Using PXE Technology on Compaq ProLiant Servers

Abstract: 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 Pre-Boot eXecution Environment
- Configuring a target server for PXE support
- Configuring PXE NICs in Non-PXE-enabled Machines
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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. Compaq has worked to build support for network control of these headless servers by supporting PXE.

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](image-url)
System Configuration Support

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

Table 1. System Configuration Support

<table>
<thead>
<tr>
<th>ProLiant Server</th>
<th>System Configuration Utility</th>
<th>ROM-Based Setup Utility 1.0</th>
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<tr>
<td>ProLiant BL e-Class</td>
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</tbody>
</table>

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 Compaq configuration utilities are:

- System Configuration Utility
- ROM-Based Setup Utility 1.0
- ROM-Based Setup Utility 2.0

Compaq ProLiant™ servers each have one of these utilities.
System Configuration Utility Method

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

The ProLiant DL360 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 are included in the Compaq SmartStart™ for Servers CD Release 5.0 and later. A ROM dated later than 09/01/2000 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 will default to PXE being disabled for both embedded NICs.

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

2. The following options will be 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

3. 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, the ProLiant DL360 always attempts to boot from the network subject to the “Boot Order Selection” configured in the “PXE Option ROM Setup Menu.” Compaq recommends that you use PXE on the first NIC only.
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ROM-Based Setup Utility 1.0 Method

The Compaq ProLiant DL320 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 as the client machine for PXE support, follow these steps:

Use the ROM-Based Setup Utility (RBSU) to enable PXE support for NIC Port 1.

1. 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.

2. When RBSU has launched, select Advanced Options then PXE Options in the Advanced Options menu. The following menu is displayed:

   - Embedded PXE Support
   - User Interface

3. 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 F12 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.

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Figure 3: PXE setup in ROM-Based Setup Utility 1.0
ProLiant DL320 F12 Prompt

As mentioned previously, the ProLiant DL320 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:

\(<F9 = \text{Setup}> < F12 = \text{Network Service Boot}>\)

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 will never attempt to boot from the network.

This functionality can be disabled in RBSU by setting User Interface to Disabled. If you have disabled an NIC through RBSU, you cannot enable PXE for that NIC.

Note: The server will not display the F12 prompt when PXE is disabled, regardless of the setting for User Interface.
ROM-Based Setup Utility 2.0 Method

Compaq 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, follow these steps:

1. Use the ROM-Based Setup Utility (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. Set the option 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](image)
Configuring PXE NICs in Non-PXE-Enabled Machines

Other Compaq ProLiant servers do not have built-in PXE capabilities, but Compaq is committed to having PXE enabled on all servers beginning in the third quarter of 2001.

To have PXE on systems with no inherent PXE support, install the Compaq 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](support.intel.com/support/network/adapter/pro100/bootagent/index.htm)

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 Rapid Deployment Pack Support Matrix.

PXE Option ROM Setup Menu

Follow the procedure below to setup the PXE Option ROM.

Note: The PXE Option ROM Setup menu is only available for the ProLiant DL360. On the ProLiant DL320, this menu is located in the Use BIOS Setup Boot Order menu. The ProLiant DL320 always attempts to boot from the network first, and then attempts to boot off any local media.

If PXE is enabled for either of the embedded NICs on the ProLiant DL320 the PXE Option ROM is executed during POST. This option ROM provides the support for booting over the network.

The PXE option ROM displays the following message during POST:

```
Initializing Intel (R) Boot Agent Version X.X.XXX PXE X.X Build XXX (WfM X.X), RPL vX.XX.
```

1. 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.

2. 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
```

3. 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.
4. The following choices are available for **Boot Order** on the ProLiant DL360:

- **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.

5. 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*

6. **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.

**Summary**

A Pre-Boot eXecution Environment (PXE) 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.

Compaq Software and Support

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

www.compaq.com/manage/toolkit.html

The download package includes the Toolkit and the following documentation:

- Compaq SmartStart Scripting Toolkit User Guide
- Compaq SmartStart Scripting Toolkit Best Practices
- General FAQs and Troubleshooting FAQs

Information about the Rapid Deployment Pack can be found at

www.compaq.com/manage/rapiddeploy

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 Compaq Best Practices for Implementing a Deployment Infrastructure.
- For a list of servers that support PXE booting and at what level they support PXE, refer to the Rapid Deployment Pack Support Matrix.

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


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www.compaq.com/activeupdate

Wired for Management Resource

See the Intel Wired for Management (WfM) resource website at

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