CompactFlash White Paper

Version 1.0.1

November 1, 1999

1.0 Overview

This document is intended to provide information that will assist system administrators in successfully establishing flash-based Network Stations. It is intended to augment the documentation in the Advanced Information manual (chapter 5), which is available on the internet at http://www.ibm.com/nc/pubs.

Note that this document is based on the Network Station Manager Version 2 Release 1.0.1 (PTF 1) code base, and is supported on the 2200 and 2800 models only (flash support is not yet available on the 300 and 1000 models). Some of the steps/circumventions in this document will no longer be necessary when PTF 2 is available, and this document will be updated to reflect those changes.

Before attempting to use the flash boot the system administrator should read thoroughly and follow the instructions provided in this document.

2.0 Installation and Setup

Once the V2R1 Network Station Manager software has been installed on the boot server, the system administrator must perform the following steps. It is critical that each of these operations are performed **before** attempting to use the flash boot function. Failure to do so will result in failures when building flash images on the client and/or when booting from flash.

1. **Update Firmware:** Flash boot will not work properly on Network Stations that do not have the most recent version of the firmware installed. The firmware date must be 8/20/99 or later. You must update the firmware for any client that will be booting from flash (it is strongly recommended that you update all clients with the latest firmware). Instructions for updating firmware may be found in chapter 3 of the "Using IBM Network Station Manager V2R1" manual, which is online at http://www.ibm.com/nc/pubs.

2. **Change .profile:** Important messages concerning the status of the flash manager will not be displayed properly on Network Station clients until the ProdBase/x86/.profile file has been changed. Before making changes to .profile you **must** make a backup copy. Once a backup copy of .profile has been made edit the file: locate the line in .profile that starts with /usr/bin/flashmgr. Remove all text on that line after flashmgr. Be careful only to delete those characters, and do not insert additional lines to the file. On Windows/NT you should only use WordPad and not NotePad to edit the file and do **not** insert any new lines into the file.

3. **Activate Flash Image Creation:** Flash image creation will not occur until the 'Check for Flash Image Updates' NSM flag is set to yes (the default is no). This flag is set in the "Hardware->Workstations" section of NSM. **Note:** you must also create a flash image that matches the 'flash image directory' field (the default is 'Default'). To create flash images use "Administration->Flash Manager" section of NSM.

4. **Flash Cards:** Engineering has qualified a set of flash cards for the 2200 and 2800 platforms. This information is also at the IBM internal Network Station support Web site http://w3.ibm.com/nc.

3.0 Flash Boot Problems/Solutions

The following sections discuss known problems/limitations associated with the flash boot function. It also provides some helpful advice/techniques for working with and managing flash based clients.

3.1 All Platforms

The following restrictions/limitations exist for all versions of NSM:

3.1.1 Server Based Flash Image Delete

System Administrators may want to delete flash images that are no longer needed or contain incomplete/incorrect flash images. The flash configuration utility does not currently support the ability to delete flash images on the server. To completely remove a flash image from an NSM server, perform the following steps:

- Remove the image entry from the images.lst file in the $Userbase/flash/ImageConfigs/ directory
- Remove the image's .log and .fls files in $Userbase/flash/ImageConfigs/ directory
- Remove the image directory from the $Userbase/flash/Images/ directory

3.1.2 Updating Flash Images Removes Customizations

Using the 'Update' button for any flash image will cause the entire contents of the flash image directory to be re-written. All files in the directory are erased, and then the image is re-written. This means that any customization to the flash image after it was initially created will be lost.

3.1.3 Coordinating the Desktop With the Flash Image

The default desktop contains icons for all applications that are available to a Network Station client when it boots over the network. However, the flash card will not contain all of those applications due to size limitations. If a user selects an icon whose code is not installed on the flash card, one of two things will happen: an error message stating the application could not be found will be popped up, or nothing will happen. This means that the desktop must be customized for users running as a flash based user.

To do this you will need to go into NSM and remove applications that are not on the flash card from the default system level desktop. If there is a mix of what is available on the flash card the customization will need to be made on a per user or per group basis.

3.1.4 Extras

Due to the size of the extra applications (Audio Player, Calculator, Calendar, File Manager, Paint, Real Player, Text Editor, and Video Player), they were not included in the default flash image. To add these applications to the flash image, you must edit the x86.Base_OS.BOM file and mark the files found in Appendix B to be included in the flash image. For more information on how to edit the BOM files, see appendix A on editing BOM files.

3.1.5   Viewing Flash Card Contents

The contents of the flash card can be displayed once the flash card has been initialized (the Network Station client initializes the flash card prior to writing an image to the card). If the flash card has not been initialized, it will not be recognized by the operating system, preventing the contents of the flash card from being seen (and since the card is not initialized, there isn't much to look at).

If the Network Station has booted from flash:
- Select "Tool Kit->Advanced Diagnostics" from the launch bar.
- When the Advanced Diagnostics application window comes up, the flash card is visible as the root directory (i.e. /)

If the Network Station has booted from the network:
- You must logon with one of the following user ID's: QSECOFR (AS/400), root (AIX), or nsm_nfsroot (Windows/NT)
- Select "Tool Kit->Advanced Diagnostics" from the launch bar.
- From the Advanced Diagnostics display, mount the flash card by issuing the following command: mount -r /dev/wd0a /mnt
  Note: it is important to specify the –r option. This causes the flash card to be mounted in read-only mode, instead of the default of read/write. When the card is mounted in write mode, the flash card is marked as 'dirty' - invalidating the contents of the card. When this happens, the boot code will see the kernel on the flash card and use it, but the operating system checks the 'dirty bit' and will not be able to use the flash card, causing flash boot to fail. If this ever happens, the Network Station must be reconfigured to boot over the network (not from flash) and then rebooted. When it is rebooted over the network, the flash card will be cleared and the flash image will be put on the flash card again.
- The contents of the flash card may be viewed from the /mnt mountpoint.

Note: If you are running in kiosk mode, you may need to boot over the network in order to see the contents of the flash card (most users of kiosk mode will not have the desktop available to launch the advanced diagnostics application).

3.1.6   Erasing Flash Cards

After booting over the network (with the flash card installed), mount the flash card (see previous section on viewing flash card contents). However, the –r parameter on the mount command must be omitted – so that the card may be modified. After mounting the flash card in write mode issue the following commands:
- cd /mnt   (sets flash card root file system as the current directory)
- rm –R *   (removes all files from the flash card except .profile)
- rm .profile   (removes the .profile file)
- At this point the card has an empty file system and will be rebuilt the next time the client is booted (assuming the appropriate client configuration).

3.1.7   Flash Card Fills Up

If the flash image is too large for a flash card, the card will fill up at which point flash image creation stops and the client will continue to boot over the network). Subsequent boot efforts will fail because the flash image is not complete. When this happens you will need to take one of the steps previously described to erase the flash card. You should also create an image that will fit on the flash card.

3.1.8   Ensuring That Flash Images Will Contain Customized Files

If a text file that is part of a flash image is changed, updating the flash image will not cause the changed file to become part of the updated flash image. For example, assume the default flash image is already created and then the system administrator changes ProdBase/x86/.profile (as was previously discussed - to direct the output of the flashmgr utility to appear on the Network Station display). The updated .profile file would not be copied into the default flash image when the update request because the NSM flash configuration utility uses the date/timestamps in the system Bill Of Material (BOM) files to determine which files have been updated. NSM does not use the date/timestamp associated with each file on the server.

If a text file that is part of a flash image is changed, the BOM file (more than likely ProdBase/x86.Base_OS.BOM) that the file belongs to must be changed so that the date/timestamp for the changed file reflect the date/time the file was changed. Once the BOM file is updated the system administrator may use NSM to update the flash images which use that file and they will be copied into the flash image.

You can also edit a flash image once it has been created. Do this by editing the BOM file in the userbase/flash/images/image_name directory. If changes are made to the flash image directory in this fashion, and the image is updated using the NSM tool, the changes you make will be lost.

Note: On Windows/NT you should only use the WordPad editor. Don't use NotePad or any other editors.

3.1.9   2200 cannot update flash image

Until PTF 2 becomes available, the flash image cannot be updated using NSM. In order to update a flash-based 2200, you must erase the flash card (discussed in previous sections), and then a new image may be installed onto the Network Station. This manual process will need to be done for the first update following the install of the PTF 2 code (in order to get the updated 'update' code into the flash image on the client).

3.1.10 Kiosk Mode

When creating flash cards, it is important to understand how kiosk mode works, as well as which configuration files are actually used. The advanced user's guide describes kiosk mode. The configuration file used when in kiosk mode is allncs.nsm (in addition to the <ip_address.nsm>, <host_name.nsm>, or <mac_address.nsm> kiosk file). The allusers files are not used.

3.1.11 ERROR_BAD_CLIENT and ERROR_PARSE_RESULTS

The NSM flash configuration utility may return an error message "ERROR_BAD_CLIENT" or "ERROR_PARSE_RESULTS" when creating a flash image – and the timeout values on the NSM web server are set too low.

To correct this you need to increase the timeout values for the web server:

On AS/400:
1. Enter CFGTCPHTTP command from the command line.
2. Select option 2 from the menu and press enter.
3. Press Enter to select the default configuration name (CONFIG); or, select a different configuration name if you know the name of a specific HTTP server configuration being used.
4. Scrll down the file and remove any HTTP directives beginning with the words **InputTimeout, OutputTimeout, and ScriptTimeout.**
5. Insert the following directives by typing 13 on any line:
   - InputTimeout   xx mins
   - OutputTimeout xx mins
   - ScriptTimeout   xx mins
6. Press F3 to exit the utility.

On Windows/NT – using the Domino Go Web Server:
1. Edit the httpd.cnf file located in the WINNT or WTSRV directory.
2. Change the following directives:
   - InputTimeout   xx mins
   - OutputTimeout xx mins
   - ScriptTimeout   xx mins

On Windows/NT – using the Microsoft Internet Information Server:
1. Note that the default setting for IIS is 15 minutes, so you may not need to update this setting. Start up Internet Service Manager (Start->Programs->Windows NT 4.0 Option Pack->Microsoft Internet Information Server->Internet Service Manager).
2. Select the Web Server to be configured at Console Root->Internet Information Server->"Your Web Server Name". You may have to "Connect" to it to see your server.
3. Select properties of your Web Server and press the Edit button from the "Master Properties" section.
4. Select the "Home Directory" tab and press the "Configuration" button.
5. Select the "Process Options" tab
6. Change the "CGI Script Timeout" to the desired value.
7. Save your settings. You do not have to restart any services for the change to take affect.

On AIX:
1. Edit the /etc/httpd.conf file
2. Change the following directives:
   - InputTimeout   xx mins
   - OutputTimeout xx mins
   - ScriptTimeout   xx mins
3. Stop and start the http daemon by using the following commands:
   - stopsrc -s httpd
   - startsrc -s httpd

The amount of time required to build the flash image will vary – depending on the server type and speed. If the problem continues, increase the timeout values.

3.1.12 [: true: unknown operand

This error message is received when a Network Station is booting and is unable to find the .profile file. This error is not particular to flash, but will occur regardless of flash or network

boot. However, the error message is quite useless and so it is documented here in case (for some reason), the .profile file is missing on a flash card.

3.1.13 Miscellaneous Items

The following additional considerations should be given to all platforms:

Description	Circumvention
Emulator help doesn't work if Euro is on and booting from flash	None (other than turning off Euro)
Flash card is not writeable	The ability to write to the flash card will be provided in a future release.
Flash cards that are too small for the flash image cause subsequent boots to fail.	Reset the flash card. See previous discussions on how to clear the flash card. Use the NSM flash configuration utility to create an image that fits on the flash card. Boot the Network Station again.
Flash update software attempts to delete a directory (fails because there are files in the directory) and then attempts to create the same directory (which also fails), and then quits.	To recover, reset the flash card and reboot the Network Station.
Workstation configuration server setting of 0.0.0.0 or Boot Server causes error message 'bomsync: /mnt: Protocol not supported'	Specify an IP address for the workstation configuration server.
Help text is not available for the print monitor application	None.
Multiple changes to the same flash image via NSM do not appear to have taken effect.	Exit Netscape whenever a change is made to a flash image and additional changes are required for that image. This will cause Netscape to reload the modified values for the image. Also hitting the reload button may work – I have not had time to verify this.
Some advanced diagnostics are not working from flash clients.	Some of the advanced diagnostics commands were not included in the flash image (error is 'file not found'). If the files are missing from the BOM, update the BOM file and re-create the flash image. If permission is denied, copy the file to the user home directory and change the permissions there.
Flash image total size is not correct	The flash image size represented in the flash configuration utility is an approximate size, and does not include the size of the file system overhead on the flash card. Add about 3 Megabytes to the flash image size displayed in NSM for this overhead to get a better estimate of the true flash image size.
System time is based on GMT when booting from flash	Flash based client is trying to sync its time with the boot server, which doesn't work for flash based clients. Problem still under investigation.
mount_ffs error message appears before the copyright message.	This is ok, and will not impact the boot sequence
rdate error occurs after the copyright	Known problem – system clock will not show the proper time

3.2 AS/400 Considerations

The following issues are particular to the AS/400 platform.

3.2.1 Need to copy applications.lst files

Copy the ProdBase/x86.applications.lst file to the
UserBase/flash/ImageConfigs/x86.applications.lst file. Note that the file may already exist, but
needs to be copied anyway.

3.2.2 Flash image creation ends in error indicating files could not be found

Some files that are included on other platforms (but are not needed) are not installed on the
AS/400. However, the BOM files for the AS/400 were not updated to reflect this. The flash
image creation software will detect that these files were part of the BOM, but could not be found
on the AS/400 and log this as an error. This will not cause problems with the flash image - the
error message can be ignored for these files in the /QIBM/ProdData/NetworkStationV2/x86/
directory:

emul/	emul/linux/
nchome/	nls/ja_JP.eucJP/
nls/ja_JP.eucJP/img/	root/
usr/X11R6/lib/de_DE	usr/X11R6/lib/de_DE/netscape/
usr/X11R6/lib/es_ES/	usr/X11R6/lib/es_ES/netscape/
usr/local/nc/admin/	usr/local/nc/admin/desktop/
usr/local/nc/registry/desktop/media/	usr/local/nc/registry/kids/
usr/local/nc/registry/kids/documents.nc	usr/local/nc/registry/kids/word_processor.nc
usr/local/nc/registry/mime/	usr/local/nc/registry/mime/audio.nc
usr/local/nc/registry/mime/audio_minimized.xpm	
usr/local/nc/registry/mime/download.nc	
usr/local/nc/registry/mime/download_minimized.xpm	
usr/local/nc/registry/mime/help.nc	usr/local/nc/registry/startup/
usr/local/nc/registry/x3270fonts/	usr/share/locale/C/
usr/share/locale/de_AT.ISO_8859-1/	usr/share/locale/en_AU.ISO_8859-1/
usr/share/locale/en_CA.ISO_8859-1/	usr/share/locale/hu_HU.ISO_8859-2/
usr/share/locale/ko_KR.EUC/	usr/share/locale/ru_SU.CP866/
usr/share/locale/ru_SU.KOI8-R/	usr/share/locale/sl_SI.ISO_8859-2/
usr/local/nc/admin/desktop/netscape_minimized.xpm	

3.3 AIX Considerations

3.3.1 File system consideration

When NSM is installed, the /usr/NetworkStationV2/userbase file system is created with an initial
size of 32 MB. The NSM flash configuration utility creates flash images into the userbase
directory, so before creating any flash images the size of the userbase file system must be
increased. The size of the increase depends on the number and size of the flash images you will
be creating. Currently, flash image sizes will range be between 48 and 80 Megabytes.

Description	Circumvention
Network Stations continually update their flash image and then reboot.	Turn off the 'check for flash updates' flag in the Hardware-Workstation section of NSM. Turn the flag on – only when a client that needs updating is being booted

	and then turn the flag back off.
NSM is unable to find /tmp/resolv.conf when creating the flash image	Copy /usr/NetworkStationV2/prodbase/ppc/etc/resolve.conf to /tmp/resolv.conf.

4.0 Appendix A: Editing BOM Files

4.1 Overview

BOM files are installed on the boot server and contain information about all files that were installed as part of the NSM product. BOM files are a very important part of flash image creation:

- BOM files are used to define which files will be part of the flash image.
- BOM files contain a list of all files that are shipped with NSM.
- There is a BOM file for each application that can be placed into a flash image. The BOM files reside in the prodbase directory (/QIBM/ProdData/NetworkStationV2/ for AS/400, /NetworkStationV2/ProdBase/ for NT and AIX).
- The format for the BOM file name is platform.application.BOM, where platform is either x86 (2200 and 2800 models) or ppc (300 and 1000 models), and application represents the application/software that will be installed on the flash card. The application names currently supported are: Base Operating System (Base_OS), Netscape Browser (Netscape), Emulators (Emulation), ICA Client (ICA_Client), ICA Remote Application Manager (ICA_RemoteAppMgr), Jave (Java), and NFS Peer Boot (NFSPeerBoot).

The format of the BOM file is:

```
F T P -r-xr-xr-x 0 0              18 May 26 15:26:53 1999 x86/usr/bin/false
F T P -r-xr-xr-x 0 0           24832 Jun 18 17:00:47 1999 x86/usr/bin/find
F T P -r-xr-xr-x 0 0           98560 Jun 18 17:00:49 1999 x86/usr/bin/ftp
- T P -r-xr-xr-x 0 0           33024 Jun 18 17:30:42 1999 x86/usr/bin/gprof
- T P -r-xr-xr-x 0 0           69888 Jun 18 17:30:38 1999 x86/usr/bin/grep
```

Where the columns in the BOM file have the following meanings/usage

Column 1   F = In flash image, '-' = Not in flash image
              X = Conditional (not if 128 bit files installed)
Column 2   T = File is marked for service – do not change this flag
              If adding a new entry, specify '-'
Column 3   P = prodbase, C = complete path
Column 4   Permissions (Unix permissions)
Column 5   User ID (must be zero)
Column 6   Group ID (must be zero)
Column 7   Size
Column 8   Month file last updated
Column 9   Day of month file last updated
Column 10 Time file last updated
Column 11 Year file last updated
Column 12 File name (path based on column 3)
Column 13 Link information (-> soft link, => hard link)
Column 14 Link file (name of associated link)

The first column is used to indicate whether or not any given file will be written into the flash image (if the application represented by the BOM file is selected to be written into the flash image). The most common customization will be adding and removing files from the flash image by replacing 'F' with '-' (file will no longer be a part of the flash image), or replacing '-' with an 'F' (file will now become part of the flash image).

4.2 Changing a BOM file

In order to make changes to a BOM file - and have that change take effect in the flash-based clients, perform the following steps:

1. Make a backup copy of the BOM file that you are going to change. Again, the BOM files reside in the prodbase directory (i.e. /NetworkStationV2/prodbase/x86.Base_OS.BOM).
2. Edit the BOM file. Toggle the first column to add/remove files from the flash image. If you need to add lines to the file (unlikely), copy a line that is 'like' the one that you are adding.
3. Use the NSM flash configuration utility to update the flash images, which use the changed BOM file.
4. Reboot the flash-based clients to load the flash image update.

IMPORTANT NOTE: The BOM files that reside in the ProdBase directory WILL BE REPLACED whenever a PTF or new release is installed. You should keep track of changes you make to the BOM files and then re-apply them after installing PTFs.

5.0 Appendix B: Additional application names

Application	Files Required (assumes ProdBase/x86)	Estimated Size
Audio Player	/nls/en_US/ audio_about.html /nls/en_US/audio_index.html /nls/en_US/ncaudio /usr/local/nc/bin/ncaudio	50K
Calculator	/nls/en_US/calc_about.html /nls/en_US/calc_index.html /nls/en_US/calc_history.html /nls/en_US/calc_index.html /nls/en_US/calc_memory.html /nls/en_US/calc_overview.html /nls/en_US/calc_science.html /nls/en_US/calc_size.html /nls/en_US/calc_units.html /nls/en_US/nccalc /usr/X11R6/include/X11/bitmaps/calculator /usr/local/nc/bin/nccalc	150K
Calendar	/nls/en_US/calendar_about.html /nls/en_US/calendar_appt.html /nls/en_US/calendar_events.html /nls/en_US/calendar_exit.html /nls/en_US/calendar_index.html	300K

	/nls/en_US/calendar_overview.html	
	/nls/en_US/calendar_print.html	
	/nls/en_US/calendar_size.html	
	/nls/en_US/calendar_todo.html	
	/nls/en_US/ncscheduler	
	/usr/local/nc/bin/ncscheduler	
File Manager	/nls/en_US/docmgr_about.html	150 K
	/nls/en_US/docmgr_exit.html	
	/nls/en_US/docmgr_files.html	
	/nls/en_US/docmgr_folders.html	
	/nls/en_US/docmgr_index.html	
	/nls/en_US/docmgr_open.html	
	/nls/en_US/docmgr_overview.html	
	/nls/en_US/docmgr_size.html	
	/nls/en_US/ncdocmgr	
	/usr/local/nc/bin/ncdocmgr	
Paint	/nls/en_US/ncpaint	1 MB
	/nls/en_US/paint_about.html	
	/nls/en_US/paint_colors.html	
	/nls/en_US/paint_create.html	
	/nls/en_US/paint_edit.html	
	/nls/en_US/paint_exit.html	
	/nls/en_US/paint_grid.html	
	/nls/en_US/paint_imagesize.html	
	/nls/en_US/paint_index.html	
	/nls/en_US/paint_line.html	
	/nls/en_US/paint_open.html	
	/nls/en_US/paint_options.html	
	/nls/en_US/paint_peneffects.html	
	/nls/en_US/paint_redo.html	
	/nls/en_US/paint_save.html	
	/nls/en_US/paint_selection.html	
	/nls/en_US/paint_seleffects.html	
	/nls/en_US/paint_size.html	
	/nls/en_US/paint_subdue.html	
	/nls/en_US/paint_text.html	
	/nls/en_US/paint_toolbar.html	
	/nls/en_US/paint_tools.html	
	/nls/en_US/paint_zoom.html	
	/usr/local/nc/bin/ncpaint	
Real Player	/usr/local/nc/bin/rvplayer	1.1 MB
Text Editor	/nls/en_US/editor_about.html	75 K
	/nls/en_US/editor_createfile.html	
	/nls/en_US/editor_createlink.html	
	/nls/en_US/editor_docformat.html	
	/nls/en_US/editor_exit.html	
	/nls/en_US/editor_find.html	
	/nls/en_US/editor_imageinsert.html	
	/nls/en_US/editor_index.html	
	/nls/en_US/editor_listformat.html	

	/nls/en_US/editor_openfile.html	
	/nls/en_US/editor_overview.html	
	/nls/en_US/editor_printing.html	
	/nls/en_US/editor_save.html	
	/nls/en_US/editor_size.html	
	/nls/en_US/editor_spacer.html	
	/nls/en_US/editor_textedit.html	
	/nls/en_US/editor_textformat.html	
	/nls/en_US/editor_undo.html	
	/nls/en_US/NCEditorGUI	
	/usr/local/nc/bin/ncedit	
Video Player	/nls/en_US/video_about.html	950 K
	/nls/en_US/video_index.html	
	/usr/local/nc/bin/ncxanim	
	/usr/local/nc/lib/libxanim.so -> libxanim.so.1	
	/usr/local/nc/lib/libxanim.so.1	