WHITE PAPER

September 2002

Prepared By
PSG Marketing

Compaq Computer
Corporation

PXE Operation Flow for Compaq Evo Thin Clients

This paper explains how a Compaq Evo Thin Client communicates with the server in a PXE environment and offers solutions for replacing corrupted firmware.

CONTENTS

Notice

PXE Operation Flow for Compaq Evo Thin Clients

North America First Edition (September 2002)

INTRODUCTION

PXE (Pre-boot Execution Environment) is supported on both the Compaq Evo T20 and T30 NTe PXE and XPe products. Intel's PXE is a protocol that defines interaction between TCP/IP, DHCP and TFTP to enable a client to download a pre-boot environment from a server. Before the operating system is started a PXE enabled client broadcasts a DHCPDISCOVER request with an extension tag that identifies it as a PXE request. A DHCP server or DHCP proxy listening for PXE requests then sends the client a list of boot servers. The client uses TFTP to download an ITF Agent, which in turn downloads a complete binary image to the terminal.

For additional information about PXE please see the *Preboot Execution Environment (PXE) Specification* white paper. This paper is available for download at the following URL:

www.intel.com/labs/manage/wfm/wfmspecs.htm

List of Terms

The following is a list of acronyms used in this paper:

Table 1. List of Terms

Acronym	**Definition**
BIOS	Basic Input Output System
BOOTP	Bootstrap Protocol
DHCP	Dynamic Host Configuration Protocol
Img2Dev	Image to Device (Agent)
IP	Internet Protocol
ITF	Internal Transport Function (Agent)
POST	Power On Self Test
PXE	Preboot eXecution Environment
TCP	Transmission Control Protocol
TFTP	Trivial File Transfer Protocol
WOL	Wake On LAN

CURRENT PXE SUPPORT PRODUCTS

Table 2. Current PXE Support Products

Model	Part Number	Config Code	O/S	Description
T30	238618-xxx	JS24	NTe	T30 64F/64R NTe PXE w/o Browser
T20	290804-xxx	JS3K	NTe	T20 64F/64R NTe PXE w/o Browser
T30	305254-xxx	JS3M	NTe	T30 128F/128R NTe PXE with Browser
T20	305253-xxx	JS3L	NTe	T20 128F/128R NTe PXE with Browser
T20 XPe	308791-xxx	JS3N	XPe	T20 300M XPe with PXE 192/256
T30 XPe	308792-xxx	JS3Q	XPe	T30 300M XPe with PXE 192/256
T30 XPe	311335-xxx	JS3S	XPe	T30 300M XPe with PXE 256/256
T20 XPe	311334-xxx	JS3R	XPe	T20 300M XPe with PXE 256/256

NOTE: PXE is not supported on CE 2.12 or CE.NET products or on previous NTe products.

PXE OPERATION FLOW: CORRUPT FIRMWARE SCENARIO

This table provides an explanation of how the thin client device communicates with the server during a corrupt firmware scenario.

Table 3. Corrupt Firmware Scenario

Step	Thin Client	Server
1	The thin client has suspected corrupt firmware and will not boot to O/S. User powers down the unit.	
2		The network administrator places O/S image pulled via 'Pull_ITFPXE_Image' or attained from HP in 'Push_ITFPXE_Image' folder in the Rapport Software Repository. **NOTE**: If the image is pulled using 'Pull_ITFPXE_Image', only the O/S will be overwritten. Images can be created which contain any combination of boot code, BIOS, OEM File System (OEMFS) drivers and/or O/S image.
3		The administrator distributes the 'Push_ITFPXE_Image' package to the powered-down client. **NOTE:** The client must have been previously discovered by Rapport (resident in Rapport database). If this is not the case, please see the "Manually Adding a New Client" topic in the Rapport Help File. **NOTE:** The administrator must modify Push_ITFPXE_Image.rsp (located in the Rapport Software Repository) to comment out the 'RB' command in the script. To do this, simply place a semi-colon before the command (e.g. ;RB).
4		Rapport issues Wake On LAN (WOL) packet to the client MAC address.
5	The client boots up and issues DHCP discover on port 67 which contains PXE Client BIOS extension information.	
6		The DHCP or DHCP Proxy server responds to the client with the IP address and location of PXE server (Rapport) on port 68.

(Continued)

Table 3. Corrupt Firmware Scenario (Continued)

Step	Thin Client	Server
7	The client responds confirming IP on port 67.	
8		The DHCP or DHCP Proxy server acknowledges on port 68.
9	The client issues a boot service discover packet containing its IP and PXEClient BIOS extension information on port 4011.	
10		Boot Service (Rapport) replies with an acknowledgment containing PXE server information and the name of the boot file (RapportITF).
11	The client issues Network Bootstrap Program Download request to TFTP port 69.	
12		The PXE server downloads Network Bootstrap Program Download (Rapport ITF) to the client's port.
13	RapportITF is mounted by the client.	
14	RapportITF requests the specified archive file (contained in Push_ITFPXE_Image within the Rapport Software Repository).	
15		Rapport downloads specified archive file to RapportITF on client (archive contains O/S image and Img2Dev).
16	Rapport ITF confirms correct flash size, negotiates flash type and executes Img2Dev to write O/S image to flash.	
17	The client device reboots, performs POST and boots to O/S; and writes computer name stored in OEM File System to new O/S image.	

REPLACING CORRUPT FLASH IMAGE USING NETXFER

NetXfer Download Utility Program is a utility program that will allow a service technician to replace the entire binary image stored on FLASH with a new image or will allow recovery of a unit where the FLASH image has become corrupt. NetXfer Utility provides an alternate way to re-flash a unit. PXE feature will work even in a unit with corrupt firmware provided the flash area corrupted is not the PXE feature code itself corrupted. If PXE feature code itself is corrupted, then NetXfer Utility can be used to re-flash the unit.

> **NOTE:** In rare cases the boot code itself may become corrupt, in this instance this program will not work and the failed unit will have to be returned to a service center for repair.

> **IMPORTANT:** This utility program is intended for use only by qualified service personnel familiar with the Evo T20 & T30 models and their applicable firmware images.

The network administrator must meet the following requirements and perform the following steps in order to use the NetXfer Download Utility Program.

System Requirements

The following items are required to use the NetXfer Download Utility Program:

- A current copy of the NetXfer utility. This utility may be downloaded from www.compaq.com/support
- Server or personal computer equipped with an Intel Pentium processor or equivalent
- Microsoft Windows 98, NT4.0, Windows 2000, or later operating system
- Internet Explorer 5.5 or later with Microsoft Virtual Machine or Sun Java Virtual Machine installed

  > **NOTE:** NetXfer will not work without Microsoft Virtual Machine or Sun Java Virtual Machine software installed.

- A 10/100 Ethernet network adapter card
- A CAT 5 crossover cable (to connect the host system to the Compaq Evo T20 or T30) or a second network card installed in a server running W2K or NT4
- Administrative rights on the server

Step 1: Obtaining the Firmware

The replacement Compaq Thin Client Evo NTe Binary firmware can be obtained at the following URL:

www.compaq.com/support/files/thinclients/

Step 2: Host System Configuration

Configure the Network Adapter card with the following information:

- IP Address: 10.0.0.1
- Subnet Mask: 255.255.255.0
- Gateway: N/A

Step 3: Host System Software Installation

Create a directory on the hard drive with the name “NETXFER”. Copy the software files into the following directory:

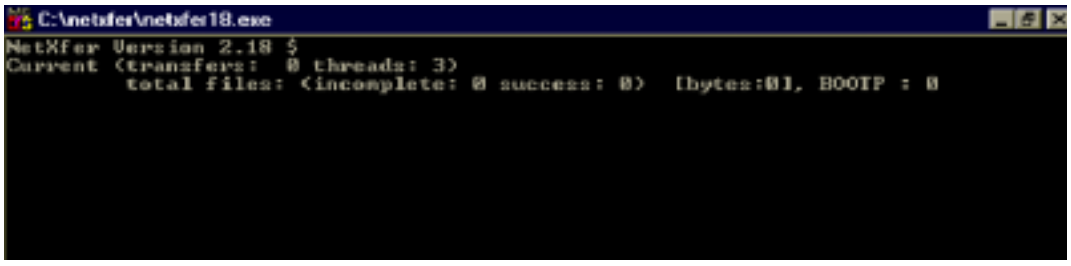
C:\NETXFER\Bootpmap\Btptab\Img2utc\Mkutc\Netxfer18\TFTP\ulc_code.pk

Step 4: Loading the T20 or T30 Firmware Image on the Host System

Copy the new firmware image (*.BIN) into the NetXfer directory. In order to function properly, the binary image that is to be downloaded to the Compaq T20 or T30 must be named “bootp.bin”. Using Microsoft Windows Explorer or a DOS command, change the name of the firmware image file in the NetXfer directory to “bootp.bin”.

Step 5: Running NETXFER Utility Software on Host PC

The NetXfer utility program runs in DOS. Double-click on the program “netxfer18.exe” or access from a DOS prompt. The application will start and display the following:



If you plan to download images to multiple units with the same firmware image be sure to run the NetXfer Utility software within the same directory where the firmware image is stored.

Step 6: Setting Up the Compaq T20 or T30

Use the following steps to setup the Evo T20 or T30 client:

a. Connect one end of the CAT 5 crossover cable to the Host System Network Adapter card.

b. Connect the other end of the crossover cable to the Compaq Evo T20 or T30.

NOTE: Ensure that the thin client is powered on, and the monitor, keyboard and mouse are attached.

IMPORTANT: This utility program is designed to run on a Host PC connected directly to the Compaq T20 or T30 and not through a networked environment.

Step 7: Starting Download

To start the download:

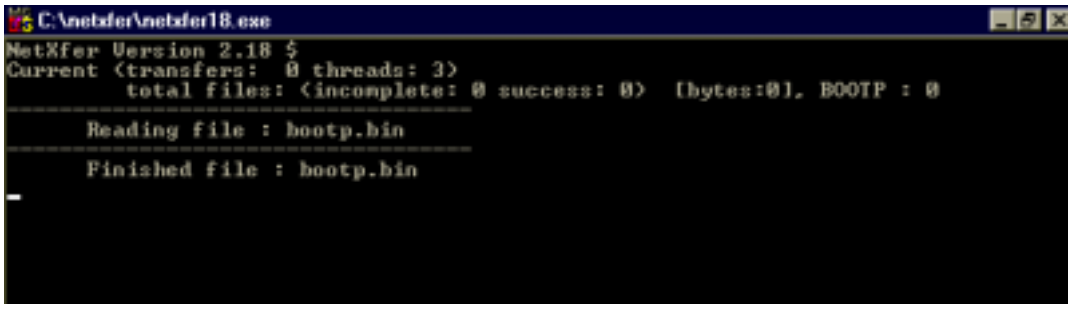
a. Press and hold down the power button for 10 seconds. This causes the unit to reboot.

b. Press and hold the “P” key on the Evo T20 or T30 keyboard until the NetXfer prompt appears on the terminal monitor.

c. Release the key. As the download program progresses, updates will appear on this monitor. The firmware will automatically be installed on the Evo T20 or T30.

> **IMPORTANT:** Do not power off or disconnect unit until the download is complete to avoid corrupting the boot flash.

When the download is complete, the terminal will automatically restart with the new firmware. The PC will indicate when the download is finished, as shown below:



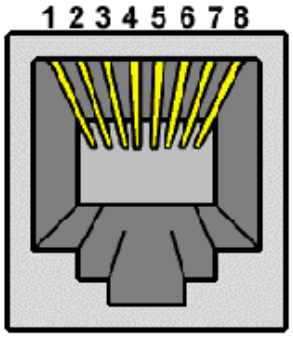
At the end of the download process the Evo T20 should re-boot normally and start up with the new firmware. The Evo T30 will display a message that says it is OK to power the unit off. Disconnect the crossover cable and reconnect the local area network cable. If there is any problem, recheck the steps listed above and try again.

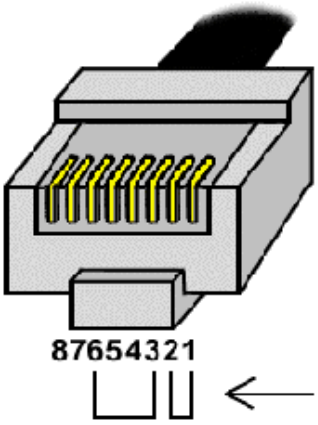
Step 8: Downloading Files to Additional Units

To download files to additional units with the same firmware image, it is not necessary to restart this program. Repeat steps 6 and 7 as documented above until all units are updated. To download images, stop the program and repeat steps 4 through 7. When all downloads are complete, simply exit the DOS session.

A description of a standard Ethernet crossover cable is shown on the following page.

RJ45 Plugs & Jacks, Ethernet Pin Assignments, Wiring Standards





EIA/TIA 568B and AT&T 258A
Pin/Wire Color Code:

EIA/TIA 568A
Pin/Wire Color Code:

An Ethernet network cable has the following pin assignment:

RJ45 Plug	to	RJ45 Plug
Pin 1	to	Pin 1
Pin 2	to	Pin 2
Pin 3	to	Pin 3
Pin 6	to	Pin 6

An Ethernet <u>crossover</u> cable has the following pin arrangement:

RJ45 Plug	to	RJ45 Plug
Pin 1	to	Pin 3
Pin 2	to	Pin 6
Pin 3	to	Pin 1
Pin 6	to	Pin 2

PXE OPERATION FLOW: GOOD FIRMWARE SCENARIO

This table provides an explanation of how the thin client device communicates with the server in a good firmware scenario.

Table 4. Good Firmware Scenario

Step	Thin Client	Server
1	The thin client is in functional state and boots to O/S.	
2		The network administrator places the O/S image pulled via 'Pull_ITFPXE_Image' or attained from HP in 'Push_ITFPXE_Image' folder in the Rapport Software Repository. **NOTE:** If the image is pulled using 'Pull_ITFPXE_Image'" , only the O/S will be overwritten. Images can be created which contain any combination of boot code, BIOS, OEM File System (OEMFS) drivers and/or O/S image.
3		The network administrator distributes the 'Push_ITFPXE_Image' package to the powered-down client.
4		Rapport processes 'Push_ITFPXE_Image' script and reboots the client.
5	The client boots up, issues DHCP discover on port 67 which contains PXEClient BIOS extension information.	
6		The DHCP or DHCP Proxy server responds to client with IP address and location of the PXE server (Rapport) on port 68.
7	The client responds confirming IP on port 67.	
8		The DHCP or DHCP Proxy server acknowledges on port 68.
9	The client issues a boot service discover packet containing its IP and PXEClient BIOS extension information on port 4011.	
10		Boot Service (Rapport) replies with an acknowledgement containing PXE server information and the name of the boot file (RapportITF).

(Continued)

Table 4. Good Firmware Scenario (Continued)

Step	Thin Client	Server
11	The client issues Network Bootstrap Program Download request to TFTP port 69.	
12		The PXE server downloads Network Bootstrap Program Download (Rapport ITF) to the client's port.
13	RapportITF is mounted by the client.	
14	RapportITF requests the specified archive file (contained in Push_ITFPXE_Image within the Rapport Software Repository).	
15		Rapport downloads specified archive file to RapportITF on the client (archive contains O/S image and Img2Dev).
16	Rapport ITF confirms the correct flash size, negotiates flash type and executes Img2Dev to write O/S image to flash.	
17	Client device reboots, performs POST and boots to O/S; and writes computer name stored in OEM File System to new O/S image.	