeded is not desired, there is a configurable parameter called `Bypass Print Buffer` that can be set to **NO** in the Network Station Manager program. In that case, if a received data size exceeds the print buffer, the job fails.

Following is a simplified description of the flow when receiving a print job from a remote LPR. There can be two situations, one is when receiving a job from non-streaming LPR, and one is when receiving a job from streaming LPR.

- The flow when receiving a print job from a non-streaming LPR:
  1. The LPD receives a receive data file from a remote LPR which contains the size of the data file.
     - If the data file is small enough to fit into the print buffer, the job is accepted and the data is read into the print buffer.
     - If the job is too large to fit into the print buffer, and the `Bypass Print Buffer` configuration option is set to **NO**, the print job request is rejected.
     - If the job is too large to fit into the print buffer, but the `Bypass Print Buffer` configuration option is set to **YES**, the job is accepted, received, and emptied onto the printer as it is being received.
  2. The remote LPR sends a receive control file which is accepted, and the control file is read into the print buffer.
- The flow when receiving a print job from a streaming LPR:
  1. The LPD receives a request to receive by streaming mode from remote LPR.
  2. The LPD replies to the request and receives the control file.
  3. The LPD then receives the data file and streams to the printer.

6.2.5 Streaming on AIX

In the LPD/LPR implementation of AIX, the streaming protocol of LPR/LPD is implemented starting with AIX V4.3, therefore AIX V4.3 is the recommended release for the IBM Network Station as the target host that use LPD/LPR protocols.

6.3 Printing Environments and Capabilities

The following table provides information for what print capabilities are available for local applications and for host-based applications.

For the local applications, Table 34 shows whether or not the applications use the print APIs, whether or not the applications can print to local printers, whether or not the applications can print to remote printers, and what print data streams are generated by the application.

Table 34. Local Application Print Capability

Application	Use API	Local Print	Remote Print	Data Streams
5250 Emulator	Yes	Yes	Yes	PostScript, PCL, ASCII
3270 Emulator	Yes	Yes (1)	Yes	PostScript, PCL, ASCII
NC Navigator Browser	Yes	Yes	Yes	PostScript
Java Applications	Yes	Yes	Yes	PostScript
VTxxx Emulator	No	Yes (2)	No (3)	ASCII

Notes:

1. The 3270 emulator only provides print screen support. It does not include 3270 LU1/LU3 client printing support at this time.
2. The emulator does not use the API but uses SERIALD to send data to either the serial or parallel port. This is discussed in 6.5.1, “Printing to a Local Printer from VTxxx” on page 158.
3. There is a way for the VTxxx emulator to print servers through a remote port by setting X resources of the terminal. This is discussed in 6.5.2, “Printing to a Remote Printer from VTxxx” on page 159.

6.4 Printing Practical Configuration Examples

In this section, the following practical configuration examples are described:

- IBM Network Station application printing to the local printer
- AIX application printing to the IBM Network Station LPD
- IBM Network Station application printing to remote LPD
- IBM Network Station application printing to remote IBM Network Station LPD
- Printing with the spooling capability of AIX Host

6.4.1 Printing from the IBM Network Station to the Local Printer

When you attach your printer to the IBM Network Station, you have to configure Printer List by using the Network Station Manager program. Figure 56 shows Printer List on the Network Station Manager program.

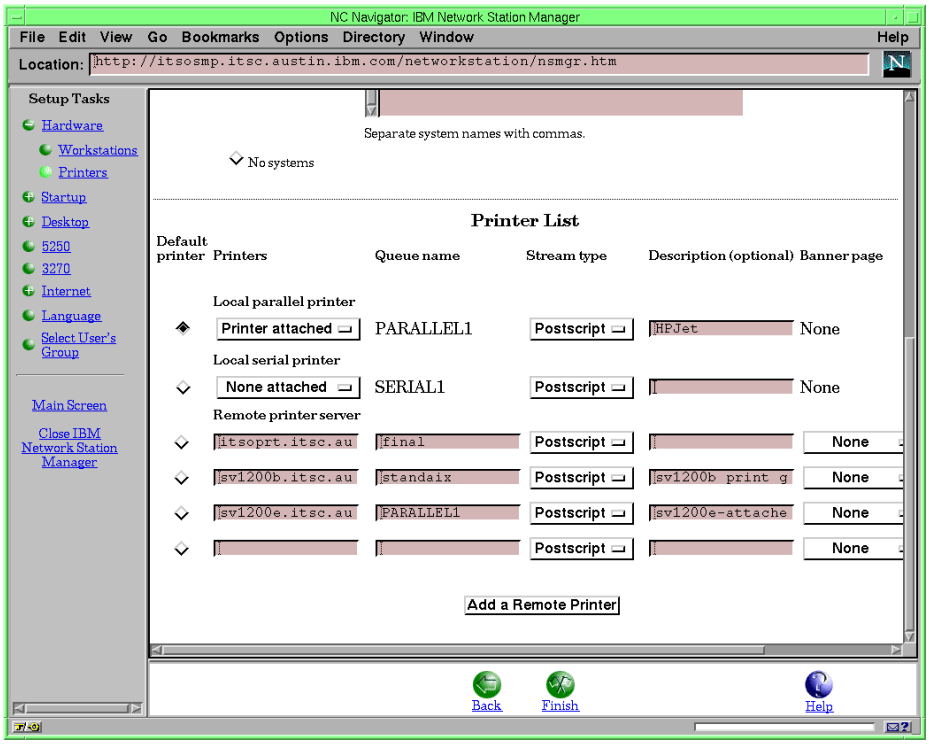

Figure 56. Printer List on the Network Station Manager program

In Figure 56, a PostScript printer is attached to the IBM Network Station through the parallel port, and the setting **Local parallel printer** is changed from **None attached** to **Printer attached**. Pressing **Finish** completes the update.

After exiting the Network Station Manager program and rebooting the IBM Network Station (if you have set the printing capabilities as system defaults), use the printer from local applications that can create a PostScript print datastream.

6.4.2 AIX Application Printing to IBM Network Station LPD

After configuring the local attached printer to the IBM Network Station, you can use the queue PARALLEL1 on the IBM Network Station from remote systems. This section shows an example of the steps needed to accomplish this.

The configuration actions required on the AIX system is to define a remote queue using this procedure:

1. Start SMIT

   You can go to the Print Spooling menu (Figure 57) directly by typing the command:

   ```
   smitty spooler
   ```

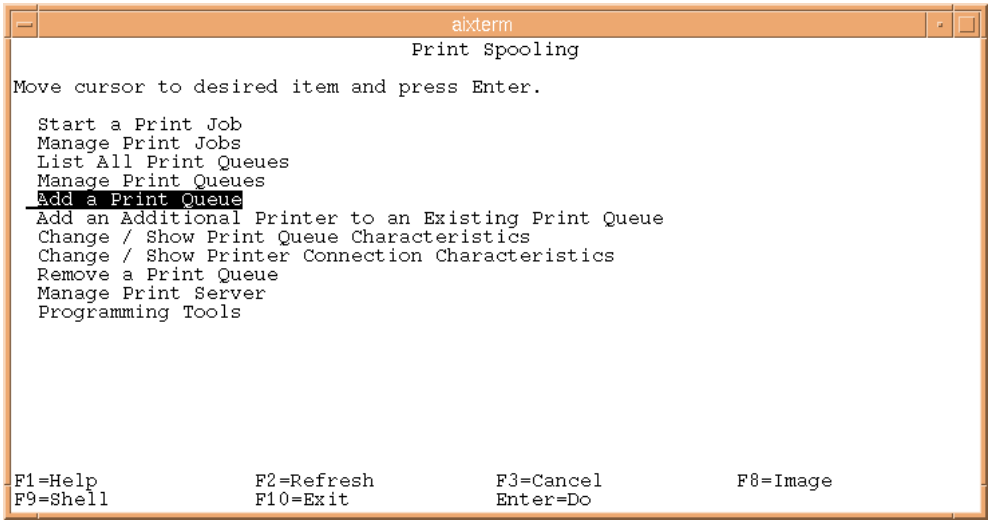

Figure 57. Adding a Print Queue

2. Select **Add a Print Queue** in the Print Spooling menu.
3. Specify the attachment type **remote** (Figure 58).

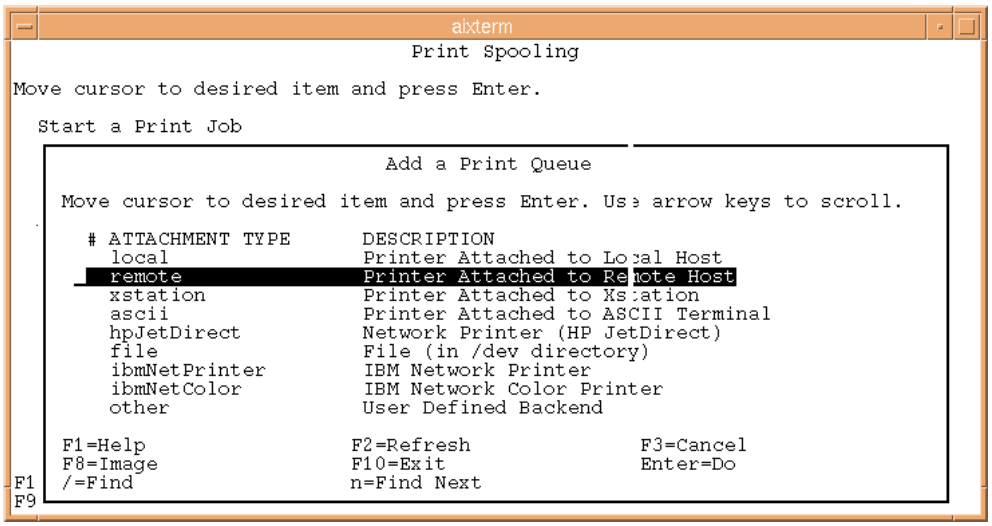

Figure 58. Selecting an Attachment Type

4. Specify the type of processing:

   On the next screen (Figure 59), you are prompted to select type of remote printing.

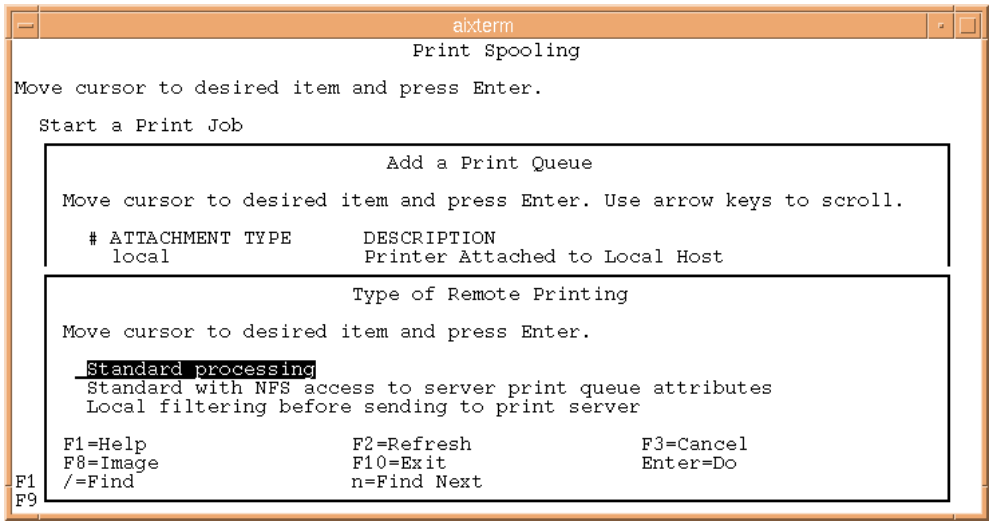

Figure 59. Selecting Type of Remote Printing

The choices are:

- Standard processing

  This sends a print file without modification, with the assumption that any necessary filtering of the print files will be performed by the server before sending the files to the printer, or the sending host creates a printer-specific data stream.

- Standard with NFS access to server print queue attributes

  Similar to standard processing except that the print server's directory of print attributes is NFS-mounted by this client. The server must be running AIX Version 4.

- Local filtering

  This provides the capability to filter the print files to make it a printer-specific stream. When you select this option, you are prompted to select the printer model to define the filter for the printer.

In this example, the `enscript` command is used to prepare a PostScript datastream. Therefore, no filtering is required. Select **Standard processing**.

5. Specify the name of the queue, remote host names and the queue name on the host.

   Figure 60 shows the last panel we have to input.

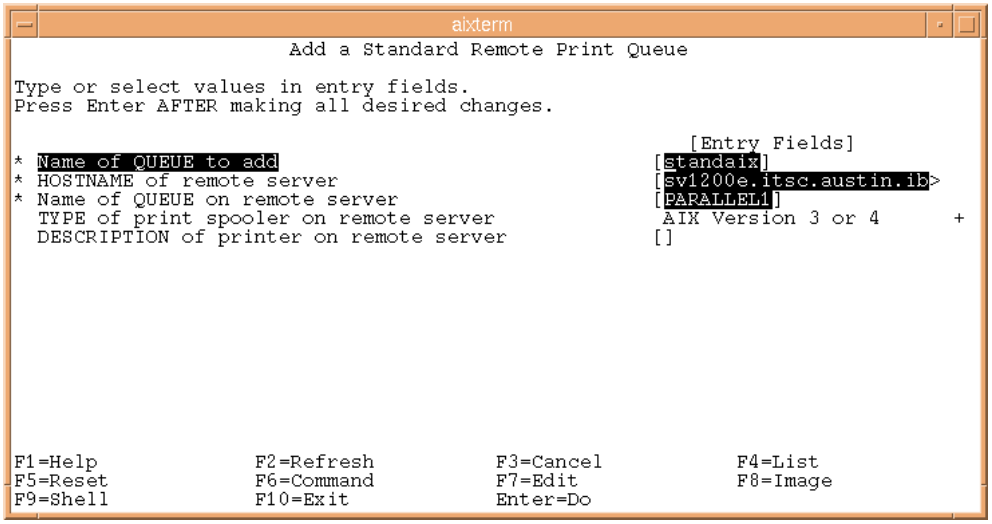

Figure 60. Adding a Standard Remote Print Queue

Input the following entries:

- Name of QUEUE to add

  This is the name of queue you use on the AIX system. Choose a descriptive name.

  In this example, `standaix` was used.

- HOSTNAME of remote server

  You need to specify the host name of the IBM Network Station or the IP address of the IBM Network Station.

- Name of QUEUE on remote server

  The queue name of the attached printer through the parallel port is `PARALLEL1`. So you need to specify `PARALLEL1`. If you attached your printer through the serial port, the name of the queue would be `SERIAL1`.

After configuration, you can send PostScript files to the IBM Network Station with the `qprt` command. For example, you can send a file named *test.ps* through *standaix* queue.

`qprt -P` *standaix test.ps*

If you want to print an ASCII file to the printer through this queue, use the `enscript` command. For example, you can send a file named *test.ascii* through *standaix* queue.

`enscript -P` *standaix test.ascii*

The `enscript` command is included in bos.txt.ts file set. If your machine does not have the `enscript` command, you need to install this fileset:

`bos.txt.ts`

6.4.3 Application Printing to Remote LPD

If you want to print to a LAN-attached network printer or a printer that attaches to a remote printer server from the IBM Network Station, you need to configure printer list on the Network Station Manager program.

The printer list configuration panel is shown in Figure 56 on page 151. In this panel, add a remote printer server name, queue name, and choose the stream type. In this example, `itsoprt.austin.ibm.com` was added as **Remote Printer server** and `final` is specified as **Queue name**.

After finishing the Network Station Manager program and rebooting the IBM Network Station, select the printer when you print from local application on the IBM Network Station.

6.4.4 Application Printing to Remote IBM Network Station

You may want to print data to the remote IBM Network Station from an application on local IBM Network Station. This is done with the combination of the configurations described in 6.4.1, “Printing from the IBM Network Station to the Local Printer” on page 151 and 6.4.3, “Application Printing to Remote LPD” on page 155.

The configuration required is the following:

- For the IBM Network Station that is attached to a printer, you need to configure **Local parallel printer** or **Local serial printer** in the Printer List panel on the Network Station Manager program. See Figure 56 on page 151.
- For the IBM Network Station that requests the printing, you need to add a remote printer server in the Printer List panel on the Network Station Manager program. In Figure 56 on page 151, `sv1200e.itsc.austin.ibm.com` as **Remote printer server** and `PARALLEL1` as **Queue name** is shown. Note that the queue name must be PARALLEL1 or SERIAL1 if the remote printer server is the IBM Network Station.

After finishing the Network Station Manager program and rebooting the IBM Network Station, select the queue name and the remote printer server to send print data.

6.4.5 Printing by Using the Spooling Capability of AIX Host

Because the IBM Network Station itself does not have the capability to store printed output on a local disk, it does not have the capability to spool print jobs. If printer usage is an occasional one, with small and infrequent jobs, there might not be a problem, but if many print jobs queue to the printer attached to the IBM Network Station, you will need a spooling system. It is not recommended to use an IBM Network Station attached printer for anything other than occasional printing. Do not expect a production workload to perform using this configuration.

One of this solutions is to use the spooling capabilities of another host. Figure 61 shows this scenario:

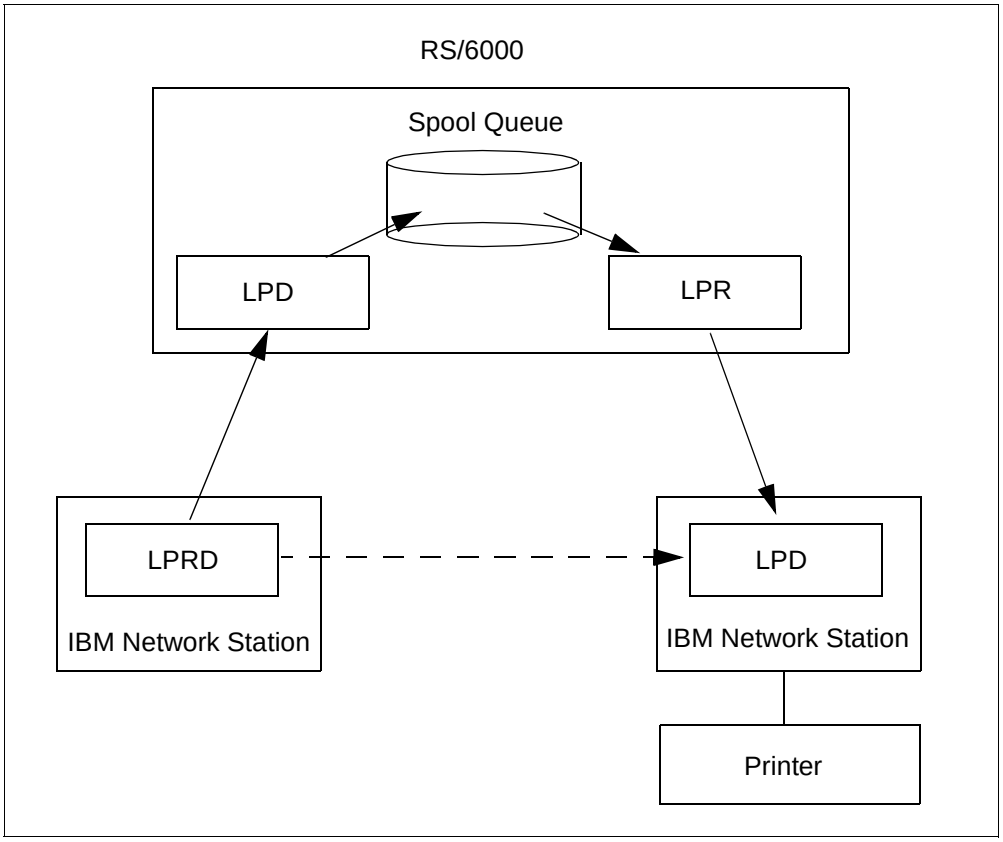

Figure 61. Using the Spooling Capability of the RS/6000

When one printer is attached to the IBM Network Station in your office, and you wish to print to the printer, you can send a print request to the LPD on the IBM Network Station by choosing the PARALLEL1 queue on the IBM Network Station.

Instead, by configuring print spooling on RS/6000, you can send a print request to the LPD on the RS/6000. After receiving it, the print request is queued on the RS/6000 and resent to the LPD on the Network Station.

To configure the print spooling, perform the following steps:

1. Add a queue on the RS/6000 to print to the printer that is attached to the IBM Network Station.

   See 6.4.2, “AIX Application Printing to IBM Network Station LPD” on page 151, to know how to add a queue on the RS/6000.

2. Add a remote printer to the printer list on the IBM Network Station to send a print request to the RS/6000

   See 6.4.3, “Application Printing to Remote LPD” on page 155, for information how to add a remote printer to printer list on the IBM Network Station.

3. Start the print server subsystem on the RS/6000 (start the lpd daemon).

   To start print server subsystem on the RS/6000, you need to do the following procedure:

   1. Start SMIT

You can get the Print Spooling menu (Figure 62) by typing the command:

```
smitty spooler
```

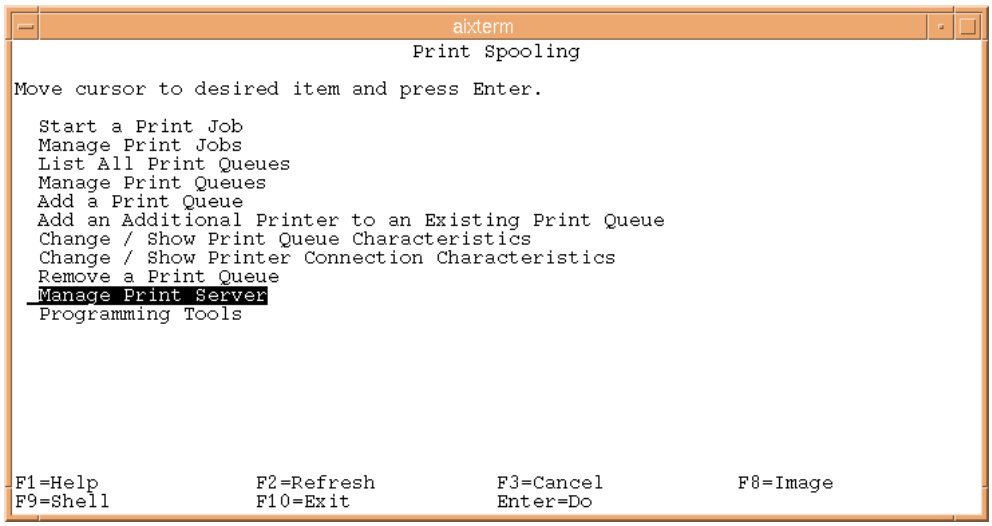

Figure 62. Selecting Manage Print Server

2. Select **Manage Print Server**.
3. Select **Add Print Access for a Remote Client**.

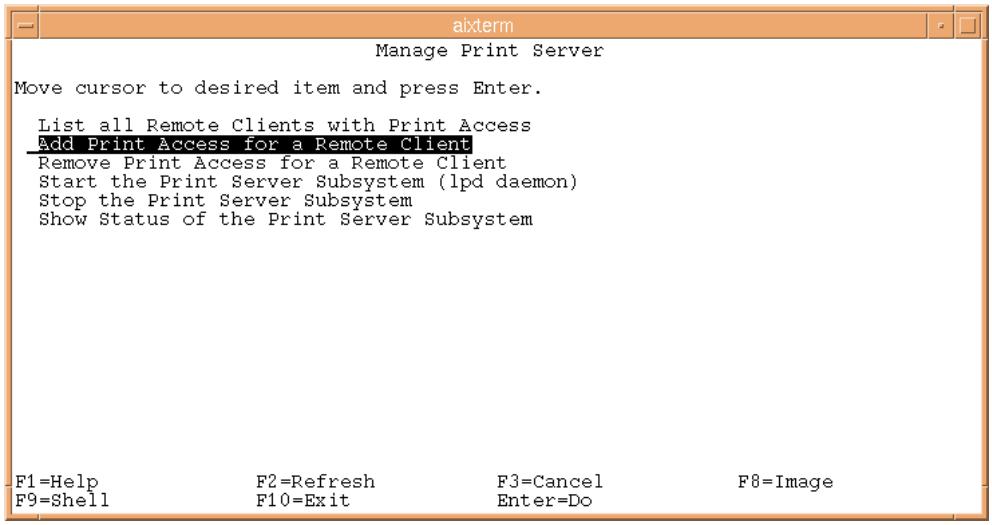

Figure 63. Adding Print Access for a Remote Client

By selecting this menu, you are prompted to input a name of remote client. You need to input the host name of the client machine to permit access to print queue on this machine. After successfully setting the host name, go to previous menu by pushing the **F3** key.

After entering the host name, the host name is registered in /etc/hosts.lpd file.

4. Start the Printer Server Subsystem.

The final task is to start the lpd daemon. To start the lpd daemon, select **Start the Printer Server Subsystem**. You can start lpd immediately.

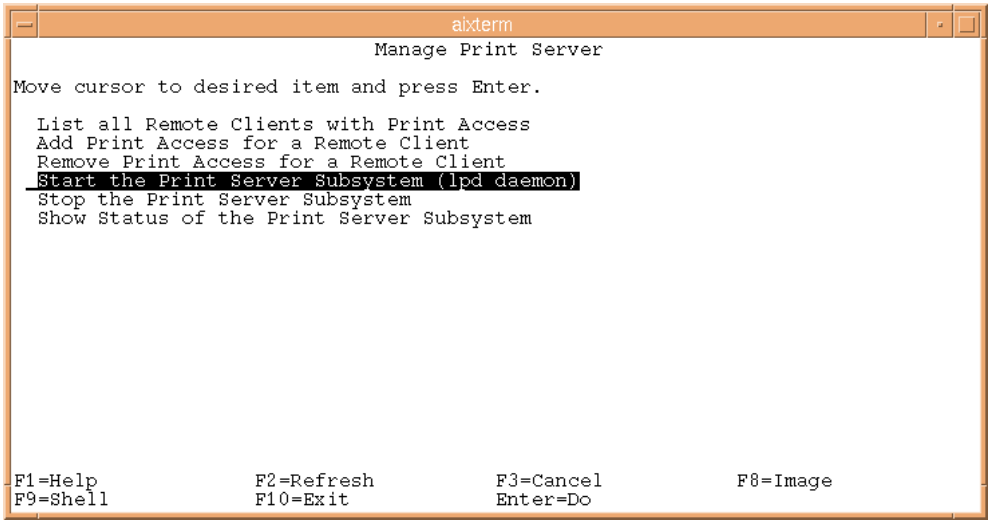

Figure 64. Starting the Print Server Subsystem (LPD Daemon)

After completing the above procedure, you can select the queue name on RS/6000 from the IBM Network Station. By selecting the queue name on the IBM Network Station, you can print through the spooling system of the RS/6000.

6.5 Terminal Emulator VTxxx Printing

The IBM Network Station Terminal Emulator prints to a printer attached to either the serial or the parallel port directly without using print APIs. When printing to remote system, you cannot use LPRD from a VTxxx application. So this section describes the printing method from a VTxxx emulator.

6.5.1 Printing to a Local Printer from VTxxx

In this section, a couple of usage tips are given regarding print support using VT terminal emulation.

6.5.1.1 Terminal Emulator Printing Options

From the emulator, select to print one of the following:

- The current emulator window
- The scroll buffer for the emulator window
- A portion of the emulator window marked by the mouse

6.5.1.2 Terminal Emulator Printing Process

The following is the procedure for printing to the local ports from a terminal session.

1. Attach a printer to the serial 9-pin connector or the 25-pin parallel connector.
2. From the **File** menu on the Terminal Emulator, choose the port where the printer was attached. Select either:
   - **Print on Serial line 1**

- **Print on Parallel line 1**

3. To select a specific text section of the telnet window to print, move the mouse to the beginning of the text block, hold down the left mouse button, and move the cursor to the end of the desired text block.
4. From the File menu, select one of these options:
   - **Print Screen**
   - **Print Log Buffer**
   - **Print Selection**

Figure 65 shows the File pull-down menu with the print options.

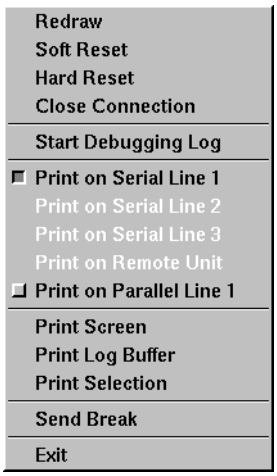

Figure 65. Choosing the Printer from the File Menu

6.5.2 Printing to a Remote Printer from VTxxx

The following procedure allows the Network Station to print to any queue on a remote AIX host. The basic concept is to set up the terminal session to print to a remote port. This is combined with setting up the AIX host to use inetd to accept the data from the Network Station and to send it to a print queue.

The following describes the steps required to set up remote printing from the IBM Network Station to a queue on AIX.

1. Create a queue on AIX to a ASCII printer.
2. Add the following line to the /etc/inetd.conf file.

```
ncdlpd stream tcp   nowait  nobody  /usr/bin/enq enq -P<queue> -Ttitle
```

   - `ncdlpd` is a symbol name for the TCP/IP port.
   - `nobody` is the user (login) name `enq` will run under. This will also be the name that will appear as the user (login) name on the banner name.
   - `/usr/bin/enq` is the full path name of the print program. Any of the AIX print commands could be used in place of `enq`.
   - `enq` the print command must be specified again.
   - `-P` is the flag for enq to specify the AIX queue for printing. This should be a text queue.

- `-T` allows a title to be added. If it is not specified, the title will be from stdin and the /var/spool/qdaemon temporary name.

3. Add the following line to /etc/services.

   ```
   ncdlpd    5600/tcp        # ncdterm port
   ```

   The default port for ncdterm is 87, but this service is already taken by the link service. The port should not be 5600 or any in the privileged range (BSD: 0-1024 or ATT: 1-255).

4. Refresh the inetd daemon to read the /etc/inetd.conf file:

   ```
   refresh -s inetd
   ```

5. Add the following resources into a configuration file:

   ```
   set xserver-initial-x-resources = "\n\
   NCDterm.printerHost:       138.43.150.11:5600\n\
   NCDterm.printerTimeout:    15\n\
   NCDterm.printerFormFeed    True"
   ```

   where

   - `printerHost` specifies the IP address and port number
   - `printerTimeout` specifies a time-out period connecting to the host
   - `printerFormFeed` specifies if a form feed is added at the end of the print job.

6. Reboot the IBM Network Station
7. From the **File** pull-down menu, choose: **Print on 138.43.150.11:5600**, as shown in Figure 66.

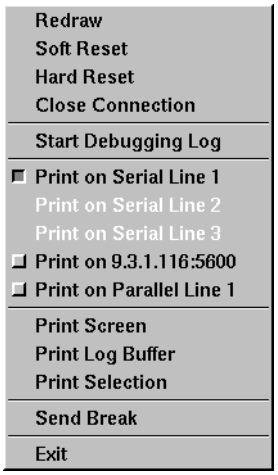

Figure 66. Choosing Printer from File (Local)

8. From the **File** pull-down menu, choose: **Print Screen**

The output will now be directed to the printer.

6.6 Using the AIX Queue to Print IBM Network Station Windows

There are several X-Window programs that will capture an individual window or the entire screen. One of the programs that ships with AIX is called xwd. This program will capture the windows only in black and white. This program can print to a laser printer by passing the output through the xpr filter. Use `man` or `info` for more details on these commands.

To use the xwd utility to capture the screen, the AIX host initiating the command must have X-access to the Network Station display. See Section 4.5.6, “X Client Access Control” on page 105, for more information on X-access control.

The specific command to use to capture a screen depends on the type of printer and the amount of the window to capture. The following is a command example for PostScript printers:

```
xwd -display insv1:0.0 -xy | xpr -device ps | qprt -Ppsque
```

This command can be directed to any AIX PostScript queue, including one that prints to a Network Station-attached printer.

To use these commands, follow these steps:

1. Issue the `xwd` command from an AIX window.
2. Move the + sign cursor to the desired window.
3. Click the **left mouse button**.

Many public domain and non-IBM programs can also be used to capture X-Windows for printing, such as xv and pbmplus. These programs are available at `aixpdslib.seas.ucla.edu` using anonymous FTP.

Chapter 7. National Language Support

This chapter describes the National Language Support of the IBM Network Station Manager Release 3 and subsequent releases.

7.1 Overview

IBM Network Station Manager Release 3 provides National Language Support for international users. Most of the world market can select their own language on IBM Network Station by using National Language Support.

There are six main concepts you should consider when you change your language environment;

- Boot Monitor language selection. This is discussed in 7.2, “Boot Monitor Language Selection” on page 163, and is independent of that of the kernel. You can select the language by Network Station Manager program and IBM Network Station Setup Utility.
- Language environment in the kernel. This is discussed in 7.3, “Language Environment on the Kernel” on page 165, and is determined by `LANG` and `LC_*` environment variables. These variables can be changed with Network Station Manager program.
- Keyboard language. This is discussed in 7.4, “Keyboard Language” on page 167. You have to select a keyboard with Network Station Manager program and IBM Network Station Setup Utility.
- DBCS input method. This is discussed in 7.5, “DBCS Input Method Support” on page 169, and in 7.6, “Wnn6 for IBM Network Station” on page 169. For Japanese, Wnn6 for IBM Network Station is the technology that offers this. To use this input method, you have to select the input method with Network Station Manager program.
- ACTlogin window language. There is a unit-initial-locale parameter that is not managed by the IBM Network Station Manager. This parameter should be manually updated if a non-default ACTlogin window language is needed. This is discussed in “Login Window Language” on page 179.
- Language of the Network Station Manager. The Network Station Manager consists of many HTML panels that can be tailored to several language preferences. See “Language of the IBM Network Station Manager” on page 180.

7.2 Boot Monitor Language Selection

The Boot Monitor supports the following six languages:

- English
- German
- Spanish
- Italian
- French
- Japanese

The user is able to select the language in one of two ways: through the Network Station Manager program or using a language selection screen in the IBM Network Station Setup Utility, as follows:

- Selecting the language through the Network Station Manager program

  You can set this variable as a system default or workstation default. Depending on which language defaults you choose, the language settings you specify can be used by all workstations or for a particular workstation. For setting the language environment, follow this procedure:

  1. Select **Hardware** in main menu of Network Station Manager program.
  2. Select **Workstations.**
  3. Select which default you want: **System defaults** or **Workstation defaults**.
  4. You can find the **Boot Parameters** menu in Network Station Manager program (Figure 67). Select the language to be used during the boot sequence.

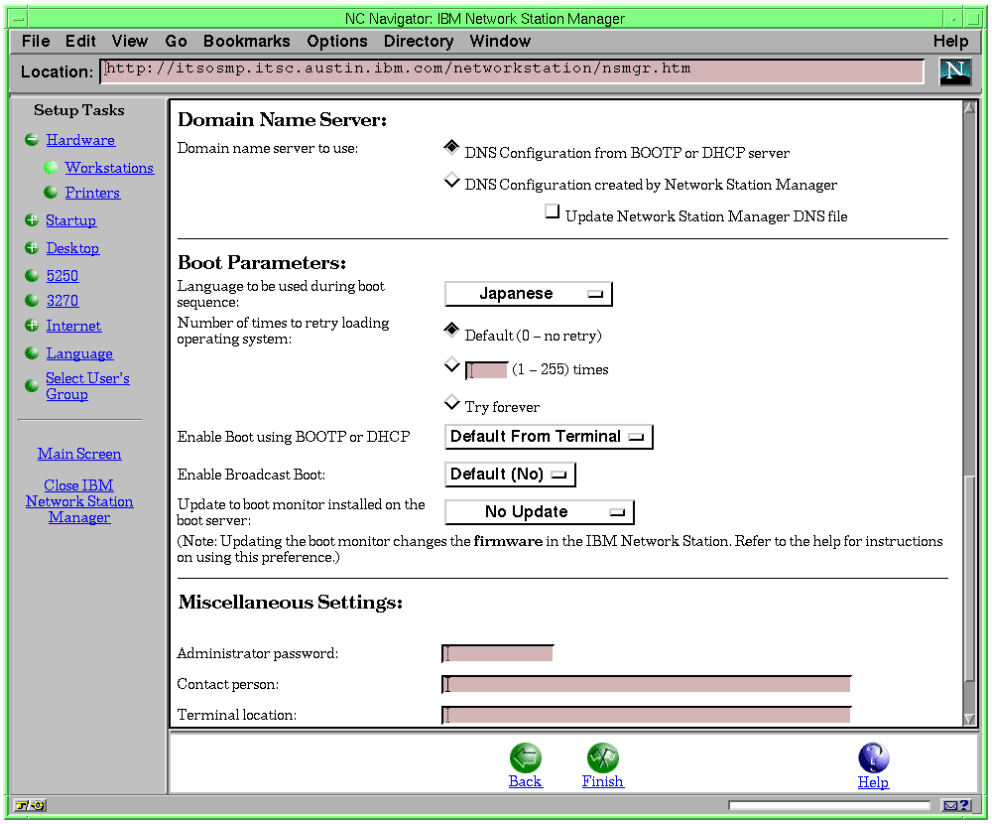

Figure 67. Boot Parameters Setting Menu in Network Station Manager Program

By setting up the language through the Network Station Manager program, the Network Station Manager program adds the following parameter to the configuration file:

`set boot-prom-language=`*language*

where language choices are: English, French, German, Italian, Spanish, and Japanese.

Notes:

1. A IBM Network Station reboot is required to change the boot language.
2. This language value overrides the language value in NVRAM. Therefore this overrides the value selected in the IBM Network Station Setup Utility.

- Selecting the language through the IBM Network Station Setup Utility

  When the Network Station is powered on, the boot process proceeds. From the moment the message `NS0500 Search for Host System...` is displayed until the end of the kernel load, press the **Esc** (Escape) key to enter IBM Network Station Setup Utility.

  In IBM Network Station Setup Utility, follow these steps:

  1. Select **F7**, **Set Language Parameters**.
  2. Select **F3**, **Select Startup Language**.
  3. Move the cursor keys on the language you select and press **Enter**.

  After this procedure, the language of the Boot Monitor is changed immediately.

Note: The language of the Boot Monitor does not effect the language used by the kernel. The language used by the kernel is discussed in the following section.

7.3 Language Environment on the Kernel

The language environment used on the kernel is determined by setting a locale to the `LANG` and `LC_*` environment variables. The locale is defined to be the subset of a user's environment that depends on the language and cultural conventions of that user.

7.3.1 The Locale

A locale name is composed by the language and territory. For example, Chinese used in Taiwan is named as ZH_TW. In Network Station Manager program, you have to specify your locale in both the `LANG` and `LC_*` environment variables.

7.3.2 LANG and LC_* Environment Variables

National Language Support (NLS) uses several environment variables to influence the selection of locales. You can set the values of these variables to change locale information:

`LANG`	`LANG` is a superset environment variable that when specified sets all LC_variables to the defaults for the language specified. The default is Default (from server). This means that the value for this field is taken from the host server that the IBM Network Stations are booted from.
`LC_TIME`	Determines the rules governing the date and time formatting.
`LC_MONETARY`	Determines the rules governing the monetary-related formatting.
`LC_NUMERIC`	Determines the rules governing the non-monetary numeric formatting.

LC_CTYPE	Determines character-handling rules governing the interpretation of sequences of bytes of text data characters (that is, single-byte versus multi-byte characters), the classification of characters (for example, alpha, digit, and so on), and the behavior of character classes.
LC_MESSAGES	Determines rules governing affirmative and negative responses and the locale (language) for messages and menus.

7.3.3 Setting the Language Environment

The LANG and LC_* variables can be set with IBM Network Station Manager program. You can set these variables as system defaults, group defaults or user defaults value. Depending on which language defaults you choose, the language settings you specify can be used by all users, a specific group, or a specific user. For setting language environment, use the following procedure;

1. Select **Language** in main menu of Network Station Manager program.
2. Select which defaults you want to set as, System defaults, Group defaults or User defaults. You can choose any of these.
3. You can see the Language Settings menu in Network Station Manager program (Figure 68).

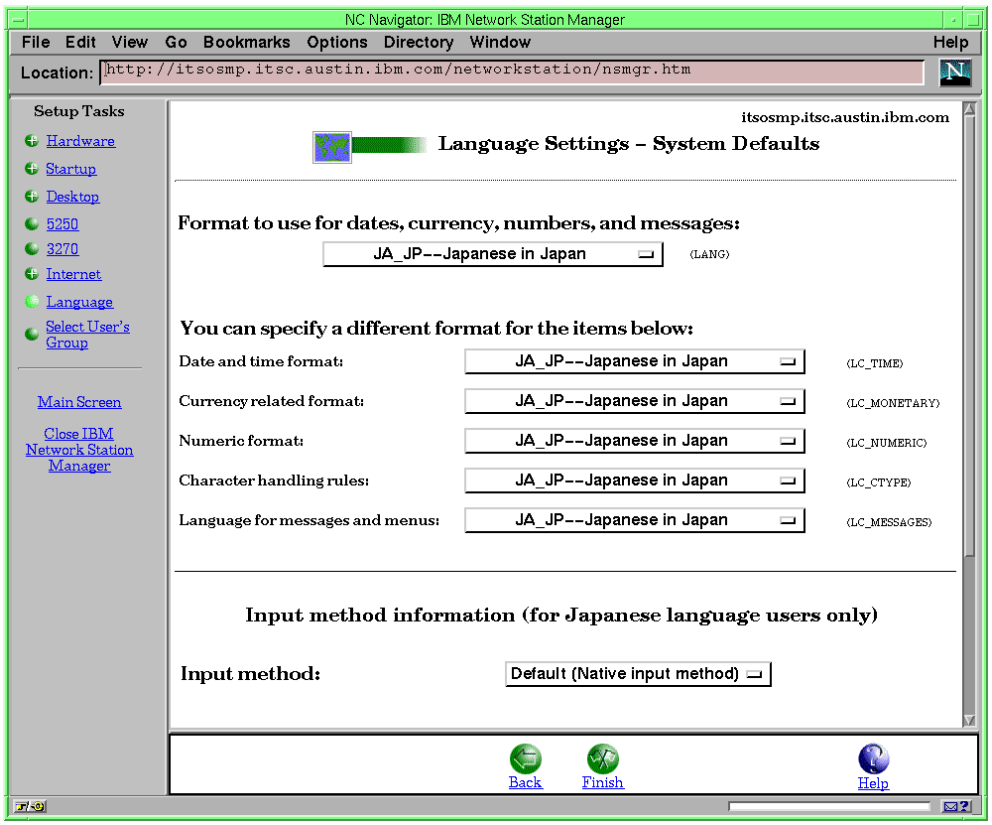

Figure 68. Language Setting Menu in Network Station Manager Program

After this setting, these values are defined in the envvars.nsm file. The directory where envvars.nsm resides depends on which defaults you set up:

- System defaults

  /usr/netstation/nsm/SysDef/envvars.nsm

- Group defaults

  /usr/netstation/nsm/groups/*groupname*/envvars.nsm

  where *groupname* is the name of a group of users.

- User defaults

  /usr/netstation/nsm/users/*username*/envvars.nsm

  where *username* is the name of the user.

The language of the kernel can be set differently for each user even though they load from the same boot server.

7.4 Keyboard Language

You should match the keyboard mapping to the keyboard attached to IBM Network Station. After selecting the correct language, the IBM Network Station reads the keyboard-mapping file corresponding to the language in the /usr/netstation/keyboards directory.

The language is selected in one of two ways: through the Network Station Manager program or using a language selection screen in the IBM Network Station Setup Utility.

- Selecting the language through the Network Station Manager program.

  Variables for the keyboard language may be set as system defaults or as workstation defaults. Depending on which language defaults you choose, the language settings specified can be used by all workstations or for a particular workstation. For setting the language environment, perform the following steps:

  1. Select **Hardware** in main menu of Network Station Manager program.
  2. Select **Workstations**.
  3. Select which defaults you want to set: **System defaults** or **Workstation defaults**.
  4. You can see the **Keyboard Settings** menu in Network Station Manager program (Figure 69). Select the keyboard language to use.

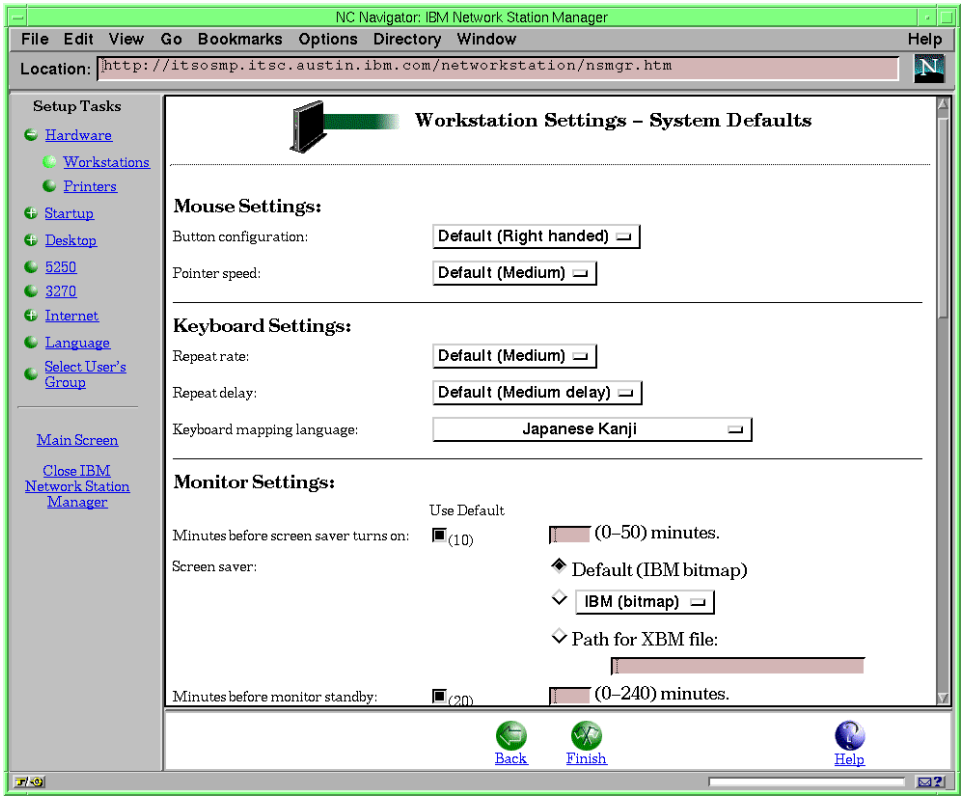

Figure 69. Keyboard Settings Menu in Network Station Manager Program

You can select the value **Use system defaults**. This value means the IBM Network Station determines the keyboard type by the value set in the IBM Network Station Setup Utility. So this time, you have to select the keyboard in the IBM Network Station Setup Utility.

- Selecting the language through the IBM Network Station Setup Utility

  When the Network Station is powered on, the boot process proceeds. Starting when the message `NS0500 Search for Host System...` is displayed until the end of the kernel load, press the **Esc** (Escape) key to enter IBM Network Station Setup Utility.

  In IBM Network Station Setup Utility, follow these steps:

  1. Select **F7**, **Set Language Parameters**.
  2. Select **F2**, **Select Keyboard Language**.
  3. Move the Cursor keys on the language you select and **Enter**.

  Notes:

  This keyboard language value is overridden by the keyboard-mapping language configured in the Network Station Manager program. Therefore, you should select same keyboard language as the keyboard-mapping language selected in the Network Station Manager program.

7.5 DBCS Input Method Support

The IBM Network Station supports the following double-byte input methods:

- Chinese(Simplified)
  - PinYin
  - English to Chinese
  - Intelligent ABC
- Chinese(Traditional)
  - Tsang-Jye
  - Phonetic Symbols
- Japanese
  - Wnn6 for IBM Network Station
  - Kana to Kanji Conversion
  - Romanji to Kana Conversion
- Korean
  - ASCII
  - Hangul
  - Hanja

7.6 Wnn6 for IBM Network Station

Wnn6 for IBM Network Station is a Japanese Kana to Kanji conversion system developed for the IBM Network Station. It is implemented as a client/server system which matches the thin client architecture of IBM Network Station. Because of this benefit, Wnn6 for IBM Network Station can use three system models for this environment, discussed later in this section.

7.6.1 Wnn6 for IBM Network Station Component

Wnn6 for IBM Network Station has three major components: dictionary, xwnmo and Jserver. They are defined as follows.

- Dictionary

  Phrase candidates are held in dictionaries. There are two kinds of dictionaries: a system dictionary and a user dictionary.

  - System dictionary

    The system dictionary is a read-only conversion dictionary shared by all users. This dictionary is loaded into Jserver memory at Jserver startup time.

  - User dictionary

    Users can have their own custom dictionary for frequently used phrases that are not in the system dictionary. These phrases are stored in the read/write user dictionary. This dictionary is private to each user and can be updated dynamically by the user. The user dictionary is loaded into

Jserver memory when xwnmo connects to the Jserver on behalf of the user.

- xwnmo

  xwnmo is an input manager that supplies the Japanese input environment to applications. xwnmo handles keyboard input from the X-server on behalf of an X-client. The protocol between the X-client, X-server, and xwnmo is the X Input Method (XIM) protocol. Keyboard input is converted into Katakana or Hiragana phonetic characters and buffered until the user hits the Kana-Kanji conversion key. The buffer is then passed to the Jserver using a private Omron protocol through a TCP/IP socket interface to convert the phonetic characters into Kanji.

- Jserver

  The Jserver component handles conversions from Kana to Kanji. This Jserver accesses the dictionaries directly, or invokes the dictionary server, to look-up the dictionaries for the list of possible candidates for each Kana to Kanji conversion. It then uses intelligent algorithms to choose the best fit for the conversion. It is referred to as the conversion server for xwnmo, which sends a conversion request to Jserver.

7.6.2 Wnn6 Configuration Models

The three major components, Jserver, xwnmo, and dictionary can be distributed to different machines in an intranet. Wnn6 for IBM Network Station supports three system models, namely:

- NS Server Model

  In this model, the Jserver runs on one Network Station. This Network Station works as the Wnn6 server. Other Network Stations require only xwnmo and work as the Wnn6 client. The xwnmo daemon on a IBM Network Station sends conversion requests to the IBM Network Station that has the Wnn6 server role. The Jserver on the IBM Network Station use an NFS or RFS protocol to load the dictionary into Jserver memory.

  This model is illustrated in Figure 70.

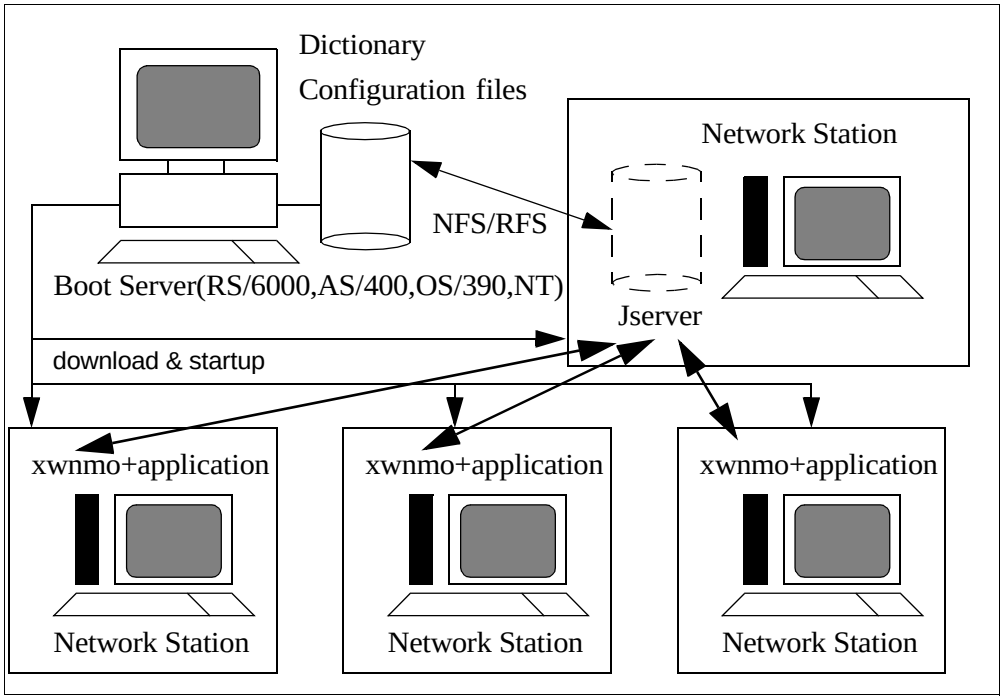

Figure 70. NS Server Model

- NS Typical Client/Server Model

  In this model, xwnmo on an IBM Network Station sends conversion requests to a Jserver running on other platforms like AIX. Therefore the IBM Network Station works as Wnn6 client. For RS/6000 servers, this is the recommended environment. The default port number is the same used as on the IBM Network Station. This model is illustrated in Figure 71.

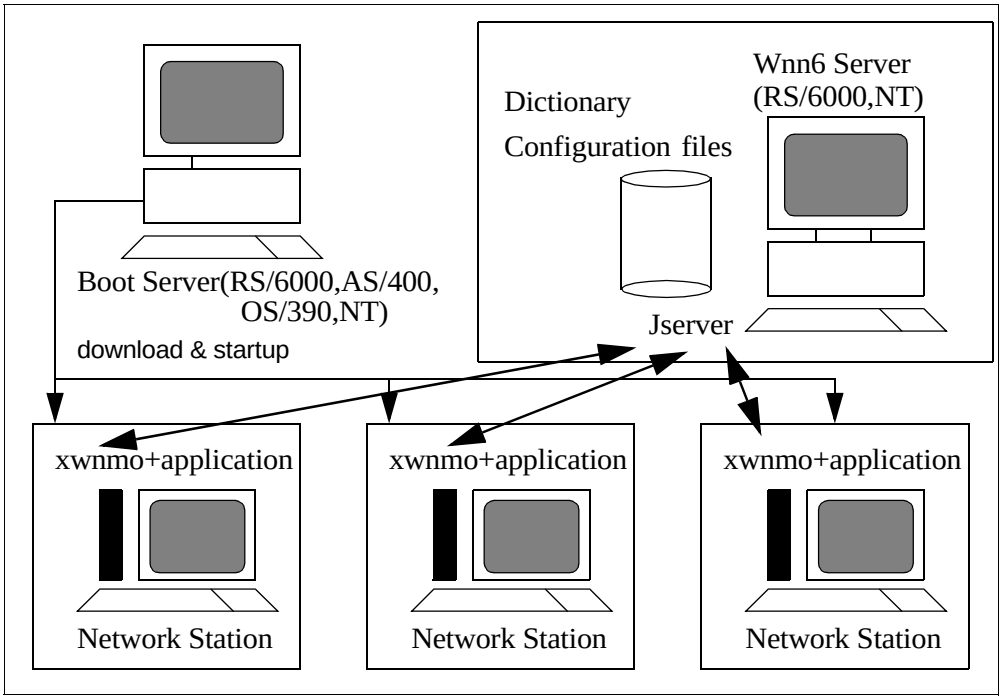

Figure 71. NS Typical Client/Server Model

- NS Fat Model

  In this model, Jserver and xwnmo run on the same machine. Therefore one IBM Network Station works as Wnn6 server and Wnn6 client at the same time. The Jserver on the IBM Network Station use the NFS or RFS protocol to load the dictionary into Jserver memory. The Jserver requires about 11 MB of IBM Network Station memory for the loaded dictionary and 2.5 MB for xwnmo. You should check your available free memory before implementing this model. This model is illustrated in Figure 72.

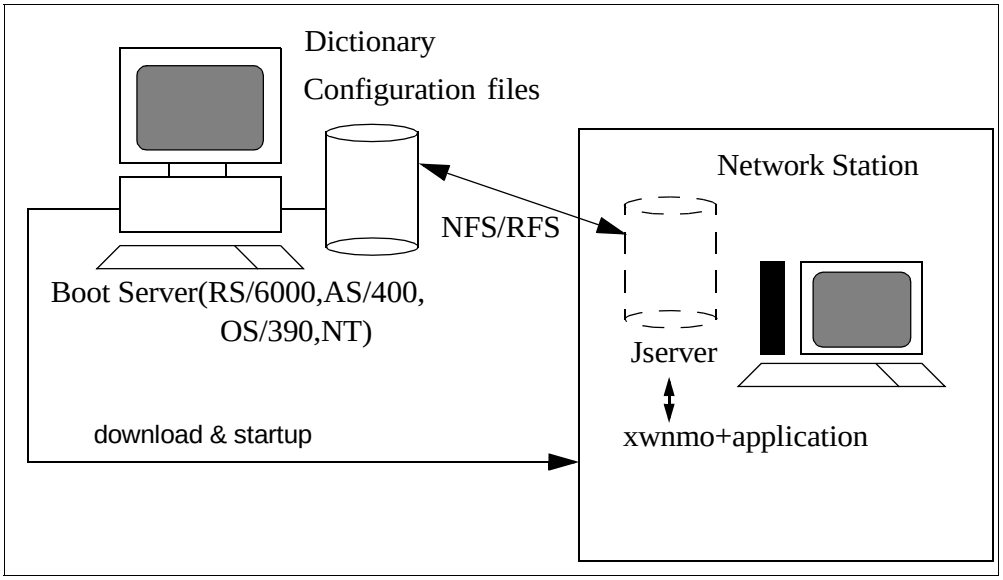

Figure 72. NS Fat Model

7.6.3 Configuration for Starting Wnn6 on the IBM Network Station

When configuring the Wnn6 for IBM Network Station, you need to determine the following things:

1. Which Wnn6 model do you use?

   If you select the NS typical client/server model, you do not need to configure Wnn6 server on the IBM Network Station. For the NS Fat model, you have to configure the Network Station as a Wnn6 server and configure the Wnn6 client on the same machine.

2. Which Network Station is configured as the Wnn6 server?

   To use an IBM Network Station as a Wnn6 server, you need to configure the Jserver to start during the boot process; therefore the Wnn6 server configuration is performed as the specific workstation default by using the Network Station Manager program.

3. Who will use the Wnn6 for IBM Network Station input method?

   You can configure xwnmo to start during the login process. The Wnn6 client can be configured as a user default, a group default, or system default.

7.6.3.1 Installation

Before using Wnn6 for the IBM Network Station, the following fileset should be installed on your base code server:

netstation.omron.rte

To confirm that this fileset has been installed, you can use `lslpp` command as follows:

```
lslpp -la netstation.omron.rte
```

If you receive the message `Fileset netstation.omron.rte not installed`, you need to install the fileset.

You can install this fileset with SMIT. See 2.6, “Software Installation on AIX” on page 27, for more information.

7.6.3.2 Configuring the IBM Network Station as a Wnn6 Server

If you use one IBM Network Station as a Wnn6 server, configure the IBM Network Station to start the Jserver automatically during the boot process.

For starting the Jserver on the IBM Network Station during the boot process, perform these tasks:

1. Start the IBM Network Station Manager program.
2. Select the **Workstations** menu in the **Hardware** menu.
3. Select **Workstation defaults**.
4. Put the host name or the IP address of the IBM Network Station in the text box.
5. Push the **Next** button at the bottom of the screen.
6. Scroll to the section labeled **Local Services.** (Figure 73).

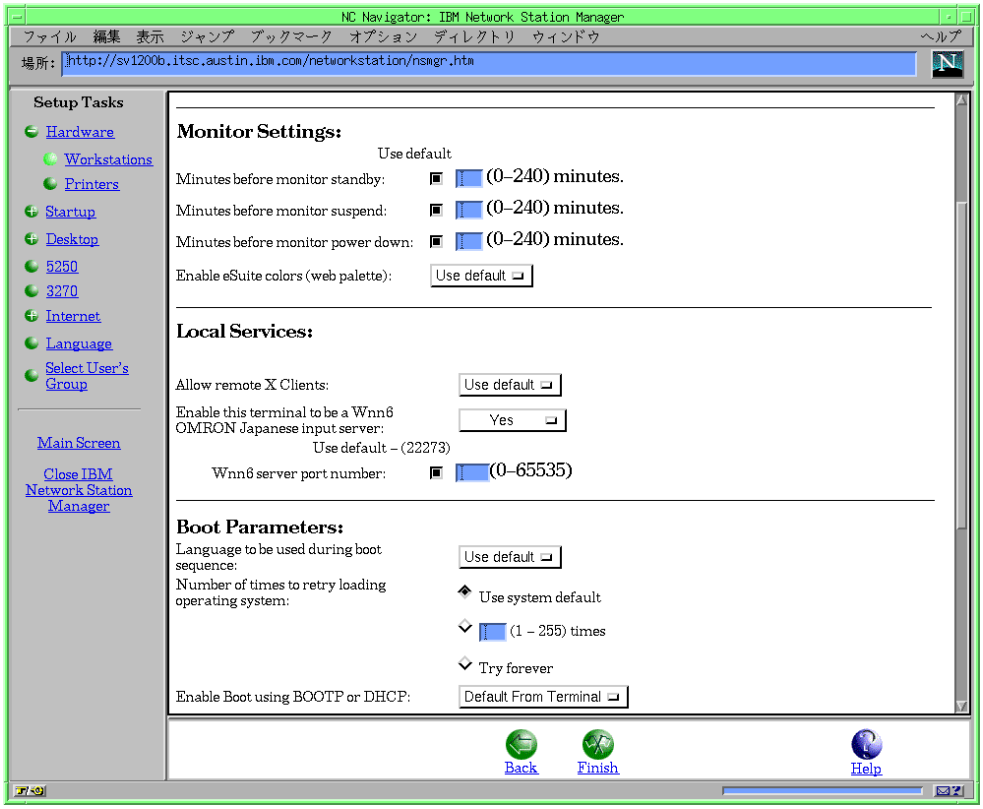

Figure 73. Jserver Autostart Setting

7. Find the field that reads **Enable this terminal to be a Wnn6 OMRON Japanese input server**. Change the value from **`Default(No)`** to **`Yes`**, as shown in Figure 73.

   Note: You do not need to specify a port number. If you specify the port number, the port number is set to `WNN_JS_PORT_NO` environment value.

8. Push the **Finish** button at the bottom of the screen.

By defining these settings, the following variables are set in a workstation configuration file:

```
set exec-startup-commands[-1]={"jserver"}
set modules-load-policy[-1]={"jserver" at-boot}
```

See 4.3.2.3, “Individual IBM Network Station Configuration Files” on page 73, for detailed information on workstation default files.

7.6.3.3 Configuring the Wnn6 Client

The default input method for the Japanese language is the Kana to Kanji conversion. To start xwnmo on the IBM Network Station, you need to configure this using the IBM Network Station Manager.

To select Wnn6 as the Japanese input method to use xwnmo on the IBM Network Station, use the following procedure.

1. Start the IBM Network Station Manager program.
2. Select **Language**.

3. Select **System defaults** for all users, **Group defaults** for a specific group, or **User defaults** for a specific user to use Wnn6 for IBM Network Station.
4. Push the **Next** button at the bottom of the screen.
5. Scroll to the section labeled **Input Method Information**.

   The configuration at this step is shown in Figure 74.

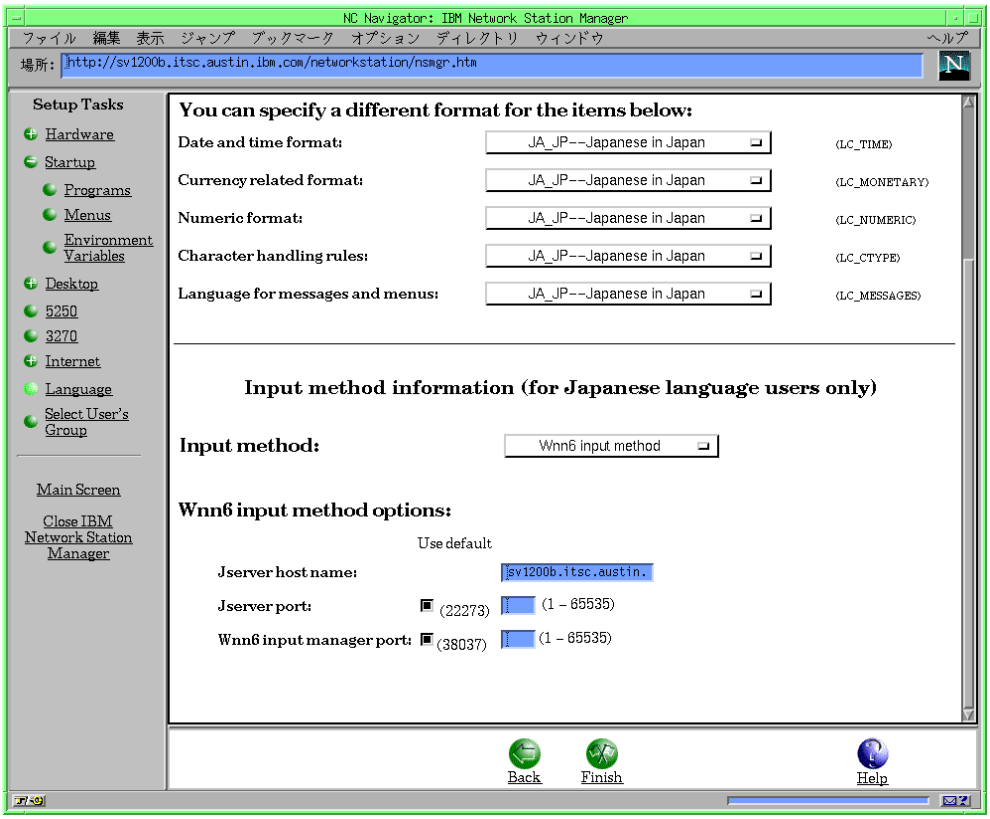

Figure 74. Selecting Input Method

6. As shown in Figure 74, select **`Wnn6 input method`** in the selection of the **Input method** items.
7. As shown in Figure 74, you can see Wnn6 input method options field. This is where you specify the host name where the jserver runs.

   Note: You do not need to specify the **Jserver port** and **Wnn6 input manager port**. If you specify these values, these values are set to the `WNN_JS_PORT_NO`, `WNN_XW_PORT_NO` variables.
8. Click the **Finish** button at the bottom of the screen to execute the settings.

After configuring, the following values are set in envvars.nsm file:

```
set WNN_JSERVER jserver_hostname
set WNN_USING_IM Wnn6
```

where *jserver_hostname* is *a hostname* of the Wnn6 server. See 4.3.5, “Startup Configuration Files” on page 79, for detailed information on envvars.nsm file.

7.6.4 Wnn6 for IBM Network Station Operation Example

This section explores a simple example of Wnn6 for IBM Network Station in operation. Before showing the example, a brief description of the Japanese characters are given.

7.6.4.1 Japanese Characters

The Japanese written sentence is a mixture of Kanji, Hiragana, and Katakana characters. There are more than 10,000 Kanji characters and approximately 2,000 are commonly used. Each Kanji character may be read (pronounced) in several different ways, as determined by the context. Also, there are a lot of Kanji characters that have same pronunciation.

Hiragana and Katakana are phonetic characters and consist of 48 characters each. Each character of Hiragana has a corresponding Katakana character. Hiragana characters are used in a normal written sentence as conjunctions or as grammatical word endings.

7.6.4.2 Operation Example

This example shows general conversion process.

1. When `Ctrl-\` is entered, the Japanese input mode starts.
2. Start writing sentence by entering Roman characters. The Roman keyboard input is converted into Hiragana phonetic characters and buffered until the you press the Kana-Kanji conversion Key. Therefore, at this time, Hiragana is shown on your display (Figure 75).

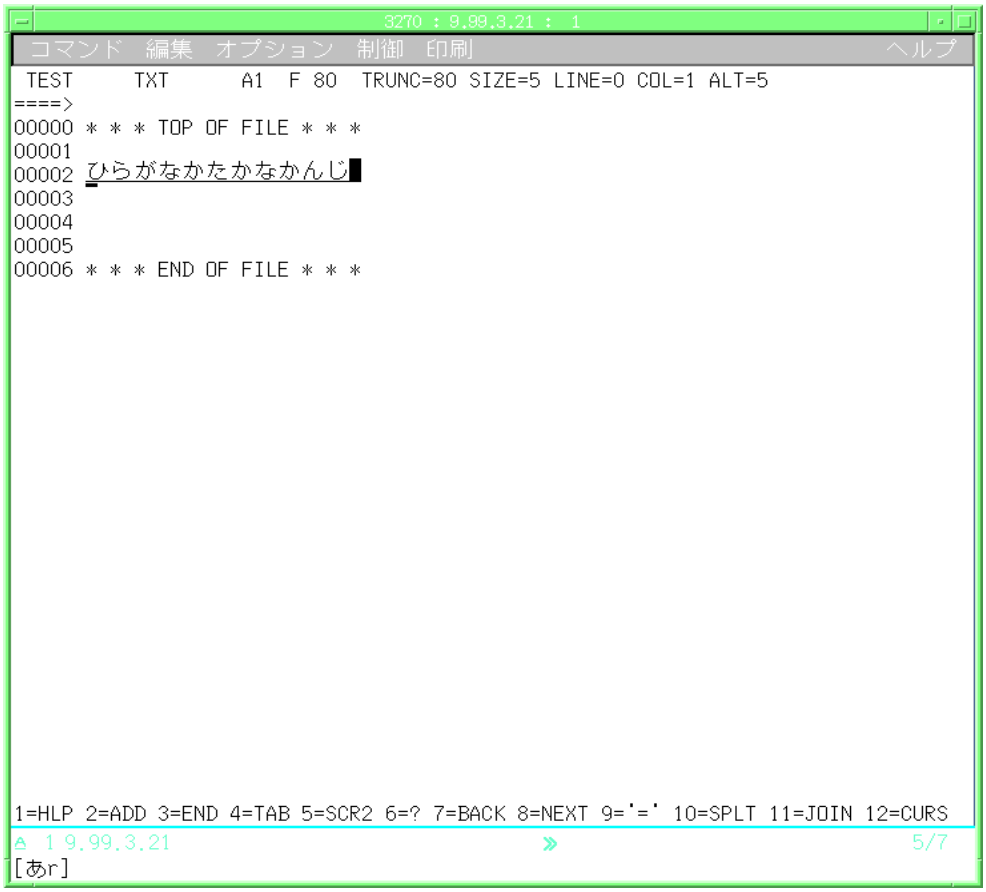

Figure 75. Hiragana before Converting to Kanji

This example shows the result when pushing the following keys:

```
hiraganakatakanakanji
```

3. If the Kana-Kanji conversion key is pushed, the Jserver converts the Hiragana to Kanji by using intelligent algorithms and dictionaries. The Jserver selects the best fit conversion result by the context; therefore some characters are converted into Kanji, some characters remain as Hiragana, and some characters are converted into Katakana. Figure 76 shows the result of the conversion:

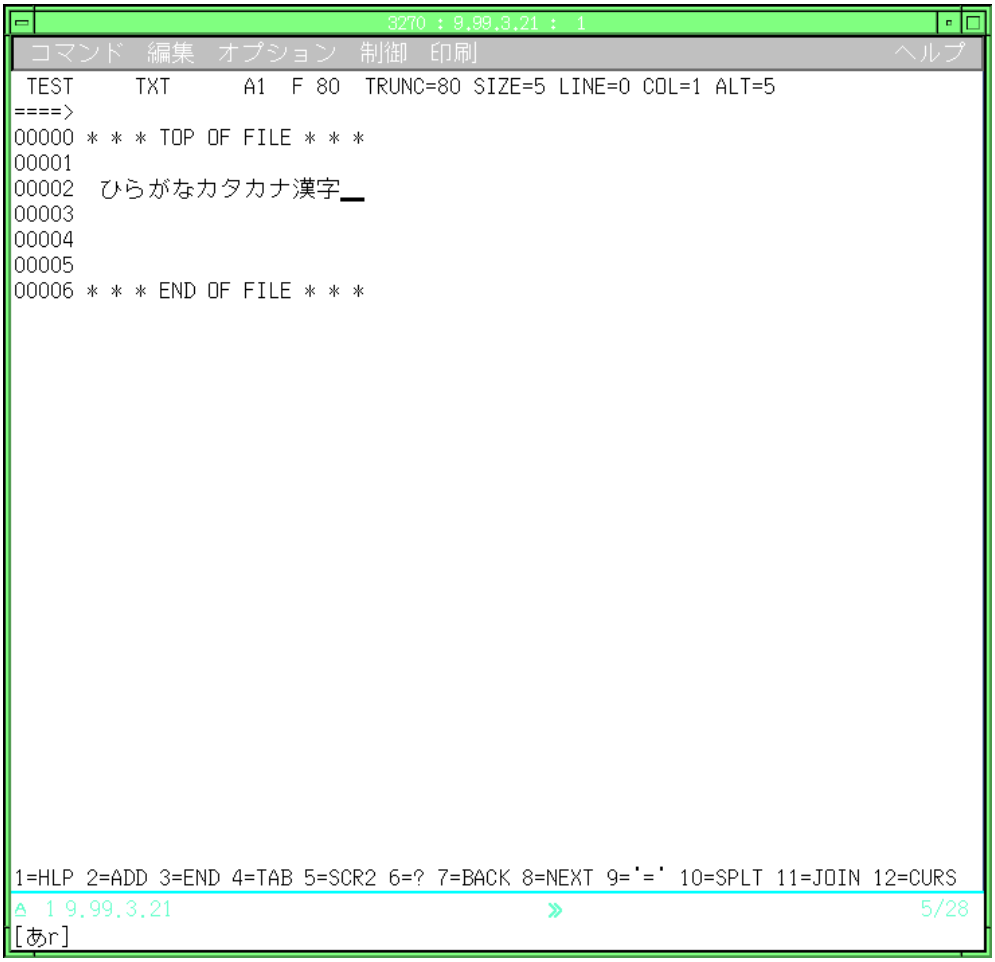

Figure 76. Converted Sentence

In Figure 76, the sentence consists of a mixture of Hiragana, Katakana, and Kanji. The first four words are Hiragana, the next four words are Katakana, and last two words are Kanji. In this case, this sentence is the using the correct words based on context. Therefore, the conversion process is finished successfully.

Sometimes, you might find the first selected conversion result is not the one you expected. In this case, you can push Kana-Kanji conversion key again. If the Kana-Kanji conversion key is pushed again, Wnn6 for IBM Network Station shows a selection box in which you can choose the fitted characters. At this point, you have to manually select the most intelligent text. Figure 77 shows this case.

In Figure 77, the selection box is shown. In this box, Wnn6 for IBM Network Station shows a list of character candidates. By selecting a correct translation, character conversion process is finished.

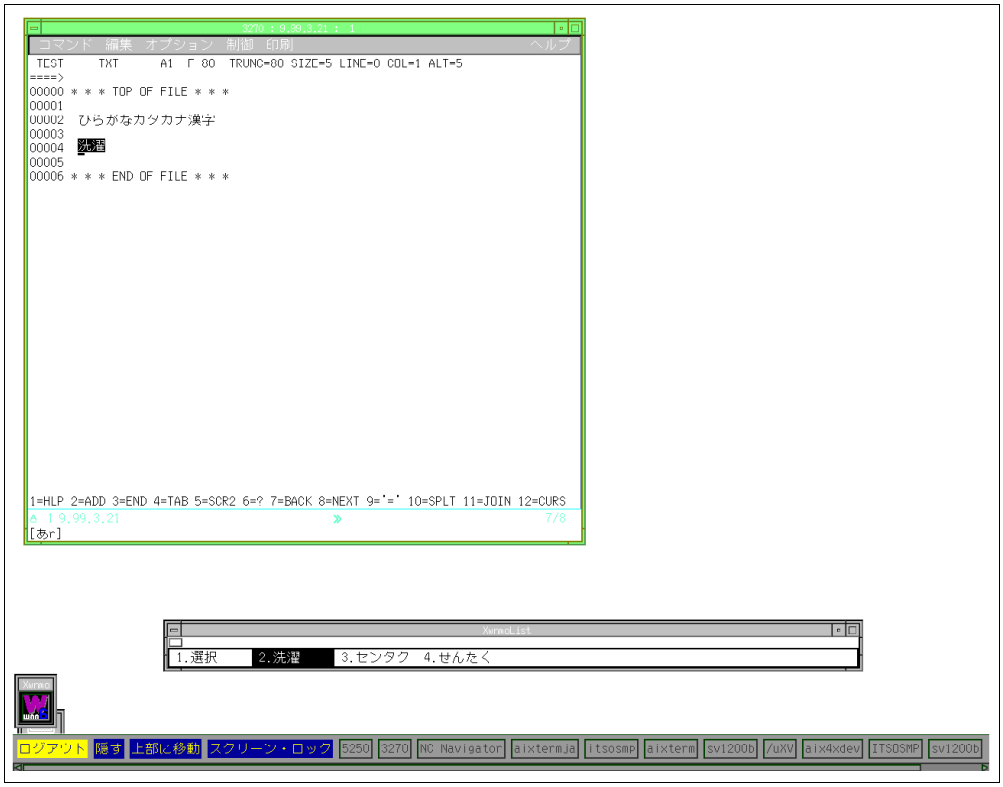

Figure 77. Selection List

4. If you want to finish Japanese Input mode, push `Ctrl-\`, and you can input Roman characters once again.

7.7 Login Window Language

The parameter unit-initial-locale, at the time of writing, is not managed by the IBM Network Station Manager. By default, this parameter is set to the primary language on the server, but there may be instances where a client does not want this language.

To change the language of the ACTLogin window, you must add the following line to the /usr/netstation/nsm/StationConfig/*NS_name*.trm file, which is not created until the IBM Network Station is configured:

```
set unit-initial-locale = FR_FR
```

where `FR_FR` is French, or any supported language. Only the network station *NS_name* will receive the update. If for some reason you wish to change the login screen for all network stations and maintain a different language on the server, the same parameter setting must be made in /usr/netstation/nsm/StationConfig/defaults.dft.

7.8 Language of the IBM Network Station Manager

The IBM Network Station Manager program provides screens with many selectable languages. The Network Station Manager program is a CGI and set of HTML panels that are executed on AIX not on the kernel of the IBM Network Station, therefore the language of the Network Station Manager program is determined by language environment on the server the httpd is running, in this case AIX.

7.8.1 Installation Considerations

To select a Network Station Manager program language, you need to install the netstation.msg.*lang*.nsm fileset for the language. This fileset provides HTML source files for the screens you will see when you use Network Station Manager program in that language. For example, you have to install netstation.msg.FR_FR.nsm if you want to interact with the Network Station Manager program in a French dialog.

7.8.2 Language Environment Value Considerations

The language of the screens on the Network Station Manager program is determined by the LANG environment value of the httpd daemon on AIX. The Network Station Manager CGI is run using the language environment inherited from the httpd daemon. For example, if you start httpd with LANG=Ja_JP or ja_JP for a Japanese environment, the Network Station Manager program runs using the Japanese environment and shows the HTML dialog panels in Japanese. Therefore, you can change the language by changing the language environment value when restarting httpd as follows:

```
stopsrc -s httpd
startsrc -s httpd -e "LANG=Ja_JP"
```

After these commands are executed, you will see Japanese language screen when using Network Station Manager program if the machine has the netstation.msg.JA_JP.nsm fileset.

Note: You may need to change the character encoding preference on your web browser for showing the language if the screen becomes unreadable.

The default setting of the Lotus Go Web server (httpd daemon) stored in /etc/rc.httpd during installation is your system's primary language environment, (the value of LANG).

If you need to provide multiple language Network Station Manager dialogs for multiple users on your system. You can start multiple httpd daemons each with a different LANG value and unique port numbers.

```
export LANG=fr_FR
httpd -r /etc/httpd.conf -p 8081
export LANG=en_US
httpd -r /etc/httpd.conf -p 8082
export LANG=Ja_JP
httpd -r /etc/httpd.conf -p 8083
```

The users on your system can access French Network Station Manager dialogs by specifying port 8081 in their URL:

`http://servername:8081/networkstation/admin`

where *servername* is the servername on which Network Station Manager program runs.

If you specify 8082 instead of 8081 as the port number in URL, you will see English Network Station Manager dialog, and port 8083 would provide a Japanese Network Station Manager dialog, as shown in Figure 78.

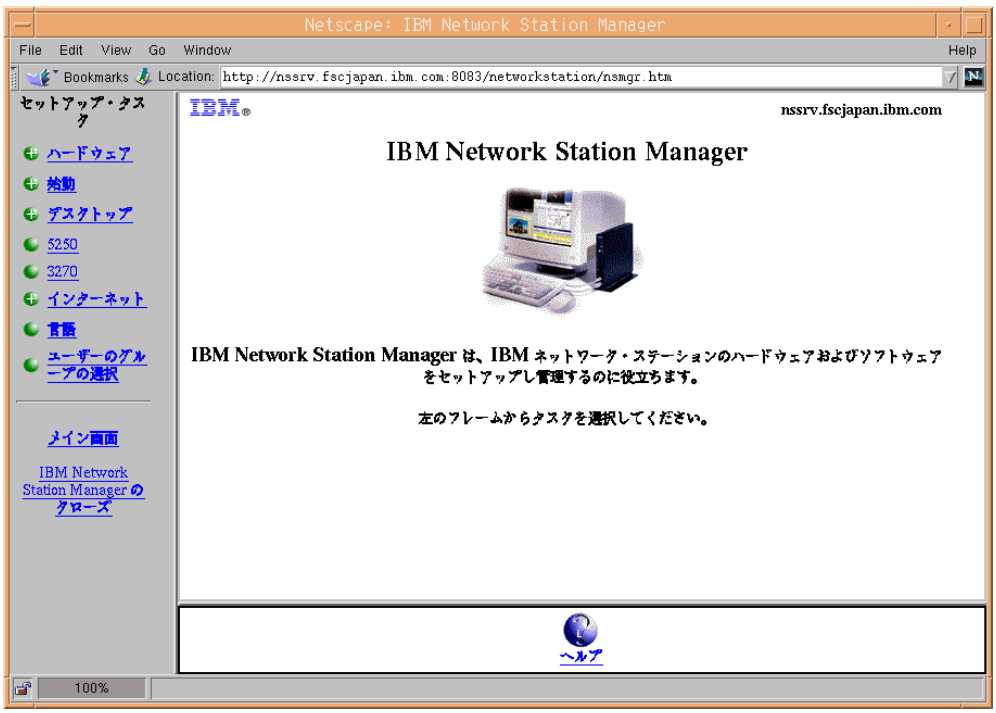

Figure 78. IBM Network Station Manager Japanese Dialog

Chapter 8. Network Station Performance Considerations

This chapter discusses performance tests that have been made, tuning procedures that have been attempted, and comments on different X environments and configurations that may affect individual performance.

8.1 Overview

There are three components involved with performance tuning in Network Stations:

- Performance of the server
- Performance of the client (Network Station)
- Performance of the connecting network

Achieving the best performance will only be obtained by optimizing each component and understanding the trade-offs when compromises must be made.

8.2 Server Performance Considerations

A server system is involved in three distinct functions of the IBM Network Station:

- Boot server
- Application server for IBM Network Station native applications
- Application server for server applications displayed on the IBM Network Station

The boot server in the system performs some or all of the following functions:

- Responds to BOOTP or DHCP requests and furnishes an address to the IBM Network Station
- Downloads the IBM Network Station kernel
- Downloads the configuration files
- Updates the IBM Network Station bootflash
- Serves as an NFS file server

The IBM Network Station application server host (which does not have to be the same as the boot server) also transfers IBM Network Station code over the network. The application server provides the local applications, such as the emulators, browsers, and Java applications, to the IBM Network Station.

When applications are run on the server, the IBM Network Station acts primarily as a remote display device, typically called an *X-terminal* in the UNIX environment. Only the graphics from the application are transferred to the Network Station, and thus the sizing of the server is completely application dependent. The considerations also can be highly dependent on the X environment.

8.2.1 Boot Performance

The boot performance of the server is a key component in how soon the user will be able to use the Network Station after it is turned on. For a single IBM Network Station, the time is between 1 and 2 minutes, depending on what applications are started at bootup time and which X Display Manager is being used. For example, CDE takes considerably longer to initialize than XDM.

8.2.1.1 Understanding the Boot Process

The boot process for the IBM Network Station consists of several phases.

8.2.1.2 Boot Phase One - IP Address Discovery

In the first phase of the boot process, the IBM Network Station obtains its IP address and other basic network information. This can be done in one of three ways:

1. Setting the network information in the IBM Network Station NVRAM
2. Requesting network information using the BOOTP protocol
3. Requesting network information using the DHCP protocol

After the IBM Network Station is given the IP address, gateway, and name server, a series of name service requests are done. Any name resolution problems will introduce delays at this time. In tests where a domain name server was not running, there were time-out delays of up to 30 seconds during the bootup phase and loading the CDE login. See Table 41.

8.2.1.3 Mounting the /usr/netstation Directory

By default, NFS is the protocol of choice for downloading most of the files needed to start up the IBM Network Station. Unless the setup has been modified to use TFTP first, the IBM Network Station will attempt to mount /usr/netstation from the workstation at this point. If that mount fails, or if TFTP is the desired protocol, then the file system will not be mounted, and the boot performance will be greatly decreased.

8.2.1.4 Boot Phase Two - Kernel Download

Phase two of the boot process is to download the IBM Network Station kernel from the server. This phase consists of downloading a single kernel file. At the time of our testing, this file was 2044868 bytes in length.

8.2.1.5 Boot Phase Three - Configuration File Download

During this stage of the boot process, the configuration files are downloaded to the IBM Network Station. These files are download using TFTP even when NFS is set as the default download protocol. At the end of the configuration download, the IBM Network Station will update this NVRAM settings if they are set in the configuration.

By default, the configuration files that are downloaded include:

- /usr/netstation/configs/standard.nsm - 122 bytes
- /usr/netstation/configs/required.nsm - 1749 bytes
- /usr/netstation/configs/control.nsm - 994 bytes
- /usr/netstation/configs/local.nsm - 418 bytes

8.2.1.6 Boot Phase Four - Resource File Download

The resources required by the IBM Network Station include:

- Bitmap and color definitions
- Keyboard maps
- Fonts

Bitmap and Color Definitions

The bitmap and color definition files that are downloaded include:

- /usr/netstation/SysDefaults/ibmwall.xbm - 3041 bytes, the wallpaper
- /usr/netstation/rgb.txt - 17159 bytes, the colormap information

Keyboard Definitions

- /usr/netstation/XKeysymDB - 3157 bytes
- /usr/netstation/keyboards/AB83useng - 7980 bytes (will vary based on language)

Font Download

The fonts that are downloaded at start up or boot time are loaded from the font path specified in the xserver-default-font-path field of /usr/netstation/configs/required.nsm. For each directory path that is specified, two files are downloaded. These files are fonts.dir and fonts.alias and typically range from a few hundred to a few thousand bytes. The default font directories include:

- Built-ins: no file download
- /usr/netstation/fonts/pcf/100dpi
- /usr/netstation/fonts/pcf/dw100dpi
- /usr/netstation/fonts/pcf/misc
- /usr/netstation/fonts/pcf/java
- /usr/netstation/fonts/pcf/ns3270

Other fonts are loaded as needed when the application starts.

Network traces indicate that several calls to the font server are also made at this time.

8.2.1.7 Boot Phase Five - Starting Base Applications

Network Station applications such as login, ns3270 and the local IBM Network Station Window Manager (wm) can be started automatically by including them in the `exec-startup-commands` options in the configuration file. By default the *login chooser* application is started, and the results from starting this application are the basis of much of the performance testing reported in this section. One of the popular ways to set up the IBM Network Station is to set the `exec-startup-command` to login to a particular RS/6000 X-server. The results of starting the CDE login as part of the boot process is also shown in some tests. The login program contains 45050 bytes.

8.2.1.8 Other Boot Activities

In addition to downloading files, the Network Station resolves host names and sets the clock.

Name Resolution
During the bootup process, the IBM Network Station requests name resolution at two times. The first time is just before the kernel is loaded to get the hostname and domain from the nameserver. The second time is just before the configuration files to get the name of the gateway.

Time Resolution
Very shortly after the configuration files are downloaded, a set time User Datagram Program UDP request is made to the server. The response is fast and requires only 4 bytes of data to receive the time information.

8.2.1.9 Timeouts
If the system is not carefully created, the boot time can be increased by wait periods for timeouts. Even with careful planning, some of these timeouts are hard to avoid. Some of these timeouts include:

- DHCP timeout - 3-5 seconds.
- DNS timeouts will introduce an extra 20 seconds on bootup if the DNS server is not configured.
- NFS file access timeouts.
- File access timeouts.
- Sleep statements in X startup scripts.

8.2.2 Effect of Default Settings
The default settings on the IBM Network Station that affect bootup time are:

- The boot addressing order
- The boot protocol order

8.2.2.1 Boot Addressing Order
The default settings for network parameters on the IBM Network Station are:

```
DHCP IP Addressing Order..... 1
BOOTP IP Addressing Order..... 2
RARP IP Addressing Order..... Disabled
```

This is a good order when using DHCP address assignment. However, when using BOOTP to assign addresses to the Network Stations, this order will cause a four-second, unnecessary delay. To avoid this, set the addressing order as follows:

```
DHCP IP Addressing Order..... Disabled
BOOTP IP Addressing Order..... 1
RARP IP Addressing Order..... Disabled
```

This is set from the Network Station Setup utility accessed by pressing **Esc** during the `NS0500 Search for Host System` part of the booting sequence and using the Set Network Parameters panel of the Setup utility to make the changes.

8.2.2.2 Boot Protocol Order
The default boot protocol order determines the TCP/IP protocol for downloading the kernel and applications to the Network Station. By default, this is set to use NFS for downloading. Using the default settings will give much faster download than switching to TFTP download. This parameter can be changed from the IBM

Network Station Setup utilities, which are accessed on bootup by pressing **Esc** during the `NS0500 Search for Host System` part of the booting sequence and accessing the Set Boot Parameters panel.

8.2.3 Test Results for Power-Out Restarts

This section describes some of the testing that was conducted to help determine the number of Network Stations that can be supported by a single server and still give the required response time for users to get back to a working state after a power outage. A power outage is one of the most demanding events since several hundred Network Stations could be configured to load from a single server. It is also one of the areas the Network Station developers are working to prevent.

8.2.3.1 Test One - Stopwatch Timing

The purpose of the first test is to examine the times for booting a single IBM Network Station from a server and to examine the individual portions of the bootup sequence. The times were taken from a stopwatch at various parts of the bootup sequence. The Verbose Diagnostic Messages were enabled through the Setup utility. The timing definitions are given in Table 35.

Table 35. Stopwatch Timing Sections

Boot Section	Description
POST (Power On Self Test	Time from power on to `NS0500 Search for Host System` message.
Network Initialization	Time from `Search for Host System` until `Searching for IP Address: BOOTP.`
BOOTP	Time from `BOOTP` until start of kernel download barcode display.
Kernel	Duration of the kernel barcode.
New page	Time from end of kernel barcode until next page.
Mount	Time from top of page two until `reading from config file: /usr/netstation/configs/standard.nsm`
Configs	Time from reading config until reading RGB file `/usr/netstation/rgb.txt`
Fonts	Time from reading rgb.txt until start of the blue background page.
Login	Time from start of blue background page until the login chooser window is displayed.

This test was conducted on using an IBM Network Station with 40 MB of memory booting from an RS/6000 Model 550 over a 16 MB token-ring. The RS/6000 server was set up using the BOOTP protocol. The only differences with DHCP timings are an additional one second during the BOOTP phase.

The results of these timings are shown in Table 36.

Table 36. Times in Seconds to Boot IBM Network Station

Boot Section	Default	DHCP Disabled	TFTP Download
POST	28.5	28.5	28.5
Network Initialization	3.9	3.9	3.9
BOOTP	5.3	1.2	1.2
Kernel	12	12	73
New Page	2	2	3
Mount	5	5	5
Configs	4	4	8
Fonts	3	3	13
Login	5	5	5
Total	69 seconds	64 seconds	140 seconds

NFS versus TFTP for Network Station Boot

The NFS download is much faster than the TFTP download. Some of the reasons for NFS being faster are:

- During the TFTP, there is a handshake between each 512-byte packet. This handshake results in a latency between packets and increased CPU utilization on the RS/6000.
- The packet size is 512 bytes for TFTP; a larger packet size (though not selectable) would improve this number.
- The default NFS packet size is 8192, which gets fragmented to the Maximum Transmission Unit (MTU) size for the network. The advantage is that there is no handshake required from the IBM Network Station between fragment packets. The default MTU size for token-ring is 1492.

When using NFS, there are several parameters that can be configured, such as:

- Number of NFSD server daemons on the RS/6000
- Number of NFS threads: `nfs_max_threads` setting returned from the `nfso` command
- MTU size for the network

The NFS parameters will have an effect only if many network stations are being booted. Increasing the threads may be required to reduce timeouts, but no testing was done with these parameters.

8.2.3.2 Test Two - Comparing RS/6000 Models 550 and J30

These tests were conducted by booting in separate tests from an RS/6000 model 550 and a four-processor RS/6000 model J30.

Test Timing

In these tests, the `tcpdump` command was used to retrieve the bootup times. The commands used are shown here:

```
tcpdump -s 192 -l -tt -i tr0
```

During the tests, times were recorded shown in Table 37.

Table 37. Tcpdump Timing Sections

Section	Description
Pre-Kernel	Time from bootpc packet until lookup kernel packet.
Load Kernel	Time from lookup kernel until the first Sun RPC call after the kernel.
Nameserver	This includes more than name server calls. Time is from Sun RPC until lookup `/usr/netstation/configs`.
Load Configs	Time from first lookup `/usr/netstation/configs` until lookup Sysdefaults packet.
Misc.	Time from lookup SysDefaults until the first call to load the fonts.
Load Fonts	Time from first call to load fonts until the first call to a font server.
Fontserver	Time from first font server packet until lookup login.nws.

Table 38 shows the latency time added when an additional IBM Network Station is added to the power-up test.

Table 38. Model J30 Boot Time Comparison

Program Section	Single Network Station		Two Network Stations	
	Module	Elapsed	Module	Elapsed
Pre-Kernel	1.22	1.22	1.22	1.22
Load Kernel	12.27	13.49	12.30	13.52
Nameserver	6.77	20.26	6.93	20.45
Load Configs	6.36	26.62	2.70	23.15
Misc.	2.06	28.68	1.65	24.80
Load Fonts	1.88	30.56	2.00	26.80
Fontserver	0.84	31.40	0.73	27.53

Booting a Single Workstation

In this test, the 550 and J30 are compared for times in booting a single Network Station. Results show that, here, the times are nearly equal, and the bottleneck is either the network or the Network Station. The tests were not conducted on an isolated network, and the J30 time is longer than one of the boot times when two Network Stations were started at once. Local file caching assists all machines.

The results of this comparison are shown in Table 39.

Table 39. Model 550 Versus Model J30 Boot Time Comparison

Program Section	Model 550 Time		Model J30 Time	
	Module	Elapsed	Module	Elapsed
Pre-Kernel	1.22	1.22	1.23	1.23
Load Kernel	12.02	13.30	12.12	13.35
Nameserver	6.97	20.27	6.76	20.11
Load Configs	2.49	22.76	3.31	23.42
Misc.	3.20	25.96	0.81	26.63
Load Fonts	1.94	27.90	1.92	27.55
Fontserver	0.88	28.78	0.85	28.40

8.2.3.3 DHCP Timeout

DHCP timeout is mentioned earlier in the timeout section. From this table, if you are booting from a BOOTP server, but have left the defaults to try DHCP first, there will be a four-second delay during the boot process. When booting from multiple network stations, this will not cause an additional delay because there is very little network traffic or host CPU requirement from this attempt.

Effect of MTU Size on Token-Ring

When using NFS mounts in AIX 4.2.1, the IBM Network Station makes one request for each 8192 bytes of data. The kernel that was tested was 2044868 bytes in length. This calculates to 250 requests for data. At the default MTU size of 1492 bytes, the NFS data is fragmented into six packets per NFS request. By increasing the MTU size to 3000, only three packets per request are required, and when it is increased to 4400, two packets are needed. The main effect of changing the MTU size is in downloading the kernel. The Table 40 lists the effect of changing the server MTU size on the download time for the kernel.

Table 40. Kernel Download Time Versus MTU Size

MTU Size	Time Seconds	Fragments per 8192 Bytes
1492	11.27	6
3000	8.50	3
4400	8.15	2

When making changes to the MTU size, care should be taken because mismatches between network segments can cause considerable packet fragmentations. This means that the entire network performance may be decreased by using nonstandard MTU sizes.

Disabling Memory Test during POST (Power-On Self Test)

It is not recommended to disable the memory test on the Network Station, but when it is disabled, the POST decreases to about 17 seconds. The time saved during bootup depends on the amount of memory installed in the IBM Network Station. Tests were made with differing amounts of memory installed.

Monitor Recognition Time

During testing of bootup times with systems using different monitors, it was determined that the Direct Digital Control (DDC) detection for different monitors can take different times. When auto detection was turned on (default setting for the Network Station), the Network Station with the IBM 15V monitor required 2-3 seconds longer to go through the POST than did one with an IBM P70 monitor.

8.2.3.4 Effects of Network Properties on Boot Performance

The network setup can make changes to the boot performance of the IBM Network Station. Some of the properties that will effect the boot performance include the type of network, the traffic on the network, the MTU size of the network, the position of routers, the existence of a domain name server, and the network adapters. A few of these factors are discussed in this section.

Ethernet versus Token-Ring Performance Differences

The IBM Network Station has a smaller latency when attached using Ethernet. When using only one server, collisions are not a problem; however, when using multiple servers, the high network utilization can create many problems. The Ethernet adapter in the Network Station has a lower latency than the token-ring adapter, and bootup times are shorter.

The results in Table 41 reflect the differences seen between a Network Station booting from a token-ring and one booting from an Ethernet. The server was an RS/6000 Power Series 850. The token-ring was the lab-production token-ring, and the Ethernet was a single machine attached to the RS/6000 with a crossover cable. The table also illustrates the error delay caused by not having a Domain Name Server configured.

Table 41. Model 850 Ethernet Versus Model J30 Token-Ring

Program Section	Ethernet Time		Token-Ring Time	
	Module	Elapsed	Module	Elapsed
Pre-Kernel	1.30	1.30	1.23	1.23
Load Kernel	4.53	5.83	12.40	13.43
Nameserver	3.46	9.29	6.75	19.15
Load Configs	2.27	11.56	2.23	21.38
Misc.	1.41	12.97	1.62	23.00
DNS Timeout	23.61	36.58	32.46	56.69
Load WM	0.91	37.49	1.29	57.98

Network and CPU Utilization

This data was taken from bootup testing with multiple network stations attached on a common power strip. The network type was Ethernet, and the server was an RS/6000 model 540. The network utilization numbers were taken with an external sniffer, and the CPU numbers are taken using the `vmstat` performance command.

Tests were conducted by starting 1, 2, 5, and 10 IBM Network Stations starting at a time. The results are shown Table 42.

Table 42. Network and CPU Utilization during NFS Bootup

Number of Stations	Peak Network	Peak CPU	Time CPU > 50%
1	40%	22%	0 sec.
2	79%	53%	5 secs.
5	96%	82%	8 secs.
10	96%	82%	20 secs.

When the tests are run with TFTP, the CPU utilization is higher, and the network utilization never is greater than 25 percent.

Loading 10 Network Stations at once with CDE login set the 540 CPU utilization at nearly 100 percent for approximately 60 seconds, indicating that the applications loaded at boot time can have a significant effect on startup performance.

8.3 Network Station (Client) Performance Considerations

The Network Station can operate in three distinct modes:

- Running native client applications such as browsers and terminal emulators
- As a remote display device
- As a native JVM (Java Virtual Machine)

8.3.1 Performance Running Native Client Applications

The performance for native clients can be divided into performance starting the application and performance in running the application.

8.3.2 Local Telnet and Terminal

By using local telnet/terminal clients on the Network Station, the load on the server can be reduced. This section describes the performance implications of using the term.nsm client versus using shell windows displayed from the X-host.

8.3.2.1 Load Time

The terminal program is 172 KB and was loaded using NFS. The time from selecting the first telnet session loaded after a boot until the request for host window appears is about four seconds. Additional sessions start immediately. The time from entering the telnet host until the login prompt is less than a second. The additional time for the first window is a combined effect of loading the program and resolving fonts.

8.3.2.2 General Performance Considerations

To test the text performance of a terminal session, the `lptest` command to generate a fixed amount of data was used. The command that was used was:

```
lptest 80 5000
```

The scrolling on the IBM Network Station was quite smooth, with only a couple of breaks in the flow of data to the screen. However, for pure performance, this does not keep up with an aixterm or dtterm displayed on the Network Station. Table 43 lists the time in seconds for this test.

Table 43. Time in Seconds to Display lptest 80 5000

Environment	Applications	Time in Seconds
CDE	Local term	68 seconds
WM	Local term	80 seconds
WM	Local term (-j)	27 seconds
CDE	aixterm	13 seconds
CDE	xterm	10 seconds
CDE	dtterm	8 seconds

The `local term -j` option causes *jump* scrolling.

8.3.3 Host Emulation Sessions

The host emulators that were examined include 3270 and 5250 emulation.

8.3.3.1 Local 3270 Emulation

During testing, it was discovered that the first call to load ns3270 took considerably longer to load than subsequent calls. The reason for this is that three libraries must be loaded first. These are libx2.nws, libxt.nws, and libxm.nws. The load times from the 850 server for the modules associated with ns3270 are shown in Table 44.

Table 44. Load Times for Modules Associated with 3270 Emulation

Module	Load Time Ethernet	Load Time Token Ring
libx2.nws	0.31 seconds	0.41 seconds
libxt.nws	2.18 seconds	2.15 seconds
libxm.nws	6.69 seconds	9.89 seconds
ns3270.nws	1.40 seconds	2.40 seconds

The libx modules can be loaded at boot time as described in 4.5.2, “Configuring the Initial Applications List” on page 100, which will increase the initial boot time, but will make users more comfortable with the application load time when selecting 3270 emulation. This is recommended when users always use 3270 emulation sessions.

Graphical Data Display Manager (GDDM) graphics performance on the Network Station is quite good from an empirical standpoint. Complex images appear with little delay.

8.3.3.2 Local 5250 Emulation

Local 5250 emulation was not tested.

8.3.4 X11Perf Benchmark

The Network Station model 8361 runs this benchmark almost as well as IBM's X-station model 145. The X11Perf benchmark number for the Network Station is 1.35, compared to 1.5 for the X-station 145.

As a summary of X performance, the IBM Network Station provides very acceptable performance for most business and Web users. The current model is probably not ready for heavy CAD/CAM and graphics-intensive users. Lotus Notes GUI performance is acceptable.

8.4 Java Performance Issues

The Java performance on the first model of the IBM Network Station is adequate only for small Java applets or programs and is not designed for commercial Java usage. This performance should increase considerably with new models.

8.4.1 High-Level Factors Affecting Java Performance

Several aspects of the system can affect perceived performance of Java code on different platforms. Some of the relative issues are:

- Native processor speed
- The relative efficiency of the JVM for the platform
- The efficiency of the byte-code server
- The efficiency of the network delivering the byte code

8.4.2 Caffeine Benchmark

The Network Station Series 100 scored a CaffeineMark of 23 in the Caffeine benchmark test. This is with the 403 PowerPC chip running at 33 MHz and compares with a Pentium 90 and 100 MHz PC. This number will certainly increase in the Series 300 and as new models are announced. For more details on the Caffine benchmark and numbers for other systems, see:

```
http:/webfayre.com/pendragonn/jpr/jpr0596-article1.html
```

8.5 Server-Run Application Issues

Although applications that run locally on the Network Station will reduce network traffic, there are many reasons why users will continue to run applications on host servers:

- The application does not run on the network station.
- The server version of the application has more full function.
- The application performance on the Network Station is not as required.
- Users prefer the native desktop environment of the host.

8.5.1 XDM Performance Issues

From an AIX standpoint, the X Display Managers that will most often be run include:

- CDE (Common Open Software Environment (COSE) Desktop)

- XDM (X-Windows)
- The local Network Station Window Manager

Each of these environment gives different capabilities and can effect the perceived performance of the system.

8.5.2 X Session Initialization

The time to initialize the desktop varies greatly with the XDM that is being used. The local Window Manager provides a session that will start quickly for support of applications running locally on the Network Station. The XDM environment provides a somewhat slower session initialization, but allows for easier user customizing. The CDE environment provides the standard COSE desktop with the icons and display pages but at a considerable cost in startup time and network utilization.

Table 45 shows the time from the logon chooser to the user logon screen for the CDE and XDM environments. The second row of data shows the time from entering the correct password until the session is ready for use assuming a single aixterm window. The third row of data shows the time to go from user logout to the login chooser window. Combining these shows the complete cycle of the login/logout process.

Table 45. XDM Log Times

Destination	CDE on 550	CDE on J30	XDM on 550
To Login	33.8 seconds	27.4 seconds	3.65 seconds
To Session	19.0 seconds	18.0 seconds	10.6 seconds
To Chooser	14.4 seconds	14.1 seconds	10.4 seconds

This shows that XDM is considerably more efficient. Investigations indicate that during CDE login, there are three separate telnet sessions operating on the Network Station. Attempts to reduce this by changing the Xstartup script gave only minimal time improvements. The local Window Manager was not included in these tests because the concept of user login is not available yet in this environment for AIX. This will come with the IBM Network Station Manager.

One interesting observation is that if the Local Monitor window is open when you log off the CDE session, it can take about 40 seconds longer to start the next CDE session for that user. However, if you start the Window Manager session before CDE, the Network Station will hang.

8.6 Performance Summary

The following is a list of some of the observations that can be made following this testing.

- Without a Domain Name Server, bootup delays are common and can delay the boot process up to 40 seconds.
- Using CDE takes more time, from turning on the Network Station until the user can do productive work, than any other Window Manager environment.
- CDE creates the most network traffic and places the greatest requirements on the server CPU and memory.

- The first time that the 3270 emulator is loaded after each boot, the load time is about 40 seconds. After this, if the emulator is reloaded, or an additional emulator session is started, the load time is only about eight seconds.
- If the IBM Network Station User Services Console is open when the CDE desktop is exited, the next user login for that user will take an additional 40 seconds longer to load than if the console is closed before exiting CDE.
- When more than five Network Stations are booted at once using the NFS protocol, the network will reach saturation, and the time for booting additional systems will increase linearly.
- When booting with the NFS protocol, the boot times are restricted by the network and the Network Station, and there is only a small effect from the CPU speed of the processor.
- When booting and loading files with TFTP, the CPU of the server becomes the limiting factor.
- When more than 10 Network Stations are booted at the same time, some of the Network Stations will not boot to completion because of built in time-outs. The boot process for these systems must be restarted.
- Using the local terminal/telnet session will reduce server utilization slightly, but the performance is slower than displaying X-based host windows such as aixterm, dtterm, and xterm.
- Local browser performance is greatly affected by the underlying file system on the server. It is recommended not to use disk caching of files in order to eliminate part of the file system load. This can be done with the Navio browser by setting the disk cache size to `0`.
- File load times for large files, such as the kernel, can be decreased by increasing adapter MTU size. However, this may effect the network performance of other users and cause fragmentation between subnets.

Chapter 9. Problem Determination

This chapter describes a series of potential IBM Network Station errors, their causes and suggested corrective actions. In addition, there are several hints and tips included.

9.1 Where to Start

When you are having problems, first look at the IBM Network Station messages, shown in Figure 79. These are seen on the Network Station display, then in the Console panel when it is available. The messages contained in the figure contain several errors. Can you spot them?

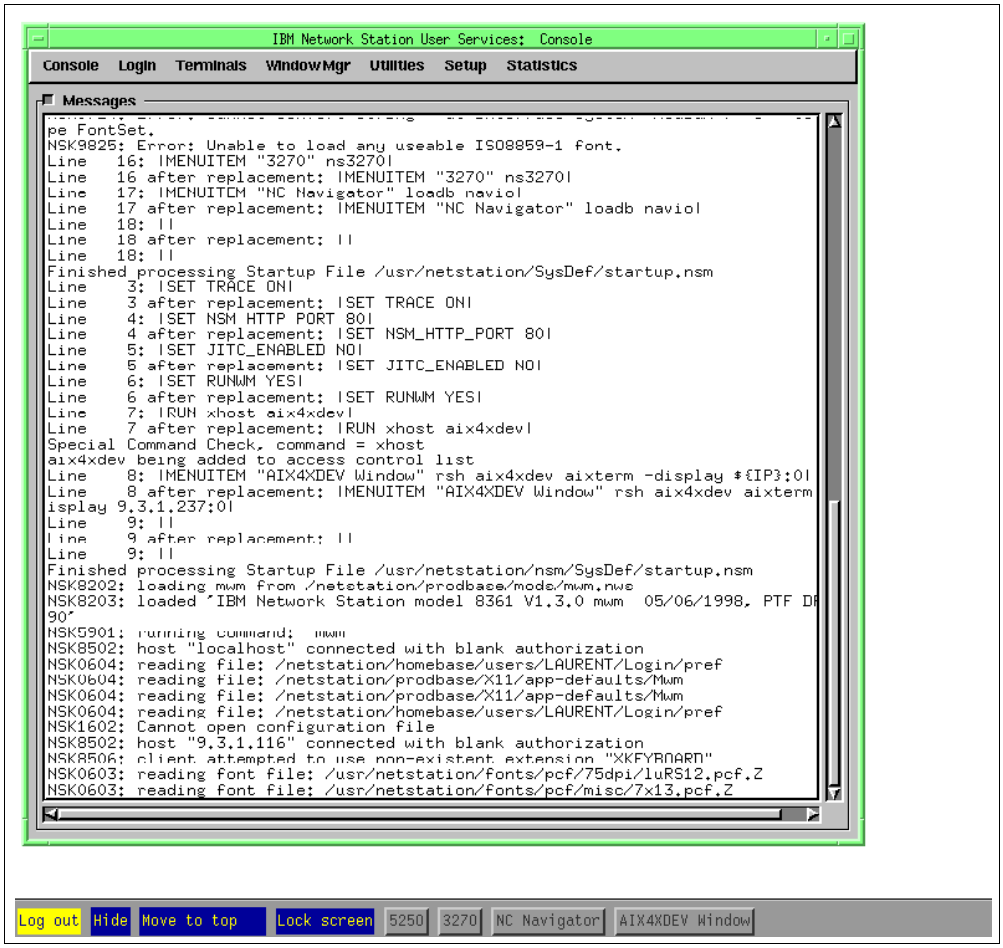

Figure 79. Messages Seen during Booting and Running of IBM Network Station

You are also able to save the messages of the IBM Network Station into a separate file; for more information, see 4.5.9, “Generating an Error Log” on page 107.

Another method to retrieve the messages shown in the console window is to telnet to the IBM Network Station using port 5998. This is the diagnostics port. See 4.6.2, “Remote Diagnostic Access” on page 111.

To save the output, you can use the AIX `script` command. This will copy all output into a special file named typescript. The following commands perform this task:

1. Enter `script` to enter a special shell.
2. Enter `tn sv1200f 5998` to telnet to the IBM Network Station.
3. Watch the buffered messages scroll by.
4. Press **Ctrl-T** to terminate the session.
5. Enter `quit` to end the telnet session.
6. Enter `exit` to exit the script shell.
7. Print or edit the typescript file, which will contain the messages.

For a complete reference of the diagnostic log, refer to 9.6, “The Diagnostic Log” on page 207.

In the diagnostic log, there may also be some warnings from the X-server, but they can be ignored. The warnings are about problems allocating color-cells or fonts and are caused by programs already allocating all available colors or fonts not available for the IBM Network Station. Nevertheless, the application will start up, but with changed colors or fonts.

9.2 Specific Problems and Solutions

A large collection of symptoms and recovery options is described in the following documentation:

- *IBM Network Station Setup and Use,* SA41-0036, *Troubleshooting* chapter.
- *IBM Network Station Manager Installation and Use,* SC41-0664, *Problem Resolution* chapter
- *IBM Network Station Runtime Environment for RS/6000 System Administrator's Guide,* SYSA-NETW, *Troubleshooting* chapter.
- *IBM Network Station Runtime Environment for RS/6000 User’s Guide,* USER-NETW, *Problem Determination* chapter.

9.3 Debugging Commands

The AIX operating system has many tools for tracing networking problems. This section includes descriptions on some that are useful for diagnosing problems with the IBM Network Station when used with AIX.

9.3.1 bootpd

During the boot process, if the IBM Network Station pauses indefinitely on the message `Searching for Host`, there may be problems with the BOOTP configuration.

To resolve BOOTP problems, run the `bootpd` command in debug mode. When bootpd is run in debug mode, the system administrator will see the BOOTP request packets coming from the IBM Network Station as well as the response from the AIX server and the information that is provided to the IBM Network Station.

The procedure for running bootpd in debug mode is:

1. Comment out the bootpd line in `/etc/inetd.conf` by adding a comment (#) at the start of the line:

   ```
   #bootps dgram udp wait root /usr/sbin/bootpd bootpd /etc/bootptab
   ```

2. Request inetd to reread the `/etc/inetd.conf` file:

   ```
   refresh -s inetd
   ```

3. Check for an existing running copy of bootpd with:

   ```
   ps -ef | grep bootpd
   ```

4. If there is a bootpd process running, kill the process.
5. Issue the `bootpd` command in debug mode:

   ```
   bootpd -d -d -d -d -s /etc/bootptab
   ```

6. Reboot the IBM Network Station.
7. Record the messages on the screen.
8. Stop bootpd with **Ctrl-C**.
9. Remove the comment (#) from the bootpd entry in `/etc/inetd.conf` to have inetd regain control of bootpd.
10. Refresh inetd again.

The things to look for in the output are:

- Does the `bootpd` command give any errors when starting? This can help detect syntax errors in the `/etc/bootptab` file if it was manually edited. An example of a message from a syntax error is shown as follows:

  ```
  BOOTPD: bootptab mtime is Thu Apr 24 15:41:31 1997
  BOOTPD: reading "/etc/bootptab"
  BOOTPD: bad hostname: "hd=/usr/netstation/"
  BOOTPD: read 2 entries from "/etc/bootptab"
  BOOTPD: dumped 2 entries to "/etc/bootpd.dump".
  ```

  This example shows the error that may occur if you put a slash (/) at the end of `hd=/usr/netstation` in the boot file. The IBM Network Station console message screen will also show a message for this problem as follows:

  ```
  File: '/QIBM/ProdData/NetWorkStation/kernel' not found.
  0827-603 Cannot file the specified field.
  File: 'usr/lpp/tcp/nstation/standard/kernal'
  0827-603 Cannot file the specified field.
  ```

- Does the AIX host see the bootpd request? A bootpd request will show on the AIX Screen as follows:

  ```
  BOOTPD: bootptab mtime is Thu Apr 24 15:41:31 1997
  BOOTPD: Received boot request.
  BOOTPD: request from hardware address 0000E568EFD8
  ```

- Does the hardware address in the request match the `ha=` address entry in `/etc/bootptab`?

  ```
  sv2040d.itsc.austin.ibm.com:ht=token-ring:ha=0000E5E8EC76:...
  ```

- Does the AIX host respond to the BOOTP request? If it does, the output will show:

```
BOOTPD: found 9.19.129.161 insv1
BOOTPD: bootfile = /usr/netstation/kernel
BOOTPD: vendor magic field is 99.130.83.99
BOOTPD: RFC1048 vendor data (bp_vend[64])99.130.83.99.255.0.0.0.0.
BOOTPD: sending RFC1048-style reply
BOOTPD: Time to create ARP entry, hardware type is 6 and ifname is tr0
BOOTPD: Creating Token Ring arp table entry
BOOTPD: Broadcast reply to all rings.
BOOTPD: ioctl(SIOCSARP): Arp entry created successfully.
```

- Does the AIX host send the right information to the IBM Network Station? The information will be shown in the bootpd output as follows:

```
BOOTPD: bootfile = /usr/netstation/kernel (from above)
BOOTPD: The following addresses are included in the BOOTP reply
BOOTPD: Client IP address (bp->bp_ciaddr) = 9.19.129.161
BOOTPD: Server IP address (bp->bp_siaddr) = 9.19.129.12
BOOTPD: Gateway IP address (bp->bp_giaddr) = 9.19.141.121
BOOTPD: ioctl(SIOCDARP): Arp entry deleted successfully.
BOOTPD: Finished processing boot request.
```

9.3.2 tcpdump

The `tcpdump` command can be used for looking at network TCP/IP traffic between AIX and the IBM Network Station. This section describes the syntax for using `tcpdump` to look at both debugging and performance issues. The `tcpdump` command can give information about the time, size, and protocol of each packet sent. The output can also be used to determine which files are sent using TFTP or NFS.

The `tcpdump` command supports several filtering flags such as port, host, or direction which can be used to look for specific information in the request.

By using the following syntax, you can obtain all the traffic for a particular Network Station and then use filters like `grep` or `sed` to look for specific information.

```
tcpdump -s 576 -l -i tr0 host sv2040g | tee sv2040g.tcpdump
tcpdump -s 576 -l -i en0 host insv02 | tee insv02.tcpdump
```

The `-s 576` flag ensures that a large enough portion of the packet is collected to give good file names and protocols in the output. By including `-l`, the data is immediately flushed to stdout and doesn't wait for the buffer to fill up. The `-i tr0` is only needed if you want to make sure the data is coming in a particular interface. By specifying the host name, only data for that host will be included in the output.

9.3.2.1 Tracing BOOTP Activity

To look at the boot packets, you can make a separate run with:

```
tcpdump -x -s 576 -l -i tr0 port bootps
tcpdump -x -s 576 -l -i en0 port bootps
```

This will show only BOOTP packets on the specified port. The following shows some of the output from this command for a IBM Network Station boot. The other option is to simply use `grep bootp insv02.tcpdump` from the data collected with the earlier syntax. The following shows the line from the IBM Network Station boot sequence that will show with this `grep` command:

```
14:20:37.897097172 itsosmp.itsc.austin.ibm.com.bootps >
sv2040i.itsc.austin.ibm.com.bootpc:  htype-#6 hlen:6
xid:0x1ba secs:100 Y:sv2040i.itsc.austin.ibm.com
S:itsosmp.itsc.austin.ibm.com G:itsorusi.itsc.austin.ibm.com
file "/usr/netstation/kernel"
```

9.3.2.2 Finding TFTP Activity

Even when using NFS, the TFTP protocol is used to download some of the configuration files. The amount of TFTP activity can be seen by using `grep tftp sv2040i.tcpdump` from the file collected during the bootup process. The following shows a typical output line during bootup with NFS enabled:

```
14:20:57.144673066 sv2040i.itsc.austin.ibm.com.1848 >
itsosmp.itsc.austin.ibm.com.tftp: 56 RRQ
"/usr/netstation/configs/standard.nsm"
```

This shows only the request for the files from the IBM Network Station. To see the actual UDP packets used for the TFTP packet, you can edit the file and search for the file name.

9.4 Looking at the NFS Activity

Each NFS request in the `tcpdump` output will contain the word `lookup`, and using `grep lookup sv2040i.tcpdump` will show all the NFS requests for files and directories. The actual packets can be seen with a `grep nfs sv2040i.tcpdump`. The following shows the lookup line, the request to read 8192 bytes (one NFS buffer) and the first packet of data from the host to the IBM Network Station:

```
14:20:39.100202292 sv2040i.itsc.austin.ibm.com.30315 >
itsosmp.itsc.austin.ibm.com.nfs:
lookup fh 2359298.3.144259 "kernel"
14:20:39.116973332 sv2040i.itsc.austin.ibm.com.40316 >
itsosmp.itsc.austin.ibm.com.nfs:
108 read fh 2359298.3.1454980 8192 (0) bytes @ 0
14:20:39.118477759 itsosmp.itsc.austin.ibm.com.nfs >
sv2040i.itsc.austin.ibm.com
reply ok 1464 (frag 23353:1472@0+)
```

This shows that with the default MTU size of 1492, 1472 bytes of the file are transferred per packet, but only one ACK is required from the IBM Network Station for each 8192 bytes.

9.4.0.1 Looking at Name Server Requests

Requests for names can be seen in the output by searching for either `arp` or `who-has`. The following shows an example of a name server request:

```
14:20:38.970989546 arp who-has itsosmp.itsc.austin.ibm.com
tell sv2040i.itsc.austin.ibm.com
```

9.4.0.2 Viewing Font Server Packets

Requests to the font server use the well-known font server port, and a search for `font server` will give the following type of output:

```
14:20:11.583282079 sv2040i.itsc.austin.ibm.com.2534 >
itsosmp.itsc.austin.ibm.com.fontserver:
R 3200022:3200022(0) win 0
```

Looking at the time stamps of this type of information may indicate delays with font services. Similar information can been seen with time services by using the grep command on time.

9.4.0.3 Examining at Network Performance

By using the right parameters, the tcpdump command will provide the time for each packet, which files are downloaded, and what protocol is used to move the packets. Because the output can become quite large, it may be desirable to filter the output with a command, such as sed, to reduce the amount of output saved to a file. The following command was used in this residency for testing boot and program load times.

```
tcpdump -s 255 -l -tt -i tr0 | sed -f go.ch | grep -e "####" > $1.out
```

The go.ch script used is shown in Figure 80.

```
s/rpc/####rpc/g
s/font/####font/g
s/log/####log/g
s/boot/####boot/g
s/look/####look/g
s/arp/####arp/g
s/time/####time/g
s/RRQ/####RRQ/g
```

Figure 80. go.ch Script

The output from the script was then refiltered to remove the #### characters that were inserted by this command. This was done with the following command:

```
sed -e "s/####//g" infile > outfile
```

9.4.1 iptrace

The iptrace command can give much larger files than tcpdump and should be used only when there is some doubt about what is inside the TCP/IP packets. The sample syntax for that iptrace command that may be useful

```
iptrace -p port -a -b -s server_name -d netstation outfile
```

Specifying a port such as bootpc, bootps, or nfs will allow only data for that port to be collected. The -a flag specifies that arp packets are excluded. The -b flag specifies to include packets in both directions. The source and destination host names are specified with the -s and -d flags.

An example of an application for which iptrace was useful was looking for data going the RS/6000 from the IBM Network Station when printing from term.nsm and attempting to print from the NC Navigator browser. With iptrace, the tests showed that NC Navigator attempted to connect to the RS/6000 on port 515 (LPD), but AIX rejected the connection because no queue name was given.

9.4.2 syslog

The syslogd daemon in AIX collects error information from the subsystems and saves that information based on the /etc/syslog.conf file. The amount and level of information can be controlled. For more information on syslog, see AIX InfoExplorer, or enter man syslogd

For debugging, the following line was placed in `/etc/syslog.conf`:

```
*.debug                 /tmp/syslog
```

This entry is interpreted by the syslogd daemon to report errors from all daemons at the debug level. At this level all critical, error, warning, and informational messages will also be reported.

It is important to make sure syslogd is running so that information is recorded. To start syslogd, use the `smitty syslogd` fastpath, and choose: **Start Using the syslogd Subsystem**. To check the status of the syslogd daemon, enter: `lssrc -s syslogd`. When syslogd is active, lssrc will show:

```
Subsystem         Group            PID     Status
syslogd           ras              3532    active
```

After making any changes to `/etc/syslog.conf`, request the daemon to read the file by entering:

```
refresh -s syslogd
```

The type of information about the IBM Network Station that will be included in the log file includes:

- Failed calls to the font server
- Failed calls to the portmapper
- Failed login attempts from the IBM Network Station telnet session
- tftpd timeouts
- NFS file mounts
- CDE socket errors
- Errors in the inetd.conf file
- Out of memory errors on the server

Typical messages in the found in the log file are shown in this example:

```
Jun 3 10:52:06 aix4xdev syslog: libtt[19636r]:
_Tt_rpc_client::init(): fcntl(F_SETFD): m
Jun 3 10:55:07 aix4xdev syslog: libtt[35570]:
ttdt_Xt_input_handler():
tttk_message_receive() TT_ERR_NOMP No ttsession process is running,
Jun 3 11:07:37 aix4xdev syslog: libttr 9052: clnt_create for
rpc.ttdbserverd on sv2040d failed: RPC: 1832-018
Port mapper failure - RPC: 1832-008 Timed out
Jun 3 11:51:53 aix4xdev syslog inetd.conf : invalid tftpd option.
Jun 4 09:56:34 aix4xdev inetd 4350 : fork:
There is not enough memory available now.
```

This tool is more useful for looking at the general server activity than for actually diagnosing IBM Network Station problems, but should be part of an experienced administrators tools.

9.5 Common Failures

In the following sections, command, NFS, DHCP, DNS, and memory errors are explained.

9.5.1 NFS

If you are experiencing file access problems, the first step you should take is to enable extended file diagnostics as described in 9.7, “File Access Caveats” on page 209. This can produce a large amount of diagnostic messages, and you may find it helpful to store these messages in a file for later examination as described in 9.6, “The Diagnostic Log” on page 207. Definition of the VFS is probably the most complex configuration task; so you should carefully check the configuration files for errors with reference to 4.5.4, “Configuring the Local File System” on page 103. You should also check the NFS UID and GID values as they will be used for file access. These values can be changed on login when using CDE or XDM.

The existence of an entry in the Virtual File System (VFS) does not guarantee that the file system has been successfully mounted.

You can determine which file systems have actually been mounted by using the following command on the file server:

```
showmount -a
```

The output of this command is a simple list of host names and the mounted file systems. The mount daemon will also generate messages in the syslog. Refer to 9.4.2, “syslog” on page 202, for details. The file server must be able to resolve the IP address of the IBM Network Station to a host name; otherwise you will get a permission denied error.

Make sure that the options for mounting the specified file system in the configuration file will loaded and executed by the IBM Network Station before accessing files within this file system. Because the IBM Network Station executes the configuration files step by step, it must first encounter the mount statement (`file-service-table`) before accessing files.

9.5.2 DHCP

It is easy to maintain many IP addresses with a DHCP server. But configuring DHCP is more difficult than configuring a BOOTP server. It is important to enable all logging facilities during your configuration testing because this is the only way to receive error information from DHCP. See 3.2.4, “Setting Up DHCP” on page 41, for information on DHCP. If you want to receive information about which IP address is allocated, you can issue this command:

```
refresh -s dhcpsd
```

If you have all logging facilities enabled, you will receive a list of adapted IP addresses in the log file. If the IP address is occupied, you will also receive the corresponding MAC address.

Be sure to use the right network mask for your network. In the `network` statement you have to use exact the network mask that matches this IP address. If you divided a class A IP net, for example, into several `subnets`, you have to use the class A network mask on the `network` statement and list your subnets with the `subnet` command with the appropriate subnet mask. Examine the log files for error messages.

Never delete the files /etc/dhcps.ar and /etc/dhcps.cr because DHCP uses these files to store information about already occupied IP addresses so it is able to

recover the latest status after a restart. If you delete these files, all IP addresses will be marked as unused, and the next renewal request from the IBM Network Station will fail. This forces the IP address to expire and all IBM Network Stations using this server to receive their IP address will shut down their TCP/IP stack, and they must be rebooted.

Take Note

In the version of the IBM Network Station used to develop this publication, if the option `config-auto-save-nvram = true` is set in the configuration file, the IBM Network Station will save every parameter into NVRAM. This is also true for the IP address in use. If DHCP decides to assign a new IP address to your IBM Network Station at next boot time and there is a different IP address stored in your NVRAM, the IBM Network Station is not able to change its IP address. This will result in an endless loop right before downloading the kernel at the next reboot. Resetting the IP address to 0.0.0.0 in the NVRAM and switching back to `IP Addressed From .... Network` will solve this problem. To avoid this problem, never configure the IBM Network Station to save the options into its NVRAM automatically or obtain the latest level of code.

9.5.3 DNS

Normally, you will have the IBM Network Station configured to use the DNS server of the boot server. If you use the static host table resolution, you can skip this section, just make sure the resolution table in the configuration files are up to date (see 4.5.1, “Configuring the Local Host Name Cache” on page 100). If you discover delays during boot or during start up of modules, this may be caused by problems with the DNS server.

If your primary DNS server does not respond, the IBM Network Station will get a delay of about 30 seconds for each query of host names. However, it is highly recommended to set up secondary name servers in your network and configure the IBM Network Station to use them in a case of failure.

Moreover, you have two possible options inside IBM Network Station Manager to set the way you are going to use a DNS. In the **Hardware -> Workstations** menu, choose the **System Defaults Settings**. You will find then the Domain Name Server section which is shown in Figure 81 on page 206.

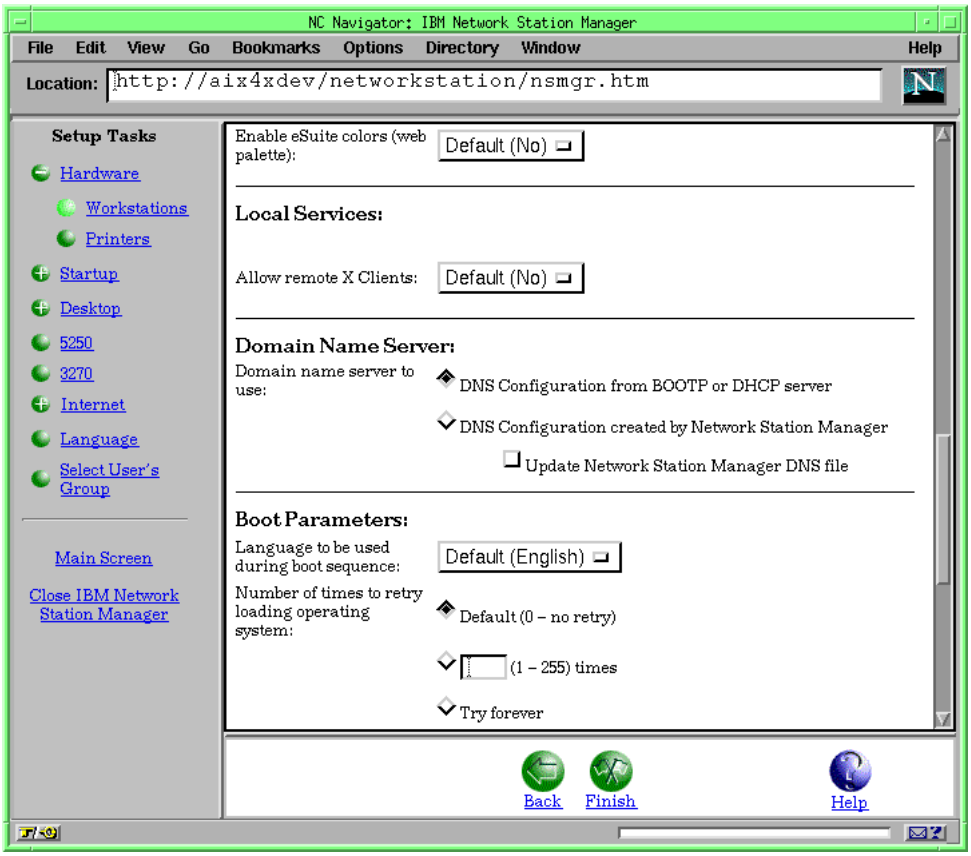

Figure 81. IBM Network Station Manager: Domain Name Server Fields

If you choose the option **DNS Configuration created by IBM Network Station Manager**, it is recommended to check the checkbox field **Update Network Station Manager DNS file** in order to take account into some possible future modifications.

Take Note

Selecting the option **DNS Configuration created by IBM Network Station Manager** overrides any existing name server or domain name configuration data provided by BOOTP or DHCP.

Discovering errors in your DNS configuration is difficult. The DNS daemon uses syslogd for logging errors, see 9.4.2, “syslog” on page 202 for information on syslogd. In addition, you can use the nslookup tool for creating queries to your DNS server and check its configuration.

For confirming DNS entry, you can use `nslookup` command and `host` command from AIX. To check the name resolution for a unit (hostname sv1200e, IP address 9.3.1.236), you can use `host` command like this:

```
host sv1200e
host 9.3.1.236
```

And output is the following:

```
sv1200e.itsc.austin.ibm.com is 9.3.1.236
```

9.5.4 Memory Fragmentation

The IBM Network Station does not have a Virtual Memory Manager. Therefore it is not able to move memory blocks to another location in its physical memory.

This results in memory fragmentation as the IBM Network Station loads and unloads external modules or data structures of dissimilar sizes. The IBM Network Station attempts to compact free memory blocks into one single, large free memory block and uses an algorithm for searching the best free memory block during the load of new modules, but you always will have some level of memory blocks that cannot be used.

How large the fragmentation of your IBM Network Station is can be verified in the memory statistic tool in the console windows. This tool shows the amount of free memory, the total amount of free memory, and the size of the largest free memory block. This last information is vital for the size of the module you are able to load before running into memory problems.

9.6 The Diagnostic Log

The diagnostic log is the primary problem determination tool on the IBM Network Station. The diagnostic log always includes a base set of messages. This set of messages may be enhanced by setting configuration options. Each message has four components, which are:

1. The subsystem generating the message
2. The message level, which may be one of the following:
   - **I** Information
   - **W** Warning
   - **E** Error
3. The message type
4. The message description and any parameters

The following list is some of the more important of the base messages. Some of the messages may not appear in your diagnostic log depending on the IBM Network Station configuration:

%TOKEN_RING_I_ADDRESS The network interface type and hardware address.

%CONFIGD-E-MOUNTFAILED The internal file server could not export the local file system because there is not memory card installed in the PC-card slot, or there is no file system on the installed card.

%CONFIGD-E-NOREAD The specified file cannot be read because either the directory containing this file was not exported, or it does not have read access to this file.

%CONFIGD-I-IPADDR The unit IP address.

%CONFIGD-I-HOSTNAME	The unit hostname (if `unit-query-for-name-at-boot` is set).
%CONFIGD-I-DOMAIN	The DNS domain (if `unit-query-for-name-at-boot` is set and `tcpip-name-server-protocol = dns`).
%CONFIGD-I-READ	The initial configuration file name.
%CONFIGD-I-READ	The imbedded configuration file names (if any).
%CONFIGD-W-NOTIME	The IBM Network Station is unable to get the local time because the configured time server is unreachable, or the IP address of the `time-server` option is not valid.
NS5005	The current boot EPROM version (if `boot-prom-update-file` is set).
%KBM-I-READINGFILE	The keyboard file name.
%FILE-I-READ	Reading font files and directories.
%XSERVER-I-NEWCLIENT	Connections from X-clients.
%NETSRV-I-ACCEPT	Access to the daemons (EXECD, CONFIGD, and DIAGD).
%RTLD-I-LOADING	Loading programs and dependent modules.

The Messages window on the Console utility displays the diagnostic messages in a scrollable window. To activate the Console utility, refer to 5.3, “Special Keys and Key Combinations” on page 119. To hide or show the messages window, toggle the **Messages** switch on the Console utility, shown in Figure 82. However, the Message window does not display the entire diagnostic log and does not include time stamps.

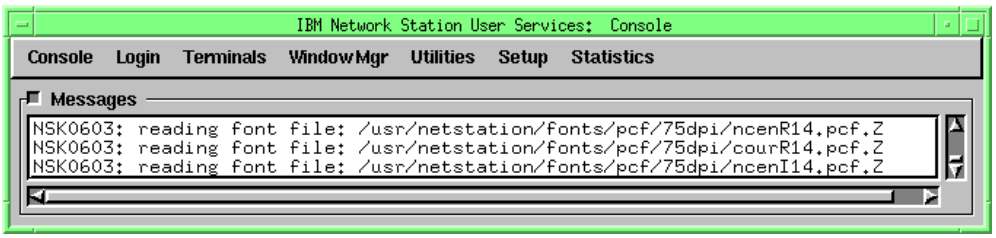

Figure 82. Console Utility Messages Window

The diagnostic log is 16 KB in size. It is possible to increase this by `using the diag-buffer-size` parameter, but a better solution is to save the diagnostic log to a file on a server as described later in this section. There are three ways to access the diagnostic log:

- Access the diagnostic log locally on the IBM Network Station. From the Console utility, select **Terminals**; then select **New Terminal**. This opens the terminal application in local mode. In the Default Hosts window, select **Diag**; then select **OK**. This opens the Local Diagnostic Manager shown in Figure 83 on page 209.

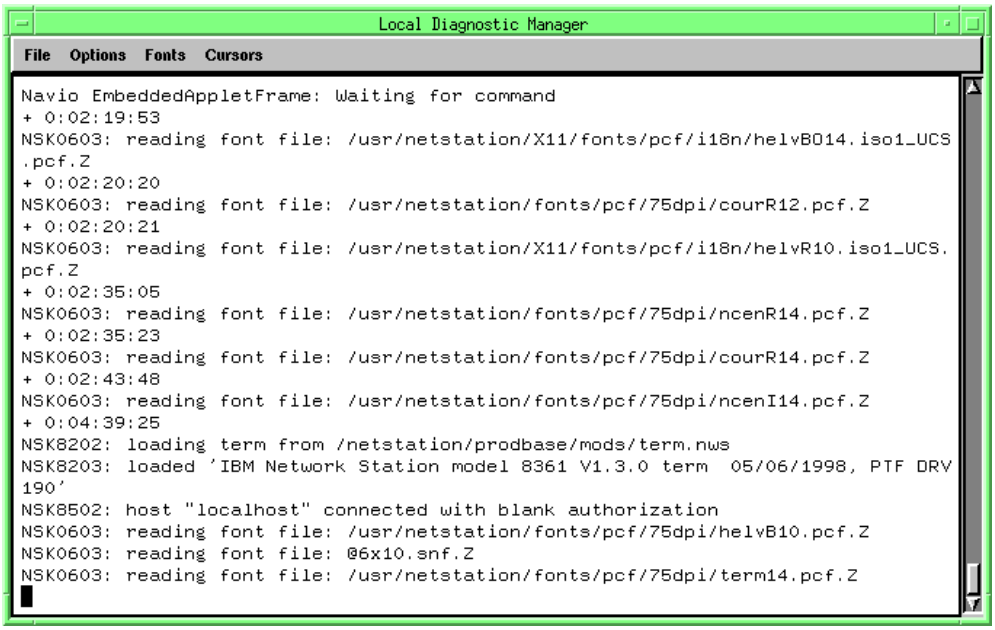

Figure 83. Local Diagnostic Manager

The entire log is displayed, but this method has very little advantage over the Messages window in the Console utility.

- Log the diagnostics messages to a file. See 4.5.9, “Generating an Error Log” on page 107, for more information.

  Note: The log file is buffered, and therefore the last few diagnostic messages may not be displayed.

- Access the diagnostics daemon. See 4.6.2, “Remote Diagnostic Access” on page 111, for more information.

  The diagnostics daemon listens for network connections, and once a connection is made, it sends all the diagnostic messages across the connection. The diagnostics daemon listens, by default, on TCP port 5998, but you can change this port using the `diag-telnet-port` parameter. When directly editing the configuration files, use the following syntax:

  ```
  set diag-telnet-port = 6998
  ```

Take Note

The port number must be greater than 1024; so you cannot set it to the telnet default port of 23. This means that you must have a telnet application that allows you to specify an alternative port.

9.7 File Access Caveats

All local file access is made through the Virtual File System (VFS), which must be correctly defined in order for the IBM Network Station to operate properly. The file server must also be correctly configured to allow the IBM Network Station access. For more information on configuring the VFS, refer to 4.5.4, “Configuring the Local File System” on page 103. You should be careful when defining the VFS,

particularly when multiple servers and protocols are involved. There are five types of operation performed through the VFS, but they are not all supported by both file access protocols as shown in Figure 46.

Table 46. NFS File Operations

Operation	Description	Protocols
OPEN	File open	TFTP and NFS
STAT	File status	NFS only
PERMCHK	File permission check	NFS only
MKDIR	Create directory	NFS only
RENAME	File rename	NFS Only

The IBM Network Station can be configured to generate a diagnostic message for any attempted file access in the VFS. When editing the configuration files directly, use the following syntax:

```
set file-extended-diagnostics = true
```

If using the Setup utility, select **File Service** from the main window, and activate the **Extended Diagnostics** switch.

The following list is a description of the content of these diagnostic messages:

%NETFILE-I-OPENATTEMPT The local file name to open (similarly for `STAT`, `PERMCHK`, `MKDIR`, and `RENAME`).

%NETFILE-I-OPENSUCCESS File open successful (similarly for `STAT`, `PERMCHK`, `MKDIR`, `RENAME`).

%NETFILE-I-MATCHATTEMPT The protocol in use (NFS or TFTP), server file name, and server IP address.

%NETFILE-W-MATCHFAIL The return status and reason for failure.

%NETFILE-E-OUTOFMATCHES No more matching entries in the VFS.

The IBM Network Station is configured, by default, with a primary and a secondary protocol to use for file access. This generates two entries for each server file system in the `file-service-table`. If the primary protocol fails, then the secondary protocol is used. There is a small performance improvement to be gained from using only one protocol. On AIX, NFS is the preferred file access protocol as described in 3.4, “NFS versus TFTP Downloads” on page 52. To use only NFS for file access, both the primary and secondary protocols should be set to NFS. When editing the configuration files directly, use the following syntax:

```
set file-initial-protocol-1 = nfs
set file-initial-protocol-2 = nfs
```

If using the Setup utility, select **File Service** from the main window, and change the option menu **Initial Protocol 1** and **Initial Protocol 2** to **NFS**.

It is possible to have multiple server file systems mapped to the same local mount point in the VFS. This may be necessary if file systems are split across multiple servers, but could also be the cause of unexpected behavior. This should be avoided unless absolutely necessary because it is inefficient.

Normally, only the longest matching entry (or entries) in the VFS is used to access a file. However, it is possible to configure the IBM Network Station so that all matches are used. When editing the configuration files directly, use the following syntax:

```
set file-try-all-matches-on-open = true
```

If using the Setup utility, select **File Service** from the main window, and activate the **Try All Matches on Open** switch. This should be avoided unless absolutely necessary because it is inefficient.

9.8 Font Caveats

Most of the font warning messages generated in the diagnostic log can be ignored. If a particular font cannot be found, an alternative font is selected. The missing font messages are generally caused by improper access to the AIX X11 fonts in /usr/lib/X11/fonts.

Take Note

There is a problem with the CDE resource file /usr/dt/config/$LANG/sys.font, which incorrectly specifies font names with a trailing `':'`. This can result in a kernel panic under certain situations but only when using CDE. To check if this is a problem on your system, run the following command and check for a `':'` at the end of the `*FontList` resource. If it is present, then you should override the font resources with those supplied with the IBM Network Station Manager. The easiest way to do this is to create a file /etc/dt/config/$LANG/sys.resources that contains the following line:

```
#include "/usr/netstation/SysDefaults/sys.font"
```

This will ensure that the fix remains in place even if the CDE code is updated. Then logout and login to CDE and check again.

The nsconf script will configure the X11 font server if it is installed as described in 2.7, “Alternate Installation” on page 32. If there is no font server available (for example with AIX V3), these files can be accessed using the VFS by adding the /usr/lib/X11/fonts directory to the VFS and to the font path. When directly editing the configuration files, use the following syntax:

```
set file-service-table[-1] = { "/usr/lib/X11" nil \
9.3.1.27 nfs "/usr/lib/X11" unix 3 30 8192 8192 }
set xserver-default-font-path {
   { built-ins }
   { "/usr/lib/X11" }
}
```

If using the Setup utility, select **File Service** from the main window, and edit the **File Service Table** as described in 4.5.4, “Configuring the Local File System” on page 103. Next, select **Fonts** from the main window, and edit the **Default Font Path** table as described in 4.4.4, “Editing Parameter Tables” on page 99.

Some X applications attempt to set the font path and assume that they are executing on a UNIX host with a standard UNIX file system. If the font path cannot be found in the VFS, a diagnostic message of type `%XSERVER-E-BADFONTPATHELEMENT`

is generated. It is possible to configure the VFS to eliminate these messages. However, as long as the fonts are available using the X11 font server, this should not cause a problem.

The IBM Network Station is able to use all of the standard X11 font utilities to examine the available fonts. To list all of the available fonts, use the following command:

```
xlsfonts
```

To list the currently set font path use the following command:

```
xset -q
```

The IBM Network Station internal fonts are denoted by the *built-ins* path. The following is a list of the available internal fonts:

- -adobe-helvetica-bold-r-normal--14-100-100-100-p-82-iso8859-1
- -adobe-helvetica-bold-r-normal--17-120-100-100-p-92-iso8859-1
- -dec-terminal-medium-r-normal--14-140-75-75-c-8-iso8859-1
- -misc-fixed-medium-r-normal--10-100-75-75-c-60-iso8859-1
- -misc-fixed-medium-r-normal--13-120-75-75-c-80-iso8859-1
- -misc-fixed-medium-r-normal--15-140-75-75-c-90-iso8859-1
- -misc-fixed-medium-r-normal--20-200-75-75-c-100-iso8859-1
- -misc-fixed-medium-r-semicondensed--13-120-75-75-c-60-iso8859-1
- -ncd-terminal-medium-r-normal--18-140-100-100-c-110-iso8859-1
- 10x20
- 6x10
- 6x13
- 8x13
- 9x15
- Cursor
- Fixed
- Vtsingle

Note: It is possible for applications or users to dynamically modify the font path. Refer to the `xset` command in your AIX documentation for more details.

Normally, the X-server will access the fonts in /usr/netstation/fonts using the VFS. However, it is possible to use the X11 font server for all font access. A small performance increase may be noticed when using this method. You must specify only the internal fonts and the X11 font server in the font path. When directly editing the configuration files, use the following syntax:

```
set xserver-default-font-path = {
   { built-ins }
   { "tcp/9.3.1.27:7500" }
}
```

If using the Setup utility, select **Fonts** from the main window, and edit the **Default Font Path** table as described in 4.4.4, “Editing Parameter Tables” on page 99.

You must also change the X11 font server configuration file /usr/lib/X11/fs/config to include the /usr/netstation/fonts directories as in the following example:

```
catalogue = /usr/lib/X11/fonts/,/usr/lib/X11/fonts/misc/,
/usr/lib/X11/fonts/75dpi/,/usr/lib/X11/fonts/100dpi/,
/usr/lib/X11/fonts/i18n/,/usr/lib/X11/fonts/ibm850/,
/usr/lib/X11/fonts/Type1/,/usr/lib/X11/fonts/oldx10/,
/usr/lib/X11/fonts/oldx11/,/usr/lib/X11/fonts/info-mac/,
/usr/lib/X11/fonts/bmug/,/usr/netstation/fonts/pcf/100dpi/,
/usr/netstation/fonts/pcf/dw100dpi/,/usr/netstation/fonts/pcf/misc/,
/usr/netstation/fonts/pcf/java/,/usr/netstation/fonts/pcf/ns3270/
```

Then restart the font server using the following commands with AIX 4.3.x:

```
stopsrc -s xfs
startsrc -s xfs
```

9.9 X-Server Extensions

X-server extensions are additions to the standard X protocol that provide extra function in the X-server. The extension modules must be linked into the X-server and are specific to a particular software architecture. If an X application attempts to use an unsupported extension, you will get a diagnostic message of type `%XSERVER-W-NOEXTENSION`. Well-behaved X applications check for the existence of a particular extension before using it. If it is not available, they should choose an alternative method or exit gracefully. The IBM Network Station X-server supports the following extensions:

- SHAPE
- MIT-SUNDRY-NONSTANDARD
- XIdle
- XC-MISC
- ServerManagementExtension
- NCD-SETUP
- NCD-WinCenterPro
- DEC-XTRAP
- XInputExtension
- NCD-SIE
- XTEST

This list can be generated by running the `xdpyinfo` command. All of the extensions are defined as symbols for the X resource database preprocessor. These symbols can then be used to create conditional statements to set X resources for the IBM Network Station only. The `NCD_SETUP` extension is normally used for this purpose as in the following example:

```
#if defined (EXT_NCD_SETUP)
XLock.remote: on
#endif
```

9.10 Configuration File Syntax Errors

Configuration file syntax errors are of type `%CONFIGD-E-SYNTAX` and are associated with a line number. The associated file will be the previous `%CONFIGD-I-READ` type message unless you have imbedded files with the `read` statement interspersed with the parameter `set` statements. For this reason, it is recommended that you imbed files at the beginning of a configuration file.

9.11 NVRAM Parameter Persistence

Not all of the NVRAM parameter settings are defined in the IBM Network Station configuration files. Consequently, some parameters will not revert to their default values after a reboot. For example, the default value for the `file-try-all-matches` parameter is `false`. If you add `set file-try-all-matches = true` to /usr/netstation/nsm/StationConfig/defaults.dft and reboot the IBM Network Station, the parameter will be set to `true`. If you then remove the parameter from /usr/netstation/nsm/StationConfig/defaults.dft, you might expect the parameter to default back to `false`. This is not the case. As a result, the parameters in the IBM Network Station NVRAM may not match the parameters in the configuration files, and if an IBM Network Station is swapped, the new unit may have a different configuration to the old unit. Therefore, you should not remove parameters from the configuration files if they are no longer needed but simply change them to their default values. Once all of the IBM Network Stations have rebooted, the parameters can then be safely removed.

9.12 Restoring NVRAM Default Values

To load the default values into NVRAM, you must first enter the Boot Monitor as described in 5.3, “Special Keys and Key Combinations” on page 119. Then use the following procedure:

1. Enter `nv` to start the NVRAM utility.
2. Enter `l` to load the default values.
3. Enter `s` to save the values to NVRAM.
4. Enter `q` to quit the NVRAM utility.

9.13 Updating the Bootflash

If you have chosen through IBM Network Station Manager to automatically update the NVRAM of your IBM Network Stations, the two following parameters are set in /usr/netstation/nsm/StationConfig/defaults.nsm:

```
boot-prom-update-file
boot-token-ring-update-file
```

Take Note

There is no recovery built into the bootflash update process. It is imperative that you do not cycle the power during the EPROM burn.

The parameter `boot-token-ring-update-file` is new with NSM Release 3 and allows you to differentiate the IBM Network Station equipped with an Ethernet or a Token-Ring attachment.

Then, the kernel checks the version of the specified file with that of the current bootflash. If there is any difference, uplevel, then the kernel will burn the bootflash into the EPROM.

9.14 Boot Monitor Commands

The Boot Monitor program has a small set of commands that can help with problem diagnosis and recovery. To enter the Boot Monitor, you have a choice between two methods, depending on the status of the IBM Network Station:

- The first method consists of rebooting and interrupting the boot sequence. Proceed as follows:

  1. Once the boot sequence has been interrupted, enter the administrator password if necessary on panel SCRN01. This brings you to the Setup utility main menu (SCRN02).
  2. From SCRN02, use one of the following key combinations:

     101/102 keyboards Press and hold simultaneously (use both hands)
     Left Alt + Left Ctrl + Left Shift + F1

     5250/3270 keyboards Press and hold simultaneously
     Left Alt + Left Shift + F1

     The prompt character (>) appears, indicating you are now able to enter Boot Monitor commands.
  3. Use the Boot Monitor commands (see 9.14.1, “Listing the Boot Monitor Commands” on page 216).
  4. Leave the Boot Monitor commands mode by once more entering the same key combination as above.

     This will bring you back to the administrator panel (SCRN01).
  5. Enter the password if necessary and reboot.

- The second method assumes the IBM Network Station is already up and running.

  Take Note

  You cannot return to your current session from the Boot Monitor. All unsaved information in your session will be lost. The Boot Monitor can only exit to the Setup utility.

  Proceed as follows:

  1. Press the following key combination:

     Left Alt + Caps Lock + Pause

     The prompt character (>) appears indicating you are now able to enter Boot Monitor commands.

2. Use the Boot Monitor commands (see 9.14.1, “Listing the Boot Monitor Commands” on page 216).
3. Leave the Boot Monitor commands mode by once more entering the same key combination as above; that is:

   Left Alt + Caps Lock + Pause

   This will bring you back to the administrator panel (SCRN01).
4. Enter the password if necessary and reboot.

   101/102 keyboards Press and hold simultaneously (use both hands): **Left Ctrl + Left Alt + Left Shift + F1**

   5250/3270 keyboards Press and hold simultaneously: **Left Alt + Left Shift + F1**

   The prompt character (>) appears, indicating you are now able to enter Boot Monitor commands.

9.14.1 Listing the Boot Monitor Commands

To list the available commands, at the prompt, press any of the following three keys:

? or **h** or **H**

The monitor will list all available commands.

Figure 84 on page 216 lists the commands available with Version V2.8.ad of the Boot Monitor.

```
 BL[file] boot locally
BN[file][local-IP host-IP][gateway-IP][subnet-mask] boot via nfs
BT[file][local-IP host-IP][gateway-IP][subnet-mask] boot via tftp
DA display addresses
DM[addr][len] display memory
DR display registers
DS display booting statistics
EX extended tests
KM keyboard mapper
KS keyboard/mouse statistics
NF[rsize] set block size from 128 to 8192 bytes
NV NVRAM utility
PI[timeout][local-IP host-IP][gateway-IP][subnet-mask] ping host
RS reset system
SE NVRAM setup
SM show memory configuration
ST stack trace
TM[mtu] set token ring Max Trans Unit (MTU)
TR[4 or 16] set token ring network speed
UN[file][local-IP host-IP][gateway-IP][subnet-mask] upload via nfs
UP[file][local-IP host-IP][gateway-IP][subnet-mask] upload via tftp
ZK zero keyboard/mouse statistics
ZS zero boot statistics
```

Figure 84. IBM Network Station Boot Monitor Commands

Note: Depending on the Boot Monitor resolution, this list and the output of some of the Boot Monitor commands will not fit entirely on the screen. In this case, a

message is displayed on the bottom line of the screen, and the Boot Monitor enters a wait. Pressing any key will cause the listing to resume.

9.14.2 Using the Boot Monitor Commands

To use a command, enter it at the prompt, using either lowercase or uppercase characters. While entering the commands, the following key combinations may be used for editing the line:

Ctrl + a Home. Moves the cursor to the first position on the line, without deleting any characters.

Ctrl + b Moves the cursor to the left (without deleting characters).

Ctrl + f Moves the cursor to the right (without deleting characters).

Ctrl + d Deletes the character at the current position.

Ctrl + h Backspace (deletes characters).

Ctrl + e Positions the cursor at the end of the line.

Ctrl + k Clears characters from the current position until the end of the line.

Ctrl + u Clear. Moves the cursor to the first position on the line, deleting all characters.

Ctrl + j Line feed to next line.

Ctrl + m Enter.

Ctrl + n Retrieves the next command.

Ctrl + p Retrieves the previous command.

The following list describes the Boot Monitor commands in more detail:

`BL` Read the specified boot file from the local file system. This command has the following syntax:

```
BL <file>
```

`BN` and `BT` These commands read the specified boot file. The `BN` command uses NFS and the `BT` command uses TFT. These commands have the following identical syntax (only the `BN` command is shown):

```
BN <file> <local-IP host-IP> <gateway-IP> <subnet-mask>
```

Note: The command line parameters are positional. For example, to specify the third parameter, you must also specify the first and second parameters.

`DA` Displays the IP addresses known to the IBM Network Station.

`DM` Displays the IBM Network Station memory contents. This command has the following syntax:

```
DM <address>
```

`DR` Displays the processor registers.

`DS` Displays boot statistics.

`EX` Enters the extended tests menu.

`H` Lists the Boot Monitor commands.

`KM` Keyboard mapper.

`KS` Displays keyboard and mouse statistics.

NF Sets the read block size to be used by IP applications such as TFTP. Entering the command without parameters displays the current setting. To set the read block size, use the following syntax:

```
NF <read block size>
```

If the network path from the server to the IBM Network Station includes a router or other element that does not support datagram fragmentation and reassembly, you must use this command to set the frame size to the smallest of the frame sizes allowed by the elements in the network path.

The block size must not be smaller than the minimum MTU size in your network.

In general, larger block sizes mean better performance, but for Ethernet networks, as the number of stations increases, the number of collisions also increases. In this situation, smaller block sizes may actually yield better performance.

NV Enters the NVRAM utility menu. The following is a list of the valid subcommands:

```
C <address> - Change contents at address.
D <start-address> <end-address> - Display contents  between
addresses.
L - Load defaults X server.
Q - Return to boot monitor main menu.
R - Reload factory defaults.
S - Save.
```

PI This is the standard `ping` command. It is useful to confirm that a host is active. This command has the following syntax:

```
PI <timeout> <local-IP host-IP> <gateway-IP> <subnet-mask>
```

Note: The command line parameters are positional. For example, to specify the second parameter, you must also specify the first parameter.

RS Restarts the system as if you had pressed the power button.

SE Switches to the Setup utility and displays the main menu panel (SCRN02).

SM Displays the memory configuration.

TM Sets the Maximum Transmission Unit (MTU) size. Entering the command without parameters displays the current setting. To set the MTU size, use the following syntax:

```
TM <MTU>
```

For Ethernet, this value is normally limited to a maximum of 1536 bytes. The MTU value should be less than or equal to the smallest of the MTU sizes of the hosts to be accessed from the IBM Network Station. This value should be obtained from your network administrator.

TR Sets the token-ring adapter speed. This command has the following syntax:

```
TR 4 | 16
```

You should not need to set the speed because the IBM Network Station automatically determines the correct value.

UN and UP
: These commands upload a snapshot dump of the IBM Network Station memory to a server. The UN command uses NFS, and the UP command uses TFTP. Once on the server, the dump file can be forwarded to IBM support. These commands have the following identical syntax (only the UN command is shown):

  ```
  UN <file> <local-IP host-IP> <gateway-IP> <subnet-mask>
  ```

  Note: The command line parameters are positional. For example, to specify the third parameter, you must also specify the first and second parameters.

ZK
: Clears the keyboard and mouse statistics that are displayed using the KS command.

ZS
: Clears the boot statistics that are displayed using the DS command.

Undocumented Commands

The following two commands are not listed in the available documentation:

DF
: Displays eight lines of 32 characters each, corresponding to the 8-bit ASCII table.

MT
: Causes the display monitor to enter a loop of grid and bars patterns. The only way to stop this loop is to power off the IBM Network Station.

For more information on the Boot Monitor commands, see *IBM Network Station Service Information*, SY44-0068.

Appendix A. NC Navigator

This appendix describes the Web browser that is designed for the IBM Network Station.

A.1 Introduction

NC Navigator 3.0x for the IBM Network Station is a fully compatible subset of the popular Netscape Navigator 3.0x browser. It features the same *look and feel* of versions of Navigator 3 found on other platforms; so users who are already familiar with Navigator will feel right at home and will have a browser which produces the same results on-screen as any other version of Netscape Navigator 3.

It is an upgrade of the existing NC Navigator 3.0x product that was introduced on Release 2 of the IBM Network Station, and it replaces that product in Release 3 of the IBM Network Station.

The code is based on a port of the UNIX/Motif version of Netscape Navigator 3.0x to ensure high compatibility with the original Netscape product. The porting work is done by Network Computer Incorporated (NCI), formerly Navio Communications.

The Navio brand is dropped, and the official product name is now NC Navigator, a trademark of NCI.

Key features available in this release of the browser include the following:

- Ability to display Web pages that contain text, HTML, GIF images (including animated GIFs), and JPEG images in a manner that is compatible with the UNIX version of Netscape Navigator 3.0x.
- JavaScript 1.1 (same as in Navigator 3.0x).
- SSL 2 and SSL 3 encryption, at 128- or 40-bit levels (in separate versions of the product, for US & Canada or export, respectively), with server and client certificates.
- Ability to execute Java applets.

A.2 New Features in IBM Network Station Manager Release 3

Features new to this product compared to its predecessor are:

- The Mail client function, which allows a IBM Network Station user to be able to receive e-mail from a POP3 server. Previously, it had been possible to send e-mail but not receive it.
- The News Reader function, which allows a IBM Network Station user to read news items on an NNTP server.
- Ability to print to remote printers (printers elsewhere in the network). Previously, it had only been possible to print to a locally-attached printer.
- Ability to execute Java applets that require authentication, for example applets that are stored on a server that require a user ID and password. Previously, it had not been possible to execute such applets.

- Ability for the JVM to use the auto-proxy feature when running applets from the browser. Previously, the JVM could not access the auto-proxy configuration used by the browser, and it was always necessary to manually configure proxies if they were needed.
- Some (but not full) support for Java Version 1.1.
- Localized versions in French, German, and Japanese (in addition to English), as well as the ability to display content using many new document encodings (including Korean, traditional and simplified Chinese, Turkish, Greek, Russian, and Central European).
- Ability to invoke the 3270 emulator and telnet applications from the browser using URLs of type `TN3270:` and `TELNET:`.
- Roaming capability, where a user can run the browser from an IBM Network Station that has been booted from his home server, yet still be able to access his original preferences. See A.4.4, “Roaming” on page 225, for more information.
- Read-only mode, which allows the browser to be used in situations where end-users are not allowed to make any changes to the browser configuration, save anything into the file system, modify anything in the file system (including bookmarks), send any e-mail, and so forth. This mode is intended for kiosk or *walk up and use* situations. It also allows the browser to operate when the IBM Network Station is run without a server and the code is loaded from a flash card. This mode can be turned on or off from the IBM Network Station Manager.
- Chromeless mode, in which the screen area available for content is maximized by the suppression of the *chrome* items (such as the various toolbars which appear at the top of the browser window). This mode can be turned on or off from the IBM Network Station Manager.

A.3 Features Included in Netscape Navigator but Not in the NC Navigator

Features found in other versions of Netscape Navigator 3.0x but that are not available in this product include:

- Helper applications and plug-ins. This means that the browser is unable to display mime types that are not natively supported by the browser, including audio, video, Shockwave, Adobe Acrobat (PDF), to name a few.

Features found specially in Netscape Navigator 4.0x but not in this product include:

- Dynamic HTML as defined by Netscape Navigator 4.0x, including HTML positioning and layering, dynamic style sheets, dynamic fonts, and the use of the new `<object>` tag for invoking applets.
- The new GUI provided by Navigator 4.0x.
- JavaScript 1.2

Although the browser will run on any model of the IBM Network Station that has at least 16 megabytes of memory (more memory is required if Java is used), for best results, a minimum configuration of a Series-300 (66 MHz GCX model) with 24 megabytes of memory is recommended. The browser requires IBM Network Station Manager Release 3 and will not run on any previous release (1, 2, or 2.5).

The 40-bit version of the browser is now included as part of IBM Network Station Manager Release 3 (similar to the 5250 and 3270 emulator applications), thus simplifying the ordering and installation process. It is automatically installed as part of the installation of the Network Station Manager. However, the 128-bit version of the browser is still a separate product that must be ordered and installed separately due to US export law restrictions. When installed, it replaces the 40-bit version of the product.

As before, the browser will continue to use the Java Virtual Machine (JVM) provided by the Network Station instead of using the built-in Netscape JVM. In this release, the JVM has been upgraded to JDK level 1.1.4.

A.4 Specifications

This section includes the main external and internal specifications of the NC Navigator, but it is not exhaustive.

A.4.1 Content Types Supported

The browser supports the following MIME types as described in Table 47.

Table 47. Supported MIME Types

Type / Subtype	Usage
text/plain	plain text with no HTML tags
text/html	text with HTML markup tags text/html
image/gif	GIF images, including animated GIFs
image/jpeg	JPEG images
image/xbm	XBM images
applications/x-ns-proxy-autoconfig	automatic proxy configuration

No other MIME types are supported because they require plug-ins or helper applications.

A.4.2 URL Types Supported

The browser can handle the following URL types, as described in Table 48.

Table 48. URL Types Supported

URL types	Usage
HTTP	Display content using HTTP protocol (Web page with HTML)
HTTPS	Same as HTTP, but using SSL security
MAILTO	Invoke the e-mail editor to create and send an e-mail message
ABOUT	Display information about the browser, including: <blank> = display the splash screen cache = display disk cache usage and contents memory-cache = display memory cache image-cache = display image cache build = display build ID (unique to NC Navigator)
FTP	Open an FTP session

URL types	Usage
WAIS	Open an WAIS session
JAVASCRIPT	Run JavaScript
MOCHA	Same as JAVASCRIPT (probably for historical reasons)
VIEW-SOURCE	Display source file
TELNET	Start a telnet session
TN3270	Start a TN3270 session
NEWS	Invoke the news reader application

A.4.3 Security

As with Netscape Navigator 3 or 4, the NC Navigator supports different levels of encryption.

A.4.3.1 Levels of Encryption

The browser provides the ability to access URLs of type HTTPS to provide encryption of the data that flows between it and the server using the secure sockets layer (SSL).

As with the previous release of the browser, there are two versions of the browser in this release:

- A version with 40-bit encryption, for sale and use anywhere in the world.
- A version with 128-bit encryption, for sale and use only in the USA and Canada.

These two versions are externally identical, the only difference being the level of encryption supported. The 128-bit version of the browser is a superset of the 40-bit version. It can handle content that has been encrypted with 40 bits of encryption as well as 128 bits.

A.4.3.2 Securing Transactions

NC Navigator provides both SSL 2 and SSL 3 levels of security for transactions. Server certificates are supported, allowing browser users to connect to applications on servers which use certificates to authenticate themselves; so the browser user is assured that the server can be trusted.

One of the features of SSL 3 is client certificates, which allows a browser user to obtain and use a digital ID to authenticate himself to an application on a server, so the server can be assured that the browser user can be trusted.

Client certificates, if present, are stored for each user by the browser in the file system in the $(HOME)/NAV directory (there is one of these per user ID). They are stored in the clear, with a checksum. The protection of these certificates depends upon the integrity and security of the server's file system, as well as the security of the connection between the IBM Network Station and the server.

A.4.4 Roaming

The browser will provide limited *roaming* capabilities. Roaming is the ability for a user to use a IBM Network Station that is attached to a server other than its home

server, yet still have access to his established defaults and preferences. In this section, the term *files* refers only to those files that are shared between the browser and NSM, which are only the set of files named *pref*.

An additional complication exists because there are incompatibilities between the files used by Navigator 3 in NSM Release 2.x and the files used by Navigator 3 in this release. Release 2.x files are in ASCII format, while Release 3 files introduce an additional format, Unicode. However, the Release 3 browser is able to read files in either format.

For this reason, It will not be possible to use the Release 2.x browser to access files created by the Release 3 browser.

A.4.5 Directories and Files Used

Although the browser runs on a diskless IBM Network Station, it still makes extensive use of a file system. In this case, the file system is located on a server system and is accessed using normal file system APIs that are redirected to the actual file system on a server system using NFS or equivalent.

The browser never uses any hard-coded paths to find the files it uses. All paths are dynamically constructed, and environment variables are always used to define the highest level qualifiers of all paths to ensure that the browser will work properly across all server systems. Thus, the browser never reads or writes to directories such as /temp, /etc, /usr, and so forth.

A.4.5.1 Home Directory

Navigator normally stores a variety of files in a directory called .netscape in the user's file space. On the IBM Network Station, the NAV directory under the user ID will be used.

All items stored in this directory are built dynamically by the browser. None of them are shipped objects.

The working directory is located by: `${HOME}/NAV/'` under the path /usr/netstation/users/*username*/NAV/ and is created by either the browser or NSM, whichever has need for it first.

Table 49 describes some items stored in this directory.

Table 49. Home Directory Content

Name	Description
bookmark.html	Bookmarks
cookies	Cookies
preferences	Preferences set by the user through browser dialogue boxes
cache/	Directory for disk cache (usually not present)
tmp/	Directory for temporary data
nsmail/	Directory for holding mail that has been read from POP3 server
news/	Directory for temporarily holding news items from NNTP server
proxyconf	Automatic proxy configuration file

Name	Description
address-book.html	Address book
certificates	Various security items, including client certificates

In addition, some of the mail and news items will need to be stored in this directory. Moreover, It is assumed that only the person authorized to the user ID can access this directory.

A.4.5.2 Temporary Directory

NC Navigator requires the use of a temporary directory. In other versions of Navigator, the user can specify the location of the temporary directory through a user dialogue setting. On the IBM Network Station, the temporary directory is located by `${HOME}`/NAV/tmp/ under the path /usr/netstation/users/*username*/NAV/tmp and is created by the browser, when needed.

This type of temporary directory is needed because the IBM Network Station does not support the concept of a UNIX temporary directory (/tmp). Thus the browser will never use /tmp, but will use this directory instead. Management of the contents of this directory are the responsibility of the browser. Normally, the browser will erase the contents of this directory each time the NC Navigator is invoked.

Similarly, the IBM Network Station does not provide a /null directory, and so it is not used by the browser, either.

A.4.6 Java Support

Unlike other versions of Navigator which include their own built-in Java virtual machine (JVM), this version uses a JVM supplied by the IBM Network Station. This requires changes to Navigator.

Despite these changes, the overall objective is to provide functionality and operation which is equivalent to that provided by the other versions of Navigator.

The IBM Network Station JVM is shared by all applications that run on the IBM Network Station and is currently limited to being able to execute one Java applet or application at a time. The Desktop Launcher arbitrates between requests for use of the JVM, and thus the browser uses the Desktop Launcher to execute Java.

Moreover, the browser will not implement the Java Console. All Java messages will be written to the IBM Network Station Console.

A.4.6.1 New Capabilities with NSM Release 3

New in this release is the ability to run Java applets which require authentication, as well as for the JVM to use the browser's auto-proxy feature for obtaining proxy configuration information when running at the request of the browser.

A.4.7 E-mail and News Reader Support

The e-mail function is enabled in this release of the browser, thus providing the ability to receive e-mail from a POP3 server as well as send e-mail to an SMTP server. Movemail is not supported.

The news reader function is also enabled, allowing the user to read news items from an NNTP server.

Configuration of certain items is either controlled by NSM or is automatically preconfigured as shown in Table 50. All other items that are present in the Mail and News Preferences dialogue boxes under the **Options** pull-down can be configured by the end user.

Table 50. E-mail and News Reader Configuration

Property	Function	How handled
SMTP Server	Defines server for outgoing mail	NSM
POP3 Server	Defines server for incoming mail	NSM
POP3 User Name	Name of user for receiving mail	Defaulted to value in USERID environment variable, but user can change
Check for Mail	Sets how often NC Navigator should check the POP3 server to see if mail has arrived	NSM
Mail Directory	Where mail is stored after it has been retrieved from the POP3 server	Set to fixed value; cannot be changed
News (NNTP) Server	Defines server for news function	NSM
News Directory	Where news items are stored temporarily	Set to fixed value; cannot be changed

Storage of e-mail items that have been removed from the POP3 server will be in the user's file space (the directory pointed at by the HOME environment variable) on the server system. This is done through the use of configuration statements in the default pref file.

NNTP (news) items will also be stored in the user's file space.

A.4.8 Printing

Printing support is enhanced to allow printed output from the browser to be directed to other printers on the network.

The browser will use the IBM Network Station print APIs. These APIs will be used to support the browser printer selection dialogues for the selection of any network-accessible printer.

All printed output will be in PostScript level 1. The browser will limit the possible target printers to only those printers which have been defined as PostScript printers. No PCL or ASCII printers will be shown in the printer selection dialogue box that is presented by the browser.

A.4.9 Migration and Coexistence

When the IBM Network Station Manager Release 3 is installed on a server which has a previous IBM Network Station Manager release installed, the IBM Network Station Manager installation program will do the following:

- Change the IBM Network Station directory structure to conform to the Release 3 design.
- Copy all Navigator pref files to their new locations.
- Copy all files (bookmarks.html, cookies, and so forth) from the Navigator HOME directory to its new location
- Delete the old directories.
- Convert all four existing Navigator pref files to Unicode, if they exist.

A.5 Java Limitations

Although IBM objective has been to have the browser provide support that is identical to the equivalent version of Netscape Navigator, there are some differences in the area of Java. This occurs mostly because the browser uses the IBM Network Station Java Virtual Machine instead of the built-in Netscape JVM that is used by all other versions of Navigator on other platforms.

This section will provide some guidance as to the nature of these differences.

A.5.1 Out of Memory Error on Running Java Applets

You may encounter a situation where a java applet on a HTML page may fail to run with an error message on the console of the IBM Network Station, stating "Out of Memory". If selecting the **show memory** option from the statistics pulldown menu on the console window shows there is enough memory available on the IBM Network Station; this might be a cause of confusion.

The reason for this is that you might tend to interpret the error message to mean that the IBM Network Station itself has run out of memory, which is incorrect. The message should be interpreted to mean that the JVM has run out of Java heap space and is unable to run any more applets.

To solve this problem, enter Network Station Manager, and select the **Internet**->**Applet Viewer** menu. Then, select the **User defaults** checkbox on the scope panel for this user and press the **Next** button. Once on the settings page for AppletViewer for this user, set the **Java Heap size** to a larger value than what it is set to. Press the **Finish** button at the bottom of the page to commit the change. Logging out and logging back on the IBM Network Station will cause the change to take effect. From then on, you should be able to restart the browser and be able to run the applet(s) that you had tried to run previously before they ran out of Java Heap memory.

A.5.2 NC Navigator and JVM 1.1.x

While the Navio NC Navigator is a port of the UNIX version of Netscape Navigator 3, Netscape's JVM was not ported along with it. Instead, the NC Navigator uses the IBM Network Station’s own JVM. This is different from other versions of Netscape Navigator which always come bundled with, and highly integrated with, Netscape's JVM. The JVM that Netscape bundles with Navigator 3 is at JVM level

1.0.2, which was the same level as originally shipped with the IBM Network Station. In Release 2.5 of the IBM Network Station Manager, the JVM was ungraded to level 1.1.2, and consequently, that is what Navio NC Navigator now uses. Users may thus be under the impression that if they write Java code for JVM 1.1 that it will work running as an applet in Navio NC Navigator.

However, certain JVM 1.1 features (such as signed applets and others) also require explicit browser support to work, and that support is not provided in NC Navigator 3. Thus it is not safe to assume that just because the IBM Network Station support JVM level 1.1 as of Release 2.5 that all such applets will run from Navio NC Navigator. Items that are known not to work include:

- JAR files
- Signed applets and signed JAR files

A.5.3 Java Applets in an HTTPS Page

If you reference a Java applet from a secure page, a page that is accessed through a URL of type `https`, you will get an unknown protocol error message. This is because the JVM on the IBM Network Station does not support SSL and cannot use the browser SSL capability because the JVM is separate from the browser on the IBM Network Station.

This restriction, which requires a change or addition to the JVM, is a current restriction.

A.5.4 Communication between Two Applets on the Same Page

When two applets are on the same HTML page and one tries to find the other, there are problems. In Java, there is a method to find another applet on the same page; this method does find the applet object, but does not recognize it as an applet, and this causes a `ClassCastException`.

In the following example, you have a description of what one customer did to solve the problem: In this design, two applets on the same HTML page are used. One applet was called `JComm` communicates to the host, the second applet, `NetDSM`, is a 2915/3270 emulator. On start up of the second applet `NetDSM`, the applet was looking for the `JComm` applet on the same page to establish the communication to the host. In Java, there is a method to find another applet on the same page, this method did find the `JComm` object, but did not recognize it as an applet and this gave us a `ClassCastException`. To avoid this trouble, you have not to look for the `JComm` object anymore by including `JComm` as class in the `NetDSM`.

The following code segment shown in Figure 85 contains one method how this problem was solved.

```
//---------------------------------------------------------------------
public boolean FindJComm()
{
    Enumeration  AppletList;
    Applet       Next;
    try
    {
       AppletList = getAppletContext().getApplets();
       while (AppletList.hasMoreElements()) {
          Next = (Applet)AppletList.nextElement();
          // This caused a ClassCastException in  the NAVIO browser
          if(Next instanceof JComm) {
              Comm = (JComm)Next;
              return true;
          } // endif
       } // endwhile
    }
   catch (Exception e) {
      e.printStackTrace();
      // Link it staticly in the case of an exception and also in
      // the case of the ClassCastException in the NAVIO browser
      Comm = new JComm();
      return true;
   }
   // JComm not found, link it staticly
   Comm = new JComm();
   return true;
}
```

Figure 85. Communication between Two Applets on the Same Page

A.5.5 Multiple Windows Appearing for the Same Java Applet

When a browser user presses **shift-Reload**, the Web page and all of its contents are reloaded from the HTTP server (instead of from the browser cache). In a normal Netscape implementation, if the page contains a Java applet, the `destroy()` function is called to close the applet, and then `init()` follows to restart the applet. However, on the IBM Network Station, only the `init()` function is performed and not the `destroy()`. This causes an extra instance of the applet to be started, and if that applet opens a window, that extra window will remain displayed. Each time the user presses **shift-Reload**, another extra window will be opened. So, IBM recommends not pressing **shift-Reload**.

Appendix B. Thin Client Product Comparison

This appendix introduces a selection of thin clients from several manufacturers and discusses their differences. The configurations and capabilities are given.

This information is based on publicly available information, information made available by various companies, and opinions of the authors. The information contained in this presentation is believed to be accurate by the authors at the time of writing. However, IBM does not warrant or guarantee the accuracy of this information.

B.1 Positioning the Different Technologies

Table 51 outlines different technologies which are designed to reduce the Total Cost of Ownership (TCO) of the installed client terminals

Table 51. Positioning

Device	Characteristics
Network Computer	Runs local applications using Java Windows applications run only in a remote NT server Does not depend on a disk drive Various models run local emulation, X-server, ICA, browser
Windows Based Terminal	Originally a $500 Windows CE-based client. For now, can use other OS. Runs everything at the NT server via T.Share or ICA Does not run browser, Java, or applications locally No disk Vendor option to embed a local emulator Local boot
Intel Lean Client	Optimized for Intel architecture Specifications were out in early 1998. Devices in mid 1998 Addresses end-to-end (client, server, management) Supports a variety of operating systems: Microsoft, IBM WSOD, Citrix, NCI, Novell, SCO are working with Intel Similar end objective to IBM Network Station
NetPC	Sealed, Pentium PC No floppy disk Achieves improved manageability through Zero Administration Windows (ZAW) software Can boot from network or hard disk and run local Windows applications
Managed PCs	Uses the same ZAW software that drives NetPC Full PC client - but ZAW can lock down and control the desktop As PC price declines, this has become more popular than NetPC Full ZAW software support won't arrive until late 1998 or 1999 (NT 5.0)

B.2 NC Elements between WBT and NetPC

Figure 86 shows an outline of application characteristics with respect to the various types of thin clients.

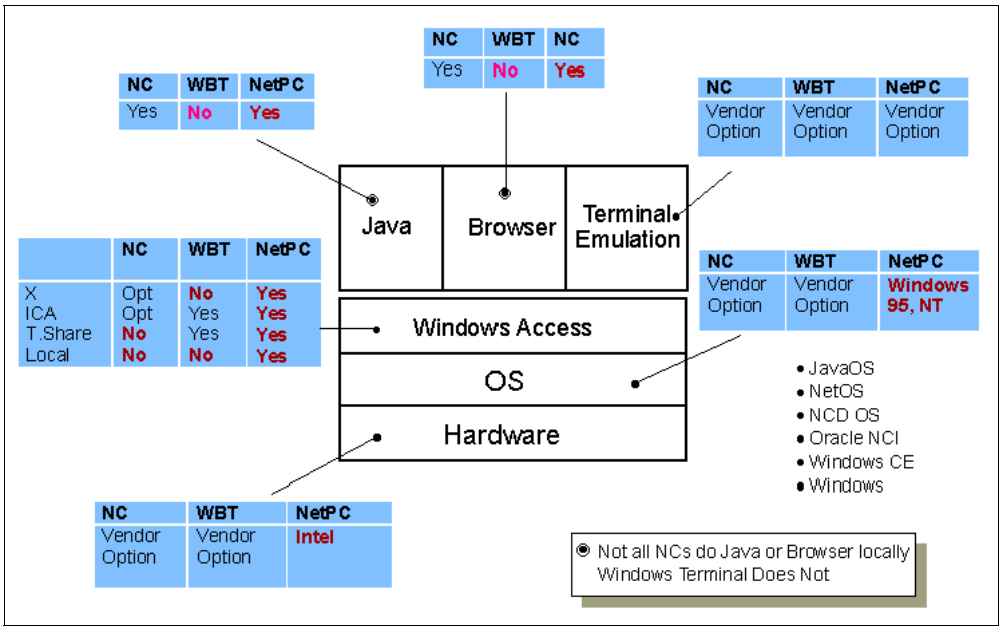

Figure 86. NC versus WBT versus NetPC

B.3 The Good Choice for IBM Terminal Replacement

In the Network Computing TCO, edition April 98, Gartner Group says:

- The IBM Network Station is the best IBM terminal replacement.
- The primary market for NCs will be for dumb terminal replacement.
- Microsoft Windows terminals will become a formidable competitor.
- Network Computers will not replace PCs, NCs and PCs will coexist in the enterprise for at least the next five years.
- The shipments of NC-type devices will total 20 percent of all desktop units by 2002.

Figure 87 on page 233 shows the placement of the IBM Network Station with respect to various vendors. The major consideration during the placement was for replacement terminals.

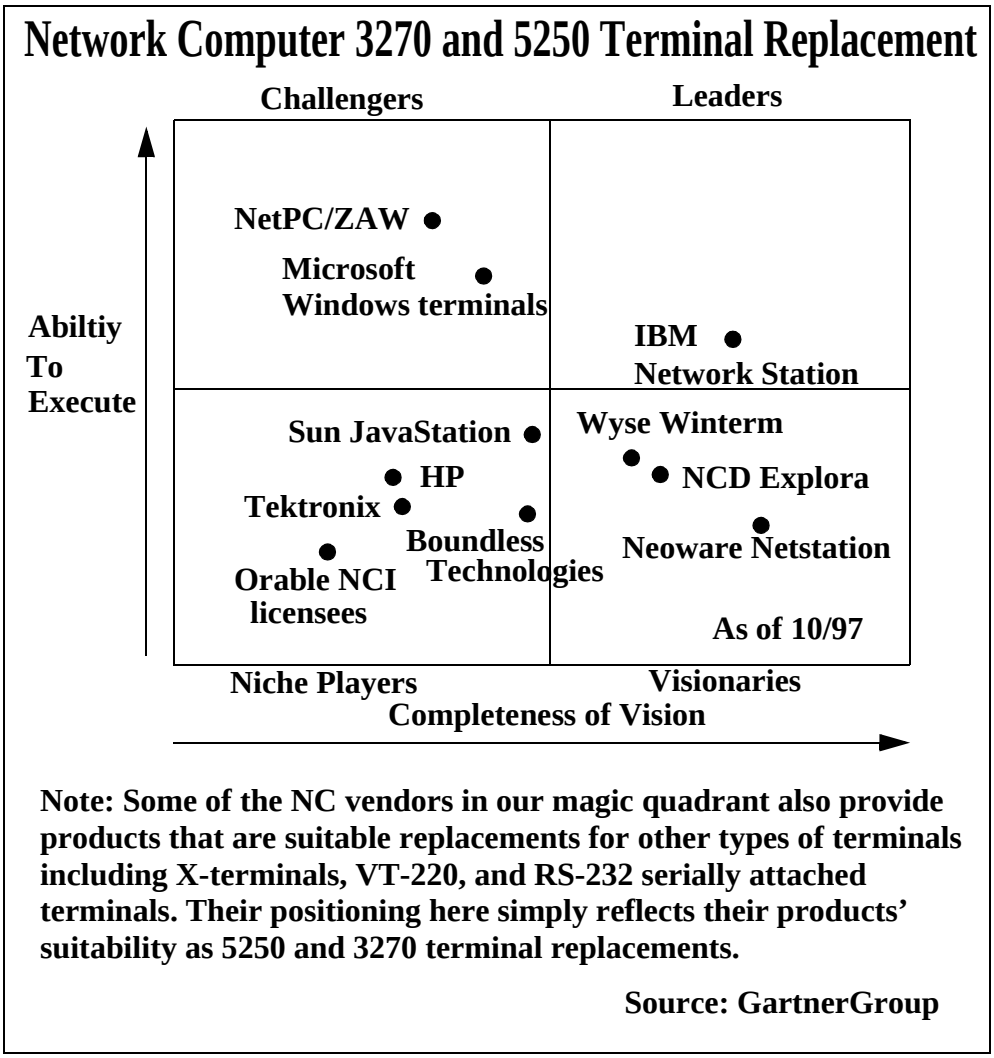

Figure 87. IBM Terminal Replacement Competitive Positioning

B.4 Windows Based Terminal

The Windows Based Terminal, WBT, runs an embedded Remote Desktop Protocol (RDP) and/or ICA display protocol to communicate with a Windows Terminal Server, WTS, whose code name was Hydra. The main characteristics are:

- Does not run a browser locally
- Vendor option to run RDP or ICA or both
- Vendor option to run an embedded terminal emulator
- Microsoft prevents WBT vendors from offering a Java Virtual Machine
- Diskless

The main differentiation from the Network Computer is:

- No local downloading of the OS or applications

- No local processing of applications at the client
- No Java Virtual Machine or browser at the client

At the time of writing, the companies who are providing such a device are:

- Wyse, Boundless, NCD are currently shipping ICA Windows Terminals
- Wyse, Boundless, NCD, Tektronix, Neoware are working with Microsoft to develop Windows Based Terminals that will use T.Share

B.5 Boundless Technologies

Boundless Technologies' primary business is manufacturing text and graphical terminals, but they have begun focusing on computer networking solutions. They offer several Network Computers, called Viewpoint TC, mainly for use in the Microsoft Windows environment with the WinFrame NT software product or with Windows Terminal Server (WTS). The Boundless Technologies Network Computer is not able to act as an X-server, thus making it impossible to access programs with a GUI on UNIX workstations. However, there are integrated emulators for 3270 and DEC terminals.

Every Viewpoint Model has 133 MHz 586 processor, is upgradable to the next model through a software upgrade and supports flash memory and PCI/ISA expansion slots.

Moreover, the Viewpoint TC Administrator software, which is a systems management utility, centralizes the management of all Viewpoint TCs on a network and allows administrators to convert the functionality of one model to another.

At the time of writing, the different Viewpoint models are the following:

- **Viewpoint TC 100:**
  - Networking Text Terminal
  - Targets those moving from green screen terminals
  - Compatibility with UNIX, AS/400, and OpenVMS applications
  - Adds four telnet sessions, TCP/IP, and color to monochrome applications
  - Ethernet 10 Base T (Option 100 BaseT, token-ring)
- **Viewpoint TC 200:**
  - Windows-based terminal
  - Not Windows CE
  - ICA - Note Remote Desktop Protocol
  - Ethernet 10 BaseT (Option: 100 BaseT, token-ring)
- **Viewpoint TC 300 and TC 400:**
  - Windows-based Terminal
  - Windows CE
  - Remote Desktop Protocol

B.6 Compaq NetPC

In order to find a answer to the Network Computer arrival, Microsoft and Intel have created the NetPC concept, which should decrease the Total Cost of Ownership as the NC does it. However, the NetPC needs every feature provided with the Zero Administration Windows to reach this target. But full ZAW software support will not arrive until late 1998 or 1999 with the availability of NT5.0.

Compaq provides such a terminal with the DeskPro family. The DeskPro computer have a processor of 166, 200, and 230 MHz.

DeskPro 4000N has the following characteristics:

- NT 4.0
- No Floppy or CD-ROM
- 166 MHz Pentium
- 32 MB RAM
- 1.6 or 2.1 GB disk
- One expansion slot
- Embedded controllers for 10/100X Ethernet, and graphics

The management facilities include:

- DMI 2.0 Compliant
- Insight Manager:
  - Superset of DMI 2.0
  - Ships standard on many of Compaq's enterprise and workgroup servers
  - A desktop component (Personal Edition) runs on the client and communicates with Insight Manager over the network
  - Provides information about the basic condition and health of the hardware (disk performance, temperature, display problems)
  - Central administration/asset management reports on make, model, S/N, monitor, RAM, and so on
- NT auto installs when the machine is turned on
- TCP/IP - manual install

With ZAW on the server, you should be able to succeed the following tasks:

- System wake up through network access
- From a centralized server:
  - Install software upgrades
  - Flash-upgrade the system's ROM BIOS
  - Shut down the system

B.7 Neoware

Neoware is the new name, since August 1, 1997, of HDSystems Network Systems, Inc. (a computer company focusing on Network Computers). Neoware

Systems, Inc. is a supplier of Network Computers and associated software that provide solutions for the integration and delivery of information and applications to the desktop. Their first model was shipped in June 1996 and was one of the first computers to directly support the Java Virtual Machine. The company's @workStation Network Computer runs Java, Microsoft Windows, UNIX, Netscape, and Web applications.

Neoware has two product ranges:

- @workStation:
  - Original product family
  - i960 RISC processor
- NeoStation
  - Newest product family
  - i960 RISC processor
  - Latest one, Neostation 200: Power PC driven WBT runs NetOS

The possible features are:

- Token-ring, 100 Mb Ethernet
- Netscape and Spyglass browsers
- Boot using CIFS, FTP, TFTP or NFS
- 3270, VT320, and 32 third-party emulators

Their OS is NetOS, which has the following characteristics depending on the options:

For WinTerminals Everything runs at NT Server through ICA

For Enterprise Adds emulation, X11, PPP, an so on

For Intranets Adds Java, browser, e-mail, news reader, to name a few

B.8 Oracle and partners

Oracle is lessening its NC push in order to concentrate on its core database business. However, some Oracle partners are providing Network Computers based on Oracle NCI specifications. Table 52 outlines these partners and their offerings.

Table 52. Oracle NCI Partners

Partner	What they have	Comments
Acorn	Non Java, 40 MHz ARM, "Corporate NC" coNCord Reference platform, 233 MHz StrongARM TVCentric design. Java-based	Acorn worked with Oracle on original design Acorn's 1.5 year contract with Oracle is ending Wants to license designs, not produce NCs
RCA	$299 Set-top BOX (Consumer Device)	Not a commercial NC Requires a special ISP (Netchannel)
Digital	Reference Design StrongARM processor & Oracle SW	Digital decided to not make an NC Switched to StrongARM Windows Terminal
Uniden	Intel-based NC-1000, Java capable Also a StrongARM model, Java capable	Focus on schools / education

Partner	What they have	Comments
Umax	200 MHz Pentium NC ($750)	$900 for Server Software (5 user) Not available yet
Funai	33 MHz Intel based, Java capable, smartcard	
Accton	Intel 133 MHz (Pentium II in 2Q 98) Home, Office, NCTV, Mobile	Remote boot from TCP/IP or IPX Servers Multimedia, USB, Wake on LAN, 10/100 EN

B.9 SUN Microsystems

As the inventor of Java, Sun has chosen to call their Network Computer the JavaStation. Although not yet equipped with a real Java processor, its operating system is based on Java and thus enables it to run any Java program. All the other programs, such as the HotJava Web browser, are written in Java.

The standard features of the Sun JavaStation are:

- SPARC 8 processor, 100 MHz
- 32 MB RAM
- 10/100BaseT Ethernet network adapter
- One serial Interface
- 16-bit audio and headphone jack
- 104 PC standard keyboard
- 2-button mouse

The JavaStation can be equipped with up to 64 MB of RAM and has 4 MB of flash memory to save its configuration and boot files. The WWW browser, HotJava, offers an integrated e-mail client. Sun delivers several programs, such as a Netra j 2.0 software (includes JavaStation Software Environment), NTrigue client for Java (X), calendar and a NameView database, all written in Java.

The JavaStation Software Environment is a program for developers which includes:

- JavaOS 1.1 FCS
- HotJava Views 1.0 FCS
- HotJava Browser Limited Access Release
- Views manager (Requires JDK 1.1.2 on server)
- JavaStation manager (Requires JDK 1.1.2 on server)

B.10 Wyse

Wyse's primary business is to develop terminals and thin-client devices. Their experience with corporate intranets leveraged their entrance in the Network Computer market.

Wyse delivers several Network Computers for different environments, starting with small versions with only a terminal resolution of 640 X 480 pixels and 16 colors, up to high-end products with 1024 x 786 and 256 colors.

Wyse decided to launch a Java network terminal (Winterm 4010) lately in 1997, but it cancelled this JavaOS device which would replace with thin Java capability.

The standard features of the Wyse Winterm 2000 family, the only actual range of products, are:

- RISC processor
- 16 MB memory
- 10BaseT Ethernet network adapter
- One parallel and two serial interfaces
- 2-button mouse
- 101 PC standard keyboard

The software used by Wyse is able to access Windows NT server through the ICA protocol, and there are VT100, VT320, TTY, and PC terminal emulators available.

Wyse Network Computers can only be used with Microsoft Windows; so it is not possible to launch X applications on UNIX machines. For use in this environment, they are well suited, but if you want to use them in a mixed network with UNIX and Microsoft Windows applications, you might run into trouble. Moreover, these NC do not support local Java.

B.11 Other Manufacturers

The intent of this publication is not to cover all the current models available but to demonstrate that many companies have a Network Computer solution available.

The most elemental function of a Network Computer is to provide end-user access to data. Machines that provide access to the broadest range of heterogeneous hosts should be considered more desirable than machines that do not.

The boot process and configuration of Network Computer is about the same for every manufacturer. They all support the common BOOTP protocol for receiving their kernel and configuration files from a centralized server. Some of them offer the possibility to save the boot files in internal memory; so they are fast to reboot, but these terminals introduce specific administration requirements.

Appendix C. TFTP Directories

This appendix contains a complete list of the directories that are added to the /etc/tftpaccess.ctl file to make them accessible to IBM Network Stations using TFTP for file access.

```
allow:/usr/netstation/nsm
allow:/usr/netstation/nsm/users
allow:/usr/netstation/nsm/groups
allow:/usr/netstation/StationConfig
allow:/usr/netstation/nsm/StationConfig
allow:/usr/netstation/SysDef
allow:/usr/netstation/nsm/SysDef
allow:/usr/netstation/configs
allow:/usr/netstation/mods
allow:/usr/netstation/bin
allow:/usr/netstation/doc
allow:/usr/netstation/servbase
allow:/usr/netstation/Service
allow:/usr/netstation/servbase/cgi-bin
allow:/usr/netstation/servbase/httpd
allow:/usr/netstation/servbase/image\
allow:/usr/netstation/aix
allow:/usr/netstation/aix/lib
allow:/usr/netstation/aix/tools
allow:/usr/netstation/Tmpls
allow:/usr/netstation/SysDef/NAV
allow:/usr/netstation/SysDef/NCDwm
allow:/usr/netstation/SysDef/NS3270
allow:/usr/netstation/SysDef/NS5250
allow:/usr/netstation/X11
allow:/usr/netstation/X11/DA_DK
allow:/usr/netstation/X11/DA_DK/app-defaults
allow:/usr/netstation/X11/DE_DE
allow:/usr/netstation/X11/DE_DE/app-defaults
allow:/usr/netstation/X11/EN_US
allow:/usr/netstation/X11/EN_US/app-defaults
allow:/usr/netstation/X11/ES_ES
allow:/usr/netstation/X11/ES_ES/app-defaults
allow:/usr/netstation/X11/FR_FR
allow:/usr/netstation/X11/FR_FR/app-defaults
allow:/usr/netstation/X11/IT_IT
allow:/usr/netstation/X11/IT_IT/app-defaults
allow:/usr/netstation/X11/JA_JP
allow:/usr/netstation/X11/JA_JP/app-defaults
allow:/usr/netstation/X11/KO_KR
allow:/usr/netstation/X11/KO_KR/app-defaults
allow:/usr/netstation/X11/NL_NL
allow:/usr/netstation/X11/NL_NL/app-defaults
allow:/usr/netstation/X11/PT_BR
allow:/usr/netstation/X11/PT_BR/app-defaults
allow:/usr/netstation/X11/SV_SE
allow:/usr/netstation/X11/SV_SE/app-defaults
allow:/usr/netstation/X11/ZH_CN
allow:/usr/netstation/X11/ZH_CN/app-defaults
allow:/usr/netstation/X11/ZH_TW
allow:/usr/netstation/X11/ZH_TW/app-defaults
```

```
allow:/usr/netstation/X11/app-defaults
allow:/usr/netstation/X11/fonts
allow:/usr/netstation/X11/fonts/pcf
allow:/usr/netstation/X11/fonts/pcf/i18n
allow:/usr/netstation/X11/locale
allow:/usr/netstation/X11/locale/UTF-8_AR-AA
allow:/usr/netstation/X11/locale/UTF-8_AR-AA/XLC_LOCALE
allow:/usr/netstation/X11/locale/UTF-8_BASE-0
allow:/usr/netstation/X11/locale/UTF-8_C
allow:/usr/netstation/X11/locale/UTF-8_CJK
allow:/usr/netstation/X11/locale/UTF-8_CJKCN
allow:/usr/netstation/X11/locale/UTF-8_CJKJP
allow:/usr/netstation/X11/locale/UTF-8_CJKKO
allow:/usr/netstation/X11/locale/UTF-8_CJKTW
allow:/usr/netstation/X11/locale/UTF-8_TH_TH
allow:/usr/netstation/X11/locale/UTF-8_iso8859-1
allow:/usr/netstation/X11/locale/UTF-8_iso8859-2
allow:/usr/netstation/X11/locale/UTF-8_iso8859-5
allow:/usr/netstation/X11/locale/UTF-8_iso8859-7
allow:/usr/netstation/X11/locale/UTF-8_iso8859-9
allow:/usr/netstation/fonts
allow:/usr/netstation/fonts/pcf
allow:/usr/netstation/fonts/pcf/100dpi
allow:/usr/netstation/fonts/pcf/75dpi
allow:/usr/netstation/fonts/pcf/IBMmisc
allow:/usr/netstation/fonts/pcf/dw100dpi
allow:/usr/netstation/fonts/pcf/dw75dpi
allow:/usr/netstation/fonts/pcf/java
allow:/usr/netstation/fonts/pcf/misc
allow:/usr/netstation/java
allow:/usr/netstation/java/lib
allow:/usr/netstation/java/lib/security
allow:/usr/netstation/keyboards
allow:/usr/netstation/mods
allow:/usr/netstation/mods/NAV
allow:/usr/netstation/nls
allow:/usr/netstation/nls/CS_CZ
allow:/usr/netstation/nls/CS_CZ/MRI
allow:/usr/netstation/nls/CS_CZ/msg
allow:/usr/netstation/nls/DA_DK
allow:/usr/netstation/nls/DA_DK/MRI
allow:/usr/netstation/nls/DA_DK/msg
allow:/usr/netstation/nls/DE_CH
allow:/usr/netstation/nls/DE_CH/MRI
allow:/usr/netstation/nls/DE_CH/msg
allow:/usr/netstation/nls/DE_DE
allow:/usr/netstation/nls/DE_DE/MRI
allow:/usr/netstation/nls/DE_DE/msg
allow:/usr/netstation/nls/EL_GR
allow:/usr/netstation/nls/EL_GR/MRI
allow:/usr/netstation/nls/EL_GR/msg
allow:/usr/netstation/nls/EN_US
allow:/usr/netstation/nls/EN_US/MRI
allow:/usr/netstation/nls/EN_US/msg
allow:/usr/netstation/nls/ES_ES
allow:/usr/netstation/nls/ES_ES/MRI
allow:/usr/netstation/nls/ES_ES/msg
allow:/usr/netstation/nls/FI_FI
```

```
allow:/usr/netstation/nls/FI_FI/MRI
allow:/usr/netstation/nls/FI_FI/msg
allow:/usr/netstation/nls/FR_BE
allow:/usr/netstation/nls/FR_BE/MRI
allow:/usr/netstation/nls/FR_BE/msg
allow:/usr/netstation/nls/FR_CA
allow:/usr/netstation/nls/FR_CA/MRI
allow:/usr/netstation/nls/FR_CA/msg
allow:/usr/netstation/nls/FR_CH
allow:/usr/netstation/nls/FR_CH/MRI
allow:/usr/netstation/nls/FR_CH/msg
allow:/usr/netstation/nls/FR_FR
allow:/usr/netstation/nls/FR_FR/MRI
allow:/usr/netstation/nls/FR_FR/msg
allow:/usr/netstation/nls/HU_HU
allow:/usr/netstation/nls/HU_HU/MRI
allow:/usr/netstation/nls/HU_HU/msg
allow:/usr/netstation/nls/IT_CH
allow:/usr/netstation/nls/IT_CH/MRI
allow:/usr/netstation/nls/IT_CH/msg
allow:/usr/netstation/nls/IT_IT
allow:/usr/netstation/nls/IT_IT/MRI
allow:/usr/netstation/nls/IT_IT/msg
allow:/usr/netstation/nls/JA_JP
allow:/usr/netstation/nls/JA_JP/MRI
allow:/usr/netstation/nls/JA_JP/msg
allow:/usr/netstation/nls/KO_KR
allow:/usr/netstation/nls/KO_KR/MRI
allow:/usr/netstation/nls/KO_KR/msg
allow:/usr/netstation/nls/NL_BE
allow:/usr/netstation/nls/NL_BE/MRI
allow:/usr/netstation/nls/NL_BE/msg
allow:/usr/netstation/nls/NL_NL
allow:/usr/netstation/nls/NL_NL/MRI
allow:/usr/netstation/nls/NL_NL/msg
allow:/usr/netstation/nls/NO_NO
allow:/usr/netstation/nls/NO_NO/MRI
allow:/usr/netstation/nls/NO_NO/msg
allow:/usr/netstation/nls/PL_PL
allow:/usr/netstation/nls/PL_PL/MRI
allow:/usr/netstation/nls/PL_PL/msg
allow:/usr/netstation/nls/PT_BR
allow:/usr/netstation/nls/PT_BR/MRI
allow:/usr/netstation/nls/PT_BR/msg
allow:/usr/netstation/nls/PT_PT
allow:/usr/netstation/nls/PT_PT/MRI
allow:/usr/netstation/nls/PT_PT/msg
allow:/usr/netstation/nls/RU_RU
allow:/usr/netstation/nls/RU_RU/MRI
allow:/usr/netstation/nls/RU_RU/msg
allow:/usr/netstation/nls/SV_SE
allow:/usr/netstation/nls/SV_SE/MRI
allow:/usr/netstation/nls/SV_SE/msg
allow:/usr/netstation/nls/TR_TR
allow:/usr/netstation/nls/TR_TR/MRI
allow:/usr/netstation/nls/TR_TR/msg
allow:/usr/netstation/nls/ZH_CN
allow:/usr/netstation/nls/ZH_CN/MRI
```

```
allow:/usr/netstation/nls/ZH_CN/msg
allow:/usr/netstation/nls/ZH_TW
allow:/usr/netstation/nls/ZH_TW/MRI
allow:/usr/netstation/nls/ZH_TW/msg
allow:/usr/netstation/nls/codepage
allow:/usr/netstation/nls/jls
allow:/usr/netstation/nls/jls/default
allow:/usr/netstation/nls/jls/dict
allow:/usr/netstation/nls/kls
allow:/usr/netstation/nls/kls/default
allow:/usr/netstation/nls/kls/dict
allow:/usr/netstation/nls/tls
allow:/usr/netstation/nls/tls/default
allow:/usr/netstation/nls/tls/dict
allow:/usr/netstation/nls/zhls
allow:/usr/netstation/nls/zhls/dict
allow:/usr/netstation/proms
allow:/usr/netstation/zoneinfo
allow:/usr/netstation/zoneinfo/Africa
allow:/usr/netstation/zoneinfo/America
allow:/usr/netstation/zoneinfo/America/Indiana
allow:/usr/netstation/zoneinfo/Asia
allow:/usr/netstation/zoneinfo/Atlantic
allow:/usr/netstation/zoneinfo/Australia
allow:/usr/netstation/zoneinfo/Etc
allow:/usr/netstation/zoneinfo/Europe
allow:/usr/netstation/zoneinfo/Indian
allow:/usr/netstation/zoneinfo/Pacific
```

Appendix D. Special Notices

This publication is intended to help IBM Network Station users, IT planners, network administrators, systems programmers, and systems engineers install, set up, and use the IBM Network Station in their own environment. The information in this publication is not intended as the specification of any programming interfaces that are provided by the IBM Network Station. See the PUBLICATIONS section of the IBM Programming Announcement for IBM Network Station for more information about what publications are considered to be product documentation.

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Any pointers in this publication to external Web sites are provided for convenience only and do not in any manner serve as an endorsement of these Web sites.

Any performance data contained in this document was determined in a controlled environment, and therefore, the results that may be obtained in other operating environments may vary significantly. Users of this document should verify the applicable data for their specific environment.

The following document contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples contain the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

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Appendix E. Related Publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

E.1 International Technical Support Organization Publications

- For information on ordering these ITSO publications see Chapter , “How to Get ITSO Redbooks” on page 251.
- *S/390 - IBM Network Station - Getting Started*, SG24-4954
- *S/390 - IBM Network Station - End User Information,* SG24-4955
- *AS/400 - BM Network Station - Getting Started*, SG24-2153
- *IBM Network Station Guide for Windows NT,* SG24-2127
- *IBM Network Station Printing Guide,* SG24-5212
- *TCP/IP Tutorial and Technical Overview*, GG24-3376
- *IBM TCP/IP Version 3 Release 2 for MVS Implementation Guide*, SG24-3687

E.2 Redbooks on CD-ROMs

Redbooks are also available on CD-ROMs. **Order a subscription** and receive updates 2-4 times a year at significant savings.

CD-ROM Title	Subscription Number	Collection Kit Number
System/390 Redbooks Collection	SBOF-7201	SK2T-2177
Networking and Systems Management Redbooks Collection	SBOF-7370	SK2T-6022
Transaction Processing and Data Management Redbook	SBOF-7240	SK2T-8038
Lotus Redbooks Collection	SBOF-6899	SK2T-8039
Tivoli Redbooks Collection	SBOF-6898	SK2T-8044
AS/400 Redbooks Collection	SBOF-7270	SK2T-2849
RS/6000 Redbooks Collection (HTML, BkMgr)	SBOF-7230	SK2T-8040
RS/6000 Redbooks Collection (PostScript)	SBOF-7205	SK2T-8041
RS/6000 Redbooks Collection (PDF Format)	SBOF-8700	SK2T-8043
Application Development Redbooks Collection	SBOF-7290	SK2T-8037

E.3 Other Publications

These publications are also relevant as further information sources:

- *IBM Network Station Service Information*, SY44-0068
- *IBM Network Station Manager for OS/390*, SC31-8546
- *IBM Network Station Manager User’s Guide*, SC41-0632
- *IBM Network Station Runtime Environment for RS/6000*, Release Notes (Loaded during AIX install)
- *IBM Network Station System Administrator’s Guide*, SYSA-NETW (Shipped with Network Station)
- *IBM Network Station Use,* SA41-0036

- *AIX Version 4 System Administration Guide*, SR23-7935

E.4 WWW Resources

This section includes a list of pages and FTP sites worth a look at if you are interested in learning more about the Network Station or network computing.

E.4.1 General and AIX Network Station Resources

Following is a list of sites that will help you find general information on the IBM Network Station or related topics.

E.4.1.1 Internal sites

Currently, these sites are limited to access by IBMers only. Please contact your IBM support person to request the information provided on these pages.

http://nc.hursley.ibm.com/
An excellent collection of competitive links, essays, and technical data about the IBM Network Station and network computing.

http://w3.hursley.ibm.com/newsgroups/webnews.pl?ibm.ibmpc.nc
The NC Forum. Many questions/answers about the IBM Network Station.

http://tesch.aix.dfw.ibm.com/ins/findex.html
A lot of information about the IBM Network Station. It is probably the best place for AIX on the Web (besides this publication).

http://w3.rchland.ibm.com/~jepe/navio.html
NC Navigator information. Navio Support hints, documentation and reference information.

http://bissell.austin.ibm.com/nc/index.html
Local Boot for IBM Network Station. Everything you need for booting your IBM Network Station from a flash card or a thin server.

http://eagleb3.austin.ibm.com
SmartCard solutions with the IBM Network Station. Demos, software downloads, hints and tips.

http://w3.mo.us.ibm.com/tco
IBM Global Services - Total Cost of Ownership. A large collection of documents including the ThinStation IBM Project:NC700.

http://w3.austin.ibm.com/:/projects/ncperf/brantley/ete/index.html
The IBM Network Station Performances site. A useful collection of documentation about the performance of the architectures IBM Network Station.

http://fixit.austin.ibm.com/javanet/home.html
Java testing and benchmarks. Many references to Spec v19, benchmarks and performance tests results.

http://w3.hursley.ibm.com/java/sig/code_reuse.html
A large collection of applets, applications, and beans.

http://w3.ncs.ibm.com
The NC Advisor. A page with network computing trends and developments.

http://suave.austin.ibm.com
A large collection of many tools and information about many technical fields, including the IBM Network Station.

http://tesch.aix.dfw.ibm.com/mypage/httplist.html
A list of general URLs. Most non-INS related.

E.4.1.2 External sites

The following sites have unrestricted access.

http://www.nc.ihost.com
Description of the NC Reference Profile 1

http://www.pc.ibm.com/networkstation
IBM Network Station's home page. A lot of general information.

http://www.as400.ibm.com/nstation/pub.htm
A source page with documentation and a link to product information.

http://service.boulder.ibm.com/nc
IBM Network Station download site. NSM for every supported platform server.

http://aix.software.ibm.com/aix.us/aixfixes?lang=english
AIX Fix distribution site.

http://www.ibm.com/java
Lots here on Java.

http://www9.s390.ibm.com/nc
The S/390 network computing home page.

http://www.opencard.org
OpenCard Framework site. Everything you want to know on this standard.

http://www.ncworldmag.com
Network computing has spawned its own magazine. This is the home page.

http://www.thinworld.com
The magazine of the thin client world. The latest news about NC, WBT,.

http://www.sandybay.com/pc-web/network_computer.htm
Type just a couple of keywords on a Web site and you will have a world of knowledge on your screen. This is a site with lots of links on it. It will take you to about everywhere from one page.

E.4.2 Hardware Vendors

Following is a list of useful sites if you are interested in the hardware.

http://www.hds.com/@workPage.html
HDS line of Network Computers.

http://www.idea.com/Products/
IDEA's home page.

http://www.ncd.com/
NCD has an extensive line of network station and X station products.

http://www.sun.com/javasystems/krups/
Sun JavaStation

http://www.neoware.com/
Neoware Systems' home page.

http://techweb.cmp.com/crw/061996/1hw0603.html
You man need to look around here a little bit to see what news is developing in the market. Something changes every day in this fast moving market.

http://www.techweb.com/tools/netpc/netpc5.html
If you want a product comparison chart, this is a good start. It lists some of the current vendors of network stations.

http://www.acorn.co.uk/acorn/products/nc/
The Acorn/Oracle Network computer.

E.4.3 Industry News

For up to the minute industry news, consider the information on one of these pages.

http://192.9.9.100/sunworldonline/swol-07-1996/swol-07-nc.html
SunWorlds Network Computing information page.

http://192.9.9.100/sunworldonline/swol-03-1997/swol-03-netpc.html
Another Sunworld page.

http://www.zonaresearch.com/reports/NC.htm
A research group on network computing trends.

http://www.duke.edu/%7Emccann/q-tech.htm#moore's cannibal principle
Here is a page that has predictions on all of the future industry trends for network computing.

http://www.news.com/
General computer industry news. Search from this page.

http://www.idcresearch.com/gens6.htm
IDresearch is an industry consortium. There is a Network Computer debate on this page.

List of Abbreviations

ACK	Acknowledgment
AIX	Advanced Interactive Executive (IBM's flavor of UNIX)
APAR	Authorized Program Analysis Report
API	Application Program Interface
ARM	Acorn RISC Machine
ASCII	American National Standard Code for Information Interchange
ATT	American Telephone & Telegraph
BOOTP	Boot Protocol
BSD	Berkeley Software Distribution (UC at Berkeley, UNIX)
CAD	Computer Aided Design
CAD/CAM	Computer Aided Design/Computer Aided Manufacturing
CD-ROM	(Optically read) Compact Disk - read-only memory
CDE	Common Desktop Environment (from X/Open)
CLK	Clock
CONFIG	Configuration/Configure
COSE	Common Open Software Environment (IBM, HP, Sun, and so forth.)
CPU	Central Processing Unit
DDC	Display Data Channel
DDNS	Dynamic Domain Name System, (Dynamic DNS) (5/96)
DEC	Digital Equipment Corporation (USA)
DHCP	Dynamic Host Configuration Protocol (support)
DNS	Domain Name Service
DPMS	Display Power Management Signaling
DRAM	Dynamic Random Access Memory
EPROM	Erasable Programmable Read Only Memory
FTP	File Transfer Protocol
GA	General Availability
GDDM	Graphical Data Display Manager (IBM program product)
GIF	Graphic Interchange Format
GNU	The Free Software Foundation's UNIX-like operating system project
GOPHER	A menu-based search scheme, used to find information on the Internet. Originally developed at the University of Minnesota it lets you reach a destination on the Internet by selecting items from a series of text menus.
HDS	Hitachi Data Systems
HDX	Half Duplex
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
I/O	Input/Output
IBM	International Business Machines Corporation
ICA	Independent Computing Architecture (Citrix)
IDEA	Industrial Design Excellence Award (sponsored by *Business Week* magazine, conducted by IDSA)
INEWS	Information News Facility (IBM)
INTERNET	A worldwide network of TCP/IP-based networks
IP	Internet Protocol (ISO)
ISDN	Integrated-Services Digital Network
IT	Information Technology
ITSO	International Technical Support Organization
JAR	Java Archive
JES	Job Entry Subsystem (MVS counterpart to VM's RSCS)
JVM	Java Virtual Machine
LAN	Local Area Network
LED	Light Emitting Diode
LPD	Line Printer Daemon (AIX)

LPP	Licensed Program Product
LSI	Large Scale Integration
MAC	Medium Access Control
MB	Megabyte, 1,000,000 bytes (1,048,576 bytes memory) case should be MB
MTBF	Mean Time Between Failures
MTU	Maximum Transmission Unit (Internet protocols)
MVS	Multiple Virtual Storage (IBM System 370 & 390)
NC	Network Computer
NCD	Network Computing Devices (X-terminals, mail software)
NFS	Network File System (USA, Sun Microsystems, Inc.)
NIM	Network Install Manager
NPT	Nonprogrammable Terminal or Workstation
NSM	Network Station Manager
NVRAM	Non-Volatile Random Access Memory
PARM	Parameter
PC	Personal Computer
PCL	Printer Control Language (Hewlett-Packard Co.)
PCMCIA	Personal Computer Memory Card International Association
PID	Process Identifier/Identification
POST	Power-On Self-Test
PPP	Point-To-Point Protocol
PTF	Program Temporary Fix
RAM	Random Access Memory
RARP	Reverse Address Resolution Protocol (Internet RFC 903)
RGB	Red, Green, Blue
RISC	Reduced Instruction Set Computer/Cycles
RSCS	Remote Spooling Communications Subsystem (VM's counterpart to MVS JES NJE)
RSH	Remote Shell execution on a remote host (AIX)
SIMM	Single In-Line Memory Module
SMIT	System Management Interface Tool (see also DSMIT)
SPARC	Scalable Processor Architecture (Sun Microsystems, Inc.)
SVGA	Auper Video Graphics Array/Adapter
TCP	Transmission Control Protocol (USA, DoD)
TCP/IP	Transmission Control Protocol/Internet Protocol (USA, DoD, ARPANET; TCP=layer 4, IP=layer 3, UNIX-ish/Ethernet-based system-interconnect protocol)
TCPIP	Transmission Control Protocol Internet Protocol
TFTP	Trivial File Transfer Protocol
UDP	User Datagram Protocol (TCPIP)
UNIX	An operating system developed at Bell Laboratories (trademark of UNIX System Laboratories, licensed exclusively by X/Open Company, Ltd.)
URL	Uniform Resource Locator
VESA	Video Electronics Standards Association (international organization)
VFS	Virtual File Systems
VGA	Video Graphics Array/Adapter (PS/2)
VM/ESA	Virtual Machine/Enterprise Systems Architecture (IBM)
VSE	virtual storage extended (IBM System/370)
VTAM	Virtual Telecommunications Access Method (IBM) (runs under MVS, VM, & DOS/VSE)
X	X-Window System (trademark of MIT)
XDM	X Display Manager (AIX and X/Motif)
XDMCP	X Display Manager Control Protocol

How to Get ITSO Redbooks

This section explains how both customers and IBM employees can find out about ITSO redbooks, CD-ROMs, workshops, and residencies. A form for ordering books and CD-ROMs is also provided.

This information was current at the time of publication, but is continually subject to change. The latest information may be found at `http://www.redbooks.ibm.com/`.

How IBM Employees Can Get ITSO Redbooks

Employees may request ITSO deliverables (redbooks, BookManager BOOKs, and CD-ROMs) and information about redbooks, workshops, and residencies in the following ways:

- **Redbooks Web Site on the World Wide Web**

  `http://w3.itso.ibm.com/`

- **PUBORDER** – to order hardcopies in the United States
- **Tools Disks**

  To get LIST3820s of redbooks, type one of the following commands:

  ```
  TOOLCAT REDPRINT
  TOOLS SENDTO EHONE4 TOOLS2 REDPRINT GET SG24xxxx PACKAGE
  TOOLS SENDTO CANVM2 TOOLS REDPRINT GET SG24xxxx PACKAGE (Canadian users only)
  ```

  To get BookManager BOOKs of redbooks, type the following command:

  ```
  TOOLCAT REDBOOKS
  ```

  To get lists of redbooks, type the following command:

  ```
  TOOLS SENDTO USDIST MKTTOOLS MKTTOOLS GET ITSOCAT TXT
  ```

  To register for information on workshops, residencies, and redbooks, type the following command:

  ```
  TOOLS SENDTO WTSCPOK TOOLS ZDISK GET ITSOREGI 1998
  ```

- **REDBOOKS Category on INEWS**
- **Online** – send orders to: USIB6FPL at IBMMAIL or DKIBMBSH at IBMMAIL

Redpieces

For information so current it is still in the process of being written, look at "Redpieces" on the Redbooks Web Site (`http://www.redbooks.ibm.com/redpieces.html`). Redpieces are redbooks in progress; not all redbooks become redpieces, and sometimes just a few chapters will be published this way. The intent is to get the information out much quicker than the formal publishing process allows.

How Customers Can Get ITSO Redbooks

Customers may request ITSO deliverables (redbooks, BookManager BOOKs, and CD-ROMs) and information about redbooks, workshops, and residencies in the following ways:

- **Online Orders** – send orders to:

	IBMMAIL	**Internet**
In United States	usib6fpl at ibmmail	usib6fpl@ibmmail.com
In Canada	caibmbkz at ibmmail	lmannix@vnet.ibm.com
Outside North America	dkibmbsh at ibmmail	bookshop@dk.ibm.com

- **Telephone Orders**

United States (toll free)	1-800-879-2755
Canada (toll free)	1-800-IBM-4YOU
Outside North America	(long distance charges apply)
(+45) 4810-1320 - Danish	(+45) 4810-1020 - German
(+45) 4810-1420 - Dutch	(+45) 4810-1620 - Italian
(+45) 4810-1540 - English	(+45) 4810-1270 - Norwegian
(+45) 4810-1670 - Finnish	(+45) 4810-1120 - Spanish
(+45) 4810-1220 - French	(+45) 4810-1170 - Swedish

- **Mail Orders** – send orders to:

IBM Publications Publications Customer Support P.O. Box 29570 Raleigh, NC 27626-0570 USA	IBM Publications 144-4th Avenue, S.W. Calgary, Alberta T2P 3N5 Canada	IBM Direct Services Sortemosevej 21 DK-3450 Allerød Denmark

- **Fax** – send orders to:

United States (toll free)	1-800-445-9269
Canada	1-800-267-4455
Outside North America	(+45) 48 14 2207 (long distance charge)

- **1-800-IBM-4FAX (United States)** or **(+1) 408 256 5422 (Outside USA)** – ask for:

  Index # 4421 Abstracts of new redbooks
  Index # 4422 IBM redbooks
  Index # 4420 Redbooks for last six months

- **On the World Wide Web**

Redbooks Web Site	http://www.redbooks.ibm.com
IBM Direct Publications Catalog	http://www.elink.ibmlink.ibm.com/pbl/pbl

Redpieces

For information so current it is still in the process of being written, look at "Redpieces" on the Redbooks Web Site (`http://www.redbooks.ibm.com/redpieces.html`). Redpieces are redbooks in progress; not all redbooks become redpieces, and sometimes just a few chapters will be published this way. The intent is to get the information out much quicker than the formal publishing process allows.

IBM Redbook Order Form

Please send me the following:

Title	Order Number	Quantity

First name | Last name

Company

Address

City | Postal code | Country

Telephone number | Telefax number | VAT number

☐ Invoice to customer number

☐ Credit card number

Credit card expiration date | Card issued to | Signature

We accept American Express, Diners, Eurocard, Master Card, and Visa. Payment by credit card not available in all countries. Signature mandatory for credit card payment.

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ITSO Redbook Evaluation

IBM Network Station - RS/6000 Notebook
SG24-2016-01

Your feedback is very important to help us maintain the quality of ITSO redbooks. **Please complete this questionnaire and return it using one of the following methods:**

- Use the on-line evaluation form found at http://www.redbooks.ibm.com
- Fax this form to: USA International Access Code + 1 914 432 8264
- Send your comments in an Internet note to redbook@us.ibm.com

Which of the following best describes you?
_ **Customer** _ **Business Partner** _ **Solution Developer** _ **IBM employee**
_ **None of the above**

Please rate your overall satisfaction with this book using the scale:
(1 = very good, 2 = good, 3 = average, 4 = poor, 5 = very poor)

Overall Satisfaction _____

Please answer the following questions:

Was this redbook published in time for your needs? Yes___ No___

If no, please explain:

_____

_____

_____

_____

What other redbooks would you like to see published?

_____

_____

_____

Comments/Suggestions: (THANK YOU FOR YOUR FEEDBACK!)

_____

_____

_____

_____

_____

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