rapid deployment pack

february 2003

technical white paper

using PXE technology with hp ProLiant servers

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introduction

Pre-Boot eXecution Environment (PXE) is a component of the Intel® Wired for Management (WfM) specification. The PXE model provides servers with the ability to load and execute a network bootstrap program (NBP) from a PXE server and to execute a preconfigured image.

With the design of new headless servers, the reliance on network deployment and software maintenance becomes mandatory. HP has worked to build support for network control of these headless servers by supporting PXE.

executive summary

This white paper provides details on configuring your server for a Pre-Boot eXecution Environment (PXE).

The following topics are covered in detail throughout this paper:

- Introduction to the PXE
- Configuring a target server for PXE support
- Configuring PXE NICs in Non-PXE-enabled machines

importance of PXE

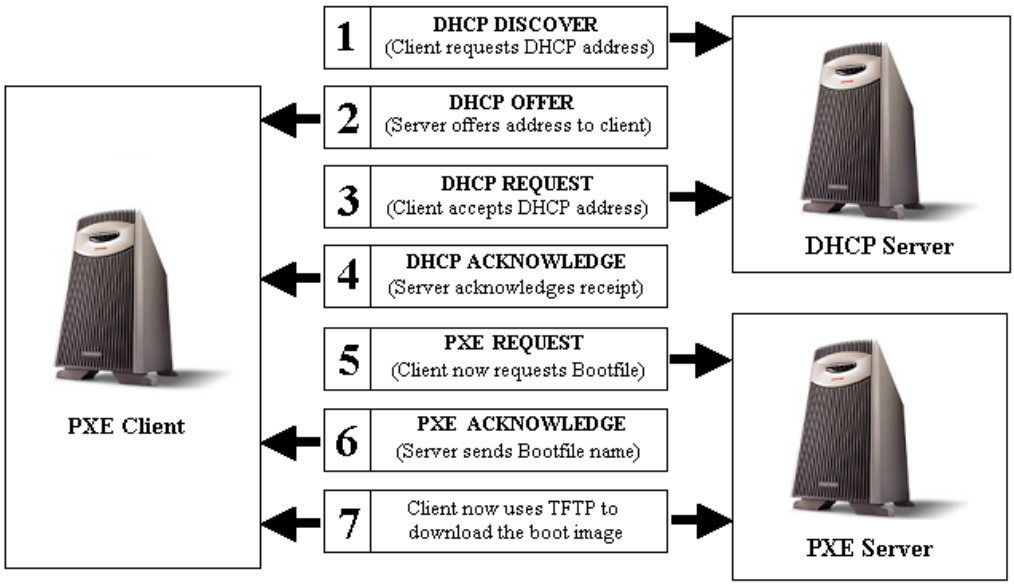
PXE allows a server to boot as if a physical boot diskette were in the system by using a network-based boot image. This enables you to remotely configure and deploy an unattended server.

When a PXE-enabled client boots, it obtains an IP address from a DHCP server. The client obtains the name of the NBP from the appropriate Boot Server. Then the client uses the Trivial File Transfer Protocol (TFTP) to download the NBP from the Boot Server and executes the image. The image can be an operating system image created by software utilities, or a boot diskette image. This white paper details how to configure the target server or servers being deployed or installed to be PXE capable.

Limitations of PXE:

- DHCP must be present because PXE is an extension of DHCP.
- If you are using a routed network, the routers must be configured to pass multicast and UDP packets.

figure 1. PXE boot process



system configuration support

Table 1 lists the server configuration support matrix for servers that have embedded PXE support.

Table 1. System Configuration Support for PXE

ProLiant Server	System Configuration Utility	ROM-Based Setup Utility 1.0	ROM-Based Setup Utility 2.0
ProLiant DL320		X	
ProLiant DL360	X		
ProLiant ML370			X
All ProLiant ML G2 servers			X
All ProLiant DL G2 servers			X
All ProLiant BL servers			X

configuring the target server for PXE support

Before network imaging and scripting can occur, the target server must be configured to support PXE.

The three HP configuration utilities are:

- System Configuration Utility
- ROM-Based Setup Utility (RBSU) 1.0
- RBSU 2.0

HP ProLiant servers each have one of these utilities.

system configuration utility method

You must manually enable PXE on the embedded NICs for ProLiant servers that use the System Configuration Utility.

The ProLiant DL360 server requires an upgrade of the system BIOS (P21) and the System Configuration Utility to support PXE on the embedded NICs. ROM and System Configuration Utility support for the ProLiant DL360 Server are included in the HP SmartStart for Servers CD Release 5.0 and later. A ROM dated later than 08/03/2001 is required for this support.

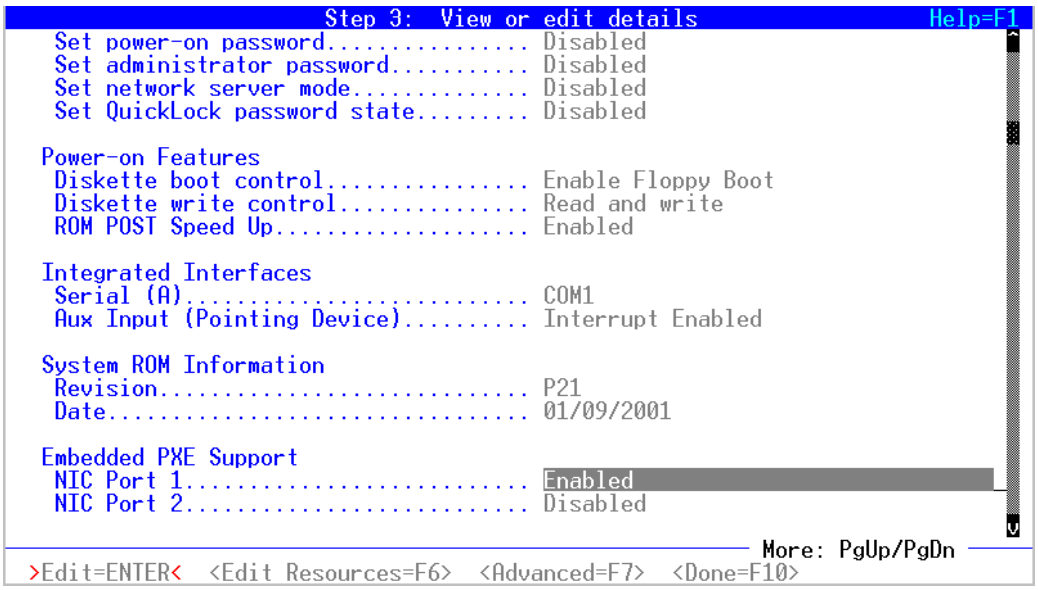
PXE support can be enabled or disabled for the embedded NICs through the System Configuration Utility 2.53 or later. The system defaults to PXE being disabled for both embedded NICs.

To enable PXE support, run the System Configuration Utility, then select **View** and **Edit Details.**

The following options are part of the main configuration menu:

Embedded PXE Support:
NIC Port 1: Disabled
NIC Port 2: Disabled

figure 2. PXE setup in System Configuration Utility



PXE support can be enabled for either of the embedded NICs. However, PXE support cannot be enabled for both NICs at the same time. Enable PXE support for the NIC connected to the network containing the PXE server.

NOTE: Unlike the ProLiant DL320 server, the ProLiant DL360 server always attempts to boot from the network. The only way to modify the default boot order is by using the STBTORDR.EXE utility found in the HP SmartStart Scripting Toolkit. PXE boot order is not configurable through the System Configuration Utility.

ROM-based setup utility 1.0 method

The ProLiant DL320 server allows a connection to a PXE server by means of an embedded NIC. The server defaults to disabling PXE support on the embedded NIC.

To configure the ProLiant DL320 server as the client machine for PXE support:

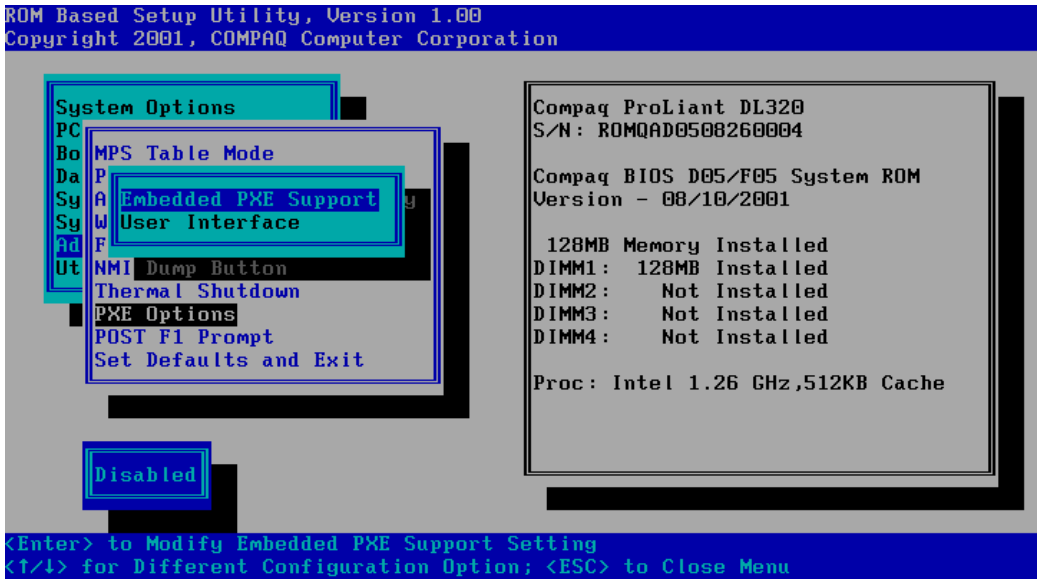
1. Use RBSU to enable PXE support for NIC Port 1.
2. Connect NIC Port 1 to the network containing the PXE server. To enable PXE support for NIC Port 1, press the **F9** key during the Power-On Self-Test (POST) to enter RBSU.
3. When RBSU has launched, select **Advanced Options,** and then **PXE Options.** The following menu is displayed:

   Embedded PXE Support
   User Interface

4. Select **Embedded PXE Support** and change the option to **Enabled** (the default is **Disabled**) to enable PXE support for NIC Port 1.

NOTE: By selecting **User Interface,** you can control whether the system automatically attempts a network boot during POST or the user must press the **F12** key during POST to attempt a network boot. If **User Interface** is disabled, the system always attempts to boot from the network. This selection defaults to enabled. To automatically attempt network boot, you must set this option to **Disabled.**

figure 3. PXE setup in ROM-Based Setup Utility 1.0



ProLiant DL320 server F12 prompt

As mentioned previously, the ProLiant DL320 server may require pressing the **F12** key before attempting to boot from the network. The **User Interface** selection in RBSU controls this action. If **User Interface** is enabled, the following message is displayed in the lower right corner of the screen during POST:

<**F9** = Setup> < **F12** = Network Service Boot>

When this prompt displays, pressing the **F12** key causes the system to search for a PXE server and attempt a network boot. If you do not press the **F12** key, the system never attempts to boot from the network.

This functionality can be disabled in RBSU by setting **User Interface** to **Disabled.**

NOTE: The server does not display the **F12** prompt when PXE is disabled, regardless of the setting for **User Interface.**

NOTE: If you have disabled a NIC through RBSU, you cannot enable PXE for that NIC.

ROM-based setup utility 2.0 method

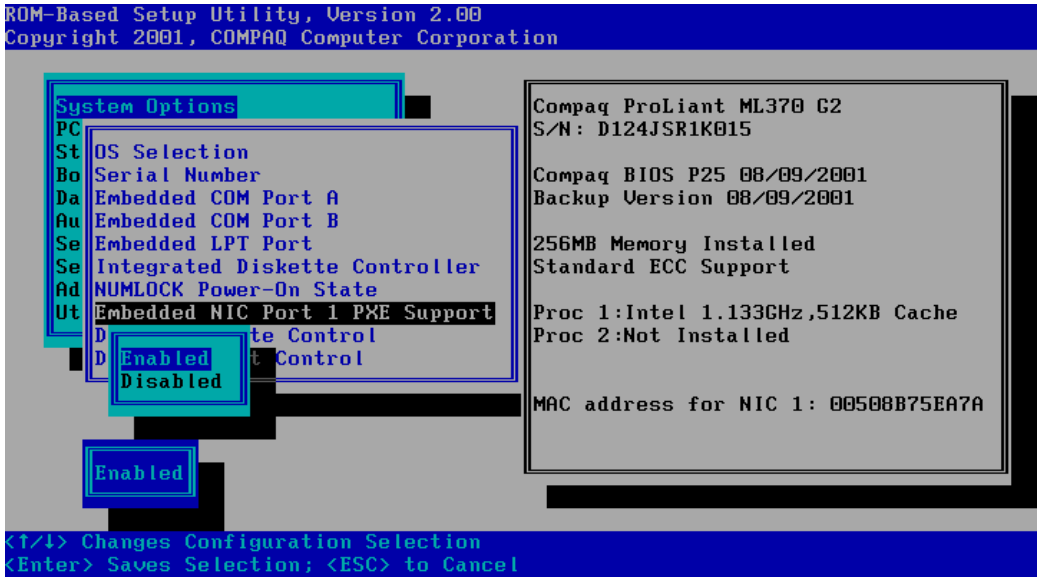
ProLiant servers that use RBSU 2.0 allow a connection to a PXE server using an embedded NIC. The server defaults to enabling PXE support on the first embedded NIC. To configure a ProLiant server that has RBSU 2.0 as the client machine for PXE support:

1. Use RBSU to enable PXE support for NIC Port 1.
2. Connect NIC Port 1 to the network containing the PXE server. To enable PXE support for NIC Port 1, press the **F9** key during POST to enter RBSU.
3. When RBSU has launched, select **System Options** then **Embedded NIC Port 1 PXE Support.** The following menu is displayed:

   Enabled
   Disabled

4. Be sure the option is set to **Enabled** (the default is **Enabled**) to enable PXE support for NIC Port 1.

figure 4. PXE setup in ROM-Based Setup Utility 2.0



configuring PXE NICs in non-PXE-enabled machines

Other ProLiant servers do not have built-in PXE capabilities, but HP is committed to having PXE enabled on all new server models.

To have PXE on systems with no inherent PXE support, install the NC3123 network card, which has a built-in option ROM that can be flashed using the Intel FBOOT.EXE program to enable PXE support.

NOTE: You can obtain the FBOOT utility and more information about the Intel Boot Agent from the Intel website at

support.intel.com/support/network/adapter/pro100/bootagent/index.htm

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With a PXE-enabled PCI NIC in the system, your ProLiant server **should** be able to boot to PXE with no problem. Certain servers may not fully support this feature and, therefore, may continue to boot to local boot devices. In this case, you must use a boot diskette for these servers.

For a list of servers that support PXE booting and at what level they support PXE, refer to the *HP ProLiant Essentials Rapid Deployment Pack Support Matrix*.

PXE Option ROM Setup Menu

Follow this procedure to set up the PXE Option ROM on servers using the NC3123 NIC.

The PXE option ROM displays the following message (or similar) during POST:

```
Initializing Intel (R) Boot Agent Version 4.0.17 PXE 2.0 Build 083 (WfM 2.0)
Press Ctrl+S to Enter Setup Menu
```

If you press the **CTRL+S** keys while this message is displayed (you have approximately two seconds to make this selection), the system enters the **PXE Option ROM Setup** menu. This menu allows you to choose the boot order for the network boot.

The following menu is displayed:

Network Boot Protocol	PXE
Boot Order	Try network first, then local drives
Show Setup Prompt	Disabled
Setup Menu Wait Time	2 seconds
Legacy OS Wakeup Support	Disabled

To attempt a network boot by means of PXE, the Network Boot Protocol must be set to **PXE.** The **Boot Order** selection allows you to select the order of the devices that the system attempts to boot.

The following choices are available for **Boot Order** on the ProLiant DL360 server:

- **Try network first, then local drives**—The system searches for a PXE server and performs a network boot, if available. If no PXE server is found, the system performs the normal boot order (such as diskette, CD, then fixed disk).
- **Try local drives first, then network boot drive**—The system attempts to boot local media first, even if a PXE server is present. If no local media is bootable, the system attempts to boot from a PXE server.
- **Try network only**—The system only attempts to boot over the network. Booting to local media is never attempted. The system searches for a PXE server, and if none is found, a message is displayed indicating you must press the **CTRL+T** keys to attempt booting from the network again.
- **Try local drives only**—The system always attempts to boot local media. Although the PXE option ROM executes, the system never attempts to boot over the network.

If you enable **Show Setup Prompt,** the option ROM prompts you to enter the **PXE Option ROM Setup** menu by displaying the following message after the normal PXE option ROM initialization text:

```
Press CTRL+S to enter Setup Menu
```

Show Setup Menu Wait Time controls the amount of time allotted to press the **CTRL+S** keys to enter the **Setup** menu during POST. The default value is two seconds, but the timeout can be increased to eight seconds.

The Legacy operating system Wakeup Support selection is not related to PXE support.

default boot order

The boot order of a computer determines which devices, in a specific order, are tried as boot devices when the machine is powered on or rebooted. The default boot order on ProLiant servers may vary depending on the server model or the options installed, but can always be modified to your specifications using the methods described in this document.

The default location of PXE in the boot order is especially important when using PXE as a remote configuration method. Because the first bootable device found is used to bring up the system, the presence of a bootable device before PXE in the boot order may mean that PXE is never be used, unless you use the one-time boot EV to set the boot order for the next reboot only.

The following table displays the default boot order of ProLiant servers (with PXE already enabled using the methods described in this document).

table 2. Default Boot Order

ProLiant Server	1st Device	2nd Device	3rd Device	4th Device
ProLiant DL320	PXE*	A :	CD	C :
ProLiant DL360	PXE	A :	CD	C :
All G2 and BL servers	A :	CD	C :	PXE
Other servers using NC3123 NIC	PXE	A :	CD	C:

*With “User Interface” disabled in RBSU 1.0

With servers prior to RBSU 2.0, it is not possible to set the location of PXE in the boot order using the System Configuration Utility (or RBSU 1.0 in the case of the DL320 Server). It is possible to modify the setting such that PXE is not used as the default bootable device.

HP recommends that you enable PXE as the non-default bootable device, so that when a valid partition exists on the server, PXE is not used unless the boot order is reset or the one-time boot EV is set to PXE. This configuration prevents security issues with rogue PXE servers that could attach to active servers that are being rebooted because PXE is not used as a boot device unless the administrator specifies it as part of a deployment activity. This configuration also prevents accidental modification of existing servers by valid PXE servers that might not discriminate between configured and unconfigured servers.

summary

A PXE environment makes it possible to configure or reconfigure a system remotely. The computer system has a universal service agent loaded locally in the BIOS. This agent allows the system to interact with a remote server to dynamically retrieve the requested boot image across the network, making it possible to install the operating system and user configuration of a new system without a technician present. This type of remote operating system installation saves time and IT resources, allowing companies to lower their total cost of ownership.

There are many methods of integrating a PXE environment for an operating system installation. Some operating systems provide utilities that allow the user to create operating system images for PXE boot.

additional information

The following information is provided as additional software support resources.

hp software and support

The SmartStart Scripting Toolkit can be downloaded from the HP website at

www.hp.com/servers/sstoolkit

The download package includes the Toolkit and the following documentation:

- *SmartStart Scripting Toolkit User Guide*
- *SmartStart Scripting Toolkit Best Practices*
- *SmartStart Scripting Toolkit Server Deployment Guide: Windows 2000 Network Deployment* white paper
- General FAQs and Troubleshooting FAQs

Information about the Rapid Deployment Pack can be found at

www.hp.com/servers/rdp

The following documentation is available:

- For information about the server deployment process, refer to the *ProLiant Integration Module for Altiris eXpress User Guide*.
- For information about maximizing the use of the ProLiant Integration Module for Altiris eXpress for your individual environment, refer to the *HP ProLiant Essentials Rapid Deployment Pack Planning and Implementation Guide*.
- For a list of servers that support PXE booting and at what level they support PXE, refer to the *HP ProLiant Essentials Rapid Deployment Pack Support Matrix*.

New and updated server support software and drivers can be found at

www.compaq.com/support/files/server/us/index.html

For proactive notification of new updates, subscribe to HP ActiveUpdate at

www.compaq.com/activeupdate

wired for management resource

Refer to the Intel Wired for Management resource website at

developer.intel.com/ial/wfm/index.htm

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