



Flash Memory Card Support for the IBM Network Station Version 1 Release 3

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IBM Network Computer Division

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This is the overview documentation for flash boot support. **The features described in this document pertain only to IBM Network Station Manager Version 1 Release 3.0.3 (aka 1.3.0.3) or later.** Information on flash boot support in Version 2 for the Series 300, 1000, 2200, and 2800 is contained in the publications.

Flash boot support was released as a Request for Price Quote (RPQ) on Network Station Manager for Version 1 Release 3 in North America. North America RPQ orders are subject to IBM Network Station Division approval; Europe/Middle East/Africa RPQs will be generally available upon request. More information can be obtained at <http://www.pc.ibm.com/us/accessories/networkstation/flashcard.html>.

1. Introduction

The IBM Network Station is a diskless, dataless device designed to be booted from a server. All of the software required to run the Network Station (e.g. operating system, window manager, Java virtual machine, emulators, browsers, fonts, applications) are loaded from a server. Several protocols are available to transfer the data, including TFTP and NFS, over ethernet or token ring. Once the basic operating system software has been loaded from a *boot server*, a user logs in to an *authentication server* and then communicates with one or more *application servers* on the network for terminal emulation, Windows access via Citrix MetaFrame and the ICA client, browser access, and Java applications. The application server can be the same system as the boot server or authentication server or a number of different systems.

As currently packaged, the Network Station requires that an AIX, AS/400, S/390, NT, or OS/2 boot server be reachable over the network. (It is possible to configure other servers as boot servers provided they support the TFTP or NFS protocol). Many customers have only a minimal number of Network Stations at a site or branch. They do not want the cost and management of a full server at a remote location or within a workgroup just to boot their Network Stations.

In many cases, the Network Stations are attached to a remote server via a wide-area network routed to a local ethernet or token-ring network. Loading the operating system kernel and a typical set of applications over a typical frame relay WAN at 56 Kbits/second can take 10-30 minutes. In countries with high communications tariffs this is not only slow but uneconomical as well.

Even at larger sites with servers already in place, customers are concerned about server and network loading after a power failure or first thing in the morning when many Network Stations try to boot at once. Servers are very often mission-critical resources and customers are reluctant to use them for other purposes which might put unpredictable loads on the server or require excess server capacity that is seldom used. They want to isolate their boot servers from their file/application servers.

For example, few customers want to boot directly from their S/390 systems. However, many also don't want the cost and administrative overhead associated with having a full PC or other server just to boot Network Stations. With Windows NT Terminal Server Edition, it is generally recommended that customers use a separate NT 4.0 box as the boot server to avoid taxing the Windows NT Terminal Server Edition applications server.

Flash memory cards represent one solution to these problems. Other alternatives, such as the [Quick Start Server](http://www.pc.ibm.com/networkstation/support/quickstart.html) (<http://www.pc.ibm.com/networkstation/support/quickstart.html>) and [thin servers](http://www.cobaltmicro.com) (<http://www.cobaltmicro.com>) should also be evaluated. The Quick Start Server offers the widest range of performance and maintenance for the IBM Network Station.

Document Terminology and Conventions

The terms "flash", "flash memory", "flash card", and "flash memory card" are used throughout the document to refer to the PCMCIA flash memory card. "flash boot" and "flash memory boot" are used

interchangeably to refer to the process of loading a Network Station from a PCMCIA flash memory card.

The terms "kernel" and "operating system" are used interchangeably throughout the document. The Network Station operating system consists of a small, multi-tasking, UNIX-derivative kernel. It provides X Window support and also recognizes a limited set of commands to run built-in applications. Numerous extensions and libraries provide modular functionality for emulators, browser, console, ICA client, etc.

Peer Boot

A flash card in one Network Station can be used to boot other Network Stations on a local area network using the NFS protocol. This is known as "peer booting." The other Network Stations need only be set up as if they were booting from any other server. The peer booting capability is built in to the Network Station and requires no additional software. To date, we have tested up to nine Network Stations booting from a peer Network Station, for a total of ten systems booted from the same flash card.

Separation of Servers

Beginning in Version 1 Release 3, the Network Station's NVRAM can be configured so that the kernel is booted from one system, the configuration files are loaded from another system, and user authentication is performed to a third system.

This capability allows a Network Station with flash memory to be set up so that it boots large, stable files from a flash memory card and the more volatile configuration files from a centrally-administered server. User-specific information, such as configuration files, keymaps, and browser preferences, cannot be easily accommodated on the flash memory media as there is no way to provide per-user authentication and configuration. Since there is no local user identification/authentication to the Network Station, a server must be in place to provide the correct per-user environment setup such as home directory prior to completing the full bringup of the Network Station. This restriction does not apply to the case where the Network Station is to be configured to merely load its operating system locally and then transfer control to a server to load specific profiles and applications based on user login. The ACTLogin functionality, combined with separation of servers, enables the full bringup and user configuration of a Network Station when utilizing the flash memory boot option.

Using Network Station Manager and ACTLogin

It is recommended that separation of servers and ACTLogin be used in all flash card implementations. The recommended approach is to run Network Station Manager (NSM) at the central or regional site to configure system-wide and user-specific parameters. Then, ACTLogin is started from the flash card and is used to authenticate the user to the NSM database on the central site. This results in very low network traffic while keeping the more volatile user files and administration at the central site.

The Network Station can also be configured so that no login/authorization is required. If all Network Stations are going to use the same set of configuration/preference files, then these, along with the executable files, can be placed on the flash card. Configuration/preference files are small and tend to be somewhat volatile so managing them at the server and using separation of servers generally results in less maintenance. In this case, the flash memory can be set up to hold a generic set of configuration files and application programs. Users then validate themselves directly to the host applications where necessary when starting an application.

For example, the Network Station flash memory could be set up to boot the kernel and the 3270 emulator without any user login at the Network Station. However, the user would still be required to login to the mainframe once the emulator had been started. Each user of the Network Station would be presented with the same base system, including fonts and keyboard mapping.

Note: running the Network Station without using NSM and ACTLogin is not a supported configuration. ACTLogin provides a mode wherein an explicit user login is not required. See [Configuration Files](#) for more details.

File formats cannot be guaranteed across releases. By using NSM and ACTLogin, you ensure that the system manages most of the data and only executables and stable data reside on the flash card.

References

- A separate document detailing the procedures for creating flash memory cards will be supplied when the flash memory PRPQ order is approved.
- [IBM Network Station Manager Installation and Use](#).
This document may be ordered in the US as publication SC41-0664 or accessed on the web at <http://www.ibm.com/nc/pubs>.
- [Configuration Files](#).
This document may be accessed on the web at <http://www.ibm.com/nc/pubs>.
- [Full-Screen Solutions](#).
This document may be accessed on the web at <http://www.ibm.com/nc/pubs>.
- [AS/400 IBM Network Station: Techniques for Deployment in a WAN](#).
This Redbook may be ordered in the US as publication SG24-5187-00 or accessed on the web at <http://www.redbooks.ibm.com>. Several areas in Chapter 3 are out of date so this white paper should be used as the latest source of information.

2. PCMCIA Flash Card Memory

Overview

One alternative to booting from a server system is to use a PCMCIA flash memory card to hold the Network Station software. The interface to a flash card is a local hierarchical file system.

The code to be booted besides the (mandatory) operating system can include any of the optional software modules of the Network Station such as emulators, browser, ICA client, window manager, JVM, fonts, and browsers. In addition, the flash card may contain user Java applications.

A new flash card must first be formatted and then files can be copied to it. The Network Station's NVRAM is then changed to indicate that the Network Station is to boot itself from this local media. This procedure is detailed in the PRPQ documentation.

Characteristics of PCMCIA Flash Memory

Flash has several characteristics that need to be understood prior to implementation. It is not the solution for every remote or server-offload environment. The following sections detail as many of the issues as we have encountered to date.

The IBM Network Station products will only work with linear C series and linear D series PCMCIA flash memory cards. The maximum size of C series technology is limited to 10 Mbytes. However, D series cards are being built with as much as 40 Mbytes capacity.

The linear flash memory supported by the Network Station has the characteristic that space is allocated in contiguous blocks at the end of existing used memory. If a file is added or replaced it goes at the end of currently allocated memory and the memory allocated to the previous version of the file is effectively lost. A utility to reclaim unused space (**reclaim**) is available but it must be started manually from a command shell locally on the Network Station or remotely using telnet.

The PCMCIA flash cards are formatted using the **format** utility that is supplied with the Network Station software. Files are then copied to the card using the NFS protocol from a server. It takes approximately two minutes per megabyte to copy data to the flash card. If the copy process is interrupted, the flash card may be left in such a state that the Network Station cannot be booted from it.

Due to these limitations, it is recommended that PCMCIA flash be treated as read-only memory. While it can be written to by applications (such as a browser), the fact that space is not easily recoverable means that the card will fill up and be unusable for further updates until space is reclaimed manually.

Sizing the Flash Card

The following table gives an estimate of the card size required for each Network Station native application. Separate files are sometimes required for the Series 1000 systems. If you intend to peer boot a mixture of Series 1000 and the other systems, you will need both sets of files and the card size will approximately double. The sizes assume that the compressed files (.Z or .z suffix) are used for the kernel.

All of the sizings presume that ACTLogin is being used and that all fonts and locale-specific data (keyboards, message catalogs, etc.) are loaded from the server. If locale information is placed on the flash card, it can require up to 20 Mbytes depending on the application and the locale. (This number is even higher for double-byte locales).

Several extra megabytes should be allowed for future expansion of these files due to Network Station software enhancements. Card size should also be increased by the size of at least the largest file to be put on the card if there is any plan to update the card in place.

Function / Application	Size (Mbytes)
Emulators (3270/5250/VTxxx)	10
NC Navigator Browser (Includes Java)	20
Java Virtual Machine	16
ICA Client	8

Flash Card Management

Management of a flash card equipped Network Station is time-consuming and not yet automated. No tools are provided to synchronize the files on the flash card with those on the server or even to indicate when the files on the flash card are down-level from some designated configuration. In fact, the files on the flash card (local) file system have no timestamps so it is not easy to tell which version of each software module is on the card.

In order to update the card while it is in the Network Station, it must first be NFS-mounted to a server. Then the new files can be copied (at two minutes per Mbyte) to it. If the link goes down or the card fills up, the card may be left in a partially-updated state and render the Network Station unusable until a correctly-formatted card is obtained.

For this reason, it is recommended that when updates are required, a new flash card be sent out to the affected sites. The obsolete cards can be returned to be reformatted and flashed again at a central location. This makes the flash card very much like CDROM from the administrator's and user's perspective. This arrangement works well as long as the environment is rather static and frequent updates are not required.

A Customer Scenario

Prime Equipment in Houston was one of the first users of the PCMCIA flash card capability. They have over 30 equipment rental offices with four to thirteen Network Stations in each location. The locations are connected via 56 Kbit frame relay to an AS/400. Prime recognized early on that booting across their WAN was impractical but they did not want the expense and administrative overhead of having a server in each location.

Each location has one Network Station with a flash card and the other Network Stations peer boot from it. Thus far they have not seen the need to put a second card in any of the stores for either performance or reliability. They run the 5250 emulator and the NC Navigator browser. No performance problems have been noted even when multiple Network Stations boot simultaneously. All of their systems are accessible to everyone and thus there is no user-specific configuration information. Care was taken to manually label each card with the version of Network Station software it contained.

There is no automated management/update procedure. When a change needs to be made (configuration file changes are the most common), Prime uses a Win95 NFS package (*InterDrive Client NFS for*

Windows 95 from FTP Software) to mount the Network Station's local flash file system onto their Win95 PC. They can then copy over new versions of files as necessary. The Network Station's config files are set such that only authorized Corporate systems can NFS mount the flash card.

If it is necessary to reclaim space on the card, they telnet to the Network Station's Local File Manager port (5996) and perform the maintenance remotely. They have not done a release upgrade as yet, but expect to do that kind of major modification by just sending out new cards and retrieving the current cards for reflashing in a rolling upgrade cycle.

United Rentals is doing much the same thing as Prime, and they have deployed over 1000 Network Stations with flash memory.

Flash Card Procurement

Flash cards can be procured from several manufacturers. IBM does not manufacture or resell these cards. They should be obtained from one of the vendors listed below. Prices for these cards run from approximately \$125 for a 12 Mbyte card to \$250 for a 32 Mbyte card. Detailed pricing and quantity discounts are available by calling the vendors.

Centennial Technologies

We have tested flash cards from [Centennial Technologies](http://www.cent-tech.com) (<http://www.cent-tech.com>). Centennial's part numbers for the various size cards they can supply are shown in the following table. Evaluation cards are available by contacting Centennial.

PCMCIA Flash Card Size	Part Number
8 Mbytes	PM24104
12 Mbytes	PM24138
16 Mbytes	PM24114
20 Mbytes	PM24162
24 Mbytes	PM24136
28 Mbytes	PM24501
32 Mbytes	PM24265
40 Mbytes	PM24266



The IBM North America contact at Centennial is:
Ed Hammersley, Account Manager

7 Lopez Road
 Wilmington, MA 01887
 (800) 942-0018 x2146
 edh@cent-tech.com

The IBM contacts at Centennial for Europe is:

John Nugent, Managing Director
 London
 (44) 1925 604 954
 jcn@cent-tech-int.co.uk

Gwyneth Denis
 London
 (44) 1925 604 954
 ged@cent-tech-int.co.uk

Centennial also has a sales office in Japan.

Customers who purchased special C/D series Centennial flash memory cards for use with Release 2 of the Network Station can continue to use these cards.

SiliconTech, Inc.

We have also tested cards from [SiliconTech, Inc.](http://www.sti-oem.com) (<http://www.sti-oem.com>). SiliconTech (the OEM arm of Simple Technology) offers a full line of D series cards. SiliconTech's part numbers for the various size cards they can supply are shown in the following table.



PCMCIA Flash Card Size	Part Number
8 Mbytes	IBMFL08SD
12 Mbytes	IBMFL12SD
16 Mbytes	IBMFL16SD
20 Mbytes	IBMFL20SD
24 Mbytes	IBMFL24SD
28 Mbytes	IBMFL28SD
32 Mbytes	IBMFL32SD

Evaluation cards are available by contacting SiliconTech.

Customers who purchased special C/D series SiliconTech flash memory cards for use with Release 2 of the Network Station can continue to use these cards.

The world-wide contacts for SiliconTech are:

*Ray Buck, Account Manager
3001 Daimler Street
Santa Ana, CA 92705
(949) 260-1130
rbuck@sti-oem.com*

*Nancy Holstrom, Customer Support
3001 Daimler Street
Santa Ana, CA 92705
(949) 260-8339
nholstrom@sti-oem.com*

White Electronic Designs, Inc.

We have tested flash cards from [White Electronic Designs, Inc.](http://www.electronic-designs.com) (<http://www.electronic-designs.com>), formerly Electronic Designs, Inc. EDI's part numbers for the various size cards they can supply are shown in the following table.



PCMCIA Flash Card Size	Part Number
8 Mbytes	P0060
12 Mbytes	P0061
16 Mbytes	P0062
20 Mbytes	P0063
24 Mbytes	P0064
28 Mbytes	P0065
32 Mbytes	P0066
40 Mbytes	P0067

The IBM contact at EDI is:

*Joe Gold, Sales Manager
One Research Drive
Westborough, MA 01580
(508) 366-5151 x257*

jgold@electronic-designs.com

Joe speaks English, German, French, and Italian.

Replicating Cards

All of the flash card vendors can replicate cards for customers who need multiples to be distributed to

many locations. They can do this by copying an already-formatted card or via other methods. Contact the vendors for further details.

Network Station Series 1000 Support

Network Station Series 100 and 300 systems are supplied with built-in PCMCIA adapters. For Series 1000 systems, this adapter is an optional feature on all but the very early ethernet models. The part number for the PCMCIA Adapter on the Series 1000 is 07L8336 and can be ordered in the GEMS ordering system in the US and Canada and the UPOS ordering system in EMEA. Contact your IBM Network Station Sales representative or Business Partner to order these adapters.

Performance of Flash Memory Boot

In general, flash boot performance meets or exceeds server booting when 1-6 Network Stations are booted from the same flash. Our testing has shown that a model S/300 can easily boot 10 other Network Stations on the same subnet.

Further Information

Information on formatting and copying files to a flash memory card is provided as part of the PRPQ for this feature. Please contact your IBM representative or Network Station Business Partner for further information.

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