Novell ZENworks® 10 Configuration Management

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PREBOOT SERVICES AND IMAGING REFERENCE

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About This Guide

This *Novell ZENworks Configuration Management Preboot Services and Imaging Reference* includes information to help you successfully use Preboot Services and Imaging in a Novell® ZENworks® system. The information in this guide is organized as follows:

- Chapter 1, “Overview,” on page 11
- Chapter 2, “Setting Up Preboot Services and Imaging,” on page 37
- Chapter 3, “Using Imaging,” on page 91
- Appendix A, “Preboot Actions,” on page 133
- Appendix B, “File Sets,” on page 139
- Appendix C, “Imaging Utilities and Components,” on page 141
- Appendix D, “ZENworks Imaging Engine Commands,” on page 173
- Appendix E, “Updating ZENworks Imaging Resource Files,” on page 197
- Appendix F, “Supported Ethernet Cards,” on page 211
- Appendix G, “Accessing IP Addresses for Devices Running Dual NICs,” on page 213
- Appendix H, “Naming Conventions in ZENworks Control Center,” on page 215

Audience

This guide is intended for ZENworks Configuration Management administrators.

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We want to hear your comments and suggestions about this manual and the other documentation included with this product. Please use the User Comments feature at the bottom of each page of the online documentation, or go to the Novell Documentation Feedback site (http://www.novell.com/documentation/feedback.html) and enter your comments there.

Additional Documentation

ZENworks Configuration Management is supported by other documentation (in both PDF and HTML formats) that you can use to learn about and implement the product. For additional documentation, see the ZENworks 10 Configuration Management documentation (http://www.novell.com/documentation/zcm10/index.html).

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When a single pathname can be written with a backslash for some platforms or a forward slash for other platforms, the pathname is presented with a backslash. Users of platforms that require a forward slash, such as Linux*, should use forward slashes as required by your software.

Overview

1

In Novell® ZENworks® 10 Configuration Management, Preboot Services provides functionality that allows you to perform automatic imaging tasks on managed devices (Windows* Primary Servers and Windows workstations) before their operating systems boot. You can also perform manual imaging operations on these devices, as well as any other device with the supported file system, such as legacy Windows workstations, Linux Primary Servers, and Linux workstations.

The following sections provide an overview of Preboot Services:

- Section 1.1, “Brief Overview,” on page 11
- Section 1.2, “What Is the Preboot Execution Environment (PXE)?,” on page 15
- Section 1.3, “Preboot Services Functionality,” on page 17
- Section 1.4, “The Preboot Services Processes,” on page 23
- Section 1.5, “Preboot Strategies,” on page 31

1.1 Brief Overview

The following provides a brief overview of Preboot Services:

- Section 1.1.1, “Preboot Services Functionality,” on page 11
- Section 1.1.2, “Preboot Services Strategies,” on page 12
- Section 1.1.3, “Imaging Bundles,” on page 12
- Section 1.1.4, “Configuring Preboot Services,” on page 12
- Section 1.1.5, “Setting Up Devices to Use Imaging Bundles,” on page 13

1.1.1 Preboot Services Functionality

Preboot Services allows you to automatically or manually do any of the following to a Windows device when it boots:

- Make an image of the device’s hard drives and other storage devices
- Restore an image to the device
- Apply an existing image to multiple devices
- Run Imaging scripts on the device

To accomplish these tasks automatically using ZENworks Control Center, you simply need to have PXE (Preboot Execution Environment) enabled on your devices, then have Imaging bundles configured and assigned to the devices. The devices automatically execute these bundles when they boot.

Preboot Services utilizes the following to make its imaging functions possible:

- **PXE (Preboot Execution Environment):** An Intel* specification that allows a device to boot from the network, instead of its hard drive or other local media. ZENworks Configuration Management can use PXE to launch Preboot Services.

- **Preboot Services Bootable CD or DVD:** Used where PXE is not installed or where you want to manually perform a Preboot Services operation.
- **Preboot Services Bootable Diskette:** Enables using the Preboot Services bootable CD or DVD when the device doesn't support booting from a CD or DVD.
- **ZENworks Partition:** Enables you to set up a device for unattended imaging operations where the device is not PXE-enabled or does not have access to PXE network services.

For more information on these methods, see Chapter 3, "Using Imaging," on page 91.

1.1.2 Preboot Services Strategies

Following are some of the uses of Preboot Services:

- **Create and Restore Standard Images:** Create base images from existing devices, as well as restore images to any manageable device.
- **Set Up Devices for Future Reimaging:** Set up devices so that the next time they reboot, they do the imaging work that is contained in their assigned Imaging bundle.
- **Multicast Device Images:** Apply an image of one device to many other devices. This is an excellent feature for initially setting up a lab.
- **Restore Devices to a Clean State:** Quickly and efficiently reset devices to an initial state, such as in a lab.

For more information on these strategies, see Section 1.5, "Preboot Strategies," on page 31.

1.1.3 Imaging Bundles

In ZENworks Control Center, Preboot Services tasks are contained in Imaging bundles. The following Imaging bundle types are available:

- **Empty Bundle:** A bundle with no initial tasks. You can quickly create this bundle without performing all of tasks in the Create New Bundle wizard. Later, you can edit its details to add assignments, actions, and so forth.
- **Imaging Script Bundle:** Allows you to write a custom Imaging script. This provides detailed control over ZENworks imaging operations, as well as most Windows-based preboot tasks.
- **Multicast Image Set Bundle:** Specifies an image that can be sent through the multicast protocol. This bundle allows you to send an image to a large number of devices in a single operation, which minimizes network traffic. It is ideal for labs, classrooms, and staging areas.
- **ZENworks Image Bundle:** Lists one or more ZENworks images (base plus add-ons) that can be restored on a device. This bundle allows you to define simple imaging operations.

To create one of these bundles: in Zenworks Control Center, click *Bundles* in the left pane, in the Bundles panel click *New* > *Bundle* > *Imaging Bundle* > *Next*, then select a bundle type.

For more information on these bundles, see Section 1.3.1, "Imaging Bundles," on page 17.

1.1.4 Configuring Preboot Services

In ZENworks Control Center, you can set up default Preboot Services configurations for all of your devices. Some settings can be overridden at the device, group, and folder levels.

You can configure the following settings per ZENworks Management Zone:

- **Novell Preboot Services Menu Options:** The menu contains five options: 1) *Start ZENworks Imaging* (automatically executes the bundle); 2) *Start ZENworks Imaging Maintenance* (accesses the imaging maintenance mode prompt); 3) *Disable ZENworks Partition*; 4) *Enable ZENworks Partition*; and, 5) *Exit* (resumes booting). You can configure whether the menu is displayed upon booting, not displayed, or displayed only when Ctrl+Alt is pressed during booting.
- **Non-Registered Device Settings:** You can use Preboot Services to automatically name your non-registered devices, using such criteria as prefixes, BIOS information (such as asset tags or serial numbers), DNS suffixes, and you can set up DHCP or IP addresses.
- **Device Imaging Work Assignment:** Work assignment rules are used to determine which bundle should be applied to which device. The work rules use logic to determine whether a device meets the requirements for applying the Imaging bundle. A rule is made up of filters that are used to determine whether a device complies with the rule. The AND and OR logical operators are used for creating complex filters for the rule.
- **Server Referral List:** When a device boots, it is necessary for it to find its home Management Zone to get its assigned imaging work. If multiple Management Zones exist on the network, server referral lists provide a method for allowing a managed device to find its home zone.
- **Intel Active Management Technology (AMT):** Intel AMT provides Preboot Services with persistent device identification.

To configure these settings, click *Configuration* in the left pane to display the *Configuration* tab. If it's not expanded, click *Management Zone Settings*, then click *Device Management* > *Preboot Services* to display the Preboot Services page.

For more information, see Section 1.3, "Preboot Services Functionality," on page 17.

1.1.5 Setting Up Devices to Use Imaging Bundles

In order for a device to automatically use an assigned Imaging bundle, you must complete two tasks:

- "Setting Up the Device to Apply the Bundle" on page 13
- "Assigning a Bundle" on page 13

Setting Up the Device to Apply the Bundle

Preboot Services utilizes PXE and other boot mechanisms and media to trigger the imaging work. For information, see Section 2.2, "Setting Up the Preboot Services Methods," on page 38.

Assigning a Bundle

You can assign an Imaging bundle to devices, their parent folder, or a device group, as well as to users and user folders.

The following paths represent many of the methods for assigning bundles to devices, or devices to bundles:

- "To Device Folders" on page 14
- "To Device Groups" on page 14
- "To Individual Devices" on page 14

- "To Users" on page 15

To Device Folders

- Click *Devices* > select the check box next to a folder, then click *Action* > *Assign Bundle*.

  Where you have selected the *Servers* and *Workstations* folders' check boxes, you can assign bundles to all of the devices contained under the *Servers* and *Workstations* folders.
- Click *Devices* > select the check box next to *Servers*, then click *Action* > *Assign Bundle*.

  You can assign bundles to all of the devices in the *Servers* folder.
- Click *Devices* > select the check box next to *Workstations*, then click *Action* > *Assign Bundle*.

  You can assign bundles to all of the devices in the *Workstations* folder.

To Device Groups

- Click *Devices* > *Servers* > select the check boxes next to one or more server groups, then click *Action* > *Assign Bundle*.

  You can assign bundles to all servers that are members of the selected server groups.
- Click *Devices* > *Workstations* > select the check boxes next to one or more workstation groups, then click *Action* > *Assign Bundle*.

  You can assign bundles to all workstations that are members of the selected workstation groups.

To Individual Devices

- Click *Devices* > *Servers* > select the check boxes next to one or more servers, then click *Action* > *Assign Bundle*.

  You can assign bundles to all selected servers.
- Click *Devices* > *Workstations* > select the check boxes next to one or more workstations, then click *Action* > *Assign Bundle*.

  You can assign bundles to all selected workstations.
- Click *Devices* > *Servers* > select a server, then click *Advanced* (in *Imaging Work* on the *Summary* tab).

  You can assign a specific bundle to the server.
- Click *Devices* > *Workstations* > select a workstation, then click *Advanced* (in *Imaging Work* on the *Summary* tab).

  You can assign a specific bundle to the workstation.
- Click *Bundles* > *Servers* > select the check box next to a server, then click *Action* > *Assign Bundle*.

  You can assign multiple bundles to the server.
- Click *Bundles* > *Workstations* > select the check box next to a workstation, then click *Action* > *Assign Bundle*.

  You can assign multiple bundles to the workstation.
- Click *Bundles* > select the check boxes next to one or more bundle names, then click *Action* > *Assign Bundle to Device*.

You can assign the selected bundles to the devices that you select in the wizard.

To Users

- Click *Bundles* > select the check boxes next to one or more user folders, then click *Action* > *Assign Bundle to User*.

  You can assign multiple bundles to the users contained in the selected folders.

- Click *Bundles* > click a user folder > select the check boxes next to one or more usernames, then click *Action* > *Assign Bundle to User*.

  You can assign multiple bundles to the users that you selected.

1.2 What Is the Preboot Execution Environment (PXE)?

The following sections provide information on using PXE in Configuration Management:

- Section 1.2.1, "Understanding How Preboot Services Uses PXE," on page 15
- Section 1.2.2, "Understanding the ZENworks NBPs," on page 15
- Section 1.2.3, "Preparing to Use PXE," on page 16

1.2.1 Understanding How Preboot Services Uses PXE

PXE uses DHCP (Dynamic Host Configuration Protocol) and TFTP (Trivial File Transfer Protocol) to locate and load bootstrap programs from the network. The PXE environment is loaded from the BIOS on the NIC.

Preboot Services uses PXE to discover if there is Preboot Services work specified for a device and to provide the device with the files necessary to execute the assigned work.

Using Preboot Services, you can automatically place an image on a device, even if the device's hard disk is blank. You do not need to use the CD or DVD, or a ZENworks partition on the device.

1.2.2 Understanding the ZENworks NBPs

The Intel PXE specification defines mechanisms and protocols that allow PXE devices to use their network interface cards (NICs) to find bootstrap programs located on network servers. In the PXE specification, these programs are called Network Bootstrap Programs (NBPs).

NBPs are analogous to the bootstrap programs found in the Master Boot Records (MBRs) of other boot media, such as hard drives, floppy disks, CDs, and DVDs. The purpose of a bootstrap program is to find and load a bootable operating system. MBRs on traditional boot media accomplish this by locating the necessary data on their respective media. NBPs accomplish this by using files found on network servers, usually TFTP servers.

ZENworks Preboot Services uses two separate NBPs working together:

- "nvlnbp.sys" on page 16
- "pxelinux.0" on page 16

nvlnbp.sys

This NBP has the following responsibilities:

- Detect various SMBIOS parameters and local hardware
- Read the ZENworks identity information from the hard drives
- Communicate with novell-zmgprebootpolicy to determine if there is any preboot work applicable to the device
- Present and manage the Novell Preboot Services Menu
- If necessary, launch `pxelinux.0` to execute the assigned preboot work

pxelinux.0

The primary purpose of this NBP is to load the operating system that is required to execute the assigned preboot work.

The `pxelinux.0` file is a modified version of part of an open source project called syslinux. Although `pxelinux.0` is primarily a Linux loader, it is capable of loading other operating systems. It operates by using configuration files located on a TFTP server to provide boot instructions. The various `pxelinux.0` configuration files used by Configuration Management can be found on your Imaging Server in the `/srv/tftp` directory on Linux or the *`installation_path`*`\novell\zenworks\share\tftp` directory on Windows.

In Configuration Management, when PXE devices are assigned preboot work, they are also told which `pxelinux.0` configuration file they should use to execute that work. Similarly, when using the Novell Preboot Services Menu, each menu option corresponds to a `pxelinux.0` configuration file. For more information, see Section 2.3.4, “Editing the Novell Preboot Services Menu,” on page 63.

For more information on `pxelinux.0` and its configuration files, see the syslinux home page (http://syslinux.zytor.com/pxe.php).

For a copy of the Novell modifications to the syslinux open source project, see Novell Forge (http://forge.novell.com).

1.2.3 Preparing to Use PXE

Before you can use Preboot Services with PXE, you need to do the following:

1. Install Novell ZENworks 10 Configuration Management. For more information, see the *ZENworks 10 Configuration Management Installation Guide*.
2. Enable PXE on your Configuration Management devices. For more information, see Section 2.6, “Enabling PXE on Devices,” on page 88.
3. Have a standard DHCP server, either on your ZENworks Imaging Server or on another network server where ZENworks is not installed. For more information, see “Configuring LAN Environments for Preboot Services” on page 56.

1.3 Preboot Services Functionality

Review the following sections to understand Preboot Services functionality:

- Section 1.3.1, “Imaging Bundles,” on page 17
- Section 1.3.2, “Novell Preboot Services Menu,” on page 19
- Section 1.3.3, “Non-Registered Device Settings,” on page 19
- Section 1.3.4, “Device Imaging Work Assignment,” on page 20
- Section 1.3.5, “Server Referral List,” on page 22
- Section 1.3.6, “Intel Active Management Technology (AMT),” on page 23

1.3.1 Imaging Bundles

Configuration Management uses Imaging bundles to apply Preboot Services work to devices. For example, Imaging bundles can contain tasks, such as restoring an image, that are performed at the time a device boots.

In order for a device to utilize an Imaging bundle, the bundle must be assigned to the device, its group, or its folder.

The available Imaging bundles are:

- “Empty Bundle” on page 17
- “Imaging Script Bundle” on page 17
- “Multicast Image Set Bundle” on page 17
- “ZENworks Image Bundle” on page 18

Empty Bundle

This bundle contains no initial tasks. You can quickly create this bundle without performing all of tasks in the Create New Bundle Wizard. Later, you can edit its details to add assignments, actions, and so forth. For example, you could create an empty bundle, then in the bundle’s properties add the *Linked Application Bundle* action as its only action.

Imaging Script Bundle

Allows you to write a custom Linux script that is executed on PXE-enabled devices. This provides detailed control over ZENworks imaging operations, as well as most Linux-based preboot tasks.

For more information, see Section 3.3, “Configuring Imaging Script Bundles,” on page 122.

Multicast Image Set Bundle

Specifies an image that can be sent using the multicast protocol. This bundle allows you to send an existing image to a large number of devices in a single operation. It is ideal for labs, classrooms, and staging areas.

For more information, see Section 1.5.6, “Multicasting Device Images,” on page 33 and Section 3.2, “Multicasting Images,” on page 111.

Benefits

You can image multiple devices with the least amount of overhead. Devices to be imaged can have a variety of operating systems installed on them, or even no operating system installed.

Using the multicast capabilities of your network, you minimize network traffic by sending the image file across the network once for all devices to be imaged, rather than individually per device.

Limitations

Using the same image on multiple devices means they all have the same network identities. However, you can install the ZENworks Configuration Management Imaging Agent (novell-ziswn) on these devices prior to performing the multicast, because this agent saves each device's network identity settings and restores them after the multicast image is applied.

ZENworks Image Bundle

Lists one or more ZENworks images that can be restored on a computer. This bundle allows you to quickly define simple image restoration operations.

For more information, see Section 3.1.1, "Using ZENworks Control Center for Imaging," on page 91.

Scope

You can restore an image all of a device's hard disks, specific add-on images, and file sets.

Boot Manager Limitation

If the device you want to image has an unsupported boot manager running, such as System Commander, you must disable or remove it before attempting to image those devices. This is because boot managers create their own information in the MBR and overwrite the ZENworks boot system, preventing ZENworks imaging from being performed.

Base Images

A base image contains descriptions of all partitions and files on a hard drive. When it is restored, all existing partitions are deleted, new partitions are created from the descriptions in the base image, and all files are restored from the image.

Base images are created by taking an image of a device. You can use an option in ZENworks Control Center or you can use imaging commands at the imaging maintenance mode prompt to create a base image.

Add-On Images

These images are a collection of files added non-destructively to existing partitions. The existing partitions and files are left intact, except for any files that the add-on image might update.

Add-on images allow you to customize a device after a base image is restored. This allows you to use a base image for multiple purposes.

You can create add-on images by using the Image Explorer utility.

1.3.2 Novell Preboot Services Menu

Where PXE is enabled on a device, the Novell Preboot Services Menu can be displayed during the boot process. The following menu choices are displayed on the menu:

- **Start ZENworks Imaging:** Executes the effective Preboot Services imaging bundle.
- **Start ZENworks Imaging Maintenance:** Displays the imaging maintenance mode prompt, where you can execute imaging commands.
- **Disable ZENworks Partition:** Prevents an existing ZENworks partition from being used during booting to execute the assigned Imaging bundles.
- **Enable ZENworks Partition:** Allows an existing ZENworks partition to be used during booting to execute the effective Imaging bundle.
- **Exit:** Resumes normal booting of the device.

You can use ZENworks Control Center to configure whether this menu should be displayed on a PXE-enabled device by selecting one of the following options:

- *Always Show Imaging Menu*
- *Never Show Imaging Menu*
- *Show Imaging Menu if CTRL+ALT Is Pressed*

For the procedures in configuring the menu's display, see Section 2.4.1, "Configuring Novell Preboot Services Menu Options," on page 66.

1.3.3 Non-Registered Device Settings

Devices that are new to the Management Zone and have received their first image need certain IP configuration information to successfully access the network and network services. You can use Preboot Services to automatically name your non-registered devices, using such criteria as prefixes, BIOS information (like asset tags or serial numbers), DNS suffixes, and you can set up DHCP or IP addresses.

For example, the device needs a unique IP address and the address of at least one DNS name server. In many networks, this information is distributed through the DHCP services, but it can also be configured through the default Preboot Services configuration settings in ZENworks Control Center.

After a device has registered with ZENworks, its configuration is set and the non-registered device settings in the Management Zone no longer apply to it, because the ZENworks server now knows its identity. Whether it becomes a member of the zone or continues to be a non-registered device depends on whether the image applied to the device contains the ZENworks Configuration Management Imaging Agent (novell-ziswn).

The settings that can be adjusted for a Management Zone are:

- **DNS suffix:** Provides a suffix for all of your devices' names. For example, provo.novell.com.
- **Workgroup:** The Windows workgroup that you want the device to be a member of.
- **Name Servers:** Controls which DNS servers a device uses. You can specify multiple DNS name servers.
- **Device Name:** Configured device names can include a prefix, the BIOS asset tag, the BIOS serial number, or none of these.

- **IP configuration:** For the IP configuration, you can specify to use DHCP or a specific IP address. If you select to use IP addresses, you can provide a range of addresses in a list, or you can specify certain IP addresses. As devices are registered, they assume one of the available addresses. For IP addresses, you can also specify a subnet mask and a default gateway.

For the procedures in configuring defaults for non-registered devices, see Section 2.4.2, "Configuring Non-Registered Device Settings," on page 67.

1.3.4 Device Imaging Work Assignment

You can determine what imaging work is to be performed on a device when it boots, based on a set of hardware rules. This configuration section lets you specify a particular bundle for each set of hardware rules. The Custom Hardware Types section allows you to provide specific data for a *Hardware Type* hardware rule option.

Rules and custom types configured here are applied globally to all non-managed devices. You can also apply them to managed devices in the Management Zone by assigning those devices to the bundle that is selected for the rule. Only those devices that exactly match the rule and its custom types have the assigned bundle applied to them when they boot.

- "Hardware Rules" on page 20
- "Custom Hardware Types" on page 21
- "Allowing Overwrites" on page 22

For the procedures in configuring work assignment rules, see Section 2.4.3, "Configuring Device Imaging Work Assignments," on page 71.

Hardware Rules

You can set up hardware-based rules for your Imaging bundles. Work assignment rules are used to apply bundles to devices with specific hardware, or to match a broad set of hardware requirements.

For example, you can create a rule that applies a bundle to any device with a specific MAC address or BIOS serial number. Rules like this can only match to a single device. On the other hand, you can create a rule that applies to any device with at least 512 MB of RAM and 150 GB of hard drive space.

A work rule is comprised of filters that are used to determine whether a device complies with the rule. The rules use logic to determine whether a device meets the requirements for applying the Imaging bundle. The AND and OR logical operators are used for creating complex filters for the rule.

When a device is seeking work to be done, it scans the rules until it finds a rule where all of the rule's filters match the device, then executes the bundle assigned to the rule.

Filter information that you can provide:

- **Device component:** Any of the following:

  BIOS Asset Tag
  BIOS Serial Number
  BIOS Version
  CPU Chipset

Hard Drive Controller
Hard Drive Size
Hardware Type
IP Address
MAC Address
Network Adapter
Product Name
RAM
Sound Card
System Manufacturer
Video Adapter

- **Relationship:** This defines the relationship for a filter between the *Device component* field and the value you specify for it.

  Possibilities for the *Hard drive size* and *RAM* fields:

  < (less than)
  > (greater than)
  = (equal to)
  >= (greater than or equal to)
  <= (less than or equal to)
  <> (not equal to)

  Possibilities for all other device components:

  Contains
  Equal To
  Starts With
  Ends With

- **Component Value:** This corresponds to the match you want for the component. For example, you select *RAM (in MB)* for the filter and enter 512 for its value. Then, the relationship you select determines whether it's less than, less than or equal to, equal to, not equal to, greater than or equal to, or just greater than 512 MB.

You can have multiple filters and sets of filters in a single rule, using the AND and OR operators, and you can have multiple rules associated with the same Imaging bundle. This allows you to specify exactly which can receive a particular Imaging bundle.

Custom Hardware Types

Custom hardware types enable you to include any devices matching your custom type to have the bundle assigned to the hardware rule applied to them when the devices boot. For example, you can create a rule that applies the bundle to any device that is a laptop by entering the applicable string as a custom hardware type, selecting *Hardware Type* in the Rule Construction dialog box, then selecting your custom type.

The *Hardware Type* option does not display in the Rule Construction dialog box until at least one custom type has been configured.

Allowing Overwrites

Select the *Allow Preboot Services to Overwrite Existing Files when Uploading* check box if you want existing `.zmg` files to be overwritten by a newer version when the image is taken.

1.3.5 Server Referral List

When a PXE device boots, it makes a broadcast request on the network for PXE services. The ZENworks Proxy DHCP server (novell-proxydhcp) responds to this request with information that includes the IP address of an Imaging Server where the device can send requests for assigned imaging work.

Because PXE devices can exist in an environment with both newer and older ZENworks systems running concurrently, the device can fail to determine its assigned imaging work if it cannot find the Imaging Server for its own ZENworks version.

In ZENworks Configuration Management, devices can exist in multiple Management Zones. It is essential that the PXE device contact PXE services assigned to its home zone so that it can correctly determine if there is any imaging work assigned to it. When there is only a single Management Zone, this is easy to do because all Proxy DHCP servers provide addresses to services that belong to the same zone. Any device can request imaging work from any Imaging Server in the same zone and get the same response.

The PXE device's initial request for PXE services is sent as a broadcast to the network, and all Proxy DHCP servers respond with information pertaining to their respective zones (in ZENworks Configuration Management and ZENworks Linux Management) or Proxy DHCP servers in their trees (in traditional ZENworks versions using Windows or NetWare® Imaging Servers). Because it is impossible to determine which Proxy DHCP server responds first (if multiple Proxy DHCP servers respond), or which server's response is used by the device, it is impossible to ensure that each PXE device will contact servers in its home zone or tree.

For a ZENworks environment that has PXE services, the Server Referral List configuration section provides a method for getting PXE devices to connect with their proper Imaging Servers. Server referral lists are only used by PXE devices, and in ZENworks Configuration Management only one Management Zone needs to have an active Proxy DHCP server and server referral list. Because you can only have one referral list active in a network segment, if you have ZENworks Linux Management running with a referral list configured, you'll need to disable the Proxy DHCP service for Linux Management. This allows the Configuration Management referral list to be used by all PXE devices.

A server referral list allows you to ensure that all devices contact their home zone or tree for device imaging work assignments. The list should contain the IP address of an Imaging Server in each known Management Zone or older ZENworks system's tree. When a device requests device imaging work from a server, the server first determines if the device belongs to the same zone or tree as the server. If it does not, that server refers the request to each server in its server referral list until it finds the device's home zone or tree. The device is then instructed to send all future requests to the correct novell-proxydhcp.

For the procedures in configuring referral lists, see Section 2.4.4, "Configuring the Server Referral List," on page 82.

1.3.6 Intel Active Management Technology (AMT)

The Intel AMT functionality allows you to accurately identify devices, even if they have had physical drive replacements. This provides ZENworks Preboot Services with persistent device identification by providing ZENworks with nonvolatile memory for storing the unique device identity.

With AMT and Preboot Services, if a device has a new, unformatted hard drive, ZENworks can instantly and accurately identify the device and apply the appropriate Imaging bundle. If a device's hard drive is inactive or its drive is replaced, ZENworks can automatically identify the device in a preboot environment and provide the appropriate ZENworks-created image during a system rebuild.

AMT with ZENworks also provides easier hardware upgrading capability. For example, to upgrade applications, some of your device hardware might not meet the minimum requirements. With AMT and Preboot Services, as soon as the hard drives are replaced and before any agents or operating systems are installed, you can continue to assign Imaging bundles using the device's ZENworks identity without having to re-register the device.

If you are using Intel AMT, support for it should be enabled in the `novell-zmgprebootpolicy.conf` file.

For more information on Intel AMT, see the Intel Web site (http://www.intel.com/technology/platform-technology/intel-amt/).

1.4 The Preboot Services Processes

The following sections explain how the Preboot Services processes work:

- Section 1.4.1, "A Typical Preboot Services Operation," on page 23
- Section 1.4.2, "Illustrating the Preboot Services Processes," on page 24

1.4.1 A Typical Preboot Services Operation

A typical Preboot Services operation flows as follows:

1. An Imaging bundle is created in ZENworks Control Center and assigned to a PXE-enabled device.
2. The PXE-enabled device starts to boot.
3. The device sends a DHCP discovery request to determine the IP address of the Preboot Services Imaging Server.
4. The DHCP server responds with an IP address for the device to use.
5. Novell-proxydhcp responds with the IP addresses of the TFTP server, as well as the filename of the Preboot Services bootstrap program (`nvlnbp.sys`).
6. The PXE device downloads the Preboot Services bootstrap program using novell-tftp.
7. After the Preboot Services bootstrap program is downloaded and executed, the device checks novell-zmgprebootpolicy to see if there is any imaging work to do.
8. If there is imaging work to do (as contained in an Imaging bundle that is assigned to the device), the device downloads the Configuration Management imaging environment from the server so that the it can be booted to Linux.
9. Any imaging tasks contained in the Imaging bundle are performed.

10. If there are no imaging tasks to perform, files are not downloaded and the device proceeds to boot to its operating system.

In addition to using PXE for automation, you can also execute Preboot work manually using one of the following:

Novell Preboot Services Menu (if enabled for the device)

Preboot Services bootable CD or DVD

ZENworks partition

For more information, see Section 3.1.2, "Using a Command Line for Imaging," on page 96.

1.4.2 Illustrating the Preboot Services Processes

The following illustrations show the interaction between a Preboot Services (PXE) device and a Preboot Services Imaging Server, starting when the PXE device is turned on and begins to boot, and ending when imaging work begins on that device.

The following example assumes that the devices and Imaging Servers are in the same network segment.

- "Phase 1: Beginning the Process" on page 24
- "Phases 2 through 8: Continuing the Process" on page 27

Phase 1: Beginning the Process

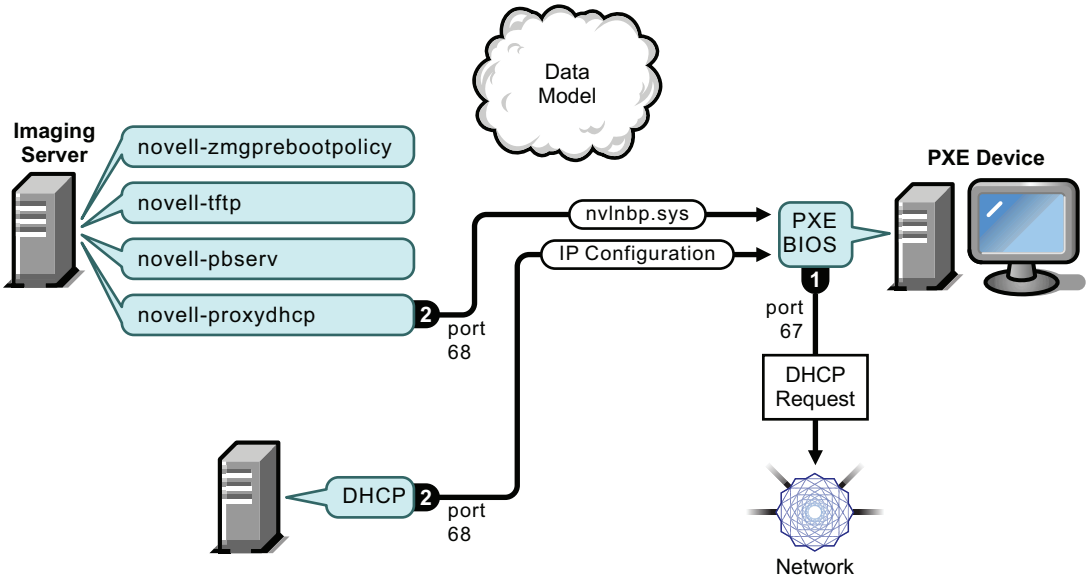
Depending on whether novell-proxydhcp is configured on the same server as the standard DHCP server or on a different server, the imaging process begins differently. The following sections illustrate how the process begins for each configuration, then the phases illustrated in "Phases 2 through 8: Continuing the Process" on page 27 are the same for them.

- "Standard DHCP and Novell Proxy DHCP Configured on Separate Servers" on page 24
- "Standard DHCP and Novell Proxy DHCP Configured on the Same Server: Part A" on page 25
- "Standard DHCP and Novell Proxy DHCP Configured on the Same Server: Part B" on page 26

Standard DHCP and Novell Proxy DHCP Configured on Separate Servers

For this example, the DHCP server and the Preboot Services Imaging Server are two separate servers on the network.

Figure 1-1 *DHCP Configuration on Separate Servers*



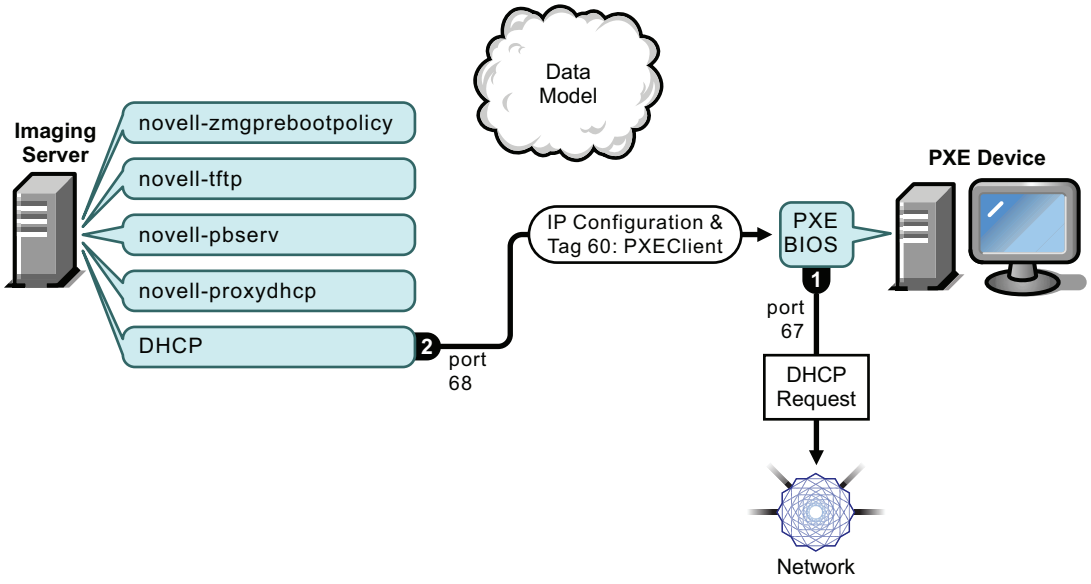
Processes:

1. When the device boots, the PXE BIOS issues a DHCP request with PXE extensions. The request is broadcast on port 67.
2. The DHCP server responds with IP configuration information on port 68, and the Proxy DHCP server responds on port 68 with the name of the bootstrap program (`nvlnbp.sys`) and the IP address of the TFTP service or daemon where it can be found.
3. Continue with "Phases 2 through 8: Continuing the Process" on page 27.

Standard DHCP and Novell Proxy DHCP Configured on the Same Server: Part A

For this example, the DHCP server and the Preboot Services Imaging Server are configured on the same server on the network. See "Standard DHCP and Novell Proxy DHCP Configured on the Same Server: Part B" on page 26 for the second part of this example.

Figure 1-2 *DHCP Configuration on the Same Server, Part A*

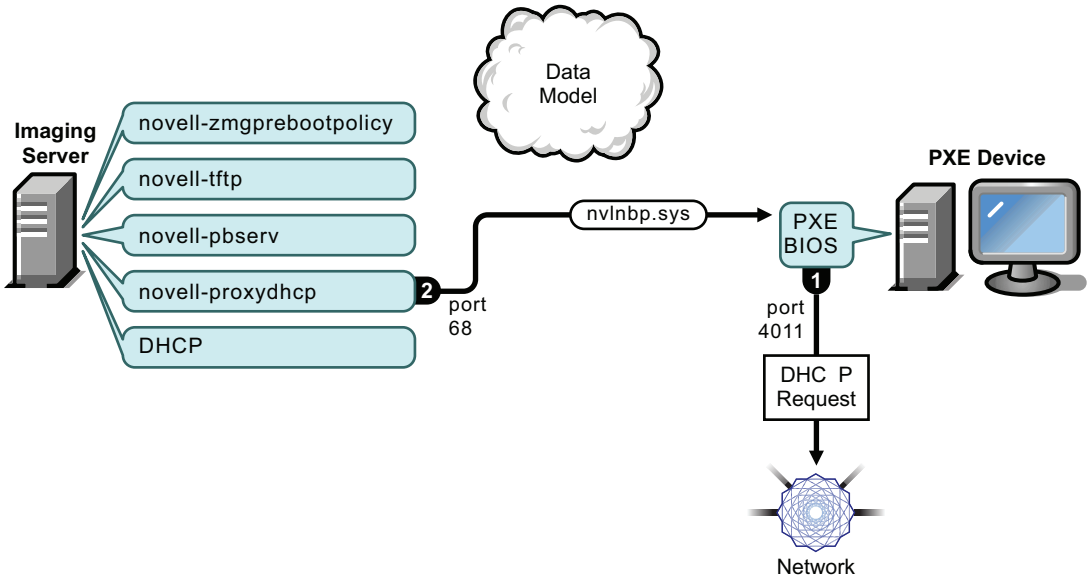


Processes:

1. When the device boots, the PXE BIOS issues a DHCP request with PXE extensions. The request is broadcast on port 67.
2. The DHCP server responds with IP configuration information on port 68, including tag 60 for PXEClient, which indicates that novell-proxydhcp is running on the same server.

Standard DHCP and Novell Proxy DHCP Configured on the Same Server: Part B

Figure 1-3 *DHCP Configuration on the Same Server, Part B*



Processes:

1. When the device sees tag 60 in the DHCP response, the PXE BIOS reissues the DHCP request on port 4011.
2. The Proxy DHCP server responds on port 68 with the name of the bootstrap program (`nvlnbp.sys`) and the IP address of the TFTP service or daemon where it can be found.
3. Continue with "Phases 2 through 8: Continuing the Process" on page 27.

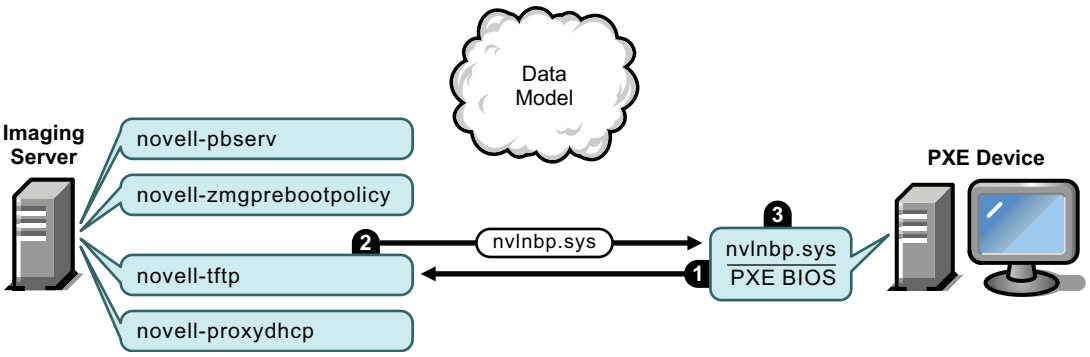
Phases 2 through 8: Continuing the Process

The following sections explain how the Preboot Services process continues after Phase 1:

- "Phase 2" on page 27
- "Phase 3" on page 28
- "Phase 4" on page 28
- "Phase 5" on page 29
- "Phase 6" on page 29
- "Phase 7" on page 30
- "Phase 8" on page 30

Phase 2

Figure 1-4 *Phase 2 of the Preboot Services Process*

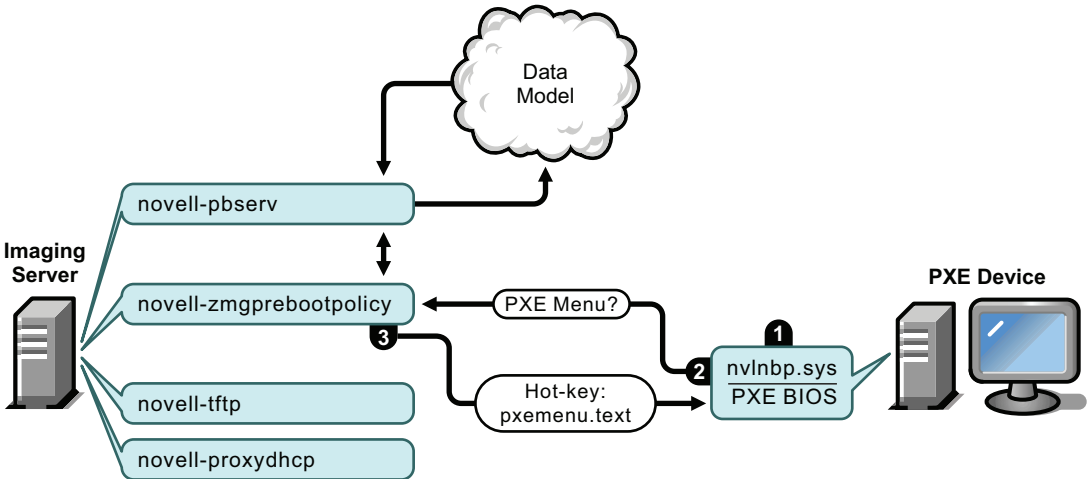


Processes:

1. The PXE BIOS requests `nvlnbp.sys` from the TFTP server.
2. The TFTP server sends `nvlnbp.sys` to the PXE device.
3. The PXE device loads `nvlnbp.sys` into memory.

Phase 3

Figure 1-5 *Phase 3 of the Preboot Services Process*

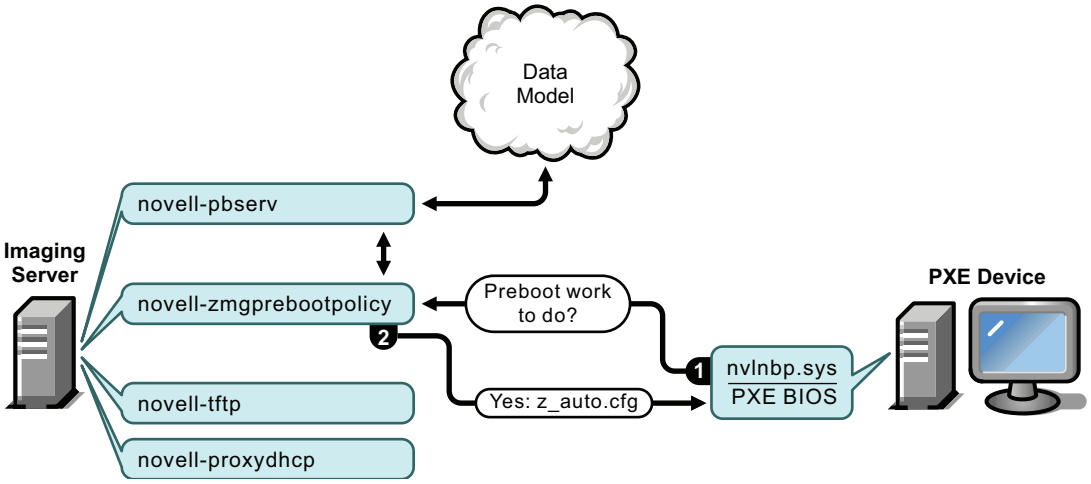


Processes:

1. Hardware detection is performed by `nvlnbp.sys` and it reads the image-safe data.
2. `Nvlnbp.sys` requests the Novell Preboot Services Menu configuration from the Data Model via novell-zmgprebootpolicy.
3. Novell-zmgprebootpolicy returns the Novell Preboot Services Menu configuration. In this case, the menu described in `pxemenu.txt` is displayed when a user presses the hot key.

Phase 4

Figure 1-6 *Phase 4 of the Preboot Services Process*



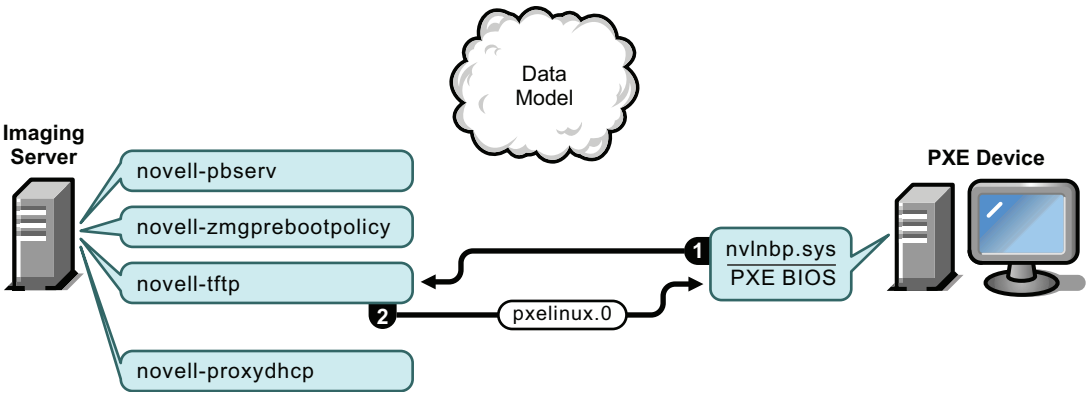
Processes:

1. Assuming no Novell Preboot Services Menu is displayed, the device asks the Data Model (via novell-zmgprebootpolicy) if any work is assigned.

2. Assuming work is assigned, novell-zmgprebootpolicy responds with the name of the configuration file to use in performing the preboot work (`z_auto.cfg` in this example).

Phase 5

Figure 1-7 *Phase 5 of the Preboot Services Process*

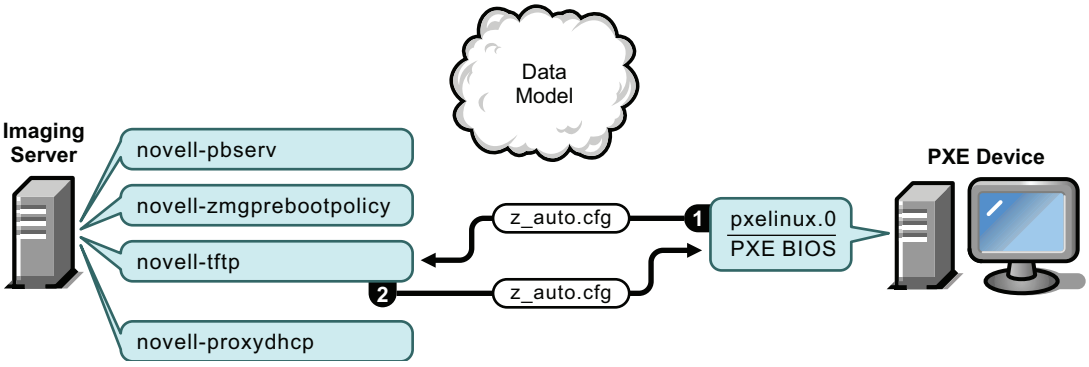


Processes:

1. The PXE device requests `pxelinux.0` from the TFTP server.
2. The TFTP server sends `pxelinux.0` to the device.

Phase 6

Figure 1-8 *Phase 6 of the Preboot Services Process*

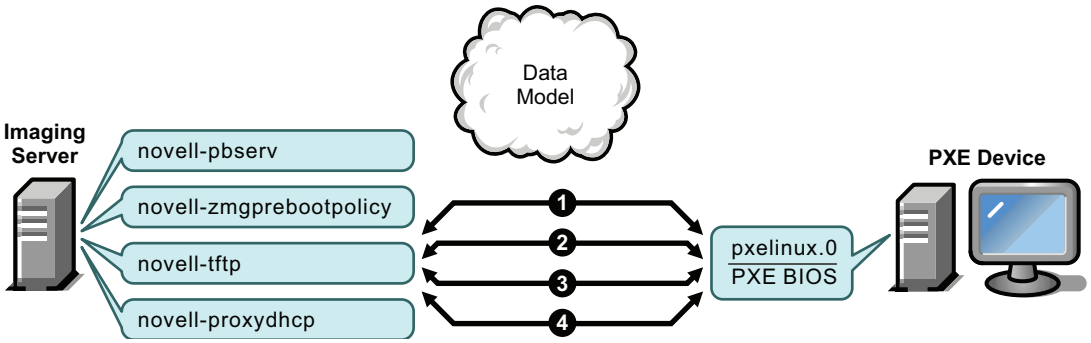


Processes:

1. Pxelinux.0 replaces `nvlnbp.sys` in memory and requests `z_auto.cfg` from the TFTP server.
2. The TFTP server sends the `z_auto.cfg` file to the device.

Phase 7

Figure 1-9 *Phase 7 of the Preboot Services Process*

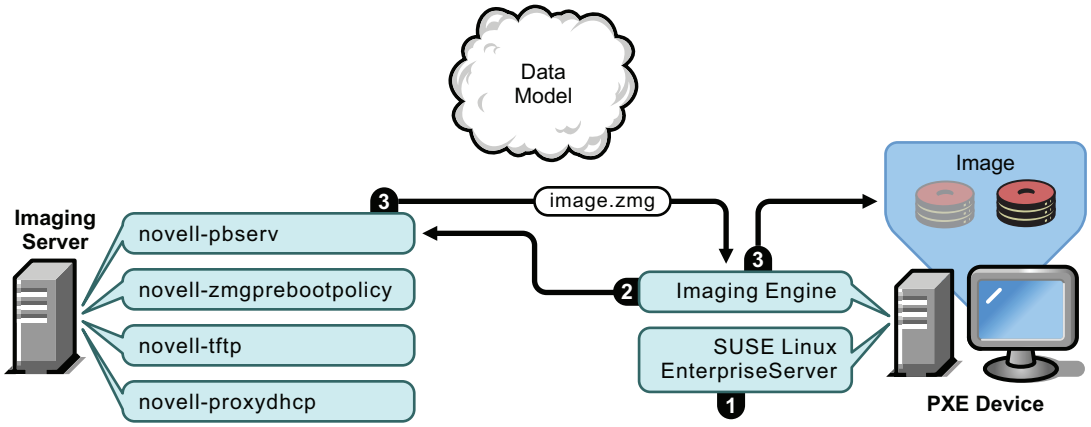


Processes:

1. `Pxelinux.0` requests and receives `/boot/kernel` from the TFTP server.
2. `Pxelinux.0` requests and receives `/boot/initrd` from the TFTP server.
3. `Pxelinux.0` requests and receives `/boot/root` from the TFTP server.
4. `Pxelinux.0` requests and receives `/boot/updateDrivers.tgz` from the TFTP server, but is denied because the file does not exist (it is used to provide post-release software updates).

Phase 8

Figure 1-10 *Phase 8 of the Preboot Services Process*



Processes:

1. SUSE® Linux Enterprise Server (SLES) is loaded and run on the device.
2. The ZENworks Imaging Engine (`img`) requests the assigned Preboot Services work details and performs the work.
3. The image is laid down on the device and it automatically reboots.

1.5 Preboot Strategies

The following sections present possible approaches to using Preboot Services. Use the following sections to determine which procedures to perform. The steps are documented in subsequent sections.

- Section 1.5.1, “Automating Imaging Tasks,” on page 31
- Section 1.5.2, “Creating, Installing, and Restoring Standard Images,” on page 31
- Section 1.5.3, “Reimaging Corrupted Devices,” on page 32
- Section 1.5.4, “Restoring Lab Devices to a Clean State,” on page 32
- Section 1.5.5, “Setting Up Devices for Future Reimaging,” on page 33
- Section 1.5.6, “Multicasting Device Images,” on page 33

1.5.1 Automating Imaging Tasks

You can automate imaging tasks in the following ways:

- **Imaging Script Execution:** The Imaging Script bundle can automate execution of an Imaging Script on a managed device, including imaging commands.
- **Device Imaging:** The ZENworks Image bundle can be used to place an image on a device.
- **Imaging Multiple Devices:** The Multicast Image Set bundle can be used to place an image on multiple devices with one pass of the image file over the network, such as in resetting lab devices.

All you need to do to accomplish any of these actions is to create and configure one of the Imaging bundle types, then assign the bundle to the desired devices. When a device boots, the assigned bundle is automatically applied before the device’s operating system starts.

You can also manually accomplish these tasks per device using the Novell Preboot Services Menu’s *Start ZENworks Imaging Maintenance* option to access the imaging maintenance mode prompt, if you have enabled the menu for the device. Or, you can use a Preboot Services bootable CD or DVD, which does not require PXE to be enabled on the device. For more information, see Section 3.1.2, “Using a Command Line for Imaging,” on page 96.

1.5.2 Creating, Installing, and Restoring Standard Images

As new devices are purchased and before deploying them, you can install a standard software platform and enable the device for future unattended reimaging.

1. Create a model device of each type that you intend to deploy.
2. Create an image of each model device on a ZENworks Imaging Server. For more information, see “Manually Taking an Image of a Device” on page 96.

   These images should include the Novell ZENworks Configuration Management Imaging Agent (novell-zislnx).
3. Optionally, you can create a preboot imaging bundle for this image. This allows the image to be assigned automatically for later use.

4. If you are using Preboot Services, install Configuration Management on a server, which makes it an Imaging Server. For more information, see Section 2.1, "Preparing a Preboot Services Imaging Server," on page 37.

   or

   If you are using a bootable CD or DVD, or a ZENworks partition, create a boot CD or DVD that points to the ZENworks Imaging Server where the model images are stored. For more information, see Section 2.2, "Setting Up the Preboot Services Methods," on page 38.

As each new device comes in, do the following if you are using Preboot Services:

1. Make sure the device is PXE capable. Enable PXE if it isn't enabled by default. For more information, see Section 2.6, "Enabling PXE on Devices," on page 88.
2. Physically connect the device to the network.
3. Boot the device from the Preboot Services Imaging Server.

If you are not using Preboot Services, boot the device with the imaging boot CD or DVD and consider installing the ZENworks partition to enable auto-imaging without the CD or DVD. For more information, see Step 3 on page 49 of Section 2.7.2, "Enabling a Device for Imaging Operations," on page 90. After you have installed the partition, reboot the device from the ZENworks partition.

1.5.3 Reimaging Corrupted Devices

Without data loss or undue disruption to users, you can fix devices that have become misconfigured or corrupted.

1. When a device needs to be fixed, have the user back up any files to the network that he or she wants to keep (if possible).
2. Create and/or assign an appropriate imaging bundle to the device.
3. If it is a device with a ZENworks partition or if it is PXE-enabled, the user should boot the device from the ZENworks partition or the Preboot Services Imaging Server (via PXE) to find and execute the assigned bundle. If you are using PXE, make sure that Preboot Services is installed on your server to make it an Imaging Server. For more information, see Chapter 3, "Using Imaging," on page 91.

   or

   If the device does not have a ZENworks partition and is not PXE-enabled, the user should boot the device with the imaging boot CD or DVD and restore the appropriate images manually.
4. After the image is laid down, restore any user files that were backed up to the network.

1.5.4 Restoring Lab Devices to a Clean State

You can restore devices to a clean state, removing any changes or additions made since the last time you restored the image on that device. This is useful for updating lab devices.

For a method to initially set up a lab, see Section 1.5.6, "Multicasting Device Images," on page 33.

The following steps assume that the devices are unregistered.

1. Create an image of a clean model device and store it on a ZENworks Imaging Server. For more information, see "Manually Taking an Image of a Device" on page 96.

2. If you are using Preboot Services, make sure that Configuration Management is installed on your server to make it an Imaging Server. For more information, see Section 2.1, “Preparing a Preboot Services Imaging Server,” on page 37.
3. If you are using Preboot Services and the devices are PXE capable, make sure that PXE is enabled. For more information, see Section 2.6, “Enabling PXE on Devices,” on page 88.

   or

   If you are not using Preboot Services or the ZENworks partition, create an imaging boot CD or DVD that points to the ZENworks Imaging Server where the clean image is stored. For more information, see Section 2.2, “Setting Up the Preboot Services Methods,” on page 38.

Deploy each lab device as follows:

1. Physically connect the device to the lab network.
2. If you are using Preboot Services, boot the device from the Preboot Services Imaging Server.

   or

   If you are not using Preboot Services, boot the device with the imaging boot CD or DVD and install the ZENworks partition. For more information, see Step 3 on page 49 of Section 2.7.2, “Enabling a Device for Imaging Operations,” on page 90. After you have installed the partition, reboot the device from the ZENworks partition.
3. At the end of each lab session, assign the Imaging bundle to the lab devices.
4. Reboot each device and let it be auto-imaged by its assignment to a ZENworks Imaging bundle.

1.5.5 Setting Up Devices for Future Reimaging

With minimal disruption to users, you can enable existing devices for future reimaging.

This process might need to be phased in by local administrators. Each administrator can do the following:

1. Install the Novell ZENworks Configuration Management Imaging Agent (novell-ziswn) on each device.
2. If the devices are PXE-capable, make sure PXE is enabled (see Section 2.6, “Enabling PXE on Devices,” on page 88) and make sure that Configuration Management is installed on your server to make it an Imaging Server (see Section 2.1, “Preparing a Preboot Services Imaging Server,” on page 37).

   or

   Prepare a few sets of imaging CDs or DVDs that users can use when they have difficulty (see Section 2.2, “Setting Up the Preboot Services Methods,” on page 38). These devices should point to an Imaging Server that contains the same clean images used for new devices.
3. If a user has difficulty, use the strategy for reimaging corrupted devices. For more information, see Section 1.5.3, “Reimaging Corrupted Devices,” on page 32.

1.5.6 Multicasting Device Images

The following sections explain the multicasting images feature:

- “Understanding Multicasting” on page 34

- "Practical Uses For Multicasting" on page 35
- "Automatic Multicasting Example" on page 35

For instructions on using multicasting, see Section 3.2, "Multicasting Images," on page 111.

Understanding Multicasting

Multicasting is a way to send the same image to multiple devices without sending that image multiple times across the network. It is done by inviting participants to join a multicast session. Multicasting is similar to broadcasting on the network, because you send the image once to the network and only those devices belonging to the multicast session can see and receive it. This saves on network bandwidth usage.

For example, if you have 10 devices in the multicast session and the image is 3 GB in size, your network experiences only 3 GB of network traffic to image all 10 devices. Without multicasting, the network experiences 30 GB of network traffic to image all 10 devices individually.

The devices to be imaged must be physically connected to the network. They can be devices with existing operating systems of any kind, or they can be new devices with no operating system installed.

IMPORTANT: For multicasting to work properly, all routers and switches on the network must have their multicast features configured. Otherwise, multicast packets might not be routed properly.

Multicasting can be done automatically or manually:

- "Automatic Multicasting" on page 34
- "Manual Multicasting" on page 34

Automatic Multicasting

In ZENworks Control Center, multicasting is accomplished by configuring a Multicast Image Set bundle. The bundle contains a base image that is taken previously from a device and is stored on an Imaging Server. This base image is applied to all multicast session participants.

When using an Imaging bundle to perform multicasting, the Imaging Server is the session master, which sends the `.zmg` image file to the session participants. Novell-pbserv is used in this process. All problems are reported and displayed on the session master device.

For more information, see Section 3.2, "Multicasting Images," on page 111.

Manual Multicasting

At the imaging maintenance mode prompt, you can enter commands to configure and initiate a multicasting session. You enter the appropriate commands on the prompt at each device, specifying one of them to be the session master. An image of the session master's hard drive is sent to each of the session participants.

For more information on the imaging commands, see Section D.5, "Session Mode (Multicast Image Set)," on page 186.

If you plan to set up multicasting by visiting each device, you need either an imaging boot CD or DVD, or the devices must be PXE-enabled. For more information, see Section 2.2, "Setting Up the Preboot Services Methods," on page 38.

Practical Uses For Multicasting

Multicasting is ideal for labs, classrooms, and staging areas, or for any place where you need to quickly create the same configuration on multiple devices, instead of taking the time to set up each device individually.

Benefits of Multicasting Images

Multicasting is the way to use ZENworks Imaging Engine for mass reimaging with the least amount of overhead. It is useful if you have one device with a clean software configuration that you want to duplicate on several other devices, or if you have a single image that you want to set up on multiple devices.

Limitations of Multicasting Images

One significant limitation of using multicast without installing any Configuration Management software is that it results in a set of devices that have duplicate network identities. The IP addresses (if the network is using static IP addressing) and device hostname are all the same and can cause conflicts if deployed on the network without change.

For a handful of devices, this might not be a problem. But for a larger number of devices, you should install the Novell ZENworks Configuration Management Imaging Agent (novell-ziswn) on each device before doing the multicast (see Section 2.7.2, “Enabling a Device for Imaging Operations,” on page 90). The Imaging Agent saves the device’s network identity settings before the multicast session and restores them afterwards.

Automatic Multicasting Example

To automatically multicast an image to multiple devices using ZENworks Control Center:

1. In ZENworks Control Center, create a Multicast Image Set bundle using a wizard.
2. Specify the source image for the bundle.

   You can multicast an existing image from your Imaging Server.
3. Configure the trigger for multicasting the bundle, as in the following examples:

   Client Count: When the specified number of clients specified in the bundle have booted and registered, the multicast session begins.

   Time Count: When the specified length of time has passed with no new clients having registered, the multicast session begins regardless of the number of client participating.

   The first trigger to be realized causes the multicast session to begin.
4. Assign the Multicast Image Set bundle to the desired devices.

   ZENworks Control Center provides a way to enable or disable a Multicast Image Set bundle, allowing you to temporarily stop the bundle from executing. This is more efficient than unasssigning the bundle from many devices.
5. Wait for the trigger to happen.

   Each device booting into the session has its boot process delayed until the session begins, which is determined by fulfillment of one of the triggers.

   The multicast happens automatically when a device assigned to the Multicast Image Set bundle boots, according the configuration you set up for the Multicast Image Set bundle and for the devices you assigned to the bundle. This bundle is applied to each session device before it

boots its operating system. The ZENworks Multicast Image Set bundle is sent over the wire just once, using the multicast capability of your network, and executed simultaneously on all participating devices.

Setting Up Preboot Services and Imaging

2

The section provides instructions for setting up Preboot Services in Novell® ZENworks® Configuration Management:

- Section 2.1, “Preparing a Preboot Services Imaging Server,” on page 37
- Section 2.2, “Setting Up the Preboot Services Methods,” on page 38
- Section 2.3, “Deploying and Managing Preboot Services,” on page 51
- Section 2.4, “Configuring Preboot Services Defaults,” on page 65
- Section 2.5, “Overriding Preboot Services Defaults,” on page 86
- Section 2.6, “Enabling PXE on Devices,” on page 88
- Section 2.7, “Setting Up Devices for Imaging,” on page 89

IMPORTANT: The Preboot Services software is automatically installed when you install ZENworks Configuration Management.

2.1 Preparing a Preboot Services Imaging Server

When you install Novell ZENworks Configuration Management on a server, the Preboot Service service or daemon (novell-pbserv) makes all Primary Servers an Imaging Server. To avoid confusion, the Proxy DHCP service or daemon (novell-proxydhcp) is installed, but not enabled. For PXE devices to be able to communicate with Preboot Services, this service or daemon must be started manually on at least one server on each network segment. Exactly how many servers and which specific servers should run this service or daemon is dictated by your network topology. As a rule of thumb, for every DHCP server deployed in your network, you should have a corresponding Proxy DHCP server.

For information on setting up management of your devices, see Section 2.3, “Deploying and Managing Preboot Services,” on page 51 and Section 2.4, “Configuring Preboot Services Defaults,” on page 65.

In addition to the specific hardware requirements for a ZENworks Server, the server used to store image files must meet the following requirements:

- **Fixed IP Address:** When you connect to the Imaging Server during an imaging operation, you must do so using the fixed IP address or DNS name of the Imaging Server.
- **Enough Space to Store Device Images:** Unless you use compression (which is enabled by default) for your device images, they are nearly the same size as the data on the device hard disk, which could be many gigabytes.

  If you want to store an image locally (on a CD, DVD, or hard disk) rather than on an Imaging Server, see “Using a CD or DVD for Disconnected Imaging Operations” on page 107 and “Using a Hard Disk for Disconnected Imaging Operations” on page 108.

2.2 Setting Up the Preboot Services Methods

The Novell ZENworks Imaging Engine that performs the actual imaging of a device is a Linux application. Unless you use automated Preboot Services with PXE-enabled devices, you need to prepare a boot medium that has the Linux kernel, ZENworks Imaging Engine, and network drivers installed.

The following sections contain additional information:

- Section 2.2.1, "Using Preboot Services (PXE)," on page 38
- Section 2.2.2, "Preparing Imaging Boot CDs or DVDs," on page 38
- Section 2.2.3, "Configuring with ZENworks Imaging Media Creator," on page 41
- Section 2.2.4, "Managing ZENworks Partitions," on page 48

2.2.1 Using Preboot Services (PXE)

Preboot Execution Environment (PXE) is an Intel specification that allows a device to boot from the network, instead of its hard drive or other local media. Configuration Management can use PXE to launch Preboot Services.

Preboot Services uses PXE to find out if there is imaging work specified for a device and to provide the device with the files necessary to boot to the ZENworks imaging environment.

Before you can use Preboot Services with automated Imaging bundles, you need to do the following:

1. Install ZENworks Configuration Management on your Imaging Server.
2. Enable PXE on the device.
3. Have a standard DHCP server, either on your Imaging Server or on another network server.

Automated Preboot Services functions can also be performed using a ZENworks partition. For more information, see "Creating a ZENworks Partition" on page 48.

Manual Preboot Services functions can be performed using CDs or DVDs. For more information, see Section 2.2.2, "Preparing Imaging Boot CDs or DVDs," on page 38.

2.2.2 Preparing Imaging Boot CDs or DVDs

If you have software for burning CDs or DVDs, you can create an imaging boot CD or DVD for imaging operations. You have two options:

- "Creating a Boot CD or DVD with Additional Files" on page 38
- "Creating a Boot CD or DVD without Additional Files" on page 40

For information on how to use the CD or DVD to perform disconnected imaging operations, see Section 3.1.3, "Setting Up Disconnected Imaging Operations," on page 106.

Creating a Boot CD or DVD with Additional Files

This section describes how to create an imaging CD or DVD that contains more than the files provided in the `bootcd.iso` image.

This method allows you to include the `settings.txt` file on the boot CD or DVD to provide the required imaging parameters. For more information on the `settings.txt` file, see Section C.5, "Imaging Configuration Parameters (settings.txt)," on page 158.

This method also allows you to add other files and drivers that you need to do the imaging.

To create an imaging boot CD or DVD that includes `settings.txt` and other files:

1. Copy the `bootcd.iso` file to a temporary location.

   On the Imaging Server where ZENworks is installed, the `bootcd.iso` file is located in:

   Windows: *`installation_path`*`\novell\zenworks\bin\preboot\`

   Linux: `/opt/novell/zenworks/zdm/winutils/`
2. In an ISO editor, open the temporary copy of the `bootcd.iso` file.

   If you experience ISO corruption after adding files into the ISO, such as a checksum error, use a more reliable ISO editor. Also, some ISO editors do not work very well with DVDs.
3. Using the temporary `bootcd.iso` file, copy the `settings.txt` file to the root of the `bootcd.iso` image.

   On the Imaging Server where ZENworks is installed, the `settings.txt` file is located in:

   Windows: *`installation_path`*`\novell\zenworks\bin\preboot\`

   Linux: `/opt/novell/zenworks/zdm/winutils/`
4. Copy any other files or drivers that you want included on the CD or DVD to the `addfiles` directory in the temporary `bootcd.iso` image.

   Any files or subdirectories that you add under the `/addfiles` directory are placed at the root of the client when booting the CD or DVD.

   IMPORTANT: When booting from the CD or DVD, the imaging engine is read into RAM. Because the imaging engine uses some of the RAM that exists on the client device, the combined size of any files that you add under the `addfiles` directory cannot exceed the amount of remaining RAM.

   ---
5. Save the updated `bootcd.iso` image file to its temporary location.
6. Use your software for burning CDs or DVDs to burn the updated `bootcd.iso` image onto the CD or DVD.
7. Boot the device to be imaged from your newly created imaging boot CD or DVD.

   Booting from a SCSI CD-ROM device is currently not supported.

To create an imaging boot CD or DVD by changing the default menu option in the `/boot/i386/loader/isolinux.cfg` file.

1. Copy the `bootcd.iso` file to a temporary location.

   On the Imaging Server where ZENworks is installed, the `bootcd.iso` file is located in:

   Windows: *`installation_path`*`\novell\zenworks\bin\preboot\`

   Linux: `/opt/novell/zenworks/zdm/winutils/`
2. In an ISO editor, open the temporary copy of the `bootcd.iso` file.

If you experience ISO corruption after adding files into the ISO, such as a checksum error, use a more reliable ISO editor. Also, some ISO editors do not work very well with DVDs.

3. In the temporary `bootcd.iso` file, open the isolinux.cfg file located in the /boot/i386/loader directory.
4. Edit the isolinux.cfg file to change the following line

   default linux

   to

   default manual
5. Save the updated `bootcd.iso` image file to its temporary location.
6. Use your software for burning CDs or DVDs to burn the updated `bootcd.iso` image onto the CD or DVD.
7. Boot the device to be imaged from your newly created imaging boot CD or DVD.

   Booting from a SCSI CD-ROM device is currently not supported.

Creating a Boot CD or DVD without Additional Files

If you do not want to include the `settings.txt` file or any other files or drivers in the imaging boot CD or DVD, you can simply create the imaging boot CD or DVD from the `bootcd.iso` image provided with ZENworks.

However, you need to provide the `settings.txt` file on a floppy diskette to provide the required imaging parameters. For more information on the `settings.txt` file, see Section C.5, "Imaging Configuration Parameters (settings.txt)," on page 158.

To create an imaging boot CD or DVD that contains only the `bootcd.iso` image:

1. Copy the `settings.txt` file containing the settings you want for the imaging boot process onto a floppy diskette.

   On the Imaging Server where ZENworks is installed, the `settings.txt` file is located in:

   Windows: *`installation_path`*`\novell\zenworks\bin\preboot\`

   Linux: `/opt/novell/zenworks/zdm/winutils/`
2. Use your software for burning CDs or DVDs to burn the `bootcd.iso` image onto the CD or DVD.

   On the Imaging Server where ZENworks is installed, the `bootcd.iso` file is located in:

   Windows: *`installation_path`*`\novell\zenworks\bin\preboot\`

   Linux: `/opt/novell/zenworks/zdm/winutils/`
3. Boot the device to be imaged from your newly created imaging boot CD or DVD.

   You will be prompted for the diskette that contains the `settings.txt` file.

   Booting from a SCSI CD-ROM device is currently not supported.

2.2.3 Configuring with ZENworks Imaging Media Creator

This utility allows you to create a bootable diskette for Preboot Services imaging functions in ZENworks Configuration Management. For example, you can do the following:

- Modify the `settings.txt` file
- Create a bootable diskette to enable booting a device from a CD or DVD when it normally cannot do so
- Create a Preboot Bootable Image (PBI) file from a bootable diskette

---

IMPORTANT: This utility is a .NET application, and therefore requires the .NET framework to be installed on the Windows device being used to run it.

For more information, see:

- "ZENworks Imaging Media Creator Features" on page 41
- "Managing the Settings.txt File" on page 42
- "Creating a Bootable Diskette" on page 45
- "Creating a Preboot Bootable Image" on page 47

ZENworks Imaging Media Creator Features

The ZENworks Imaging Media Creator utility dialog box contains two tabs:

- "CD Media Boot" on page 41
- "Preboot Bootable Image" on page 41

CD Media Boot

The *CD Media Boot* tab allows you to make an image of a bootable diskette suitable for use with PXE devices. You can:

- Create a bootable diskette to enable booting devices with a CD or DVD (when they normally can't do so) to perform imaging tasks
- Specify configuration settings that are saved in the `settings.txt` file on the bootable diskette, which are used when you boot devices with the diskette
- Modify the configuration settings after creating the bootable diskette by editing the `settings.txt` file contained on the diskette

For more information, see "Creating a Bootable Diskette" on page 45.

Preboot Bootable Image

You can create a PXE Linux configuration file that points to a Preboot Bootable Image (PBI) file, which is a raw image of a bootable diskette. This enables you to use PXE to utilize the bootable diskette information from a `.pbi` file on a TFTP server, instead of booting from the diskette for that Preboot information.

For more information, see "Creating a Preboot Bootable Image" on page 47.

Managing the Settings.txt File

There two `settings.txt` files shipped with Configuration Management:

- **Windows:** *`installation_path`*`\novell\zenworks\share\tftp\boot\`

  Linux: `/srv/tftp/boot/`

  PXE devices use this version of the file for automated preboot work. This file exists on the Imaging Server and usually does not need to be modified. During the boot process, this `settings.txt` file is read and the necessary settings information is discovered and used.

- **Windows:** *`installation_path`*`\novell\zenworks\bin\preboot\`

  Linux: `/opt/novell/zenworks/zdm/winutils/`

  The Imaging Server copy of this file needs to be modified for your network environment and a working copy of it should be maintained at the root of the imaging boot device (imaging CD or DVD, or a blank floppy diskette). When burning the imaging CD or DVD, be sure to include the edited copy of this `settings.txt` file.

  You can manage the content of this copy of the `settings.txt` file with the ZENworks Imaging Media Creator utility, as outlined in the following steps.

  To manually edit the `settings.txt` file, see Section C.5, “Imaging Configuration Parameters (settings.txt),” on page 158.

For more information, see Section C.5, “Imaging Configuration Parameters (settings.txt),” on page 158.

To manage the `settings.txt` file using the ZENworks Imaging Media Creator utility:

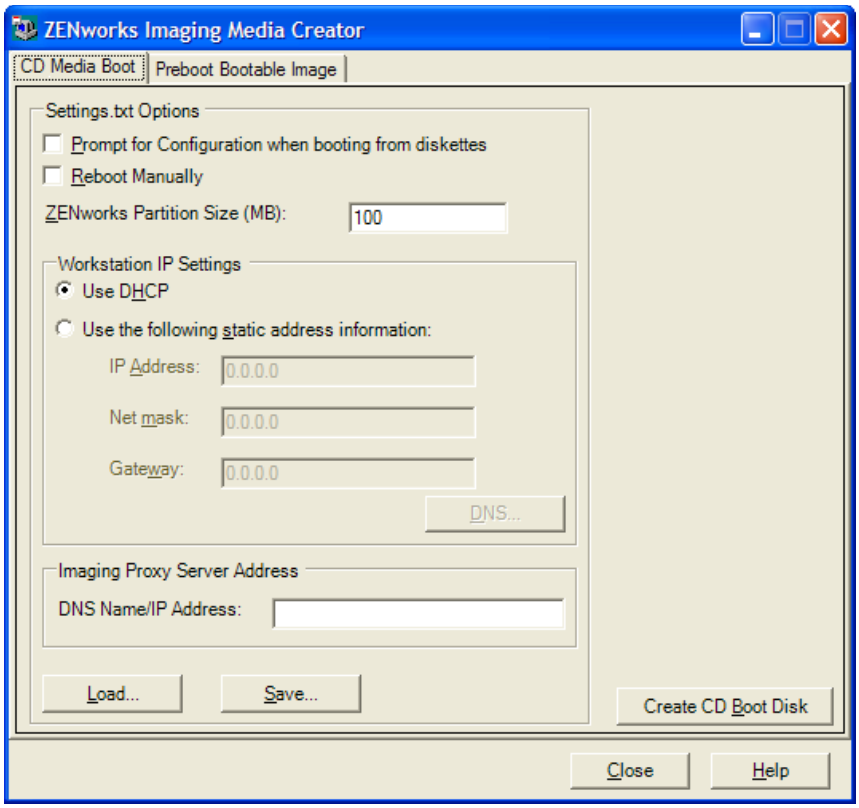
1 On a management device, run `zmediacreator.exe` from your Imaging Server:

  Windows: *`installation_path`*`\novell\zenworks\bin\preboot\`

  Linux: `/opt/novell/zenworks/zdm/winutils/`

  For the Linux server path, to use a Windows management device to access to this directory you might need to configure Samba.

  The following dialog box is displayed:



2 Click *Load*, browse for and select the `settings.txt` file, then click *Open*.

The default location is `A:\`. Browse to the following directory for the copy to be modified:

Windows: *`installation_path`*`\novell\zenworks\bin\preboot\`

Linux: `/opt/novell/zenworks/zdm/winutils/`

When the file is loaded, the fields in this dialog box are populated from the information contained in the `settings.txt` file.

3 (Optional) In the *Settings.txt Options* section on the *CD Media Boot* tab, fill in the fields:

Prompt for Configuration When Booting from Diskette: Specifies whether to prompt for these configuration settings when you boot a device with the bootable diskette and CD or DVD. If you leave this option deselected, the device boots using the configuration settings that you make here and you are not able to override the settings during bootup. If you select this option, you are given the chance to change each setting during bootup.

Reboot Manually: Specifies whether you must reboot a device manually after it was booted with the bootable diskette in automatic mode. (If the device was booted with the bootable diskette in manual mode, you must always reboot the device manually.)

If you boot a device with the bootable diskette and you let the bootup process proceed in automatic mode, the imaging engine starts and checks the Preboot server to see if an automatic imaging operation should be performed. If so, it performs the imaging operation on the device and quits. If not, it quits without doing anything. What happens next depends on whether you select this option.

If you leave this option deselected, you are prompted to remove the bootable diskette and press any key to reboot the device automatically to its native operating system. If you select this option, the device doesn't reboot automatically, but instead displays the imaging maintenance

mode prompt, allowing you to perform additional imaging-related tasks at the prompt. This is helpful if you want to do things like check the current partition information or the image-safe data before rebooting to the native operating system.

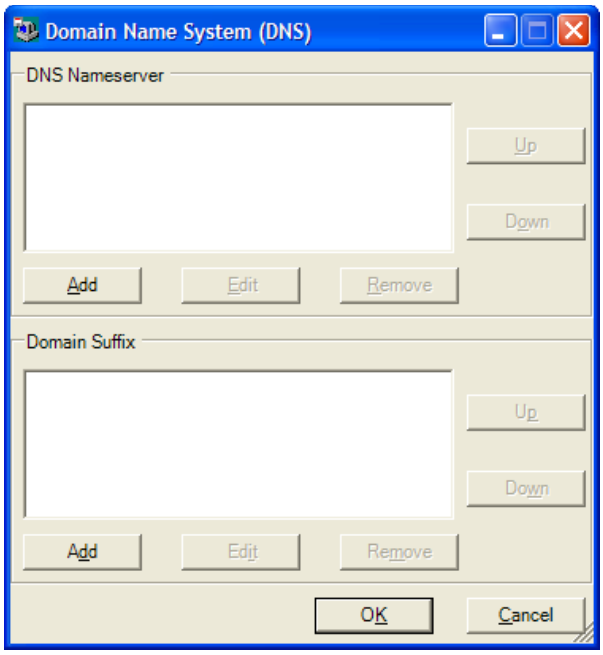
ZENworks Partition Size (MB): Specifies the number of megabytes to allocate to the ZENworks partition if you choose to create one locally on a device when you boot the device with the bootable diskette. The default size is 150 MB, which is the smallest you should make the partition. The maximum size allowed is 2048 MB (2 GB).

4 (Optional) In the *Workstation IP Settings* section on the *CD Media Boot* tab, fill in the fields:

Use DHCP: Specifies to obtain an IP address dynamically through DHCP. Use this option only if DHCP is configured on your network.

Use the Following Static Address Information: Specifies to use a static IP address. If you select this option, fill in the IP address, subnet mask, and gateway to be used.

DNS Button: This option is active only if a static IP address for the device is specified.



- **DNS Nameserver:** You must specify a nameserver if you want to use DNS to connect to servers.

  You can specify the addresses of as many DNS nameservers as you want. You can edit or remove the nameserver addresses, or you can move the addresses up and down in the list to specify the order used for contacting them.

- **Domain Suffix:** You can also specify as many DNS domain suffixes as you want. The editing, moving, and removal functions are also available for the suffixes.

5 (Required) In the *Imaging Proxy Server Address* section on the *CD Media Boot* tab, specify either the fixed IP address or the full DNS name of Preboot server (where novell-pbserv is running).

This specifies which Preboot server to connect to when you boot a device with the bootable diskette.

Use a DNS name only if it is working on your network and the Imaging Server has an entry in your DNS server's name resolution table.

6 Click *Save*, browse for where you want to save the `settings.txt` file, then click *Save*.

Saves the configurations made in the *Settings.txt Options* section to the `settings.txt` file in the specified location. The default location is `A:\`, such as for a bootable diskette (see "Creating a Bootable Diskette" on page 45).

You can save to a different location for use in burning to an imaging CD or DVD.

7 When you are finished using this utility, click *Close*.

IMPORTANT: If you manually edit the `settings.txt` file to provide paths to executables, make sure that you provide the full path, or the executable might not run.

Creating a Bootable Diskette

If you have devices that cannot normally boot a CD or DVD, but has the CD or DVD hardware installed, you can use the ZENworks Imaging Media Creator utility to create a diskette that enables the device to boot from a CD or DVD.

To create a bootable diskette:

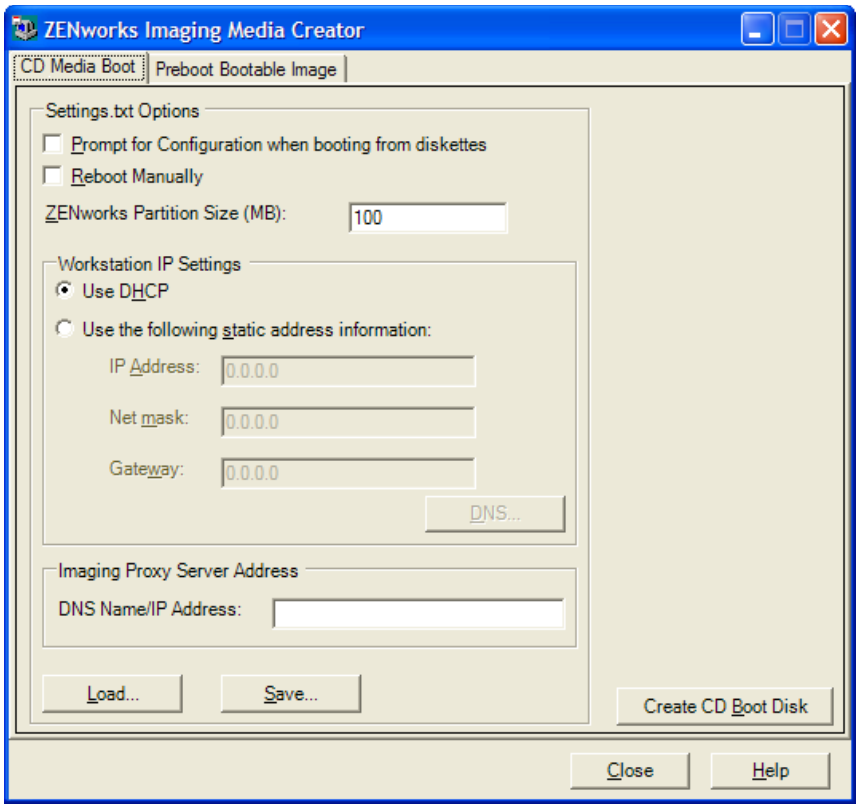
1 On a management device, run `zmediacreator.exe` from your Imaging Server:

Windows: *`installation_path`*`\novell\zenworks\bin\preboot\`

Linux: `/opt/novell/zenworks/zdm/winutils/`

For the Linux server path, to use a Windows management device to access to this directory you might need to configure Samba.

The following dialog box is displayed:



2 If you want to modify a `settings.txt` file that is to be included on this diskette, follow Step 2 through Step 4 in "Managing the Settings.txt File" on page 42, then continue with Step 3 in this section.

3 (Required) In the *Imaging Proxy Server Address* section on the *CD Media Boot* tab, specify either the fixed IP address or the full DNS name of Preboot server (where novell-pbserv is running).

   This specifies which Preboot server to connect to when you boot a device with the bootable diskette.

   Use a DNS name only if it is working on your network and the Imaging Server has an entry in your DNS server's name resolution table.

4 Format one high-density diskette, or insert a preformatted blank diskette in the diskette drive of the Windows device.

5 Click *Create CD Boot Disk*.

   This creates a bootable diskette that enables a device that cannot otherwise boot from a CD or DVD to boot from the imaging CD or DVD. Any `settings.txt` configurations made here are included in the copy written to the bootable diskette.

6 After the diskette is created, click *Close*.

7 Insert both this diskette and the imaging CD or DVD on the device to be imaged, then boot the device.

   The diskette enables the imaging CD or DVD to be booted by the device.

Creating a Preboot Bootable Image

You can create a PXE Linux configuration file that points to a Preboot Bootable Image (PBI) file, which is a raw image of a bootable diskette. This enables you to use PXE to utilize the bootable diskette information from a `.pbi` file on a TFTP server, instead of booting from the diskette for that Preboot information.

To create a PBI configuration file and then the PBI file:

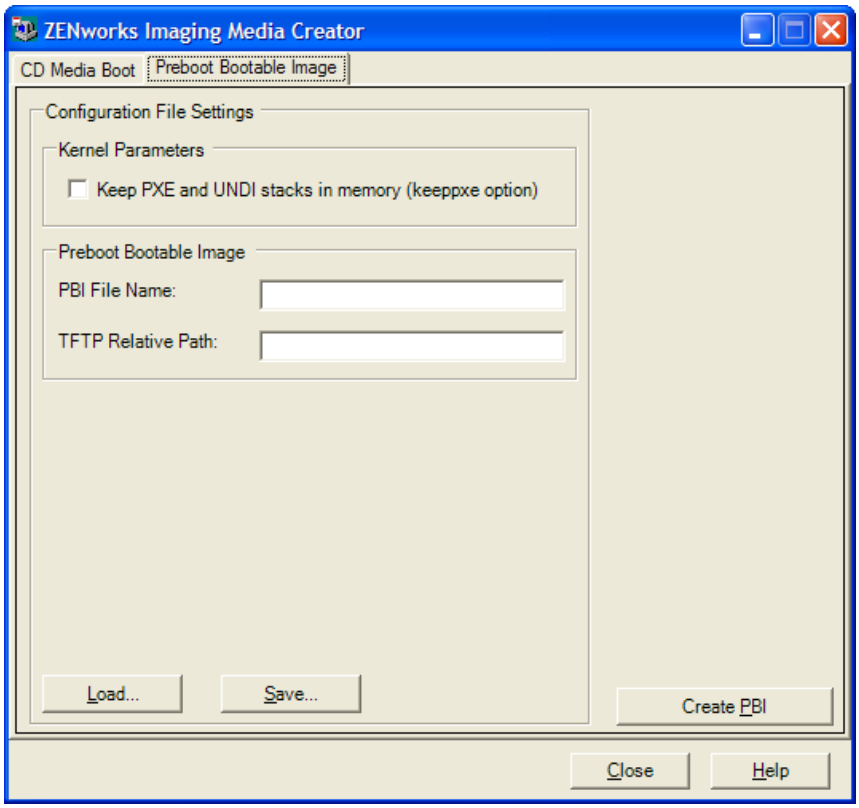
1 On a management device, run `zmediacreator.exe` from your Imaging Server:

Windows: *`installation_path`*`\novell\zenworks\bin\preboot\`

Linux: `/opt/novell/zenworks/zdm/winutils/`

For the Linux server path, to use a Windows management device to access to this directory you might need to configure Samba.

The following dialog box is displayed after you click the *Preboot Bootable Image* tab:



2 In the *Configuration File Settings* section on the Preboot Bootable Image page, fill in the fields:

Kernel Parameters: To use the kernel parameters in the `keeppxe` option, select the *Keep PXE and UNDI Stacks in Memory* option.

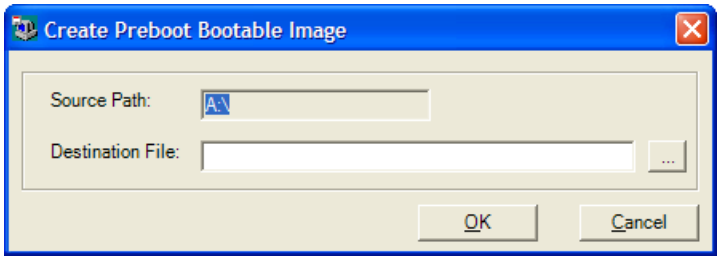
PBI Filename: Specify a filename for the PBI file, including the `.pbi` filename extension. Do not specify a path here.

TFTP Relative Path: Specify the path for the PBI file, relative to the TFTP server's default path. This is where the PBI file will be accessed by the device booting with PXE.

Load: Load a previously defined PBI configuration file, which populates the fields on this page with its information. You can edit those settings.

Save: Save the PBI configuration file to a location where you can access it again from this dialog box.

3 To create the PBI file, click *Create PBI* and fill in the fields:



Source Path: Source of the information to be imaged to a PBI file. This is normally a bootable diskette that was created on the *CD Media Boot* tab of this dialog box.

Destination File: Where the PBI file should be written. Browse for the location and type the PBI filename. The `.pbi` filename extension is automatically added.

4 After the PBI is created, click *Close*.

This PBI file can now be used by a PXE-enabled device when booting so you can access Preboot Services functionality as if you were booting the device with the bootable diskette.

2.2.4 Managing ZENworks Partitions

A ZENworks partition is used by a device when booting for automated Preboot Services work when the device does not have PXE available. The following sections explain how to manage ZENworks partitions:

- "Creating a ZENworks Partition" on page 48
- "Disabling a ZENworks Partition" on page 49
- "Removing a ZENworks Partition" on page 49

Creating a ZENworks Partition

If you want to set up a device for unattended imaging operations and are unable to use Preboot Services (PXE), you can create a ZENworks partition on the hard disk. If you make the partition large enough, you can even store an image of the device's hard disk, which can be useful if the device becomes misconfigured or corrupted when the network connection is lost.

WARNING: Installing the ZENworks partition destroys all data on that hard drive. Use this only on devices where you plan to reinstall the operating system and software programs.

To create a ZENworks partition, you must first create an imaging CD or DVD to boot the device from. (If the device cannot boot from a CD or DVD, see Section 2.2.3, "Configuring with ZENworks Imaging Media Creator," on page 41.) Then, do the following:

1 Boot the device with the imaging CD or DVD, then select *Install/Update ZEN partition* from the menu.

This starts the process of creating the ZENworks partition in the first partition slot. It destroys all existing partitions, except an existing ZENworks partition or the Dell* or Compaq* configuration partitions. By default, the ZENworks partition size is 150 MB.

If the ZENworks partition already exists, it is upgraded, and your existing partitions are left intact.

2. After the ZENworks partition is installed or updated, remove the CD or DVD and press any key to continue.
3. After removing the CD or DVD and reboot the device, install the operating system on the device.

   IMPORTANT: During installation of the operating system, you must install the boot loader where the root (/) partition is being installed. In other words, the active partition must be the root partition. You can use `fdisk` to verify that the active partition is root.
4. To take an image of the device using the ZENworks partition, see "Using the Imaging Maintenance Mode Prompt to Create an Image" on page 109.
5. When the imaging maintenance mode prompt is displayed, reboot the device.

   The device should boot to Linux. If the prompt is displayed again, enter `grub.s` and reboot a second time.

Disabling a ZENworks Partition

If you decide to enable PXE on a device, but have previously installed a ZENworks partition on it, you can disable or delete the partition, because it is no longer necessary. For information on deleting the partition, see "Removing a ZENworks Partition" on page 49.

When you boot to Linux using any imaging boot device or method other than booting from the ZENworks partition, you can disable (or enable) the ZENworks partition. Just select the menu option to do so when the Novell Preboot Services Menu is presented.

Removing a ZENworks Partition

Because you should not delete the ZENworks partition if you booted using the partition, you should boot the device from an imaging boot method other than the ZENworks partition.

WARNING: After you have deleted the ZENworks partition, you need to make sure that the image you place on the device was made on a device without a ZENworks partition. Otherwise, the wrong MBR (Master Boot Record) is restored, and the device fails to boot. You should only remove the ZENworks partition if you are going to restore an image that does not have the partition to the device.

The following are ways you can remove a ZENworks partition from a device:

- "Using an Imaging CD or DVD" on page 50
- "Using an Imaging Script Bundle" on page 50
- "Using Fdisk" on page 50

Using an Imaging CD or DVD

If you cannot perform a full restoration of the ZENworks partition at this time, you should consider removing it.

To remove a ZENworks partition:

1. Boot the device using the ZENworks imaging CD or DVD.
2. Select the *Manual mode* option.
3. At the imaging maintenance mode prompt, enter:
   ```
   img -zenpart -remove
   ```
4. After the removal is complete, eject the CD or DVD (if you are not going to use it to reimage the device).
5. If you want to restore an image before rebooting, enter the following at the prompt:
   ```
   unset ZENDEVICE
   ```
   Otherwise, reboot the device when ready.
6. Restore an image or install an operating system.

   When the device boots, its ZENworks partition is removed, then the device can be imaged from the CD or DVD without a ZENworks partition.

   If the device is assigned to an Imaging bundle, it is imaged according to that bundle.

Using an Imaging Script Bundle

If you are using Preboot Services, but formerly booted from the ZENworks partition on the device, you can delete the ZENworks partition at the same time you restore an image. However, the new image should not contain a ZENworks partition.

For example, you can do the following:

1. In ZENworks Control Center, create a Imaging Script bundle.
2. In the *Script text* field in the Create New Bundle Wizard, enter:
   ```
   img -zenpart -remove
   ```
3. In the *Script text* field (after the above command), enter the other commands necessary for the imaging work you want for this device.

   For more information, see Appendix D, “ZENworks Imaging Engine Commands,” on page 173.
4. On the Summary page of the wizard, click *Finish* (not *Next*).
5. Reboot the device.

Using Fdisk

You can remove a ZENworks partition by simply using `fdisk` to reconfigure the device’s hard drive. Then, you can either image the device using a ZENworks imaging CD or DVD, or enable PXE on the device and assign an Imaging bundle to it, then reboot it to use that bundle.

2.3 Deploying and Managing Preboot Services

The following sections explain how to set up, deploy, and manage Preboot Services, and how to set up standard DHCP and novell-proxydhcp on the same server.

- Section 2.3.1, "Checking the Preboot Services Imaging Server Setup," on page 51
- Section 2.3.2, "Deploying Preboot Services in a Network Environment," on page 52
- Section 2.3.3, "Administering Preboot Services," on page 60
- Section 2.3.4, "Editing the Novell Preboot Services Menu," on page 63

For information on using Preboot, see Chapter 3, "Using Imaging," on page 91.

2.3.1 Checking the Preboot Services Imaging Server Setup

This section provides information on how to check the configuration of Preboot Services after it is installed.

- "Overview of Preboot Services Components" on page 51
- "Checking the Setup" on page 52

Overview of Preboot Services Components

The following components are installed as part of Preboot Services:

Table 2-1 *Preboot Service Components*

Windows Executable and Service Names	Linux Daemon	Description
`novell-pbserv.exe` Novell ZENworks Preboot Service	novell-pbserv	Provides imaging services to devices.
`novell-proxydhcp.exe` Novell Proxy DHCP Service	novell-proxydhcp	Runs alongside a standard DHCP server to inform PXE devices of the IP address of the TFTP server. The Proxy DHCP server also responds to PXE devices to indicate which bootstrap program (`nvlnbp.sys`) to use.
`novell-tftp.exe` Novell TFTP Service	novell-tftp	Used by PXE devices to request files that are needed to perform imaging tasks. The TFTP server also provides a central repository for these imaging files, such as the Linux kernel, initrd, and `nvlnbp.sys`. A PXE device uses this server to download the bootstrap program (`nvlnbp.sys`).
`novell-zmgprebootpolicy.exe` Novell ZENworks Preboot Policy Service	novell-zmgprebootpolicy	The PXE devices use this to check if there are any Imaging bundles that are assigned to the device.

Novell-proxydhcp must be started manually and does not need to be run on all Imaging Servers.

The other three services are started automatically when installing Configuration Management, or any time the server is rebooted, and must run on all Imaging Servers.

For more information, see Section C.7, “Imaging Server,” on page 161.

Checking the Setup

After the Preboot Services components are installed, the following should be installed and running on the server. You can use these methods to check their status:

Table 2-2 *Preboot Services Services Or Daemons*

Service	Method to Check Its Status
novell-pbserv	**Windows:** In the Services dialog box, review the *Status* column of *Novell ZENworks Preboot Service*.
	Linux: `/etc/init.d/novell-pbserv status`
novell-tftp	**Windows:** In the Services dialog box, review the *Status* column of *Novell TFTP Service*.
	Linux: `/etc/init.d/novell-tftp status`
novell-zmgprebootpolicy	**Windows:** In the Services dialog box, review the *Status* column of *Novell ZENworks Preboot Policy Service*.
	Linux: `/etc/init.d/novell-zmgprebootpolicy status`

You should not need to change the default configuration of these services.

If the server where the Preboot Services components are installed is also a DHCP server, see “Configuring LAN Environments for Preboot Services” on page 56.

2.3.2 Deploying Preboot Services in a Network Environment

To implement the network deployment strategies outlined in this section, you must have a solid understanding of the TCP/IP network protocol and specific knowledge of TCP/IP routing and the DHCP discovery process.

Deploying Preboot Services (with PXE) in a single network segment is a relatively simple process. However, Preboot Services deployment in a multi-segment network is far more complex and might require configuration of both the Preboot Services services or daemons and the network switches and routers that lie between the server and the PXE devices.

Configuring the routers or switches to correctly forward Preboot Services network traffic requires a solid understanding of the DHCP protocol, DHCP relay agents, and IP forwarding. The actual configuration of the switch or router must be performed by a person with detailed knowledge of the hardware.

We strongly recommend that you initially set up Preboot Services in a single segment to ensure that the servers are configured correctly and are operational.

This section includes the following information:

- "Server Configuration" on page 53
- "Network Configuration" on page 54
- "Configuring Filters on Switches and Routers" on page 59
- "Spanning Tree Protocol in Switched Environments" on page 59

Server Configuration

There are three important points about configuring servers for Preboot Services:

- **DHCP Server:** The Preboot Services environment requires a standard DHCP server. It is up to you to install your standard DHCP server.
- **Preboot Services Services or Daemons:** The four Preboot Services services or daemons (novell-pbserv, novell-tftp, novell-proxydhcp, and novell-zmgprebootpolicy) are all installed on the Imaging Server when you install Configuration Management. These services or daemons must run together on the same server.
- **Imaging Server:** The Preboot Services services or daemons can be installed and run on the same or different server than DHCP.

The following sections give general information about these services:

- "The DHCP Server" on page 53
- "Novell-pbserv" on page 53
- "Novell-proxydhcp" on page 54
- "Novell-tftp" on page 54
- "Novell-zmgprebootpolicy" on page 54

It is seldom necessary to make changes to the default configuration of these services. However, if you need more detailed configuration information, see "Configuring Preboot Services Imaging Servers" on page 60.

The DHCP Server

The standard DHCP server must be configured with an active scope to allocate IP addresses to the PXE devices. The scope options should also specify the gateway or router that the PXE devices should use.

If Preboot Services (specifically novell-proxydhcp) is installed on the same server as the DHCP server, the DHCP server must be configured with a special option tag. For more information, see "Configuring LAN Environments for Preboot Services" on page 56.

Novell-pbserv

Provides imaging services to devices.

This includes sending and receiving image files, discovering assigned Imaging bundles, acting as session master for multicast imaging, and so on.

Novell-proxydhcp

The Preboot Services Proxy DHCP server runs alongside a standard DHCP server to inform PXE devices of the IP address of the TFTP server, the IP address of the server where novell-zmgprebootpolicy is running, and the name of the network bootstrap program (`nvlnbp.sys`).

Novell-tftp

Used by PXE devices to request files that are needed to perform imaging tasks. The TFTP server also provides a central repository for these files.

A PXE device uses one of these servers to download the network bootstrap program (`nvlnbp.sys`).

Novell-zmgprebootpolicy

PXE devices use novell-zmgprebootpolicy to check if there are any imaging actions that need to be performed on the device. It forwards requests to novell-pbserv on behalf of PXE devices.

If you are using Intel AMT, support for it should be enabled in the `novell-zmgprebootpolicy.conf` file, which is located at:

Windows: *`installation_path`*`\novell\zenworks\conf\preboot\`

Linux: `/etc/opt/novell/zenworks/preboot/`

Network Configuration

The configuration required to run Preboot Services in your network depends on your network setup. Design your network so that PXE devices can effectively connect to the server where the Preboot Services services or daemons are running. Make sure you consider the number of PXE devices to be installed on the network and the bandwidth available to service these devices. To understand how the devices and servers need to interact during the Preboot Services process, see Section 1.4, “The Preboot Services Processes,” on page 23.

You can configure Preboot Services where Preboot Services and DHCP are running on the same server or on different servers in both LAN and WAN/VLAN environments:

- “Understanding Preboot Services in LAN and WAN/VLAN Environments” on page 54
- “Comparing Preboot Services Setups in LAN and WAN/VLAN Environments” on page 55
- “Configuring LAN Environments for Preboot Services” on page 56
- “Configuring a WAN/VLAN with Preboot Services and DHCP Running on the Same Server” on page 57
- “Configuring a WAN/VLAN With Preboot Services and DHCP Running on Separate Servers” on page 57

Understanding Preboot Services in LAN and WAN/VLAN Environments

Imaging servers should be installed so that PXE devices have access to imaging services within their LAN. A good design ensures that a client does not need to connect to imaging services through a slow WAN link.

Although you can have any number of Imaging Servers, generally only one Proxy DHCP server should be enabled per DHCP server scope.

In a WAN, the PXE device is usually separated from the Proxy DHCP and DHCP servers by one or more routers. The PXE device broadcasts for DHCP information, but by default the router does not forward the broadcast to the servers, causing the Preboot Services session to fail.

In a VLAN (Virtual LAN) environment, the PXE device is logically separated from the Proxy DHCP server and the DHCP server by a switch. At the IP level, this configuration looks very similar to a traditional WAN (routed) environment.

In a typical VLAN environment, the network is divided into a number of subnets by configuring virtual LANs on the switch. Devices in each virtual LAN usually obtain their IP address information from a central DHCP server. In order for this system to work, it is necessary to have Bootp or IP helpers configured on each gateway. These helpers forward DHCP requests from devices in each subnet to the DHCP server, allowing the DHCP server to respond to devices in that subnet.

Comparing Preboot Services Setups in LAN and WAN/VLAN Environments

The following illustrates the differences for a LAN configuration between installing Preboot Services on the same server as DHCP, or on a separate server. In this case, only the PXE devices on the LAN connect to the Preboot Services Imaging Server.

Table 2-3 *LAN Configuration Differences Between the Same and Separate Servers*

Information	On the Same Server	On Separate Servers
Configuration	Because Preboot Services and DHCP are running on the same server, option tag 60 must be set on the DHCP server. For information on setting this tag, see "Configuring LAN Environments for Preboot Services" on page 56.	None required.
Advantages	◆ Easy installation and setup. ◆ No network configuration is required.	◆ Easiest installation and setup. ◆ No network configuration is required. ◆ No DHCP server configuration is required.
Disadvantages	◆ DHCP server configuration is required (option tag 60). ◆ Limited use, because a single-LAN environment only exists in small lab-type networks.	◆ Limited use, because a single-LAN environment only exists in small lab-type networks.

The following illustrates the differences for a WAN/VLAN configuration between installing Preboot Services on the same server as DHCP, or on a separate server. In this case, all PXE devices over the entire WAN/VLAN connect to the Preboot Services Imaging Server.

Table 2-4 *WAN/VLAN Configuration Differences Between the Same and Separate Servers*

Information	On the Same Server	On Separate Servers
Configuration	The routers/switches have been configured with IP helpers to forward network traffic to the DHCP server. Because Preboot Services and DHCP are running on the same server, option tag 60 is set on the DHCP server. For information on setting this tag, see "Configuring a WAN/VLAN with Preboot Services and DHCP Running on the Same Server" on page 57.	A DHCP relay agent or IP helper is configured on the router/switch serving the subnet that the PXE device belongs to. The helper is configured to forward all DHCP broadcasts that are detected in the subnet to the DHCP and Proxy DHCP servers. This normally requires two helpers to be configured: the first to forward DHCP broadcasts to the DHCP server, and the second to forward the DHCP broadcasts to the Proxy DHCP server.
Advantages	◆ No network equipment (routers/switches) needs to be configured to forward network traffic to the TFTP server.	◆ Common network setup. ◆ Multiple Preboot Services Imaging Servers can be installed so that each server provides service only for certain subnets.
Disadvantages	◆ DHCP server configuration required (option tag 60). ◆ Only one Preboot Services Imaging Server can be installed because it needs to run on the same server as the DHCP server (and there is usually only one DHCP server).	◆ The network equipment (routers/switches) must be configured with additional IP helpers. Some network equipment might not function properly when more than one additional IP helper is configured.

Configuring LAN Environments for Preboot Services

If you have Preboot Services and DHCP running on separate servers, no network configuration is required.

If you have Preboot Services and DHCP are running on the same server, option tag 60 must be set on the DHCP server. Do the following to set up standard DHCP and Proxy DHCP on the same server:

1. Stop the DHCP services on the Imaging Server.
2. On this server, open the DHCP configuration file in an editor:

   ```
   /etc/dhcpd.conf
   ```
3. Insert the following line in the file:

   ```
   option vendor-class-identifier "PXEClient";
   ```
4. Save the file.
5. Restart the DHCP service.

Configuring a WAN/VLAN with Preboot Services and DHCP Running on the Same Server

You can install Configuration Management (which includes Preboot Services) on the same server where DHCP is installed and running. However, you must do the following to make it work:

- Set option tag 60 on the DHCP server so that it can work with novell-proxydhcp. See the steps in the previous section ("Configuring LAN Environments for Preboot Services" on page 56).
- On the server, edit the `novell-proxydhcp.conf` file and change:

  `LocalDHCPFlag = 0`

  to

  `LocalDHCPFlag = 1`

  The file is located at:

  Windows: *`installation_path`*`\novell\zenworks\conf\preboot\`

  Linux: `/etc/opt/novell/`

  Then restart the service so that the change is recognized by entering the following command on the server:

  Windows: In the Services dialog box, right-click *Novell Proxy DHCP Service*, then select *Restart*.

  Linux: `/etc/init.d/novell-proxydhcp restart`

IMPORTANT: If the switch is acting as a firewall and limiting the type of traffic on the network, understand that novell-tftp and novell-zmgprebootpolicy are not firewall or network filter friendly. You should not attempt to run these services or daemons through a firewall. If users need to pass preboot work through a firewall, then all Preboot Services work needs to be on the outside and merely reference a Web service inside the firewall.

Configuring a WAN/VLAN With Preboot Services and DHCP Running on Separate Servers

You can install Configuration Management (which includes Preboot Services) on a separate server than where DHCP is installed and running. However, you must configure the network equipment so that it correctly forwards Preboot Services network traffic.

IMPORTANT: If the switch is acting as a firewall and limiting the type of traffic on the network, understand that novell-tftp and novell-zmgprebootpolicy are not firewall or network filter friendly. You should not attempt to run these services or daemons through a firewall. If users need to pass preboot work through a firewall, then all Preboot Services work needs to be on the outside and merely reference a Web service inside the firewall.

An example deployment is given below of a WAN/VLAN environment with Preboot Services and DHCP running on the same server. The following sections provide the specific steps required to configure network equipment so that it correctly forwards Preboot Services network traffic.

Example Deployment

In this example, three VLANs are configured on a Bay Networks* Accel 1200 switch running firmware version 2.0.1. One VLAN hosts the Proxy DHCP server, the second VLAN hosts the DHCP server, and the third VLAN hosts the PXE device. The PXE device's DHCP broadcast is forwarded by the switch to both the Proxy DHCP server and the DHCP server. The response from

both servers is then routed correctly back to the PXE device, and the PXE device starts the Preboot Services session correctly.

The three VLANs are all 24-bit networks; their subnet mask is 255.255.255.0.

The first VLAN gateway is 10.0.0.1. This VLAN hosts the PXE device that is allocated an IP in the range of 10.0.0.2 to 10.0.0.128. This VLAN is named VLAN1.

The second VLAN gateway is 10.1.1.1. This VLAN hosts the DHCP server with IP 10.1.1.2. This VLAN is named VLAN2.

The third VLAN gateway is 196.10.229.1. This VLAN hosts the server running novell-proxydhcp and novell-zmgprebootpolicy. The server's IP is 196.10.229.2. This VLAN is named VLAN3.

Routing is enabled between all VLANs. Each VLAN must be in its own spanning tree group.

Configuring Cisco Equipment

1. Go to the Global configuration mode.
2. Type `ip forward-protocol udp 67`, then press Enter.
3. Type `ip forward-protocol udp 68`, then press Enter.
4. Go to the LAN interface that serves the PXE device.
5. Type `ip helper-address 10.1.1.2`, then press Enter.
6. Type `ip helper-address 196.10.229.2`, then press Enter.
7. Save the configuration.

Configuring Nortel Networks Equipment

1. Connect to the router with Site Manager.
2. Ensure that IP is routable.
3. Enable the *Bootp* check box on the PXE device subnet/VLAN.
4. Select the interface that the PXE devices are connected to.
5. Edit the circuit.
6. Click *Protocols*.
7. Click *Add/Delete*.
8. Ensure that there is a check mark in the *Bootp* check box.
9. Click *OK*.
10. Click *Protocols > IP > Bootp > Relay Agent interface table*.

    The interface where Bootp was enabled is visible in the list.
11. Click *Preferred server*.
12. Change the *Pass through mode* value to Bootp and DHCP.
13. Set up the relay agents:

    13a Click *Add*.

    13b In the *Relay agent IP address* box, type the local LAN IP address.

    13c In the *Target server IP address* box, type the DHCP server IP address.

13d Click *OK*.

13e Change the *Pass through mode* value to Bootp and DHCP.

13f Perform Step 1 to Step 5 again and specify the Proxy DHCP server IP address at Step 3.

13g Apply the configuration.

Configuring Bay Networks Equipment

Perform the following steps on the switch:

1. Enable DHCP for the client VLAN using the following command lines:
   ```
   # config vlan1 ip
   # dhcp enable
   ```
2. Configure IP helpers to forward DHCP requests from the device subnet to the TFTP server, using the following command lines:
   ```
   # config ip dhcp-relay
   # create 10.0.0.1 10.1.1.2 mode dhcp state enable
   # create 10.0.0.1 196.10.229.2 mode dhcp state enable
   ```
   The `create` command has the form `create` *`agent server`* `mode dhcp state enable`, where *`agent`* is the IP address of the gateway that serves the PXE device, and *`server`* is the IP address of the server that the DHCP frame should be forwarded to.
3. Save the configuration.

Configuring Filters on Switches and Routers

Some network devices filter network traffic that passes through them. Preboot Services makes use of several different types of traffic, and all of these must be able to successfully pass through the router or switch for the Preboot Services session to be successful. The Preboot Services session uses the following destination ports:

Table 2-5 *Destination Ports for Preboot Services*

Component	Port
DHCP and Proxy DHCP servers	UDP Ports 67, 68, and 4011
TFTP server	UDP Port 69
novell-zmgprebootpolicy	UDP Port 13331

IMPORTANT: If the switch is acting as a firewall and limiting the type of traffic on the network, understand that novell-tftp and novell-zmgprebootpolicy are not firewall or network filter friendly. You should not attempt to run these services or daemons through a firewall. If users need to pass preboot work through a firewall, then all Preboot Services work needs to be on the outside and merely reference a Web service inside the firewall.

Spanning Tree Protocol in Switched Environments

The spanning tree protocol (STP) is available on certain switches and is designed to detect loops in the network. When a device (typically a network hub or a device) is patched into a port on the

switch, the switch indicates to the device that the link is active, but instead of forwarding frames from the port to the rest of the network, the switch checks each frame for loops and then drops it. The switch can remain in this listening state from 15 to 45 seconds.

The effect of this is to cause the DHCP requests issued by PXE to be dropped by the switch, causing the Preboot Services session to fail.

It is normally possible to see that the STP is in progress by looking at the link light on the switch. When the device is off, the link light on the switch is obviously off. When the device is turned on, the link light changes to amber, and after a period of time changes to a normal green indicator. As long as the link light is amber, STP is in progress.

This problem only affects PXE devices that are patched directly into an Ethernet switch. To correct this problem, perform one of the following:

- Turn off STP on the switch entirely.
- Set STP to Port Fast for every port on the network switch where a PXE device is attached.

After the problem is resolved, the link light on the port should change to green almost immediately after a device connected to that port is turned on.

Information about STP and its influence on DHCP can be found at Using PortFast and Other Commands to Fix End-Station Startup Connectivity Problems (http://www.cisco.com/univercd/cc/td/doc/cisintwk/itg_v1/tr1923.htm#xtocid897350).

2.3.3 Administering Preboot Services

This section includes information about administering and configuring Preboot Services:

- "Configuring Preboot Services Imaging Servers" on page 60
- "Configuring IP Port Usage" on page 62

Configuring Preboot Services Imaging Servers

In Preboot Services, the services or daemons do not use switches. Instead, to configure a service or daemon to do something that is not a default, you need to edit the configuration files.

You can edit configuration files while the service or daemon is running, because they are only read when the service or daemon starts. After editing the file you must restart the service or daemon for the changes to take effect.

For more information on the service or daemon configuration files, see Section C.7, "Imaging Server," on page 161.

The following sections explain how to configure the following ZENworks Imaging Servers:

- "Configuring the TFTP Server" on page 61
- "Configuring the Proxy DHCP Server" on page 61
- "Configuring Novell-pbserv" on page 61
- "Configuring Novell-zmgprebootpolicy" on page 62
- "Configuring the DHCP Server" on page 62

Configuring the TFTP Server

It is seldom necessary to change the default TFTP server configuration values. If you need to change them, use the following procedure:

1. Open the following file in an editor:

   Windows: *installation_path*\novell\zenworks\conf\preboot\novell-tftp.conf

   Linux: /etc/opt/novell/novell-tftp.conf
2. Edit the configuration settings according to the instructions within the file.
3. Save the changes.
4. On a command line, enter the following:

   Windows: In the Services dialog box, right-click *Novell TFTP Service*, then select *Restart*.

   Linux: /etc/init.d/novell-tftp restart

Configuring the Proxy DHCP Server

The Proxy DHCP server provides PXE devices with the information that they require to be able to connect to the Preboot Services system.

Use the following steps to modify the settings of novell-proxydhcp:

1. Open the following file in an editor:

   Windows: *installation_path*\novell\zenworks\conf\preboot\novell-proxydhcp.conf

   Linux: /etc/opt/novell/novell-proxydhcp.conf
2. Edit the configuration settings according to the instructions within the file.
3. Save the changes.
4. On a command line, enter the following:

   Windows: In the Services dialog box, right-click *Novell Proxy DHCP Service*, then select *Restart*.

   Linux: /etc/init.d/novell-proxydhcp restart

You can set any of the IP address fields to 0.0.0.0 in the configuration utility. The server replaces these entries with the IP address of the first network adapter installed in the server.

Configuring Novell-pbserv

Novell-pbserv provides imaging services to the devices.

Use the following steps to modify the settings of novell-pbserv:

1. Open the following file in an editor:

   Windows: *installation_path*\novell\zenworks\conf\preboot\novell-pbserv.conf

   Linux: /etc/opt/novell/novell-pbserv.conf
2. Edit the configuration settings according to the instructions within the file.

3 Save the changes.

4 On a command line, enter the following:

Windows: In the Services dialog box, right-click *Novell ZENworks Preboot Service*, then select *Restart*.

Linux: `/etc/init.d/novell-pbserv restart`

Configuring Novell-zmgprebootpolicy

Novell-zmgprebootpolicy is used to check if there are any imaging actions that need to be performed on the device. It forwards requests to novell-pbserv on behalf of PXE devices.

Use the following steps to modify the settings of novell-zmgprebootpolicy:

1 Open the following file in an editor:

Windows: `installation_path\novell\zenworks\conf\preboot\novell-zmgprebootpolicy.conf`

Linux: `/etc/opt/novell/novell-zmgprebootpolicy.conf`

2 Edit the configuration settings according to the instructions within the file.

3 Save the changes.

4 On a command line, enter the following:

Windows: In the Services dialog box, right-click *Novell ZENworks Preboot Policy Service*, then select *Restart*.

Linux: `/etc/init.d/novell-zmgprebootpolicy restart`

Configuring the DHCP Server

The DHCP server needs to have option 60 (decimal) added to the DHCP tags if the Proxy DHCP and DHCP servers are running on the same physical server. This option should be a string type and must contain the letters PXEClient.

For more information, see "Configuring LAN Environments for Preboot Services" on page 56.

Configuring IP Port Usage

This section describes the network ports used by Preboot Services. Using the information in this section, you can configure routers to correctly forward the network traffic generated by Preboot Services. For further information about configuring routers, see Section 2.3.2, "Deploying Preboot Services in a Network Environment," on page 52.

Preboot Services uses both well-known and proprietary IP ports.

The well-known IP ports include:

- **67 Decimal:** The Proxy DHCP server listens on this port for PXE information requests. This is the same port used by a standard DHCP server.
- **68 Decimal:** The DHCP/Proxy DHCP server responds to client requests on this port. This is the same port used by a standard DHCP server.
- **69 Decimal:** The TFTP server listens on this port for file requests from PXE devices.

- **4011 Decimal:** When running on the same server as the DHCP service or daemon, the Proxy DHCP server listens on this port for PXE information requests.

The proprietary IP ports include:

- **998 Decimal:** Novell-pbserv client connection port. It receives all connection requests from the Preboot Services devices on this port.
- **13331 Decimal:** Novell-zmgprebootpolicy client connection port. It receives all connection requests from the PXE devices on this port.

Although PXE devices make their initial requests to novell-tftp and novell-zmgprebootpolicy on the ports listed above, the remainder of the transactions can occur on any available port. For this reason, Imaging Servers cannot be separated from their clients by a firewall.

IMPORTANT: Novell-tftp and novell-zmgprebootpolicy are not firewall or network filter friendly. You should not attempt to run these services or daemons through a firewall. If users need to pass preboot work through a firewall, then all Preboot Services work needs to be on the outside and merely reference a Web service inside the firewall.

2.3.4 Editing the Novell Preboot Services Menu

Depending on the configuration settings for Preboot Services in ZENworks Control Center, PXE devices might be able to display the Novell Preboot Services Menu during the boot process. The menu has the following options:

- *Start ZENworks Imaging*
- *Start ZENworks Imaging Maintenance*
- *Disable ZENworks Partition*
- *Enable ZENworks Partition*
- *Exit*

For information on configuring how the menu used, see Section 2.4.1, “Configuring Novell Preboot Services Menu Options,” on page 66.

There might be circumstances when you want to modify the options on the Novell Preboot Services Menu. You can customize these options by editing a text file contained on the Imaging Server. For example, you can:

- Add, delete, and modify menu options
- Add submenu items
- Change the color scheme
- Change the menu title and screen name

The following procedure should be done on each Imaging Server where you want to customize the menu.

To edit the menu:

1. In a text editor, open the following file on an Imaging Server where the ZENworks Proxy DHCP server (novell-proxydhcp) is running:

Windows:

installation_path\novell\zenworks\share\tftp\pxemenu.txt

Linux: /srv/tftp/pxemenu.txt

IMPORTANT: If you want to save the default options for this menu, we recommend that you make a backup copy of pxemenu.txt, such as pxemenu_orig.txt.

The following is the content of the default menu's pxemenu.txt file:

```
#This file describes a PXEMenu

ScreenName = Novell Preboot Services Menu
ScreenInfo = Version 2.0  July, 2007
MenuTitle = ZENworks Preboot Options

FormatVersion = 2

#The screen colors determine the color of the main part of the menu
screen
ScreenColor = bright_white
ScreenBackgroundColor = blue

#The info colors determine the color of the screen information at
the top
#of the menu screen
InfoColor = yellow
InfoBackgroundColor = blue

#The hint colors determine the color of the hint line at the bottom
of the screen
HintColor = lt_cyan
HintBackgroundColor = blue

#The menu colors determine the color of the menu box and menu title
MenuColor = yellow
MenuBackgroundColor = blue

#The option colors determine the color of the menu option
OptionColor = BRIGHT_WHITE
OptionBackgroundColor = BLUE

#The chosen colors determine the color of the high-lighted option
ChosenColor = BRIGHT_WHITE
ChosenBackgroundColor = RED

#The 'forced option' is the option that will be automatically
#executed without presenting a menu to the user.  It MUST be an
#option on the first ('Main' by default) menu.  The following
#example will force 'Start ZENworks Imaging Maintenance'
#ForceOption=2

StartMenu = Main
```

```
#Note:  The original version of the pxemenu.txt file does not
#       require submenus, but example syntax is provided in
#       comments for demonstration purposes.

[Main]
MenuTitle = ZENworks Preboot Options
option = execute ; "Start ZENworks Imaging" ; "ZENworks Imaging
         in Automated Mode" ; pxelinux.0 ; z_auto.cfg
option = execute ; "Start ZENworks Imaging Maintenance" ;
         "ZENworks Imaging Linux Session in Interactive Mode" ;
         pxelinux.0 ; z_maint.cfg
option = execute ; "Disable ZENworks Partition" ; "Disable
         Existing ZENworks partition" ;pxelinux.0 ; z_zpdis.cfg
option = execute ; "Enable ZENworks Partition" ; "Re-enable
         Existing ZENworks partition" ;pxelinux.0 ; z_zpen.cfg
#option = submenu ; "Sub Menu Options >>" ; "Submenu example with
         more options" ; SUBMenu
option = exit ; "Exit" ; "Boot to local hard drive"

#[SUBMenu]
#MenuTitle = Sub Menu Options
#option = execute ; "Sub Menu #1" ; "Description for sub menu #1" ;
#        pxelinux.0 ; submenu1.cfg
#option = execute ; "Sub Menu #2" ; "Description for sub menu #2" ;
#        pxelinux.0 ; submenu2.cfg
#option = return ; "Return" ; "Return to main menu"
#option = exit ; "Exit" ; "Boot to local hard drive"
```

2 To change the appearance of the menu, edit the first seven sections (title and colors).

To change colors, the settings you enter must be selected from the following:

BLACK	RED	GRAY	LT_GREEN
BLUE	MAGENTA	YELLOW	LT_CYAN
GREEN	BROWN	BRIGHT_WHITE	LT_RED
CYAN	WHITE	LT_BLUE	LT_MAGENTA

3 To change the menu options, edit the sections under `[Main]`.

The menu options, their hint descriptions, the `pxelinux.0` executable, and configuration file (`.cfg`) are listed on the `option =` line.

4 When you are finished, save the `pxemenu.txt` file.

2.4 Configuring Preboot Services Defaults

You can configure Preboot Services default settings for a ZENworks Management Zone. These are settings that apply globally to all devices in the Management Zone.

Some of these settings enable you to automatically register devices with the ZENworks Server, and some can be overridden by configurations done for devices or folders containing devices. For more information, see Section 2.5, “Overriding Preboot Services Defaults,” on page 86.

The following default settings can be configured in ZENworks Control Center:

- Section 2.4.1, “Configuring Novell Preboot Services Menu Options,” on page 66
- Section 2.4.2, “Configuring Non-Registered Device Settings,” on page 67
- Section 2.4.3, “Configuring Device Imaging Work Assignments,” on page 71
- Section 2.4.4, “Configuring the Server Referral List,” on page 82
- Section 2.4.5, “Configuring Intel Active Management Technology (AMT),” on page 86

2.4.1 Configuring Novell Preboot Services Menu Options

The Novell Preboot Services Menu provides options for how Preboot Services can be used on your devices. The following options are presented when the menu is displayed:

Table 2-6 *Novell Preboot Services Menu Options*

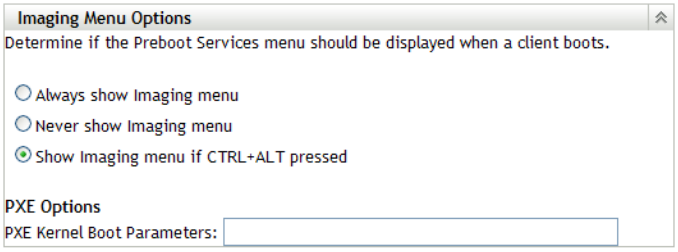
Menu Option	Function
Start ZENworks Imaging	Executes the assigned Preboot Services imaging bundles.
Start ZENworks Imaging Maintenance	Displays the imaging maintenance mode prompt, where you can execute imaging commands.
Disable ZENworks Partition	Prevents an existing ZENworks partition from being used when booting to execute the assigned Imaging bundles.
Enable ZENworks Partition	Allows an existing ZENworks partition to be used when booting to execute the assigned Imaging bundles.
Exit	Resumes booting of the device without doing any Imaging bundle work.

Generally, if your Preboot Services work is completely automated, you should select to never display the Novell Preboot Services Menu on the device when it boots. Conversely, if you need to do manual Preboot Services functions for some or all devices, then select to always display the menu. A compromise is where you select to display the menu if Ctrl+Alt is pressed, allowing unattended Preboot Services work while allowing you the opportunity to display the menu when needed.

IMPORTANT: PXE must be enabled on the device for the menu to be displayed.

To determine whether the Novell Preboot Services Menu is displayed on your devices when they boot:

1. In ZENworks Control Center, click *Configuration* in the left pane to display the *Configuration* tab, then if it’s not expanded, click *Management Zone Settings*.
2. Click *Device Management* to expand its listing, then select *Preboot Services* to display the configuration sections.
3. Locate and expand the Preboot Menu Options section:



4 Select one of the following:

- *Always Show Imaging Menu*
- *Never Show Imaging Menu*
- *Show Imaging Menu if CTRL+ALT Pressed*

5 To provide PXE boot options, specify them in the *PXE Kernel Boot Parameters* field.

Each parameter should be separated by a space.

6 Click either *Apply* or *OK* to save the change.

This sets the default menu display mode for the Management Zone. This can be overridden at the folder or device level. For more information, see Section 2.5, "Overriding Preboot Services Defaults," on page 86.

2.4.2 Configuring Non-Registered Device Settings

The following configurations can be set after a device is imaged. The settings are applied to devices that are not registered in the Management Zone and are placed in the devices' image-safe data.

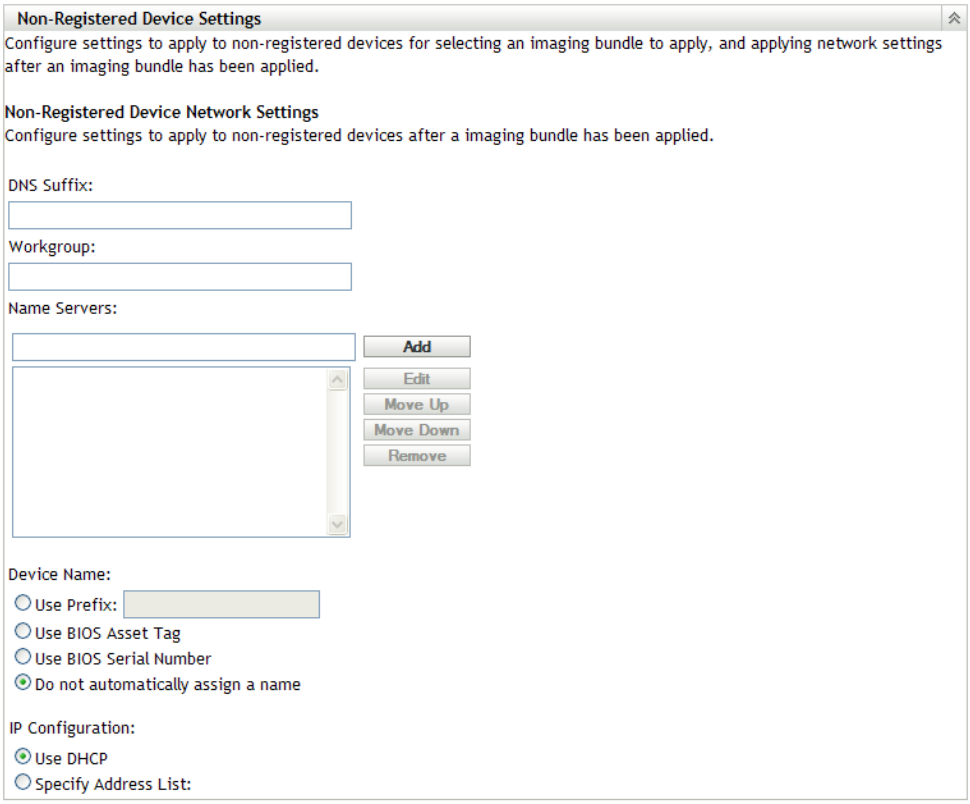
For more information, see Section 1.3.3, "Non-Registered Device Settings," on page 19.

To configure default ID settings for non-registered devices:

1 In ZENworks Control Center, click *Configuration* in the left pane to display the *Configuration* tab, then if it's not expanded, click *Management Zone Settings*.

2 Click *Device Management* to expand its listing, then select *Preboot Services* to display the configuration sections.

3 Locate and expand the Non-Registered Device Settings section:



4 Fill in the fields:

DNS Suffix: Provides a suffix for all of your device's names.

For example, if you enter "provo.novell.com" and a device's name is "device1," that device's full name becomes "device1.provo.novell.com."

Workgroup: Specify the Windows workgroup that you want the device to be a member of.

The workgroup is made part of the image for the device.

Name Servers: To control what DNS servers the device uses, specify a DNS name server, then click *Add* to place it into the listing.

So that a booting device can find a name server efficiently, specify multiple DNS name servers.

For optimal availability of a DNS server for a device, you can rearrange the order using *Move up* and *Move down*, one name server entry at a time.

You can delete multiple name servers by selecting them and clicking *Remove*.

Device Name: You can specify the default device names for non-registered devices. The name is applied after the device is imaged.

This can be useful for when you have multiple devices to be imaged. You can automatically provide unique names for each device (from its BIOS asset tag or its BIOS serial number), as well as group devices by providing the same prefix for their names.

- **Use Prefix: ____:** This provides a common prefix to the device names, such as Lab1, to distinguish them from the devices in Lab2. This can be useful when doing bulk imaging of certain groups of devices. It is limited to 8 characters.

If this option is used, the prefix you enter here is appended with a random string of letters and numbers to make the device name 15 characters long. Underscores and hyphens are valid in your prefix. The remaining random string uniquely names the device.

For example, if you enter Lab1_, then ten other characters are randomly generated to complete the name with Lab1 separated from the random characters by the underscore for readability.

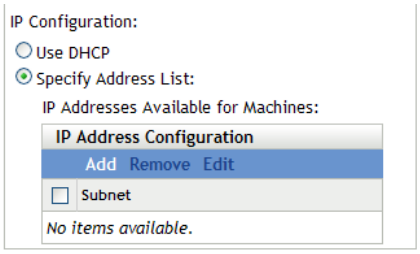
- **Use BIOS Asset Tag:** This is the asset tag stored in the device's BIOS, which is unique for every device. This can be useful for tracking a device based on its asset tag.
- **Use BIOS Serial Number:** This is the serial number stored in the device's BIOS, which is unique for every device. This can be useful for tracking a device based on its serial number.
- **Do Not Automatically Assign a Name:** Select this option if you do not want to use any of the above options. This is the default option.

IP configuration: You can select either *Use DHCP* or *Specify address List* to identify devices for Preboot Services work.

These are the settings that the device is told to use after it is imaged. It uses them for Preboot Services work any time it reboots.

For IP configuration, select one of the following options:

- **Use DHCP:** Allows the devices to be dynamically assigned IP addresses.
- **Specify Address List:** Uses IP addresses to identify your devices. The addresses you add to the list are available to be used by your devices. This way, you can specify a range of IP addresses or individual IP addresses that you want your devices to use. For example, you can ensure that all of your lab devices use addresses between 10.0.0.5 and 10.0.0.25.



If you select *Specify Address List*, perform the tasks contained in the following table:

Task	Steps	Additional Details
Add an IP address range	1. In the *IP Address Configuration* panel, click *Add* to open the Range Information dialog box. 2. Specify a subnet mask in the *Subnet in CIDR Notation* field. Device IP address ranges are provided by subnet masks. 3. Specify the subnet's gateway in the *Default Gateway* field. This assigns devices to the gateway for access to the Internet or network after the device has been imaged and rebooted. 4. To place IP addresses in the *Available Address Ranges* field, specify an address range using CIDR notation in the *Add* field, then click *Add*. 5. To remove an IP address range from the *Available Address Ranges* list, select the entry then click *Remove*. You can only remove address ranges, not specific IP addresses within a range. 6. Click *OK* to place the address ranges into the *IP Address Configuration* listing in the *Non-Registered Device Settings* section.	After a device is imaged, IP settings are applied to the device. The IP address that gets assigned to the imaged device is no longer displayed in the available list, but is instead listed in the *Used Address Ranges* list. The *Used Address Ranges* list in the Range Information dialog box indicates those that are currently being used by devices in the zone. With CIDR (Classless Inter-Domain Routing) notation, the dotted decimal portion of the IP address is interpreted as a 32-bit binary number that has been broken into four 8-bit bytes. The number following the slash (/n) is the prefix length, which is the number of shared initial bits, counting from the left side of the address. The /n number can range from 0 to 32, with 8, 16, 24, and 32 being commonly used numbers. For example: ◆ `123.45.678.12/16` matches all IP addresses that start with 123.45 ◆ `123.45.678.12/24` matches all IP addresses that start with 123.45.678
Remove IP addresses from the *IP Address Configuration* listing	1. Select the check boxes for one or more IP address entries in the list, then click *Remove*.	
Remove displayed IP address ranges from the Range Information dialog box	1. In the *IP Address Configuration* panel, click *Edit* to open the Range Information dialog box. 2. In the Used Address Ranges section, select an IP address range in the listing, then click *Remove Range*.	

Task	Steps	Additional Details
Remove specific IP addresses from the Range Information dialog box	1. In the *IP Address Configuration* panel, click *Edit* to open the Range Information dialog box. 2. In the Used Address Ranges section, enter a specific IP address or a range of addresses in the *Remove* field, then click *Remove*.	
Edit an IP address entry	1. Select the check boxes for an IP address entry in the list, then click *Edit* to open the Range Information dialog box. 2. Modify the information as necessary. 3. Click OK to save the changes.	

5 Click either *Apply* or *OK* to save the changes.

This sets the default device ID method for the Management Zone.

2.4.3 Configuring Device Imaging Work Assignments

You can determine what imaging work is to be performed on a device when it boots, based on a set of hardware rules. This configuration section lets you specify a particular bundle for each set of hardware rules. The Custom Hardware Types section allows you to provide specific data for a *Hardware Type* hardware rule option.

All rules and custom types configured here are applied globally to all managed devices in the Management Zone. However, only those devices that exactly match the rule and its custom types have the assigned bundle applied to them when they boot.

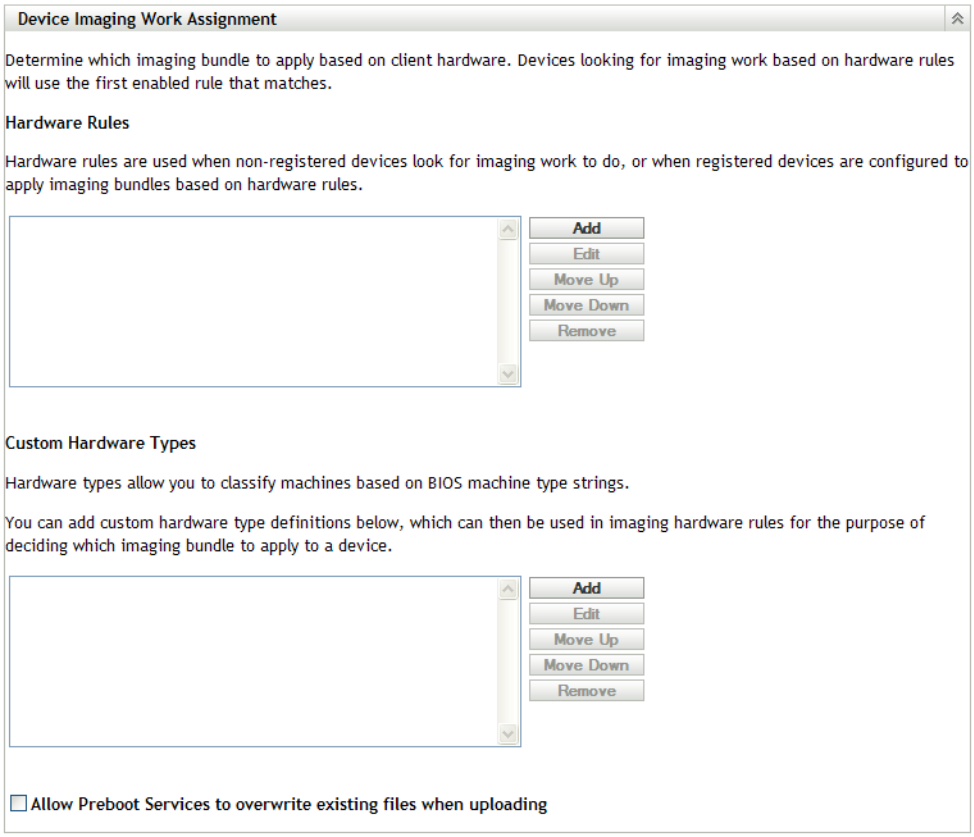
For more information, see Section 1.3.4, “Device Imaging Work Assignment,” on page 20.

To configure default imaging work assignments for non-registered devices:

1 In ZENworks Control Center, click *Configuration* in the left pane to display the *Configuration* tab, then if it’s not expanded, click *Management Zone Settings*.

2 Click *Device Management* to expand its listing, then select *Preboot Services* to display the configuration sections.

3 Locate and expand the Device Imaging Work Assignment section:



4 Configure the following:

- "Hardware Rules" on page 72
- "Custom Hardware Types" on page 78
- "Allow Overwrites" on page 82

5 Click either *Apply* or *OK* to save the changes.

This sets the default imaging work assignments for devices registered in the Management Zone.

Hardware Rules

You can specify hardware-based rules for a Imaging bundle. This enables any device matching those rules to have the specified bundle applied to it when it boots.

For example, you can create a rule that applies a bundle to any device with at least 512 MB of RAM and 150 GB of hard drive space.

A work rule is made up of filters that are used to determine whether a device complies with the rule. The rules use logic to determine whether a device meets the requirements for applying the Imaging bundle. The AND, OR, and NOT logical operators are used for creating filtering for the rule.

When a device is seeking work to be done, it scans the rules until it finds a rule where all of the rule's filters match the device, then executes the bundle assigned to the rule.

The following table lists the tasks you can perform to configure hardware rules:

Table 2-7 *Hardware Rules Tasks*

Task	Steps	Additional Details
Add a hardware rule	1. Click *Add* next to the *Hardware Rules* list box, which opens the Rule Construction dialog box. 2. To create the hardware rule, follow the instructions contained in "Rule Construction Dialog Box" on page 74. 3. After exiting the Rule Construction dialog box, click *Apply* at the bottom of the configuration page to save the new rule.	The information that you configure in the Rule Construction dialog box comprises one rule. You can add multiple rules. Each time you click *Add* to use the Rule Construction dialog box, you can select the same bundle as the previous time that you used the dialog box, or you can select a different bundle for the rule. Only the first hardware rule that is matched is used when a device boots to apply the assigned bundle.
Edit a hardware rule	1. Select a hardware rule, then click *Edit*, which opens the Rule Construction dialog box in edit mode. 2. To edit the hardware rule, follow the instructions contained in "Rule Construction Dialog Box" on page 74. 3. After exiting the Rule Construction dialog box, click *Apply* at the bottom of the configuration page to save the rule's changes.	
Disable or enable a hardware rule	1. Select a hardware rule, then click *Edit*. 2. In the Rule Construction dialog box, select the check box for *Enabled* to enable or disable it. 3. Click *Apply* at the bottom of the configuration page to save the rule's change.	This is the only way to change the status of a hardware rule. Whether a hardware rule is enabled or disabled is indicated in the *Hardware Rules* list box. For example, `Enabled - Asset Tag Rule`.
Rearrange the order of the hardware rules	1. Select one hardware rule, then click either *Move Up* or *Move Down*. You cannot move multiple rules at one time. 2. Repeat as necessary to arrange the order of the hardware rules. 3. Click *Apply* at the bottom of the configuration page to save the new rule order.	The hardware rule order is important because when the device boots, the first rule that is found to match the device is used to apply the bundle. The other rules are ignored. This means that only one bundle can be applied to a booting device by virtue of a hardware rule match.

Task	Steps	Additional Details
Remove hardware rules	1. Select one or more hardware rules, then click *Remove*. 2. Click *Apply* at the bottom of the configuration page to cause removal of the rules from the list.	You can use the Ctrl or Shift keys to select multiple hardware rules to remove them from the list. If you remove a hardware rule, any work you did to create it is lost. Removed rules do not have any of their information saved anywhere. Therefore, if you only want to remove the rule temporarily, take note of the rule's content before deleting it so that you can more easily re-create it. For example, either select it and click *Edit* and note the data, or take a screen shot of the dialog box.

Rule Construction Dialog Box

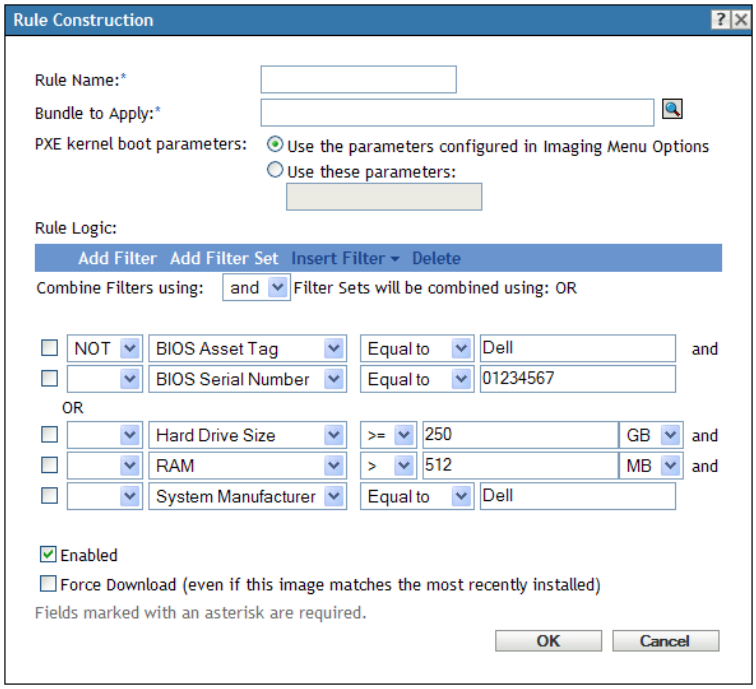
Understanding rule logic is important in using this dialog box. For more information, see "Rule Logic" on page 76.

To configure a hardware rule:

1. If you plan to select *Hardware Type* when constructing a rule, you must first configure the hardware type.

   For instructions, see "Custom Hardware Types" on page 78.

2. Click *Add* in the Hardware Rules section to display the Rule Construction Dialog box:



3 In the Rules Construction dialog box, fill in the following fields and select or deselect the options:

Rule Name: This name is displayed in the rules listing on the *Preboot Services* page in the *Device Imaging Work Assignment* section. Make it descriptive enough that you can later remember its purpose.

Bundle to Apply: When a device is seeking work to be done, it scans the rules until it finds a rule where all of the rule's filters match the device, then executes the bundle assigned to the rule. Each rule can be applied to only one bundle.

Because the rules, not the bundles, are listed in the *Device Imaging Work Assignment* section, you can apply multiple rules to a given bundle. This means that a bundle has multiple chances to be selected for device imaging work.

When multiple rules are listed, the first rule with criteria to match a device causes that rule's assigned bundle to be applied to the device.

If no rules match a device, then none of the applicable bundles are applied to the device.

PXE Kernel Boot Parameters: Select one of these two options:

- **Use the Parameters Configured in Imaging Menu Options:** This causes the rule to use the default boot parameters for the Management Zone.
- **Use These Parameters:** Only the boot parameters that you specify here are used for this rule.

  Each parameter should be separated by a space.

Enabled: This is the only way that you can temporarily disable a hardware rule. It is enabled by default.

The rule's status is shown by the first word in the work rules listing on the *Preboot Services* page. For example, `Enabled - Asset Tag Rule`.

Force Download: Forces the download of the assigned bundle, even if it matches the most recently installed bundle. By default, downloading the hardware rule is not forced.

By default, ZENworks imaging does not reimage a machine containing the same image. This option allows you to force the image to be reapplied to the device. For example, you might want to refresh all of your lab machines for the next use of the lab.

IMPORTANT: Use this option cautiously. It can create an endless loop, because the option remains selected after an image has been applied. If you image a device that remains non-registered after it is imaged, it is reimaged with the same image over and over each time it boots. To prevent this, edit this hardware rule and deselect this option after you have imaged the applicable devices.

---

4 Using the *Rule Logic* fields and options, create the hardware rule expression using the following options:

- **Add Filter:** Adds the new filter at the end of the list of filters.

  Because the filter is added to the end of the last filter set, you cannot use this option to select which filter set to add it to. Use the *Insert Filter* option to add a filter into an earlier filter set.
- **Add Filter Set:** Adds a new set of filters, beginning with one filter in the set. The filter set order cannot be rearranged.
- **Insert Filter:** Allows you to insert a new filter either above or below the selected filter. This also enables to you specify which filter set to add a filter to.

- **Delete:** Removes the selected filters from the rule.
- **Combine Filters Using:** The default is to have filters ANDed and filter sets ORed. You can use this field to reverse these Boolean functions for the filters and sets.

  Using OR for filter sets means that all filters in a set must be matched to apply the rule, but any of the sets can be matched to apply the rule.

  Using AND for the filter sets means the reverse. At least one filter in each set must be matched for the rule to be applied.

An expression consists of a criteria option, operator, and value, and in some cases, a qualifier. For example:

```
RAM (in MB) =< 512 MB
```

`RAM (in MB)` is the criteria option, =< is the operator, `512` is the value, and `MB` is the qualifier.

If necessary, you can use NOT (in the first blank field with a down-arrow) to perform a logical negation of the expression. For example:

```
NOT RAM (in MB) =< 512 MB
```

In the above example, the rule is applied only to devices with less than 512 MB of RAM.

You can use more than one expression for the rule. For example:

```
RAM (in MB) =< 512 MB or
Hard Drive Size (in MB) < 20 GB
```

Hardware Type displays in the criteria options list only if you have previously configured a custom hardware type and saved it by clicking *Apply* at the bottom of the *Preboot Services* configuration page.

IMPORTANT: Be aware of the possibility of creating conflicting filters or rules. For example, if you specify a RAM condition in multiple filters, make sure the effective logical operators where each is configured make sense for the megabyte values that you enter. In other words, if two filters are both required (ANDed), you would not want one filter to require exactly 512 MB of RAM and the other to specify at least 512 MB of RAM.

---

5 Click *OK* to exit the dialog box and place the new hardware rule into the *Hardware Rules* list box on the *Preboot Services* configuration page.

Rule Logic

A rule is made up of one or more filters that are used to determine whether a device complies with the rule. The Rule Construction dialog box begins with one empty filter. A device must match the entire filter list of a rule (as determined by the logical OR nd AND operators that are explained below) for the rule to apply to the device.

A filter is a row of fields providing a condition that must be met by a device in order for the bundle to be applied. For example, you can add a filter to specify that the device must have exactly 512 MB of RAM in order to be accepted by the rule, and you can add another filter to specify that the hard drive be at least 20 GB in size. There is no technical limit to the number of filters that you can add in the rule, but there are practical limits, such as:

- Designing a rule that is easy to understand
- Devising the rule so that you do not accidentally create conflicting filters
- Being able to view the dialog box as it grows in size because of the filters and filter sets that you add

Filters can be added individually or in sets. Each set contains logical operators within the set and logical operators determine the association between the sets.

By default, the logical operator AND is displayed for the filters within a set in the *Combine Filters Using* field (which you can change), and OR is displayed in the *Filter Sets Will Be Combined Using* field (display-only). If you change the *Combine Filters Using* field to OR, the *Filter Sets Will Be Combined Using* field then displays AND.

You can think of filters and filter sets as using algebraic notation parentheticals, where filters are contained within parentheses, and sets are separated into a series of parenthetical groups. Logical operators (AND and OR) separate the filters within the parentheses, and the operators are used to separate the parentheticals.

For example, "(u AND v AND w) OR (x AND y AND z)" means "match either uvw or xyz." In the Rule Construction dialog box, it looks like this:

```
u AND
v AND
w
OR
x AND
y AND
z
```

Filter sets cannot be nested. You can only enter them in series, and the first filter set to match the device (the default of OR) is used to validate the rule so that the bundle can be applied to do imaging work on the device.

The order in which filters and filter sets are listed does not matter. For the OR operator, the first to be met satisfies the rule. For the AND operator, all items must be met to satisfy the rule.

TIP: You can easily run a test to see how these logical operators work. Access the Rule Construction dialog box, click both the *Add Filter* and *Add Filter Set* options a few times each to create a few filter sets, then switch between AND and OR in the *Combine Filters Using* field and observe how the operators change. Then, either select the filters that you added and click *Delete*, or click *Cancel* to exit the Rule Construction dialog box.

You can set up the conditions for a rule by adding all of the filters and filter sets that you need to identify the type of device you want to match. You typically do not need to set up complex rules. However, because you can apply multiple rules to a bundle, you can further complicate the use of logical operators, because each rule is considered to be an OR condition for the bundle, causing the bundle to be applied if any one of the rules matches the device.

For example, you could create several rules for the bundle with each rule being a long listing of AND conditions to be met. This means that each rule becomes a specific set of criteria for a device to meet, causing the bundle to be applied if one is met. Conversely, if you add that same amount of information into one rule (using filter sets for the AND and OR conditions), it might make the dialog box so long that it becomes unmanageable.

To determine what you need, consider the following possibilities:

- One filter set with multiple filters
- Multiple filter sets with only one or a few filters per set

- Multiple filter sets each with multiple filters
- Multiple rules per bundle

Remember that the logical operators for filters within a set are the opposite of the operators between the sets, and all rules for a bundle use the OR condition. For example, suppose you are selecting the operator in the *Combine Filters Using* field:

Table 2-8 *OR and AND Operator Explanations*

Operator	Within Filter Sets	Between Filter Sets	Multiple Rules Per Bundle
OR	Only one filter in the set needs to apply to the device (OR condition). The first filter that applies is used.	Each filter set must have one filter in it that applies to the device (AND condition).	The first rule that applies is used (OR condition).
AND	All filters within the set must apply to the device (AND condition).	Only one filter in the set must apply to the device (OR condition). The first filter that applies is used.	The first rule that applies is used (OR condition).

Obviously, adding filter sets complicates the use of logical operators, and adding multiple rules to the bundle further complicates it. Therefore, carefully plan how to configure your information before using the Rules Configuration dialog box.

Custom Hardware Types

Custom hardware types enable you to include any devices matching your custom type to have the bundle assigned to the hardware rule applied to them when the devices boot. For example, you can create a rule that applies the bundle to any device that is a laptop by entering the applicable string as a custom hardware type, selecting *Hardware Type* in the Rule Construction dialog box, then selecting your custom type.

The *Hardware Type* option does not display in the Rule Construction dialog box until at least one custom type has been configured.

The following table lists the tasks you can perform to configure custom hardware types:

Table 2-9 *Custom Hardware Type Tasks*

Task	Steps	Additional Details
Add a custom hardware type	1. Click *Add* next to the *Custom Hardware Types* list box, which opens the Custom Hardware Type dialog box. 2. To create the custom hardware type, follow the instructions contained in "Custom Hardware Type Dialog Box" on page 80. 3. After exiting the Custom Hardware Type dialog box, click *Apply* at the bottom of the configuration page to save the new custom type.	In the Custom Hardware Type dialog box you can add multiple strings, which identify specific hardware type information in the device's BIOS. The set of strings that you add in the dialog box is considered one custom hardware type that is identified by the name you also provide in the dialog box. The custom type won't display in the drop-down list of hardware items on the Rule Construction dialog box until you click *Apply* or *OK* to save the configuration.
Edit a custom hardware type	1. Select a custom hardware type, then click *Edit*, which opens the Custom Hardware Type dialog box in edit mode. 2. To edit the custom hardware type, follow the instructions contained in "Custom Hardware Type Dialog Box" on page 80. 3. After exiting the Custom Hardware Type dialog box, click *Apply* at the bottom of the configuration page to save the custom type's changes.	
Rearrange the order of the custom hardware types	1. Select one custom hardware type, then click either *Move Up* or *Move Down*. You cannot move multiple types at one time. 2. Repeat as necessary to arrange the order of the custom hardware types. 3. Click *Apply* at the bottom of the configuration page to save the new custom type's order.	The custom hardware type order is important because when the device boots, the first type that is found to match the device is used to apply the assigned bundle. The other types are ignored.

Task	Steps	Additional Details
Remove custom hardware types	1. Select one or more custom hardware types, then click *Remove*. 2. Click *OK* to exit the dialog box and save the deletions. 3. Click *Apply* at the bottom of the configuration page to remove the custom types from the list.	You can use the Ctrl or Shift keys to select multiple custom hardware types to remove them from the list. By removing a custom hardware type, any work you did to create it is lost. Removed types do not have any of their information saved anywhere. Therefore, if you only want to remove the rule temporarily, take note of the type's content before deleting it so that you can more easily re-create it. For example, either select it and click *Edit* and note the data, or take a screen shot of the dialog box.

Custom Hardware Type Dialog Box

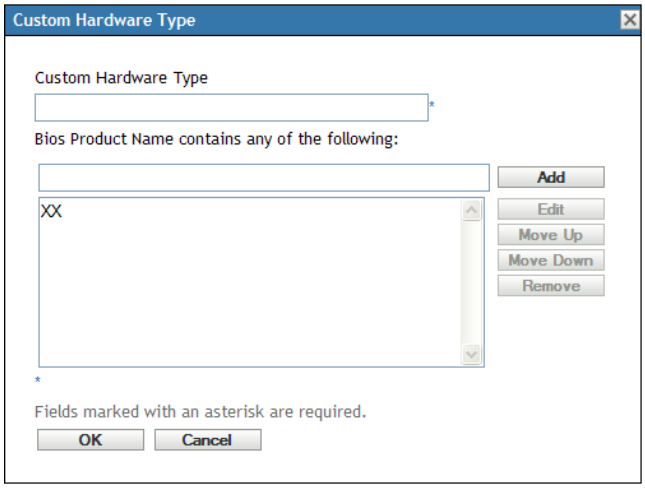
Custom hardware types enable you to include any devices matching your custom type and to have the bundle assigned to the hardware rule applied to them when the devices boot. For example, you can create a rule that applies the bundle to any device that is a laptop by entering the applicable string as a custom hardware type, then select *Hardware Type* in the Rule Construction dialog box and select your custom type.

The *Hardware Type* option does not display in the Rule Construction dialog box until at least one custom type has been configured.

Your custom hardware type definitions are applicable only to rules; they do not otherwise apply to the Management Zone.

Following is the Custom Hardware Type dialog box:

Figure 2-1 *Custom Hardware Type dialog box*



To configure custom hardware types, perform the tasks in the following table:

Table 2-10 *Custom Hardware Type Tasks*

Task	Steps	Additional Details
Configure a custom hardware type	1. Specify a name for the custom type in the *Hardware Type Name* field. 2. Specify a string in the *BIOS Strings* field, then click *Add* to add it to the list box. 3. Repeat Step 2 for each BIOS string to be added to this custom type. 4. Click *OK* to exit the dialog box. 5. Click *Apply* (located at the bottom of the *Preboot Services* configuration page) to save your new custom type.	The new custom type does not display in the Rule Construction dialog box until you have clicked *Apply* to save it. The strings you can enter are anything that you want to match in the device's BIOS. To determine the BIOS product names of your servers or laptops, use the `img -i` command at the imaging maintenance mode prompt, which displays various BIOS information. The BIOS information that you need is listed in the *Product Name* field. For servers and laptops, you can enter partial strings to select all BIOS product names containing that string.
Edit a custom hardware type	1. In the Custom Hardware Type dialog box, to edit the custom hardware type's name, edit the name in the *Hardware Type Name* field. 2. To edit a string in the list, select it, then click *Edit*. 3. In the Edit String dialog box, edit the string, then click *OK*. 4. Click *OK* to exit the dialog box. 5. Click *Apply* (located at the bottom of the *Preboot Services* configuration page) to save your custom type changes.	
Rearrange the order of the strings in the list	1. In the Custom Hardware Type dialog box, select one string, then click either *Move Up* or *Move Down*. 2. Repeat as necessary to arrange the order of the strings. 3. Click *OK* to exit the dialog box. 4. Click *Apply* (located at the bottom of the *Preboot Services* configuration page) to save your custom type changes.	You cannot move multiple strings at a time.

Task	Steps	Additional Details
Remove strings from the list	1. In the Custom Hardware Type dialog box, select one or more strings, then click *Remove*. 2. Click *OK* to exit the dialog box. 3. Click *Apply* (located at the bottom of the *Preboot Services* configuration page) to save your custom type changes.	You can use the Ctrl or Shift keys to select multiple strings to remove them from the list.

Allow Overwrites

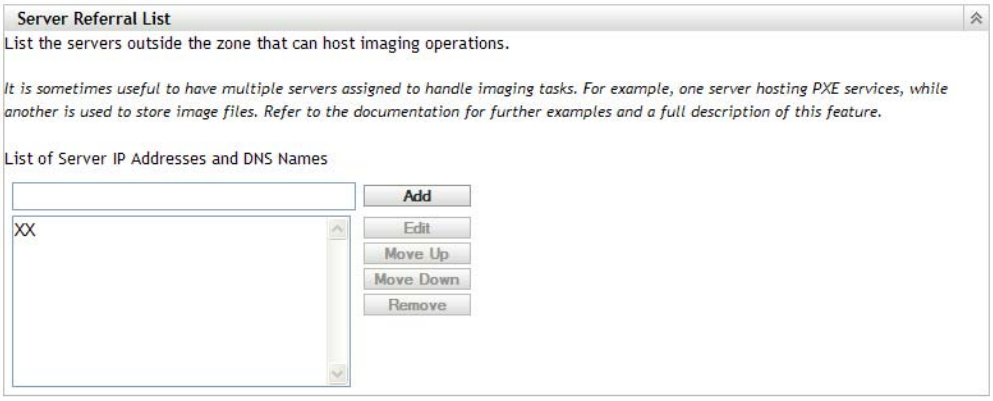
Select the *Allow Preboot Services to Overwrite Existing Files when Uploading* check box if you want existing `.zmg` files to be overwritten by a newer version when the image is taken.

2.4.4 Configuring the Server Referral List

Referral lists are used to make sure managed devices belonging to other Management Zones can access their home zone. For more information, see Section 1.3.5, "Server Referral List," on page 22.

1. In ZENworks Control Center, click *Configuration* in the left pane to display the *Configuration* tab, then if it's not expanded, click *Management Zone Settings*.
2. Click *Device Management* to expand its listing, then select *Preboot Services* to display the configuration sections.
3. Locate and expand the Server Referral List section:

Figure 2-2 *Server Referral List panel*



4. To configure a server referral list, complete the tasks in the following sections, as applicable:
   - "Configuring Imaging Servers in the Server Referral List" on page 82
   - "Configuring ZENworks Mixed Environment Imaging Servers" on page 83

Configuring Imaging Servers in the Server Referral List

To configure the *List of Server IP Addresses and DNS Names* list box, perform the tasks in the following table:

Table 2-11 *Server Referral List Configuration Tasks*

Task	Steps	Additional Details
Add a server to the server referral list	1. In the *List of Server IP Addresses and DNS Names* field, specify the DNS name or IP address of a server that can host preboot operations, then click *Add* to place it into the list. 2. Repeat as necessary to complete the list of servers in your environment capable of preboot operations.	You can add a range of IP addresses by typing the beginning IP address, type a space, a dash, another space, then type the ending IP address of the range. However, these are displayed as you typed them when you click *Add*; the addresses within the range do not separate into individual IP addresses in the list.
Edit a listed server	1. Select a server in the list, then click *Edit*. 2. In the Edit String dialog box, edit the IP address or DNS name that is displayed there, then click *OK* to save the changes.	
Rearrange the order of the servers in the server referral list	1. Select one server, then click either *Move Up* or *Move Down*. 2. Repeat as necessary to arrange the order of the servers.	You cannot move multiple servers at one time.
Remove servers from the server referral list	1. Select one or more servers, then click *Remove*.	You can use the Ctrl or Shift keys to select multiple servers to remove them from the list.

Configuring ZENworks Mixed Environment Imaging Servers

After you have specified all of the necessary servers in the server referral list, you must place certain files into the `tftp` directories of each ZENworks 7.*x* Imaging Server in the list in order for the referrals to work with those traditional ZENworks Imaging Servers.

Do one of the following:

- “Copy from ZENworks 10 Windows to ZENworks 7 NetWare or Windows” on page 83
- “Copy from ZENworks 10 Windows to ZENworks 7 Linux” on page 84
- “Copy from ZENworks 10 Linux to ZENworks 7 NetWare or Windows” on page 84
- “Copy from ZENworks 10 Linux to ZENworks 7 Linux” on page 85

Copy from ZENworks 10 Windows to ZENworks 7 NetWare or Windows

From the ZENworks 10 Windows Imaging Server, copy the following files:

Location	Files
install_path\novell\zenworks\share\tftp	memdisk
	nvlnbp.sys
	pxelinux.0

Location	Files
install_path\novell\zenworks\share\tftp\referral\zfd70	pxemenu.txt
	z_auto100.cfg
	z_maint100.cfg
	z_zpdis100.cfg
	z_zpen100.cfg

To the following directory on the ZENworks 7 NetWare or Windows Imaging Server:

NetWare: *drive*:\tftp

Windows: *drive*:\Program Files\ZEN Preboot Services\tftp\data

Do not replicate any directory structure from the ZENworks 10 server. Just copy the files to the tftp directory.

Copy from ZENworks 10 Windows to ZENworks 7 Linux

From the ZENworks 10 Windows Imaging Server, copy the following files:

Location	Files
install_path\novell\zenworks\share\tftp	memdisk
	nvlnbp.sys
	pxelinux.0
install_path\novell\zenworks\share\tftp\referral\zfd70	pxemenu.txt
	z_auto100.cfg
	z_maint100.cfg
	z_zpdis100.cfg
	z_zpen100.cfg

Copy the files to the following directory on the ZENworks 7 Linux Imaging Server:
/srv/tftp

Do not replicate any directory structure from the ZENworks 10 server. Just copy the files to the tftp directory.

Copy from ZENworks 10 Linux to ZENworks 7 NetWare or Windows

From the ZENworks 10 Linux Imaging Server, copy the following files:

Location	Files
/srv/tftp/	memdisk
	nvlnbp.sys
	pxelinux.0
/srv/tftp/referral/zfd70/	pxemenu.txt
	z_auto100.cfg
	z_maint100.cfg
	z_zpdis100.cfg
	z_zpen100.cfg

Copy the files to the following directory on the ZENworks 7 NetWare or Windows Imaging Server:

NetWare: *drive*:\tftp

Windows: *drive*:\Program Files\ZEN Preboot Services\tftp\data

Do not replicate any directory structure from the ZENworks 10 server. Just copy the files to the tftp directory.

Copy from ZENworks 10 Linux to ZENworks 7 Linux

From the ZENworks 10 Linux Imaging Server, copy the following files:

Location	Files
/srv/tftp/	memdisk
	nvlnbp.sys
	pxelinux.0
/srv/tftp/referral/zfd70/	pxemenu.txt
	z_auto100.cfg
	z_maint100.cfg
	z_zpdis100.cfg
	z_zpen100.cfg

Copy the files to the following directory on the ZENworks 7 Linux Imaging Server:
/srv/tftp

Do not replicate any directory structure from the ZENworks 10 server. Just copy the files to the tftp directory.

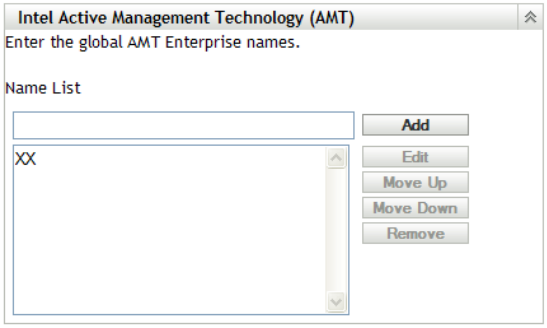
2.4.5 Configuring Intel Active Management Technology (AMT)

The Intel AMT functionality allows you to accurately identify devices, even if they have had physical drive replacements. This sets up Preboot Services with persistent device identification by providing ZENworks with nonvolatile memory for storing the unique device identity.

For more information, see Section 1.3.6, "Intel Active Management Technology (AMT)," on page 23.

To set up global Intel AMT enterprise names:

1. In ZENworks Control Center, click *Configuration* in the left pane to display the *Configuration* tab. If it's not expanded, click *Management Zone Settings*.
2. Click *Device Management* to expand its listing, then select *Preboot Services* to display the configuration sections.
3. Locate the Intel Active Management Technology (AMT) panel.



4. Fill in the fields:

   Name List: This list should contain at least one valid AMT enterprise name for every AMT device in the Management Zone. Click *Add* to place each one into the list box.

   Move Up/Move Down: Arranges the order in which the AMT names are listed. You can move only one at a time.

   Remove: To remove names from the list, select them, then click *Remove*.
5. Click either *Apply* or *OK* to save the changes

2.5 Overriding Preboot Services Defaults

You can determine which Novell Preboot Services Menu displays a configuration to use and whether the menu should be displayed on a device when it boots. By default, the Management Zone configuration applies to all folders and devices. You can override this at the folder or device level.

For more information on the Novell Preboot Services Menu options, see Section 1.3.2, "Novell Preboot Services Menu," on page 19.

The menu can be customized by editing the `pxemenu.txt` file. For more information, see Section 2.3.4, "Editing the Novell Preboot Services Menu," on page 63.

To override the default configuration at the folder or device level:

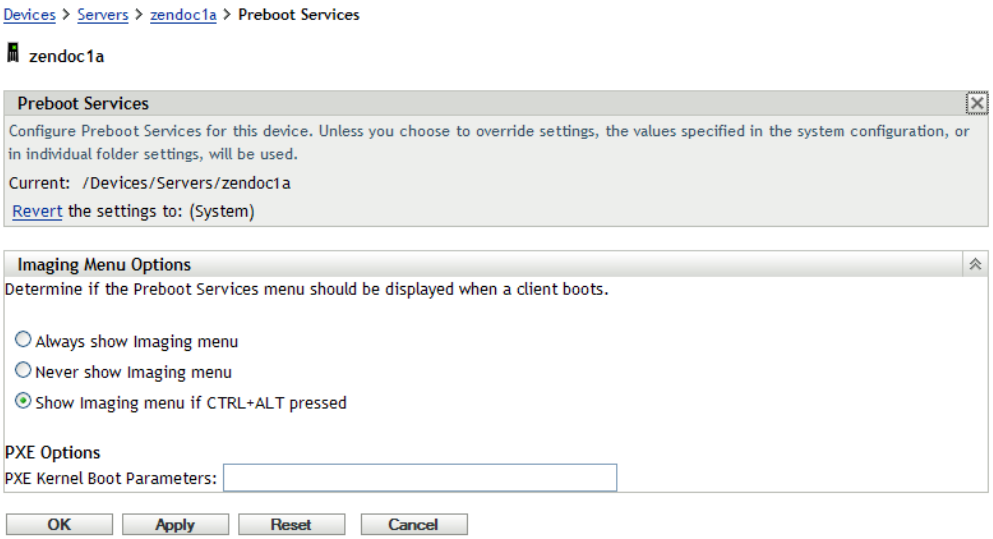
1 In ZENworks Control Center, click the *Devices* in the left pane to display the Devices panel in the *Managed* tab.

2 Select one of the following in the *Name* column:

- The *Details* option next to the *Servers* or *Workstations* folder
- The *Servers* folder, then a server contained in the folder
- The *Workstations* folder, then a workstation contained in the folder

3 On the page that is displayed, click the *Settings* tab to display the Settings page options.

4 Click *Preboot Services* to display the Preboot Services configuration page:



If you have not previously configured this folder or device, the following is displayed:

```
Current: (System) (Override settings)
```

and the *Preboot Menu Options* section is disabled for editing. The above text varies depending on whether you are at the folder or device level.

5 To configure the settings for the folder or device, click *Override*.

The following is displayed:

```
Current: /Devices/Servers
Revert to settings from: (System)
```

and the *Preboot Menu Options* section is enabled for editing. The above text varies depending on whether you are at the folder or device level.

6 Select which option to use:

- *Always Show Imaging Menu*
- *Never Show Imaging Menu*
- *Show Imaging Menu if CTRL+ALT is Pressed*

PXE must be enabled on the device for the menu to be displayed.

7 Click *Apply* or *OK*.

OK: Enables the change and exits the page.

Apply: Enables the change and retains focus on the page, so you can click *Revert* to temporarily disable the configuration change.

8 To temporarily disable the change, click *Revert* and the Management Zone settings for the menu remain in effect.

2.6 Enabling PXE on Devices

To image a device using Preboot Services, you need to find out if the device is PXE capable, and then make sure that PXE is enabled.

PXE code is typically delivered with newer devices (PC 99 compliant or later) on the NIC.

This section includes the following information:

- Section 2.6.1, "Enabling PXE on a PXE-Capable Device," on page 88
- Section 2.6.2, "Verifying That PXE Is Enabled on a Device," on page 89

2.6.1 Enabling PXE on a PXE-Capable Device

When PXE is enabled, it can lengthen the time of the boot process slightly, so most NICs have PXE turned off by default. To enable PXE on a PXE-capable device:

1 Access the computer system BIOS and look at the *Boot Sequence* options.

The PXE activation method for a device varies from one manufacturer to another, but generally one of the following methods is used:

- Some BIOS have a separate entry in the BIOS configuration to enable or disable the PXE functionality. In this case, set either the *PXE boot* setting or the *Network boot* setting to Enabled.
- Some BIOS extend the entry that allows you to configure boot order. For example, you can specify that the system should try to boot from a diskette before trying to boot from the hard drive. In this case, set the system to try *Network boot* before trying to boot from a diskette or from the hard disk.

2 If PXE is not listed in the *Boot Sequence* options and if the NIC is embedded in the motherboard, look at the *Integrated Devices* section of the BIOS, which might have an option to enable PXE. PXE might be called by another name, such as MBA (Managed Boot Agent) or Pre-Boot Service.

After enabling PXE in the *Integrated Devices* section, look at the *Boot Sequence* options and move PXE so that it is first in the boot sequence.

3 Save any changes you have made and exit the system BIOS.

4 Reboot the device.

If the device does not have the network adapter and PXE integrated into the motherboard, it uses the installed NIC management software to prompt you to start PXE configuration during the boot process.

For example, many network adapters that are PXE-aware prompt you to press Ctrl+S during the boot process to allow you to configure the PXE functionality. Other network adapters might prompt you to press Ctrl+Alt+B or another key combination to configure PXE.

If the computer system does not have an integrated NIC, you might need to use NIC management software to configure your NIC to support PXE. Refer to your NIC documentation for support of PXE.

2.6.2 Verifying That PXE Is Enabled on a Device

After you have activated PXE, it becomes available in the *Boot* section of the BIOS. PXE is correctly enabled on a device when the device attempts to establish a PXE session during the boot process. You can see this happening when the device pauses during the boot process and displays the following on the screen:

```
CLIENT MAC ADDR: 00 E0 29 47 59 64
DHCP...
```

The actual message displayed varies from one manufacturer to another, but you can identify it by the obvious pause in the boot process as the device searches for DHCP.

2.7 Setting Up Devices for Imaging

The following sections cover procedures to prepare devices for imaging. The procedures that are applicable to you depend on your imaging deployment strategy. For more information, see Section 2.3.2, “Deploying Preboot Services in a Network Environment,” on page 52.

If you are using Preboot Services (PXE) as your imaging method, you need to enable PXE on the device. For more information, see Section 2.2.1, “Using Preboot Services (PXE),” on page 38.

If you are using a ZENworks partition as your imaging method, you need to create the partition on the device. For more information, see “Creating a ZENworks Partition” on page 48.

The following sections contain additional information:

- Section 2.7.1, “Device Requirements,” on page 89
- Section 2.7.2, “Enabling a Device for Imaging Operations,” on page 90

2.7.1 Device Requirements

This section gives the requirements for using a network-connected device.

It is possible (but usually not as convenient) to image a device without connecting to the network. Such operations can’t be fully automated.

The following are the requirements for the device:

Table 2-12 *Device Requirements*

Device Must Have	Because
A supported Ethernet card	The device must connect with the Imaging Server to store or retrieve the images. This connection is made when the device is under the control of the ZENworks Imaging Engine. Therefore, make sure the device has a supported Ethernet card. For more information, see Appendix F, “Supported Ethernet Cards,” on page 211.

Device Must Have	Because
Free disk space for a ZENworks partition (optional)	Unless you are using PXE, unattended operations require a ZENworks partition to be installed on the device hard disk, so that the ZENworks Imaging Engine can gain control when booting. The default partition size is 150 MB, and the minimum partition size is 50 MB. This partition is not required if you are performing manual imaging operations using bootable CDs, DVDs, or diskettes. Partition size can be in megabytes of disk space.
Standard hardware architecture	NEC* PC98 architecture is not supported.
PXE enabled	If you are using Preboot Services, PXE must be enabled in the BIOS. For more information, see Section 2.2.1, "Using Preboot Services (PXE)," on page 38.
Supported imaging partition type	The supported partition types for imaging are the NTFS, FAT32, ReiserFS, Ext2, and Ext3 file systems.

NOTE: ZENworks imaging does not support devices running boot managers, such as System Commander. Boot managers create their own information in the MBR and overwrite the ZENworks boot system, which prevents the device from communicating with the Imaging Server. If you are using boot managers in your environment, you should disable or remove them before performing imaging operations.

2.7.2 Enabling a Device for Imaging Operations

Use one of the following methods to enable a device for auto-imaging operations:

- "Using PXE" on page 90
- "Using a ZENworks Partition" on page 90
- "Using a CD or DVD" on page 90

Using PXE

You can set up a device to be automatically imaged from Imaging bundles by enabling PXE on the device.

For more information, see Section 2.6.1, "Enabling PXE on a PXE-Capable Device," on page 88.

Using a ZENworks Partition

If you cannot enable PXE on the device, you can use a partition to perform unattended imaging operations.

For more information, see "Creating a ZENworks Partition" on page 48.

Using a CD or DVD

If you cannot use the PXE or ZENworks partition methods to automate imaging of your devices, you can manually image a device using an imaging CD or DVD.

For information, see Section 3.1.3, "Setting Up Disconnected Imaging Operations," on page 106.

Using Imaging

3

This section provides instructions on how to use Preboot Services imaging operations in Novell® ZENworks® Configuration Management:

- Section 3.1, “Imaging Devices,” on page 91
- Section 3.2, “Multicasting Images,” on page 111
- Section 3.3, “Configuring Imaging Script Bundles,” on page 122
- Section 3.4, “Assigning Imaging Bundles,” on page 123
- Section 3.5, “Editing Imaging Work,” on page 129

3.1 Imaging Devices

Preboot Services provides tools for creating and compressing images of device hard disks, as well as images of specific add-on applications or file sets. ZENworks also provides tools for customizing such images and for making images available to auto-imaging operations.

You can take images of devices, then reimage them and other devices with those images. The available devices are Windows servers and workstations.

ZENworks imaging supports devices that physically connect to the network that meet the minimum requirements for devices. ZENworks imaging does not support imaging operations (creating or restoring images) using wireless connectivity. Devices with logical volumes (LVMs) are not supported for imaging.

NOTE: ZENworks imaging does not support devices running boot managers, such as System Commander. Boot managers create their own information in the MBR and overwrite the ZENworks boot system, which prevents the device from communicating with the Imaging Server. If you are using boot managers in your environment, you should disable or remove them before performing imaging operations.

Some imaging tasks can be performed manually on a device, some in ZENworks Control Center, and some in both:

- Section 3.1.1, “Using ZENworks Control Center for Imaging,” on page 91
- Section 3.1.2, “Using a Command Line for Imaging,” on page 96
- Section 3.1.3, “Setting Up Disconnected Imaging Operations,” on page 106

3.1.1 Using ZENworks Control Center for Imaging

The following imaging tasks are available in ZENworks Control Center:

- “Taking a Base Image of a Device” on page 92
- “Creating an Add-On Image of an Installed Bundle” on page 93
- “Configuring the ZENworks Image Bundle for Automatic Imaging” on page 94
- “Using a Script to Image a Device” on page 96

Taking a Base Image of a Device

A *base* image is an image of all partitions and data on a source device's hard disks. Normally, such an image is prepared with the intent to completely replace the contents of a target device's hard disks.

You can take an image of an existing device and use it to image a similar device, or use it as a backup image for reimaging the original device.

1. In ZENworks Control Center, click *Devices* in the left pane to display the Devices panel in the *Managed* tab.
2. Click *Servers* or *Workstations*, then select the check box next to a device.

   This selects the device for taking the image.
3. Click *Actions* > *Take image*.

   You can also select the check box next to *Servers* or *Workstations* to start this wizard, then click *Actions* > *Take image*. If you do so, you are asked to select a device from the group. Then the File Information page is displayed.
4. Click *Next* to display the File Information page:
5. Fill in the fields:

   Server and File Path: (Required) Browse for the object, DNS name, or IP address of the server where the image file is to be stored, then specify the path to the storage location. This must be a server where Configuration Management is installed.

   Images can take up a large amount of disk space. Make sure your Imaging Server has the disk space available before selecting it.

   Use Compression: Compression is required. Choose one of the following:

   - **Balanced:** Automatically balances compression between an average of the reimaging speed and the available disk space for the image file. This option is displayed only for the ZENworks Image format
   - **Optimize for Speed:** Optimizes the compression to allow for the fastest reimaging time. Use this option if CPU speed is an issue.
   - **Optimize for Space:** Optimizes the compression to minimize the image file's size to conserve disk space. This can cause reimaging to take longer.

   Balanced is the default option for the ZENworks Image format .

   Create an Image Bundle: If you select this option, another wizard page is displayed (see Step 6) where you can configure the new bundle. Otherwise, the Summary is your next wizard page (skip to Step 10).
6. If you selected to create an image bundle, the New Image Bundle page is displayed.
7. Fill in the fields:

   Bundle Name: Specify a unique name for the bundle, because many other bundle names might be listed in the same folder.

   For more information, see Appendix H, "Naming Conventions in ZENworks Control Center," on page 215.

   Folder: Specify a folder where you want to list the new bundle. This is a location in ZENworks Control Center, not a file location on a device.

Description: Enter information to help you later recognize the purpose and scope of this image bundle. For example, "Image taken after the OS was installed, but before GroupWise was installed."

8 Click *Next* to display the Summary page.

9 If you want to perform other configuration tasks after the bundle has been created, select the *Define Additional Properties* check box.

For example, you can make assignments to the bundle in the *Relationships* tab, add actions in the *Actions* tab, and so on.

10 Review the configuration, then click one of the following:

Back: Allows you to make changes after reviewing the summary.

Finish: Click to take the image. If you completed Step 7, the image is assigned to the bundle when it is created.

This base image can be used in Step 8 on page 95 under "Configuring the ZENworks Image Bundle for Automatic Imaging" on page 94.

To create an add-on image of files selected from a file system for use in Step 8 on page 95, see "Creating an Add-On Image from Files in a File System" on page 101.

Creating an Add-On Image of an Installed Bundle

For the current bundle, you can create the installed version as a ZENworks add-on image.

Add-on images of bundles are useful for incorporating predelivery of bundles when you are imaging new devices, or when you are reimaging existing devices.

A newer version of the add-on image is automatically created when the bundle's version number is incremented.

The filename for the add-on bundle is automatically created and uses the following format:
`bundle_name-bundle_UID-counter.zmg`

where *bundle_name* is the name of the current bundle for which the add-on image is being created, *bundle_UID* is a UID number generated for the image, and *counter* is a four-digit counter (beginning with 0000) that is incremented each time the image is updated (that is, when the bundle's version number is changed). All ZENworks image files end in `.zmg`.

To create an add-on image:

1 In ZENworks Control Center, click *Bundles* in the left pane to display the Bundles panel.

2 In the *Name* column, click a Windows bundle to display its *Summary* tab.

3 In the General panel, click the *Create* option next to the *Add-on Image File* field.

This opens the Bundle Add-on Image Wizard.

4 In the Image Servers panel, click *Add*.

5 In the dialog box, browse for and select the server that contains the add-on image files, then click *OK*.

6 Click *Finish* to create an add-on image of the installed bundle.

You can remove an add-on image by selecting its check box and clicking *Remove*.

You do not have control over where add-on images are stored:

- For Windows servers, the path to the add-on image files is:
  `installation_path\novell\zenworks\work\content-repo\images\addon-image`

  The remainder of the path is fixed.
- For Linux servers, the path to the add-on image files is:
  `/var/opt/novell/zenworks/content-repo/images/addon-image`

The `addon-image` directory might not exist until the first add-on image has been created on the server. This directory is automatically created the first time you create an add-on image for a bundle, or you can manually create the directory for storing add-on image files that you create outside of ZENworks Control Center.

Configuring the ZENworks Image Bundle for Automatic Imaging

You can use ZENworks to install software bundle. Software included in a bundle that is assigned directly is considered mandatory; the software is installed on all assigned devices (the bundle is directly assigned to the devices, their groups, or their folders).

To configure a ZENworks Image bundle and assign devices to the bundle:

1. In ZENworks Control Center, click *Bundles* in the left pane to display the Bundles panel.
2. Click *New* > *Bundle* to start the Create New Bundle Wizard.
3. In the Create New Bundle Wizard, select *Imaging Bundle*, then click *Next*.
4. On the Select Imaging Bundle Type page, select *ZENworks Image*.
5. Click *Next* to display the Define Details page.
6. Fill in the fields:

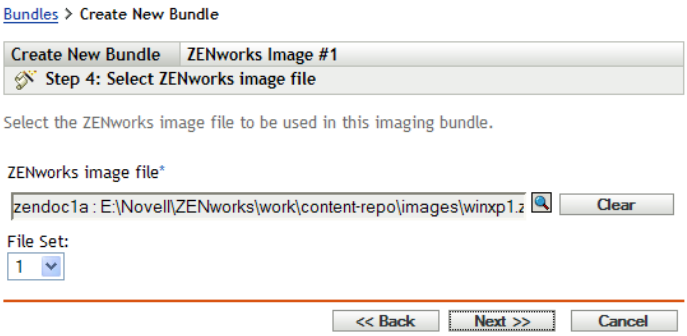
   Bundle Name: (Required) Although bundles can be identified in ZENworks Control Center by their type of icon, as well as the folder where they are listed, you should develop a naming scheme that differentiates the ZENworks Image bundles that are listed together in a folder.

   For more information, see Appendix H, “Naming Conventions in ZENworks Control Center,” on page 215.

   Folder: Browse for the location where you want the ZENworks Image bundle to be displayed in ZENworks Control Center. The folder must exist. You cannot specify a non-existent folder, because ZENworks does not create them from this wizard.

   Icon: Browse for and select an icon if you plan to use one on your desktop for this bundle.

   Description: Provide a description to help you later recognize the exact purpose of this ZENworks Image bundle.
7. Click *Next* to display the Select ZENworks Image File page:



8 Fill in the fields:

ZENworks Image File: This is an image file existing on an Imaging Server. You must provide the full path and filename here. The image filename must end in `.zmg` (case-sensitive). For information on creating a base image, see "Taking a Base Image of a Device" on page 92.

For information on creating an add-on image of files selected from a file system, see "Creating an Add-On Image from Files in a File System" on page 101.

Click the browse button to access the Server and Path Information dialog box:

- **Server Object, IP, or DNS:** The identity of the Imaging Server where the Novell ZENworks Configuration Management Imaging Agent (novell-ziswn) is installed and running, and where the base image file is stored.
- **File Path on Server:** The full path to the base image file.

File Set: Using Image Explorer, you can create file sets for selection when creating the Imaging bundle. For more information, see Appendix B, "File Sets," on page 139.

Image Explorer is executed by running:

- **Windows:**

  `installation_path\novell\zenworks\bin\preboot\zmgexp.bat`

- **Linux:** `/opt/novell/zenworks/preboot/bin/zmgexp`

9 Click *Next* to display the Summary page.

10 If you want to perform other configuration tasks after the bundle has been created, select the *Define Additional Properties* check box.

For example, you can make assignments to the bundle in the *Relationships* tab, add actions in the *Actions* tab, and so on.

11 Review the configuration, then click one of the following:

Back: Allows you to make changes after reviewing the summary.

Finish: Creates the Imaging Script bundle as configured according to the settings listed on this Summary page.

This bundle is not assigned to any device or group after it is created until you make that assignment on a *Relationships* tab.

IMPORTANT: If this Imaging bundle has been created on a management device inside the firewall and you are assigning it to a device outside the firewall, port 8089 must be open both ways (PUBLIC -> PRIVATE, and PUBLIC <- PRIVATE).

When a device assigned to the ZENworks Image bundle boots, the bundle's work is performed on the device before its operating system starts.

Using a Script to Image a Device

You can perform scripted imaging using the Imaging Script bundle. Any imaging commands can be entered for the script.

For example, if you want to mount a DVD and restore an image from it, you could enter something similar to the following in the *Script Text* field in the Create New Imaging Bundle Wizard when defining an Imaging Script bundle:

```
echo "Please insert the DVD containing the image into the drive
and press a key."
read
mount /dev/cdrom /mnt/cdrom
img -rl /mnt/cdrom/myimagefile.zmg
umount /mnt/cdrom
eject /dev/cdrom
```

This example is a combination of automatic and manual tasks, where you define the bundle in ZENworks Control Center, assign it to the device, then when the device boots, it runs the bundle's script, prompting you to insert the DVD containing an image into the device's DVD drive. The script then runs the commands to restore the image on the device and ejects the DVD when finished.

For information on creating an Imaging Script bundle, see Section 3.3, "Configuring Imaging Script Bundles," on page 122.

3.1.2 Using a Command Line for Imaging

The following manual imaging tasks are available:

- "Manually Taking an Image of a Device" on page 96
- "Using Image Explorer to Customize an Image" on page 100
- "Creating an Add-On Image from Files in a File System" on page 101
- "Manually Restoring an Image on a Device" on page 101
- "Making an Image Available for Automatic Imaging" on page 104

These instructions assume that you have already prepared the Imaging Server (see Section 2.1, "Preparing a Preboot Services Imaging Server," on page 37), prepared devices for imaging (see Section 2.7, "Setting Up Devices for Imaging," on page 89), and set up imaging defaults (Section 2.4, "Configuring Preboot Services Defaults," on page 65).

ZENworks imaging supports devices that physically connect to the network and that meet the minimum requirements for devices. ZENworks imaging does not support imaging operations (creating or restoring images) through wireless connectivity.

Manually Taking an Image of a Device

This section explains how to take an image of a device by booting from an imaging method and entering a particular imaging command. The image is stored on your Imaging Server.

If you want to store an image locally rather than on an Imaging Server, see "Using a CD or DVD for Disconnected Imaging Operations" on page 107 and "Using a Hard Disk for Disconnected Imaging Operations" on page 108.

Ensure that your Imaging Server has enough disk space for the image. Otherwise, you receive a "Failed to write to proxy" error.

The following sections contain additional information:

- "Using the Imaging Maintenance Mode Prompt to Manually Take an Image of a Device" on page 97
- "Using the ZENworks Imaging Engine Menu to Manually Take an Image of a Device" on page 99

Using the Imaging Maintenance Mode Prompt to Manually Take an Image of a Device

1. Boot the device using one of the following methods:
   - If the device is PXE-enabled, boot it from the Preboot Services Imaging Server. For more information, see Section 2.2.1, "Using Preboot Services (PXE)," on page 38.
   - Boot the device using an imaging boot CD or DVD. For more information, see Section 2.2.2, "Preparing Imaging Boot CDs or DVDs," on page 38.
   - Boot the device from the ZENworks partition. For more information, see "Creating a ZENworks Partition" on page 48.
2. Depending on how you boot, do one of the following:

   CD: Enter `manual` at the imaging maintenance mode prompt.

   PXE: Select *Start ZENworks imaging maintenance* from the Novell Preboot Services Menu.
3. (Optional) At the prompt, type `img -dump`, then press Enter.

   This displays a list of the partition slots on the device. For your reference, note the number and type of partitions and which one is active.
4. Enter a command at the prompt, using one of the following formats:
   - To create an image and store it on the Imaging Server, enter:

     `img -makep added_path/newimg.zmg [-comp=comp_level]`

     The `makep` mode command stands for "make on proxy," which creates an image and stores it on the imaging (proxy) server.

     The IP address or DNS name of your Imaging Server is not necessary because the Imaging software automatically points to the `images` directory on the Imaging Server. However, you can add structure under the `images` directory. If you do, that directory structure should be included where */added_path* exists in the command syntax above, immediately followed by `/` and the image filename (*newimg*). Also, the subdirectories in the path must exist.

     The `.zmg` filename extension is required and is case-sensitive.

     You can use the following characters in the path and filename:
     - Letters: a through z (uppercase and lowercase)
     - Numbers
     - Special characters: $ % - _ @ { } ~ #

In the above syntax, *comp level* is the amount of compression used when creating the image. Specify any number from 0-9. 0 means no compression. 1 is the same as *Optimize for speed* and is used by default if you do not specify this parameter. 6 is the same as *Balanced*. 9 is the same as *Optimize for space*. (*Optimize for speed* takes the least amount of time but creates the largest image file. *Optimize for space* creates the smallest image file but might take a significant amount of time. *Balanced* is a compromise between compression time and image file size.)

For example:

```
img -makep subdir1/cpqnt.zmg -comp=6
```

- To create an image and store it locally, enter:

  ```
  img -makel filepath [-comp=comp_level]
  ```

  The `makel` mode command stands for "make locally," which creates an image and stores it on a local hard disk.

NOTE: Unless you mount a drive before using `makel`, the image is created in RAM and is lost during a reboot of the device.

In the above syntax, *filepath* is the image filename, including the `.zmg` extension (case-sensitive) and the complete path from the root of the partition where you want it locally stored.

The directories in the path must exist.

You can use the following characters in the path and filename:

- Letters: a through z (uppercase and lowercase)
- Numbers
- Special characters: $ % - _ @ { } ~ #

In the above syntax, *comp level* is the amount of compression used when creating the image. Specify any number from 0-9. 0 means no compression. 1 is the same as *Optimize for speed* and is used by default if you do not specify this parameter. 6 is the same as *Balanced*. 9 is the same as *Optimize for space*. (*Optimize for speed* takes the least amount of time but creates the largest image file. *Optimize for space* creates the smallest image file but might take a significant amount of time. *Balanced* is a compromise between compression time and image file size.)

For example:

```
img -makel myimages/myimage.zmg -comp=6
```

IMPORTANT: Make sure to use *forward slashes* in the UNC path as shown above. Backslashes are not recognized by Linux. Or, you can use backslashes and enclose an entire UNC path in quotes. The path you specify must exist on your Imaging Server.

For more information on the mode commands and parameters you can use and usage examples, see Section D.3, "Make Mode," on page 175.

Depending on the amount of data on the hard disk, the image might take several minutes to create. If the screen goes blank, just press any key. (Linux enters a screen-saving mode after a few minutes.)

5 After the image is created and the imaging maintenance mode prompt is displayed, remove any CD or DVD from the drive and reboot the device.

6 (Optional) Verify that the image file was created on your Imaging Server. You might also want to check its size.

Using the ZENworks Imaging Engine Menu to Manually Take an Image of a Device

1 Boot the device using one of the following methods:

- If the device is PXE-enabled, boot it from the Preboot Services Imaging Server. For more information, see Section 2.2.1, "Using Preboot Services (PXE)," on page 38.
- Boot the device using an imaging boot CD or DVD. For more information, see Section 2.2.2, "Preparing Imaging Boot CDs or DVDs," on page 38.
- Boot the device from the ZENworks partition. For more information, see "Creating a ZENworks Partition" on page 48.

2 Depending on how you boot, do one of the following:

CD: Enter `manual` at the imaging maintenance mode prompt.

PXE: Select *Start ZENworks imaging maintenance* from the Novell Preboot Services Menu.

3 Enter `img` to display the ZENworks Imaging Engine menu.

4 (Optional) Click *System information* > *Drive information* to display a list of the partition slots on the device.

For your reference, note the number and type of partitions and which one is active.

5 Click *Imaging* > *Make image*.

6 In the Make Image Wizard window, specify the destination where the image is stored (Local or Server), then click *Next*.

The directories in the path must exist. You can use the following characters in the path and filename:

- Letters: a through z (uppercase and lowercase)
- Numbers
- Special characters: $ % - _ @ { } ~ #

7 Browse to and specify the path to the image archive.

8 Select the partitions that you want to include in the image.

9 Select a compression option:

None: No compression is used.

Speed: Takes the least amount of time to compress but creates the largest compressed image file. This option is used by default when an image is created.

Balanced: Represents a compromise between compression time and image file size.

Size: Creates the smallest image file but takes longer to compress.

10 Click *Next*.

11 (Optional) Fill in the fields:

Author: The name of the person creating this image.

Computer: The name of the computer being imaged.

Image Description: A description of the image.

Comments: Any additional comments about the image.

12 Click *Next*.

Depending on the amount of data on the hard disk, the image might take several minutes to create. If the screen goes blank, just press any key. (Linux enters a screen-saving mode after a few minutes.)

13 After the image is created, exit from the ZENworks Imaging Engine menu, remove any CD or DVD from the drive, then reboot the device.

14 (Optional) Verify that the image file was created on your Imaging Server. You might also want to check its size.

Using Image Explorer to Customize an Image

After you have created a base or add-on image as explained in the previous sections, you can customize it with the Image Explorer utility. Specifically, you can:

- **Compress the Image:** You can compress an image (including images created by previous versions of ZENworks) to 40-60% of the original file size, if you have not done so already during the imaging process. There are three compression options. *Optimize for speed* takes the least amount of time but creates the largest compressed image file. *Optimize for space* creates the smallest image file but might take a significant amount of time. *Balanced* is a compromise between compression time and image file size. This option is used by default when an image is created.

  The following compression methods are provided:

  - **Compress:** Use this option to compress an image file that you currently have open in Image Explorer. For more information, see "Compressing an Opened Image File" on page 145.
  - **QuickCompress:** Use this option to compress an image file without waiting for the file to fully load into Image Explorer. For more information, see "Compressing an Unopened Image File" on page 146.
- **Split the Image:** You can specify a device image file that you want to split into separate files so that the entire image can be spanned across several CDs or DVDs. Splitting a device image is helpful for applying or restoring images in a disconnected environment. For more information, see "Splitting an Image" on page 146.
- **Resize a Partition in an Image:** For base images, you can edit the value in the *Original size* text box to allow you to change how big the ZENworks Imaging Engine makes the partition when the image is restored. For more information, see "Changing a Partition's Size" on page 144.
- **Purge Deleted Files:** Excluded or hidden files and folders can be completely removed from an open image. This saves space in the image if you no longer want to include the files. For more information, see "Removing Hidden Directories and Files from the Image File" on page 148.
- **Exclude Individual Files and Folders from the Image:** In doing this, you create subsets of the image by specifying which of ten possible file sets to exclude a given file or folder from. This exists merely as internal attributes of the same image archive. For more information, see "Unhiding Directories or Files in the Image" on page 147.

IMPORTANT: Do not exclude BPB files from a base image or the device won't be able to boot the new operating system after receiving the image.

- **Add Files and Folders to the Image:** By default, any file or folder you add is included in all file sets. To change this, you must explicitly exclude the file or folder from one or more file sets. For more information, see "Adding Directories and Files" on page 150.

For information on starting Image Explorer, see Section C.1, "Image Explorer (zmgexp)," on page 141.

Creating an Add-On Image from Files in a File System

An *add-on* image is an archived collection of files to be applied to an existing installation on a target device. This is sometimes referred to as an application overlay. The existing partitions and files on the target device are left intact, except for any files that the add-on image might update.

An add-on image typically corresponds to an application or utility, or simply to a set of data files or configuration settings.

To create an add-on image:

1. Run the Image Explorer utility, which is located on the Imaging Server at:

   Windows:

   `installation_path\novell\zenworks\bin\preboot\zmgexp.bat`

   Linux: `/opt/novell/zenworks/preboot/bin/zmgexp`
2. Drag files and folders from an existing device into a new image archive.

   For more information, see Section C.1, "Image Explorer (zmgexp)," on page 141.
3. Save this image with the `.zmg` extension (case-sensitive) in the same directory on the Imaging Server where you store base images.

   Generally, an add-on image created in this manner doesn't require any post-processing on the target device. It is simply a set of files that are copied to the appropriate locations on the hard disk, much like what happens when you unzip an archive. For more information, see "Using Image Explorer to Customize an Image" on page 100.

This add-on image can be used in Step 8 on page 95 under "Configuring the ZENworks Image Bundle for Automatic Imaging" on page 94.

Manually Restoring an Image on a Device

The section explains how to restore an image to the device by booting from an imaging method and entering a particular imaging command. The image is retrieved from your Imaging Server.

Ensure that the device receiving a new image has enough disk space for the image. Otherwise, you receive a "Failed to write to proxy" error.

The following sections contain additional information:

- "Using the Imaging Maintenance Mode Prompt to Manually Restore an Image to a Device" on page 102
- "Using the ZENworks Imaging Engine Menu to Manually Restore an Image to a Device" on page 103

Using the Imaging Maintenance Mode Prompt to Manually Restore an Image to a Device

1. If you haven't already done so, create the image to restore on the device, as instructed in "Manually Taking an Image of a Device" on page 96.

   Make sure that the image is of the same type of device (same hardware configuration) and is stored on your Imaging Server. You can use a previous image of the same device.

   IMPORTANT: If you are restoring an image on a device without a ZENworks partition, make sure the image was made on a device without a ZENworks partition. Otherwise, the wrong MBR (Master Boot Record) is restored, and the device fails to boot.

   ---

2. (Optional) Boot the device from a Windows startup disk and run `fdisk` to remove all partitions from the hard disk.

   Running `fdisk` is not required, but it is recommended for purposes of comparing workstation or server partitions before and after the imaging operation.

3. Boot the device using one of the following methods:

   - If the device is PXE-enabled, boot it from the Preboot Services Imaging Server. For more information, see Section 2.2.1, "Using Preboot Services (PXE)," on page 38.
   - Boot the device using an imaging boot CD or DVD. For more information, see Section 2.2.2, "Preparing Imaging Boot CDs or DVDs," on page 38.
   - Boot the device from the ZENworks partition. For more information, see "Creating a ZENworks Partition" on page 48.

4. Enter `manual` at the imaging maintenance mode prompt.

   This step is not the same as in the previous step's manual processes.

5. (Optional) At the imaging maintenance mode prompt, type `img -dump`, then press Enter to display a list of the partition slots on the device.

   For your reference, note the number and type of partitions and which one is active. If you removed all partitions using `fdisk`, each slot should be empty and none should be active.

6. Enter a command at the prompt, using one of the following formats:

   - To restore an image from the Imaging Server and place it on a device, enter:

     `img -restorep` *`added_path/newimg`*`.zmg`

     The `-restorep` command stands for "restore from proxy." It retrieves an image from the imaging (proxy) server and restores it on this device. The IP address or DNS name should be that of your Imaging Server, and the UNC path specifies the location and filename where the image is to be retrieved from.

     For example:

     ```
     img -restorep subdir1/cpqnt.zmg
     ```

   - To retrieve an image from a local device and place it on a device:

     `img -restorel` *`filepath`*

     The `-restorep` command stands for "restore from local." It retrieves an image from a local device and restores it on this device. *Filepath* represents the filename of the image to retrieve, including the `.zmg` extension (case-sensitive) and the complete path from the root of the partition.

IMPORTANT: Make sure to use *forward slashes* in the UNC path as shown above. Backslashes aren't recognized by Linux. However, you can use backslashes and enclose an entire UNC path in quotes. The path you specify must exist.

If you want to manually restore an image from a folder that uses extended or double-byte characters in its name, you should perform an automatic image restoration. For more information, see Section 1.5.2, "Creating, Installing, and Restoring Standard Images," on page 31 or Section 1.5.4, "Restoring Lab Devices to a Clean State," on page 32.

For more information on the mode commands and parameters you can use and usage examples, see Section D.4, "Restore Mode," on page 181.

Depending on the size of the image, it might take several minutes to restore the image. Images usually take slightly longer to apply than they do to take.

7 (Optional) After the image is applied and the prompt is displayed, type `img -dump`, then press Enter.

As before, this displays a list of the partition slots on the device. You should now see information about the new partitions that are created and activated by the image that you just applied.

8 At the prompt, type `grub.s`, then press Enter.

9 Remove any CD or DVD from the drive and reboot the device.

10 Verify that the device boots to the operating system that was installed by the new image.

Using the ZENworks Imaging Engine Menu to Manually Restore an Image to a Device

1 If you haven't already done so, create the image to restore on the device, as instructed in "Manually Taking an Image of a Device" on page 96.

Make sure that the image is of the same type of device (same hardware configuration) and is stored on your Imaging Server. You can use a previous image of the same device.

IMPORTANT: If you are restoring an image on a device without a ZENworks partition, make sure the image was made on a device without a ZENworks partition. Otherwise, the wrong MBR (Master Boot Record) is restored, and the device fails to boot.

2 (Optional) Boot the device from a Windows startup disk and run `fdisk` to remove all partitions from the hard disk.

Running `fdisk` is not required, but it is recommended for purposes of comparing the workstation or server partitions before and after the imaging operation.

3 Boot the device using one of the following methods:

- If the device is PXE-enabled, boot it from the Preboot Services Imaging Server. For more information, see Section 2.2.1, "Using Preboot Services (PXE)," on page 38.
- Boot the device using an imaging boot CD or DVD. For more information, see Section 2.2.2, "Preparing Imaging Boot CDs or DVDs," on page 38.
- Boot the device from the ZENworks partition. For more information, see "Creating a ZENworks Partition" on page 48.

4 Depending on how you boot, do one of the following:

CD: Enter `manual` at the imaging maintenance mode prompt.

PXE: Select *Start ZENworks imaging maintenance* from the Novell Preboot Services Menu.

5 Enter `img` to display the ZENworks Imaging Engine menu.

6 (Optional) Click *System information* > *Drive information* to display a list of the partition slots on the device.

For your reference, note the number and type of partitions and which one is active. If you removed all partitions using `fdisk`, each slot should be empty and none should be active.

7 Click *Imaging* > *Restore image*.

8 In the Restore Image Wizard window, specify the source location of the image (Local or Server), then click *Next*.

9 Browse to and specify the path to the image archive.

10 (Optional) Specify a file set.

Using Image Explorer, you can create file sets for selection when creating the Imaging bundle. For more information, see Appendix B, "File Sets," on page 139.

11 (Optional) Specify any advanced options, such as *sfileset* or *apartition:ppartition*.

For details on this and other related `img` commands, see Appendix D, "ZENworks Imaging Engine Commands," on page 173.

12 Click *Next*.

Depending on the size of the image, it might take several minutes to restore the image. Images usually take slightly longer to apply than they do to take.

13 (Optional) Click *System information* > *Drive information* to display a list of the partition slots on the device.

As before, this displays a list of the partition slots on the device. You should now see information about the new partitions that are created and activated by the image that you just applied.

14 Exit the ZENworks Imaging Engine menu.

15 Run `grub.s` from the imaging maintenance mode prompt.

16 Remove any CD or DVD from the drive and reboot the device.

17 Verify that the device boots to the operating system that was installed by the new image.

Making an Image Available for Automatic Imaging

When you boot a device from an imaging method and allow the boot process to proceed in auto-imaging mode, the imaging operation that is performed on the device is determined by default Preboot Services settings that you define in ZENworks Control Center.

Creating an Imaging bundle also allows you to combine a base image and one or more add-on images into a single entity that can be applied on target devices. You can specify a standard image file to apply, or you can create a script to further customize your imaging operation. You can also specify that a particular file set of an image be used.

The sections that follow give instructions for performing these tasks:

- "Creating a Base Image" on page 105
- "Associating an Add-On Image with a Non-Imaging Bundle" on page 105
- "Using a File Set of an Image" on page 106

Creating a Base Image

1. Create the base image using one of the following methods:
   - **ZENworks Control Center:** See "Taking a Base Image of a Device" on page 92.
   - **Imaging Maintenance Mode Prompt:** See "Manually Taking an Image of a Device" on page 96.
2. After the base image is created, perform one of the following procedures in ZENworks Control Center:
   - If you created the image using a Imaging bundle, assign the bundle to the devices to be imaged:
     1. In ZENworks Control Center, click *Bundles* in the left pane to display the Bundles panel, then in the *Name* column click the bundle containing the base image that you want to associate the add-on images with to display its properties page.
     2. Click the *Relationships* tab, then in the Device Assignments panel, click *Add* to open the Select Objects dialog box.
     3. Select the devices or groups containing devices, then click *OK* to display the Assign Bundle Wizard page.
     4. Click *Next* to display the Summary page, then click *Finish* to assign the devices to the bundle and exit the wizard.
   - If you created the image manually, assign the image to a Preboot Image bundle, then assign that bundle to the devices to be imaged:
     1. Follow the instructions in "Configuring the ZENworks Image Bundle for Automatic Imaging" on page 94.
     2. In Step 11 on page 95, click *Next* to assign the bundle to the devices.

   The next time these devices boot, they are imaged from this Imaging bundle.

Associating an Add-On Image with a Non-Imaging Bundle

1. Create the add-on image to associate with the non-imaging bundle. For more information, see "Creating an Add-On Image from Files in a File System" on page 101.
2. Copy the add-on image file to a Configuration Management Imaging Server that is accessible in your Management Zone.

   You might want to copy your add-on images to the same location as the base image.
3. In ZENworks Control Center, click *Bundles* in the left pane to display the Bundles panel, then in the *Name* column click an imaging bundle containing a base image that you want to associate the add-on images with. Its properties page displays.
4. Click the *Actions* tab, then click *Add* > *ZENworks Image*.
5. In the Add Action - ZENworks Image dialog box, browse for and select an add-on image.

   You can associate more than one add-on image with the bundle. Repeat this step for each add-on image.
6. (Optional) In the *Action Name* field, change the default name to a useful name.

   This name is displayed in the *Name* column on the *Actions* tab.
7. (Optional) In the *File Set* field, select a file set number.

   For information on file sets, see Appendix B, "File Sets," on page 139.

8 Click OK to exit the dialog box.

9 To arrange the order in which the images are applied, select a check box and click either *Move Up* or *Move Down*.

10 Click *Apply* to save the changes.

When a device boots that is assigned to this bundle, the add-on images are applied in the order listed on this page.

Using a File Set of an Image

As explained in "Using Image Explorer to Customize an Image" on page 100, you can exclude individual files and folders from any of 10 possible file sets of an image.

Using Image Explorer, you can create file sets for selection when creating the Imaging bundle. For more information, see Appendix B, "File Sets," on page 139.

Table 3-1 *Image File Set Usages*

Type of imaging operation	How to specify the file set to use
Automatic (Preboot Services based on default settings)	In the Multicast Wizard in ZENworks Control Center, specify the number of the file set in the *File Set* field. You must create the file set using the Image Explorer utility. For more information, see Section C.1, "Image Explorer (zmgexp)," on page 141. You can create multiple Imaging bundles that point to the same base image, but to different file sets of that image.
Manual (command line or menu)	Use the `-s` parameter on the `-restore` mode command. For example, to specify file set number 3: `img -restorel myimage.zmg -s=3` or You can enter `img` at the imaging maintenance mode prompt to display a menu, select *Restore an Image*, then select *Local Image*. Specify s*fileset* (for example, s3) in the *Advanced Parameters* field. For details, see Appendix D, "ZENworks Imaging Engine Commands," on page 173.

3.1.3 Setting Up Disconnected Imaging Operations

Disconnected imaging operations are inherently manual. To perform a disconnected imaging operation on a device, you must have a storage device to hold the image to be created or restored, and that storage device must be locally accessible to the ZENworks Imaging Engine (in Linux) when you boot the device from the imaging boot media.

The following sections explain how to set up and perform disconnected operations:

- "Using a CD or DVD for Disconnected Imaging Operations" on page 107
- "Using a Hard Disk for Disconnected Imaging Operations" on page 108

Using a CD or DVD for Disconnected Imaging Operations

You can use CDs and DVDs only as the storage medium for an image to applied, not for an image to be created.

You can apply an image from a bootable or non-bootable imaging CD or DVD using either the imaging maintenance mode prompt or using the ZENworks Imaging Engine menu.

The following sections contain additional information:

- "Using the Imaging Maintenance Mode Prompt to Apply an Image" on page 107
- "Using the ZENworks Imaging Engine Menu to Apply an Image" on page 107

Using the Imaging Maintenance Mode Prompt to Apply an Image

1. Use your CD- or DVD-burning software to burn the source image onto a CD or DVD.
2. Boot the device by using one of the following methods:
   - If the device is PXE-enabled, boot it from the Preboot Services Imaging Server. For more information, see Section 2.2.1, "Using Preboot Services (PXE)," on page 38.
   - Boot the device by using an imaging boot CD or DVD. For more information, see Section 2.2.2, "Preparing Imaging Boot CDs or DVDs," on page 38.
   - Boot the device from the ZENworks partition. For more information, see "Creating a ZENworks Partition" on page 48.
3. Enter `manual` from the imaging maintenance mode prompt.
4. Insert the CD or DVD that contains the source image.
5. At the prompt, enter `cdrom.s` to mount the CD or DVD.

   This mounts the CD or DVD to `/mnt/cdrom`.
6. Enter a command by using the following format:

   `img -restorel /mnt/cdrom/`*`path`*`/`*`image_name`*`.zmg`

   where *path* and *image_name* are the path and filename of the image relative to the root of the CD or DVD.
7. When the imaging is done, remove the imaging boot media (if applicable) and do the following to boot the device with the new image:

   7a At the imaging maintenance mode prompt, type `grub.s`, then press Enter.

   7b Press Ctrl+Alt+Delete.

   If the device doesn't boot to the new operating system (that is, if the prompt is displayed), enter `grub.s` again and reboot the device a second time.

Using the ZENworks Imaging Engine Menu to Apply an Image

1. Use your CD- or DVD-burning software to burn the source image onto a CD or DVD.
2. Boot the device by using one of the following methods:
   - If the device is PXE-enabled, boot it from the Preboot Services Imaging Server. For more information, see Section 2.2.1, "Using Preboot Services (PXE)," on page 38.
   - Boot the device by using an imaging boot CD or DVD. For more information, see Section 2.2.2, "Preparing Imaging Boot CDs or DVDs," on page 38.

- Boot the device from the ZENworks partition. For more information, see "Creating a ZENworks Partition" on page 48.

3 Enter `manual` from the imaging maintenance mode prompt.

4 Insert the CD or DVD that contains the source image.

5 At the prompt, enter `cdrom.s` to mount the CD or DVD.

This mounts the CD or DVD to `/mnt/cdrom`.

6 Enter `img` to display the ZENworks Imaging Engine menu.

7 Click *Imaging*, then click *Restore image*.

8 Click *Local*, then click *Next*.

9 Browse to and specify the path to the image archive.

10 (Optional) Specify a file set.

Using Image Explorer, you can create file sets for selection when creating the Imaging bundle. For more information, see Appendix B, "File Sets," on page 139.

11 (Optional) Specify any advanced options, such as *sfileset* or *apartition:ppartition*.

For details on this and other related `img` commands and parameters, see Appendix D, "ZENworks Imaging Engine Commands," on page 173.

12 Click *Next*.

Depending on the size of the image, it might take several minutes to restore the image. Images usually take slightly longer to apply than they do to take.

13 When the imaging is done, remove the imaging boot media (if applicable) and do the following to boot the device with the new image:

13a At the imaging maintenance mode prompt, type `grub.s`, then press Enter.

13b Press Ctrl+Alt+Delete.

If the device doesn't boot to the new operating system (that is, if the prompt is displayed), enter `grub.s` again and reboot the device a second time.

Using a Hard Disk for Disconnected Imaging Operations

When you boot a device from a ZENworks imaging boot media, you can place an image on, or take an image from, any primary partition on an IDE or SCSI hard drive. You can also use the local ZENworks partition if one is installed. Any target partition must have sufficient space.

When you create an image, the partition where you store the image is itself excluded from the image. When you apply an image, the source partition is not altered.

You can create or apply an image on a hard disk by using either the imaging maintenance mode prompt or by using the ZENworks Imaging Engine menu.

The following sections contain the instructions:

- "Using the Imaging Maintenance Mode Prompt to Create an Image" on page 109
- "Using the ZENworks Imaging Engine Menu to Create an Image" on page 109
- "Using the Imaging Maintenance Mode Prompt to Apply an Image" on page 110
- "Using the ZENworks Imaging Engine Menu to Apply an Image" on page 111

Using the Imaging Maintenance Mode Prompt to Create an Image

1. Boot the device by using one of the following methods:
   - If the device is PXE-enabled, boot it from the Preboot Services Imaging Server. For more information, see Section 2.2.1, "Using Preboot Services (PXE)," on page 38.
   - Boot the device by using an imaging boot CD or DVD. For more information, see Section 2.2.2, "Preparing Imaging Boot CDs or DVDs," on page 38.
   - Boot the device from the ZENworks partition. For more information, see "Creating a ZENworks Partition" on page 48.
2. Enter `manual` from the imaging maintenance mode prompt.
3. At the prompt, enter `img -dump` to view the available partitions.

   Note the number of the partition where you will store the new image.
4. Enter a command by using the following format:

   `img -makel [-part=`*`pNumber`*`] /`*`added_path`*`/`*`image`*`.zmg [-comp=`*`comp_level`*`]`

   where *pNumber* is the number of the partition to store the image in, and *comp_level* is the amount of compression used when creating the image. Specify any number from 0-9. 0 means no compression. 1 is the same as *Optimize for speed*. 6 is the same as *Balanced* and is used by default if you do not specify this parameter. 9 is the same as *Optimize for space*. (*Optimize for speed* takes the least amount of time but creates the largest image file. *Optimize for space* creates the smallest image file but might take a significant amount of time. *Balanced* is a compromise between compression time and image file size.) *Path* and *image* are the path and filename of the new image relative to the partition root. If you omit the partition number, the local ZENworks partition is used.

   For details on other related `img` commands and parameters, see Appendix D, "ZENworks Imaging Engine Commands," on page 173.

Using the ZENworks Imaging Engine Menu to Create an Image

1. Boot the device by using one of the following methods:
   - If the device is PXE-enabled, boot it from the Preboot Services Imaging Server. For more information, see Section 2.2.1, "Using Preboot Services (PXE)," on page 38.
   - Boot the device by using an imaging boot CD or DVD. For more information, see Section 2.2.2, "Preparing Imaging Boot CDs or DVDs," on page 38.
   - Boot the device from the ZENworks partition. For more information, see "Creating a ZENworks Partition" on page 48.
2. Enter `manual` from the imaging maintenance mode prompt.
3. Enter `img` to display the ZENworks Imaging Engine menu.
4. (Optional) Click *System information* > *Drive information* to display a list of the partition slots on the device.

   For your information, note the number of the partition where you will store the new image.
5. Click *Imaging* > *Make image*.
6. In the Make Image Wizard window, click *Local* > *Next*.
7. Browse to and specify the path to the image archive.
8. Select the partitions that you want to include in the image.

9 Select a compression option:

None: No compression is used.

Speed: Takes the least amount of time to compress but creates the largest compressed image file. This option is used by default when an image is created.

Balanced: Represents a compromise between compression time and image file size.

Size: Creates the smallest image file but takes longer to compress.

10 Click *Next*.

11 (Optional) Fill in the fields:

Author: The name of the person creating this image.

Computer: The name of the computer being imaged.

Image Description: A description of the image.

Comments: Any additional comments about the image.

12 Click *Next*.

Depending on the amount of data on the hard disk, the image might take several minutes to create.

13 After the image is created, exit from the ZENworks Imaging Engine menu, remove any CD or DVD from the drive, then reboot the device.

14 (Optional) Verify that the image file was created. You might also want to check its size.

Using the Imaging Maintenance Mode Prompt to Apply an Image

1 Boot the device by using one of the following methods:

- If the device is PXE-enabled, boot it from the Preboot Services Imaging Server. For more information, see Section 2.2.1, "Using Preboot Services (PXE)," on page 38.
- Boot the device by using an imaging boot CD or DVD. For more information, see Section 2.2.2, "Preparing Imaging Boot CDs or DVDs," on page 38.
- Boot the device from the ZENworks partition. For more information, see "Creating a ZENworks Partition" on page 48.

2 Enter `manual` from the imaging maintenance mode prompt.

3 (Optional) At the prompt, enter `img -dump` to view the available partitions.

For your information, note the number of the partition where the source image is stored.

4 Enter a command by using the following format:

`img -restorel [-part=`*`pNumber`*`] added_`*`path`*`/`*`image`*`.zmg`

where *pNumber* is the number of the partition where the source image is stored, and *path* and *image* are the image path and filename relative to the partition root. If you omit the partition number, the local ZENworks partition is used.

For details on other related `img` commands and parameters, see Appendix D, "ZENworks Imaging Engine Commands," on page 173.

5 When the imaging is done, remove the imaging boot media (if applicable) and do the following to boot the device with the new image:

5a At the imaging maintenance mode prompt, type `grub.s`, then press Enter.

5b Press Ctrl+Alt+Delete.

If the device doesn't boot to the new operating system (that is, if the prompt is displayed), enter `grub.s` again and reboot the device a second time.

Using the ZENworks Imaging Engine Menu to Apply an Image

1. Boot the device by using one of the following methods:
   - If the device is PXE-enabled, boot it from the Preboot Services Imaging Server. For more information, see Section 2.2.1, "Using Preboot Services (PXE)," on page 38.
   - Boot the device by using an imaging boot CD or DVD. For more information, see Section 2.2.2, "Preparing Imaging Boot CDs or DVDs," on page 38.
   - Boot the device from the ZENworks partition. For more information, see "Creating a ZENworks Partition" on page 48.
2. Enter `manual` from the imaging maintenance mode prompt.
3. Enter `img` to display the ZENworks Imaging Engine menu.
4. (Optional) Click *System information* > *Drive information* to display a list of the partition slots on the device.

   For your reference, note the number of the partition where the source image is stored.
5. Click *Imaging* > *Restore image*.
6. Click *Local* > *Next*.
7. Browse to and specify the path to the image archive.
8. (Optional) Specify a file set.

   Using Image Explorer, you can create file sets for selection when creating the Imaging bundle. For more information, see Appendix B, "File Sets," on page 139.
9. (Optional) Specify any advanced options, such as *sfileset* or *apartition:ppartition*.

   For details on this and other related `img` commands and parameters, see Appendix D, "ZENworks Imaging Engine Commands," on page 173.
10. Click *Next*.

    Depending on the size of the image, it might take several minutes to restore the image. Images usually take slightly longer to apply than they do to take. If the screen goes blank, just press any key. (Linux enters a screen-saving mode after a few minutes.)
11. When the imaging is done, remove the imaging boot media (if applicable) and do the following to boot the device with the new image:

    11a At the imaging maintenance mode prompt, type `grub.s`, then press Enter.

    11b Press Ctrl+Alt+Delete.

    If the device doesn't boot to the new operating system (that is, if the prompt is displayed), enter `grub.s` again and reboot the device a second time.

3.2 Multicasting Images

Multicast Image Set bundles use an image that is previously taken from a device and stored on an Imaging Server. The image is sent to multiple devices at one time to reimage them, rather than being sent one time for each device, thus saving on network bandwidth usage. For example, if you have 10 devices in the multicast session and the image is 3 GB in size, your network experiences 3 GB of

network traffic to image all 10 devices. Without multicasting, the network experiences 30 GB of network traffic.

For multicasting to work properly, all routers and switches on the network must have their multicast features configured. Otherwise, multicast packets might not be routed properly.

A multicast session consists of all clients (devices) that are assigned to the Multicast Session Set bundle that are booting (joining), but must wait for a start trigger in order to complete booting. In other words, the boot processes for the devices can be held up until one of the triggers is encountered, even for as long as you specify in an elapsed time or number of clients entry.

After a session has started, other devices booting that are assigned to this bundle do not become part of this session, but become part of the next session when it triggers.

There are two triggers that you can use to determine when to start the multicast session. The first trigger to be encountered starts the session. These triggers are useful if you want economy of scale in multiple clients joining, but don't want to stall the session too long.

You can perform multicasting of images either in ZENworks Control Center or manually:

- Section 3.2.1, "Using ZENworks Control Center to Multicast an Image," on page 112
- Section 3.2.2, "Using a Command Line to Multicast an Image," on page 116

3.2.1 Using ZENworks Control Center to Multicast an Image

Multicast Image Set bundles use an image that is taken previously from a device and is stored on an Imaging Server. The image is sent to multiple devices at one time to reimage them, rather than being sent one time for each device, thus saving on network bandwidth usage. For example, if you have 10 devices in the multicast session and the image is 3 GB in size, your network experiences 3 GB of network traffic to image all 10 devices. Without multicasting, the network experiences 30 GB of network traffic.

For multicasting to work properly, all routers and switches on the network must have their multicast features configured. Otherwise, multicast packets might not be routed properly.

- "Configuring Multicast Image Set Bundles" on page 112
- "Adding Participants to a Multicast Session" on page 114
- "Enabling or Disabling a Multicast Image Set Bundle" on page 116

Configuring Multicast Image Set Bundles

With Preboot Services, multicasting is an automated procedure. You simply define a Multicast Image Set bundle and assign it to the devices. The multicast session starts when the trigger event that you configured occurs.

Using Configuration Management, you can install software by using a bundle. Software included in a bundle that is assigned directly is considered mandatory; the software is installed on all assigned devices (the bundle is directly assigned to the devices, their groups, or their folders).

To configure a Multicast Image Set bundle and assign devices to the bundle:

1. In ZENworks Control Center, click *Bundles* in the left pane to display the Bundles panel.
2. In the *Name* column, click *New* > *Bundle* to start the Create New Bundle Wizard.

3 In the Create New Bundle Wizard, select *Imaging Bundle*, then click *Next* to display the Select Imaging Bundle Type page.

4 Select *Multicast Image Set*, then click *Next* to display the Define Details page.

5 Fill in the fields:

Bundle Name: (Required) Although bundles can be identified in ZENworks Control Center by their type of icon, as well as the folder they are listed under, you should develop a naming scheme that differentiates the Multicast Image Set bundles that are listed together in a folder.

For more information, see Appendix H, "Naming Conventions in ZENworks Control Center," on page 215.

Folder: Browse for the location where you want the Multicast Image Set bundle displayed in ZENworks Control Center. The folder must exist. You cannot specify a non-existent folder, because ZENworks does not create them from this wizard.

Icon: Browse for and select an icon if you plan to use one on your desktop for this bundle.

Description: Provide a description to help you later recognize the exact purpose of this Multicast Image Set bundle.

If you are using subsets of an image, be sure to indicate which file set this bundle is configured for.

6 Click *Next* to display the Master Image Source page.

7 Fill in the fields:

File Path: The location on the Imaging Server where the image file to be used by the Multicast Image Set bundle is stored.

File Set: Using Image Explorer, you can create file sets for selection when creating the Imaging bundle. For more information, see Appendix B, "File Sets," on page 139.

Image Explorer is executed by running:

Windows:

`installation_path\novell\zenworks\bin\preboot\zmgexp.bat`

Linux: `/opt/novell/zenworks/preboot/bin/zmgexp`

8 Fill in the fields:

There are two triggers that you can use to determine when to start the ZENworks Multicast session. The first trigger to be realized starts the session.

A session consists of all clients (devices) that are assigned to the Multicast Image Set bundle that are booting (joining), but must wait for a start trigger. Therefore, the boot processes for the devices can be held up until one of the triggers is realized, even for as long as you specify in an elapsed time or number of clients entry.

After a session has started, if other devices boot that are assigned to this bundle, they do not become part of this session, but become part of the next session when it triggers.

Start the Session As Soon As: You have two choices:

- ____ clients have joined

  This trigger, if met first, limits the session to the number of clients that you specify. The default is 1.

- ____ minutes have elapsed since a new client has joined

This trigger, if met first, causes the session to start, regardless of the number of clients that have joined, except that at least one client must have joined (otherwise there is no device to multicast to).

A "new client" means that it is the first device to boot that starts this round of waiting for a trigger to be realized. The default is 5.

These triggers are useful if you want economy of scale in multiple clients joining, but don't want to stall the session too long from starting.

9 Click *Next* to display the Summary page.

10 Select the *Define Additional Properties* check box to enable it.

Because a generic non-intuitive action name is given to this bundle, you need to rename it in Step 12 after the bundle has been created.

11 Review the configuration, then click one of the following:

Back: Allows you to make changes after reviewing the summary.

Finish: Creates the Multicast Image Set bundle as configured per the settings listed on this Summary page.

12 When the bundle's *Summary* tab is displayed, click the *Actions* tab, click the bundle name in the *Name* column ("Multicast Image Set" defaults), edit the name in the *Action Name* field, then click *OK*.

This bundle is not assigned to any device or group after it is created until you make that assignment on a *Relationships* tab.

IMPORTANT: If this Imaging bundle has been created on a management device inside the firewall and you are assigning it to a device outside the firewall, port 8089 must be open both ways (PUBLIC -> PRIVATE, and PUBLIC <- PRIVATE).

When the Multicast Image Set bundle's trigger event occurs (configured in Step 8), the Multicast session begins.

Adding Participants to a Multicast Session

There are two sources for Multicast session participants: registered devices and unregistered devices. Either or both can be assigned to a given Multicast Image Set bundle.

- "Assigning Registered Devices" on page 114
- "Assigning Unregistered Devices" on page 115

Assigning Registered Devices

1 In ZENworks Control Center, click *Devices* in the left pane to display the Devices panel in the *Managed* tab.

2 Click the *Servers* or *Workstations* folder, then select the check boxes for the devices to be in the multicast session.

3 Click *Action* > *Assign Bundle*.

This starts the Assign Bundle Wizard.

4 In the Select Objects dialog box, select the desired Multicast Image Set bundle.

5 In the Shortcut Location section, make sure all check boxes are deselected, then click *OK*.

Imaging bundles do not use shortcut locations.

6 Click *Next* > *Finish* to complete the multicast session assignment.

When devices assigned to this Multicast Image Set bundle boot, they can become part of the multicast session and be imaged from the image contained in the bundle.

7 On the *Summary* tab for the device, click *Advanced* in the Imaging Work panel.

8 In the *Scheduled Work* field, select *Apply Assigned Imaging Bundle*, then click *OK*.

This sets up a device to do Multicast Image Set bundle work for its effective bundle the next time it boots.

9 (Conditional) If the multicast session needs to be enabled, continue with "Enabling or Disabling a Multicast Image Set Bundle" on page 116.

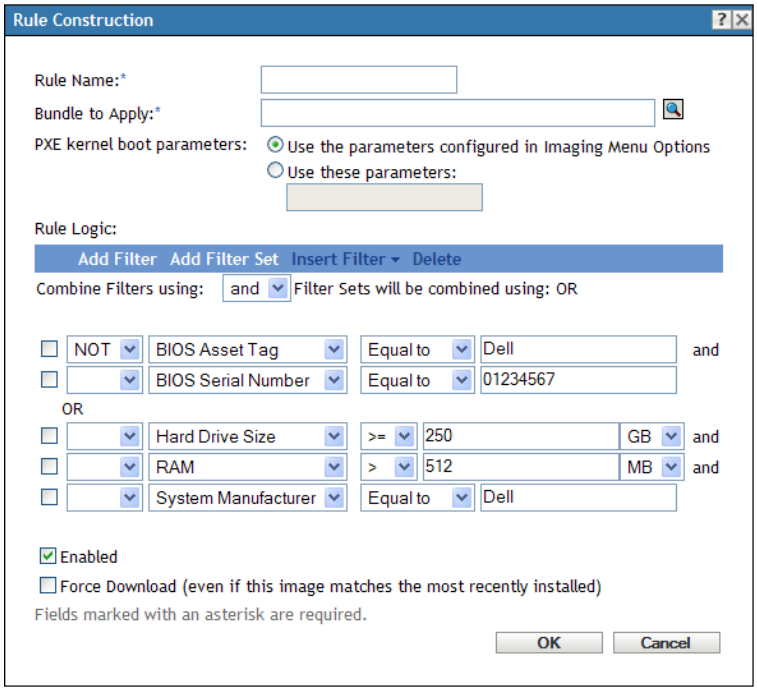
By default, a Multicast Image Set bundle is enabled when you create it.

Assigning Unregistered Devices

1 In ZENworks Control Center, click *Configuration* in the left pane to display the *Configuration* tab, if it's not expanded, click *Management Zone Settings*.

2 Click *Device Management* to expand its listing, then select *Preboot Services*.

3 If necessary, expand the Device Imaging Work Assignment section, then click *Add* in the Hardware Rules section to open the Rule Construction dialog box:



For information on the Rule Construction dialog box, see "Rule Construction Dialog Box" on page 74.

4 In the *Bundle to Apply* field, browse for and select the desired Multicast Image Set bundle.

5 Fill in remaining the fields to configure the type of device that you want to image in the multicast session.

6 Click *Apply* at the bottom of the Preboot Services section to save the non-registered device settings.

When devices fulfilling the requirements that you defined in these steps boot, they can become part of the multicast session and be imaged from the image contained in the Multicast Image Set bundle.

7 (Conditional) If the multicast session needs to be enabled, continue with "Enabling or Disabling a Multicast Image Set Bundle" on page 116.

Enabling or Disabling a Multicast Image Set Bundle

By default, a Multicast Image Set bundle is enabled when you create it. However, you can disable the bundle as a means of controlling whether to have the session run, rather than visit each device to unschedule that work.

If you have disabled the session for this bundle, the multicast session cannot occur, even when devices assigned to the bundle reboot to trigger the session.

You can cause each device assigned to the Multicast Image Set bundle to receive the bundle when it reboots, even if the imaging configuration for the device is to "do nothing" (see Step 5 through Step 6 in Section 3.5, "Editing Imaging Work," on page 129).

To enable or disable a Multicast Image Set bundle:

1 In ZENworks Control Center, click *Bundles* in the left pane to display the Bundles panel.

2 In the *Name* column, click a Multicast Image Set bundle to open its *Summary* tab.

`Multicast Image Set` is displayed in the *Category* column for all Multicast Image Set bundles.

You can use the Search panel to display only Multicast Image Set bundles. Click the down-arrow for the *Category* field and select *Multicast Image Set*.

3 Click the *Actions* tab, then do one of the following:

- To enable the bundle, select the check box for the bundle, then click *Enable*.
- To disable the bundle, select the check box for the bundle, then click *Disable*.

4 Click *Apply* to enable or disable multicasting for the devices that are assigned to this bundle.

If enabled, the next time a device assigned to the Multicast Image Set bundle boots, it can become part of that multicast session if its Imaging Work has been scheduled.

3.2.2 Using a Command Line to Multicast an Image

If you want to perform a multicast session from a command line, you need to start the multicast session from the ZENworks Imaging Server and physically visit each participating device. Performing a manual multicast session is particularly useful in a lab environment in which a small number of devices participate.

The following sections contain step-by-step information about performing a manual multicast session. You must perform the steps in both of the following sections; however, the order in which you perform these tasks does not matter.

- "Initiating a Multicast Session from the ZENworks Imaging Server" on page 117
- "Initiating a Multicast Session from Each Client" on page 119

Initiating a Multicast Session from the ZENworks Imaging Server

On the ZENworks Imaging Server, do the following to initiate the multicast session:

- "On Windows" on page 117
- "On Linux" on page 118

On Windows

1. In the Services window, determine whether the Novell ZENworks Preboot Service is running.

   If it is not running, then right-click the service and select *Start*.

2. On the command line, enter the following to enable a multicast session:

   `installation_path\novell\zenworks\bin\preboot\zmgmcast.exe -mcast arguments`

   where *arguments* represents the following that you can append to the command line:

Argument	Description
session_name	(Required) The session name is any string that uniquely identifies this multicast session from other multicast sessions that might be in progress on the network.
-p *path*	(Required) The path to the image to be multicast, which is located on the Imaging Server. This must be the full path.
-i *IP_address*	(Optional) The IP address of the Imaging Server.
-f *file_set_number*	(Optional) File sets are assigned to the current ZENworks Image bundle by using this information. **File Set:** Using Image Explorer, you can create file sets for selection when creating the Imaging bundle. For more information, see Appendix B, "File Sets," on page 139. Image Explorer is executed by running: **Windows:** `installation_path\novell\zenworks\bin\preboot\zmgexp.bat` **Linux:** `/opt/novell/zenworks/preboot/bin/zmgexp`
-t *time_wait*	(Optional) If not enough devices have booted to fulfill the Client Count requirement, the multicast session begins if a participating device boots and a certain amount of time passes without another participating device booting. Specify this amount of time. The default is 5 minutes.
-c *client_count*	(Optional) The number of participating devices you want to have booted before the multicast session begins. If you do not specify a number, the default is 1.

IMPORTANT: The image is sent to and placed on each participating device only after you initiate the multicast session from each participating client.

3. To view the status of the multicast session, enter:

   `installation_path\novell\zenworks\bin\preboot\zmgmcast.exe -status -i proxy_IP_address`

   The `-i` argument is optional.

4 To view the list of multicast sessions, enter:

`installation_path\novell\zenworks\bin\preboot\zmgmcast.exe list -i proxy_IP_address`

The `-i` argument is optional.

5 To stop a multicast session, enter:

`installation_path\novell\zenworks\bin\preboot\zmgmcast.exe -stop session_name -i proxy_IP_address`

The *session_name* is required and the `-i` argument is optional.

6 Continue with "Initiating a Multicast Session from Each Client" on page 119.

On Linux

1 On the command line, enter the following to make sure the imaging software is running:

`/etc/init.d/novell-pbserv status`

If it is not running, then enter:

`/etc/init.d/novell-pbserv -start`

2 On the command line, enter the following to enable a multicast session:

`/opt/novell/zenworks/preboot/bin/novell-zmgmcast -mcast arguments`

where *arguments* represents the following that you can append to the command line:

Argument	Description
session_name	(Required) The session name is any string that uniquely identifies this multicast session from other multicast sessions that might be in progress on the network.
-p *path*	(Required) The path to the image to be multicast, which is located on the Imaging Server. This must be the full path.
-i *IP_address*	(Optional) The IP address of the Imaging Server.
-f *file_set_number*	(Optional) File sets are assigned to the current ZENworks Image bundle by using this information. **File Set:** Using Image Explorer, you can create file sets for selection when creating the Imaging bundle. For more information, see Appendix B, "File Sets," on page 139. Image Explorer is executed by running: **Windows:** `installation_path\novell\zenworks\bin\preboot\zmgexp.bat` **Linux:** `/opt/novell/zenworks/preboot/bin/zmgexp`
-t *time_wait*	(Optional) If not enough devices have booted to fulfill the Client Count requirement, the multicast session begins if a participating device boots and a certain amount of time passes without another participating device booting. Specify this amount of time. The default is 5 minutes.
-c *client_count*	(Optional) The number of participating devices you want to have booted before the multicast session begins. If you do not specify a number, the default is 1.

IMPORTANT: The image is sent to and placed on each participating device only after you initiate the multicast session from each participating client.

3 To view the status of the multicast session, enter:

```
/opt/novell/zenworks/preboot/bin/novell-zmgmcast status -i
proxy_IP_address
```

The `-i` argument is optional.

4 To view the list of multicast sessions, enter:

```
/opt/novell/zenworks/preboot/bin/novell-zmgmcast list -i
proxy_IP_address
```

The `-i` argument is optional.

5 To stop a multicast session, enter:

```
/opt/novell/zenworks/preboot/bin/novell-zmgmcast  -stop
session_name -i proxy_IP_address
```

The *session_name* is required and the `-i` argument is optional.

6 Continue with "Initiating a Multicast Session from Each Client" on page 119.

Initiating a Multicast Session from Each Client

You can use the imaging maintenance mode prompt or the ZENworks Imaging Engine menu to perform the multicast session as you physically visit each device.

The following sections contain additional information:

- "Using the Imaging Maintenance Mode Prompt to Perform the Multicast Session" on page 119
- "Using the ZENworks Imaging Engine Menu to Perform the Multicast Session" on page 120

Using the Imaging Maintenance Mode Prompt to Perform the Multicast Session

1 (Optional) Install the Novell ZENworks Configuration Management Imaging Agent (novell-ziswn) on each of the participating devices.

If you do not install the Imaging Agent on each participating device, the devices have duplicate network identities. For more information, see "Limitations of Multicasting Images" on page 35.

2 Create an imaging boot CD or DVD for each person who will assist with the multicast session, or enable PXE on the participating devices.

If you don't know how to do this, see Section 2.2, "Setting Up the Preboot Services Methods," on page 38.

3 At each device, including the master device (unless you are starting the multicast session from the Imaging Server), access the imaging maintenance mode prompt by using the imaging boot CD or DVD, or if it is PXE-enabled, boot it.

4 Enter `manual` at the prompt.

5 To identify each participating device in the multicast session, enter the following command at the prompt of every device:

```
img -session session_name
```

where *session_name* is any string that uniquely identifies this multicast session from other multicast sessions that might be in progress on the network. Use the same session name on each

of the participating devices in this multicast session. You can specify any multicast session, including one that originates from the Imaging Server (as long as you specify the session name used by the Imaging Server).

Example: `img -session mcast01`

The `img -session` command can take other parameters that allow you to designate the master device and the imaging start time beforehand. See Appendix D, "ZENworks Imaging Engine Commands," on page 173 for details.

6 (Conditional) If you have not already done so, start the multicast session from the master device or from the imaging server.

Master device: To start the multicast session from the master device, after all of the other devices have registered as participants, click *Start session*.

If you start the session from the master device, the session master must be a device. If you start the session from the imaging server, the session master must be an imaging server that uses a previously saved image file.

The ZENworks Imaging Engine begins creating the image of the master device and the image is sent to and restored on each participating device. Any problems are reported and displayed on the master device.

Imaging server: To start the multicast session from the imaging server, follow the steps under "Initiating a Multicast Session from the ZENworks Imaging Server" on page 117.

7 At each participating device, when the imaging is done, do the following to boot the device with the new operating system:

7a At the imaging maintenance mode prompt, type `grub.s`, then press Enter.

7b Press Ctrl+Alt+Delete.

If the device doesn't boot to the new operating system (that is, if the prompt is displayed), enter `grub.s` again and reboot the device a second time.

Using the ZENworks Imaging Engine Menu to Perform the Multicast Session

1 (Optional) Install the Novell ZENworks Configuration Management Imaging Agent (novell-ziswn) on each of the participating devices.

If you do not install the Imaging Agent on each participating device, the devices have duplicate network identities. For more information, see "Limitations of Multicasting Images" on page 35.

2 Create an imaging boot CD or DVD for each person who will assist with the multicast session, or enable PXE on the participating devices.

If you don't know how to do this, see Section 2.2, "Setting Up the Preboot Services Methods," on page 38.

3 At each device, including the master device (unless you are starting the multicast session from the Imaging Server), access the imaging maintenance mode prompt by using the imaging boot CD or DVD, or if it is PXE-enabled, boot it.

4 Enter `manual` at the prompt.

or

Select *Start ZENworks Imaging Maintenance* from the Novell Preboot Services Menu.

5 To identify each participating device in the multicast session, type `img` at the prompt to display the ZENworks Imaging Engine screen.

6 Click *Imaging*, then click *Multicast session* (or click *F7 Multicast* on the task bar) to start the Multicast Wizard.

7 Enter a session name.

The session name is any string that uniquely identifies this multicast session from other multicast sessions that might be in progress on the network. Use the same session name on each of the participating devices in this multicast session. You can specify any multicast session, including one that originates from the Imaging Server (as long as you specify the session name used by the Imaging Server).

8 Select a *Session role* option:

Master: Select this option if this is the session master.

Client: Select this option if this is a participating device.

9 (Optional) If you chose Master in Step 8, click *Specify additional options*, click *Next*, then fill in the fields:

Compression Level: Specify the compression level you want to use for this multicast session:

- **None:** No data compression is used. Data is sent immediately across the network to participating devices. You might use this option if the master device has a slow CPU; the amount of time to compress the data is eliminated and the data is immediately sent across the network. However, this option creates more network traffic than if you selected one of the other compression levels (*Speed*, *Balanced*, or *Size*).
- **Speed:** Takes the least amount of time to compress the data before the data is sent across the network to participating devices. You might use this option if the master device has a slow CPU; the amount of time to compress the data is reduced before the data is sent across the network. With this option, however, the multicast session creates more network traffic than if you selected either the *Balanced* or *Size* compression level.
- **Balanced:** Represents a compromise between data compression and the amount of network traffic that the multicast session creates.
- **Size:** Takes the most amount of time to compress the data before sending it across the network to participating devices. You might use this option if the master device has a fast CPU. Using this option requires the most CPU resources to compress the data but creates less network traffic to transfer the data to the participating devices.

Automated Session: Click *Enabled* to specify the number of participating devices (clients) that must register before starting the automated multicast session and to specify the amount of time, in minutes, that can expire without the number of participating devices to register before starting the automated multicast session. If you do not click the *Enabled* check box, you must manually start the multicast session.

10 Click *Next*, then click *Start session*.

You can cancel the session by clicking *Abort session* > *Yes* > *OK* > *Close*.

11 At each participating device, when the imaging is done, do the following to boot the device with the new operating system:

11a At the imaging maintenance mode prompt, type `grub.s`, then press Enter.

11b Press Ctrl+Alt+Delete.

If the device doesn't boot to the new operating system (that is, if the prompt is displayed), enter `grub.s` again and reboot the device a second time.

3.3 Configuring Imaging Script Bundles

An Imaging Script bundle can contain any ZENworks script that you can run from the imaging maintenance mode prompt.

Using Configuration Management, you can install software by using a bundle. Software included in a bundle that is assigned directly is considered mandatory; the software is installed on all assigned devices (the bundle is directly assigned to the devices, their groups, or their folders).

To configure an Imaging Script bundle and assign devices to the bundle:

1. In ZENworks Control Center, click *Bundles* in the left pane to display the Bundles panel.
2. Click *New* > *Bundle* to start the Create New Bundle Wizard.
3. In the Create New Bundle Wizard, select *Imaging Bundle*, then click *Next*.
4. On the Select Imaging Bundle Type page, select *Imaging Script bundle*, then click *Next* to display the Define Details page.
5. Fill in the fields:

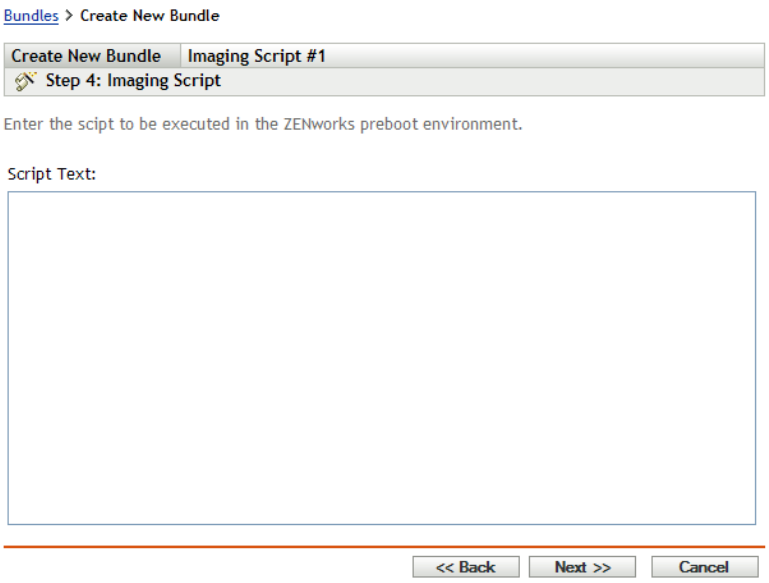
   Bundle Name: (Required) Although bundles can be identified in ZENworks Control Center by their type of icon, as well as the folder they are listed under, you should develop a naming scheme that differentiates the Imaging Script bundles that are listed together in a folder.

   For more information, see Appendix H, "Naming Conventions in ZENworks Control Center," on page 215.

   Folder: Browse for the location where you want the Imaging Script bundle displayed in ZENworks Control Center. The folder must exist. You cannot specify a non-existent folder, because ZENworks does not create them from this wizard.

   Icon: Browse for and select an icon if you plan to use one on your desktop for this bundle.

   Description: Provide a description to help you later recognize the exact purpose of this Imaging Script bundle.
6. Click *Next* to display the Imaging Script page:



7 Fill in the fields:

Script Text: Specify the text of the ZENworks script. The script is restricted to doing preboot work prior to the device booting.

IMPORTANT: If you provide any paths to executables in a script, make sure that you provide the full path, or the executable might not run.

For information on using this bundle to perform scripted imaging, see "Using a Script to Image a Device" on page 96.

8 Click *Next* to display the Summary page.

9 If you want to perform other configuration tasks after the bundle has been created, select the *Define Additional Properties* check box.

For example, you can make assignments to the bundle in the *Relationships* tab, add actions in the *Actions* tab, and so on.

10 Review the configuration, then click one of the following:

Back: Allows you to make changes after reviewing the summary.

Finish: Creates the Imaging Script bundle as configured per the settings listed on this Summary page.

This bundle is not assigned to any device or group after it is created until you make that assignment on a *Relationships* tab.

IMPORTANT: If this Imaging bundle has been created on a management device inside the firewall and you are assigning it to a device outside the firewall, port 8089 must be open both ways (PUBLIC -> PRIVATE, and PUBLIC <- PRIVATE).

When a device assigned to the Imaging Script bundle boots, the bundle's work is performed on the device before its operating system starts.

3.4 Assigning Imaging Bundles

IMPORTANT: If you are assigning a Imaging bundle that has been created on a management device inside the firewall to a device outside the firewall, port 8089 must be open both ways (PUBLIC -> PRIVATE, and PUBLIC <- PRIVATE).

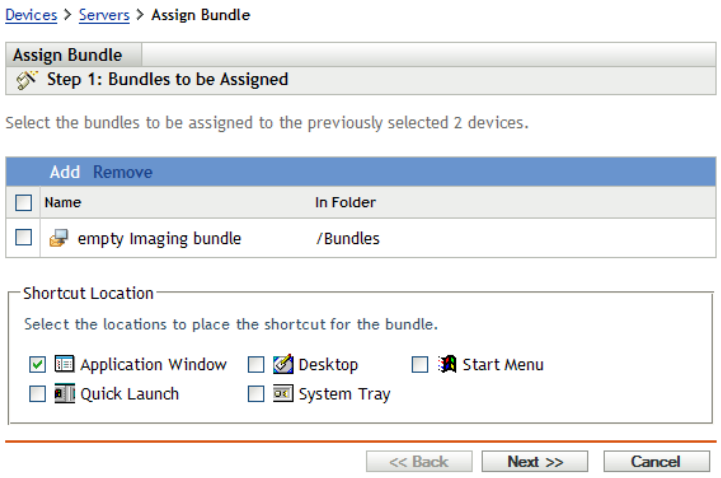
You can assign a bundle from the Devices, Users, or Bundles tabs, assign devices and users to bundle groups, and assign bundles to non-registered devices:

- Section 3.4.1, "Using the Devices Tab to Assign Bundles," on page 124
- Section 3.4.2, "Using the Users Tab to Assign Bundles," on page 124
- Section 3.4.3, "Assigning Devices or Users to Bundle Groups," on page 125
- Section 3.4.4, "Using the Bundles Tab to Assign Bundles," on page 126
- Section 3.4.5, "Assigning Bundles to Non-Registered Devices," on page 128

3.4.1 Using the Devices Tab to Assign Bundles

1. In ZENworks Control Center, click *Devices* in the left pane to display the Devices panel in the *Managed* tab.
2. In the Name column, click *Servers* or *Workstations*, select the check boxes of one or more servers or workstations, click *Action*, then select *Assign Bundle*.

   This starts the Assign Bundle Wizard.
3. In the Select Objects dialog box, select the bundle to be assigned, then click *OK* to display the Bundles to be Assigned page:



4. Click *Add* as necessary to include the desired bundles.
5. In the Shortcut Location section, make sure all check boxes are deselected.

   Imaging bundles do not use shortcut locations.
6. Click *Next* to display the Summary page.
7. Review the configuration, then click one of the following:

   Back: Allows you to make changes after reviewing the summary.

   Finish: Click to make the assignments.

When devices assigned to this Imaging bundle boot, they are imaged from the image contained in the bundle.

3.4.2 Using the Users Tab to Assign Bundles

1. In ZENworks Control Center, click *Users* in the left pane to display the User Sources panel, then select users in any of the following ways:
   - Select the check boxes of user sources.

     All users listed under these folders are assigned to the bundle.
   - Browse for subfolders and select their check boxes.

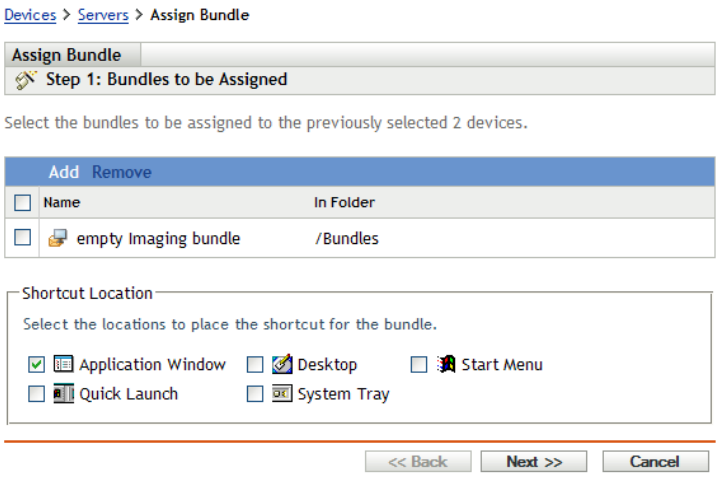
     All users listed under the subfolders are assigned to the bundle.
   - Browse for individual users and select their check boxes.

     All selected users are assigned to the bundle.

2 Click *Action*, then select *Assign Bundle*.

   This starts the Assign Bundle Wizard.

3 In the Select Objects dialog box, select the bundle to be assigned, then click *OK* to display the Bundles to be Assigned page:



4 Click *Add* as necessary to include the desired bundles.

5 In the Shortcut Location section, make sure all check boxes are deselected.

   Imaging bundles do not use shortcut locations.

6 Click *Next* to display the Summary page.

7 Review the configuration, then click one of the following:

   Back: Allows you to make changes after reviewing the summary.

   Finish: Click to make the assignments.

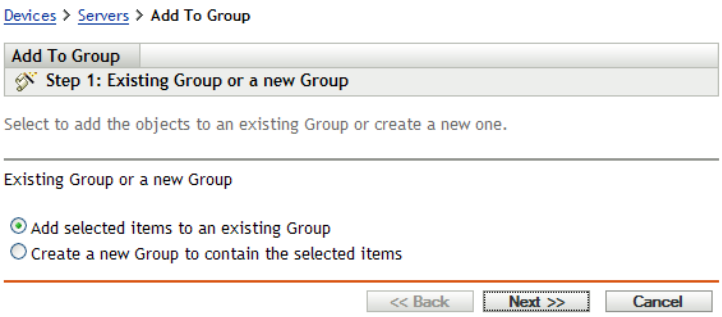
When devices assigned to this Imaging bundle boot, they are imaged from the image contained in the bundle.

3.4.3 Assigning Devices or Users to Bundle Groups

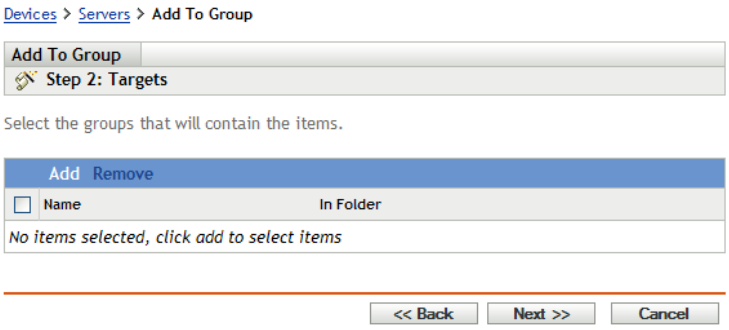
1 In ZENworks Control Center, click *Devices* in the left pane to display the Devices panel in the *Managed* tab.

2 In the *Name* column, click *Servers* or *Workstations*, then select the check boxes next to the devices to be assigned.

3 Click *Actions* > *Add to Group* to open the Add to Group Wizard:



4 Click *Next* to add to an existing group to display the Targets page:



For information on adding to a new group, see "Creating Bundle Groups" in the *ZENworks 10 Configuration Management Software Distribution Reference*.

5 Click *Add* to open the Select Groups dialog box.

6 Select the groups and click *OK*.

7 Repeat this step as necessary to include the desired groups, then click *Next* to display the Summary page.

8 Review the configuration, then click one of the following:

Back: Allows you to make changes after reviewing the summary.

Finish: Click to make the assignments.

When devices assigned to any assigned Bundle Group boot, they are imaged from the image contained in the Imaging bundle that is assigned to the group.

3.4.4 Using the Bundles Tab to Assign Bundles

To assign a bundle to devices, users, or bundle groups:

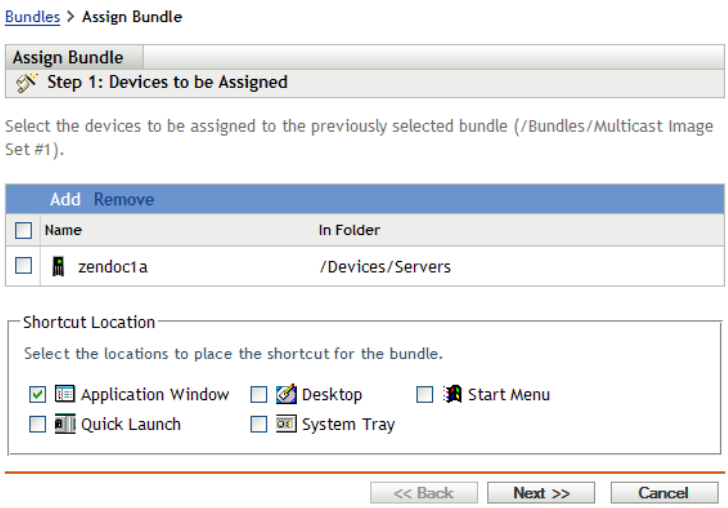
1 In ZENworks Control Center, click *Bundles* in the left pane to display the Bundles panel.

2 In the *Name* column, click the bundle to be assigned to open its properties.

3 Click the *Relationships* tab.

4 To assign the bundle to devices, in the Device Assignments panel, click *Add*, then do the following:

4a In the Select Objects dialog box, select the devices to be assigned, then click *OK* to display the Devices to be Assigned page:



4b Click *Add* as necessary to include the desired devices.

4c In the Shortcut Location section, make sure all check boxes are deselected.

Imaging bundles do not use shortcut locations.

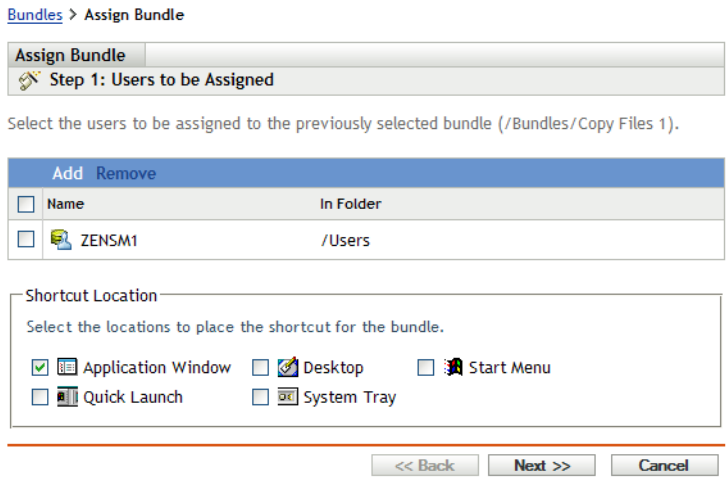
4d Click *Next* to display the Summary page.

4e Click *Finish* to complete the assignment.

4f Repeat these steps until all of the desired devices have been assigned to the bundle.

5 To assign the bundle to users, in the User Assignments panel, click *Add*, then do the following:

5a In the Select Objects dialog box, select the users to be assigned, then click *OK* to display the Users to be Assigned page:



You can select user source folders, user folders, and individual users.

Some bundle types cannot be assigned to users. When this is the case, the User Assignments panel provides a message to that effect, and the *Add* option is not available.

5b Click *Add* as necessary to include the desired users.

5c In the Shortcut Location section, make sure all check boxes are deselected.

Imaging bundles do not use shortcut locations.

5d Click *Next* to display the Summary page.

5e On the Schedules page, click *Next* without selecting any scheduling options to display the Summary page.

Imaging bundles should not be scheduled because imaging operations are based on device booting or user logins.

5f Review the configuration, then click one of the following:

Back: Allows you to make changes after reviewing the summary.

Finish: Click to make the assignments.

6 To assign the bundle to bundle groups, in the Bundle Groups panel, click *Add*, in the Select Groups dialog box, browse for and select the groups, then click *OK*.

The Bundle Groups the Imaging bundle is assigned to are listed in this panel. Repeat clicking *Add* until the Imaging bundle has been assigned to all of the desired Bundle Groups.

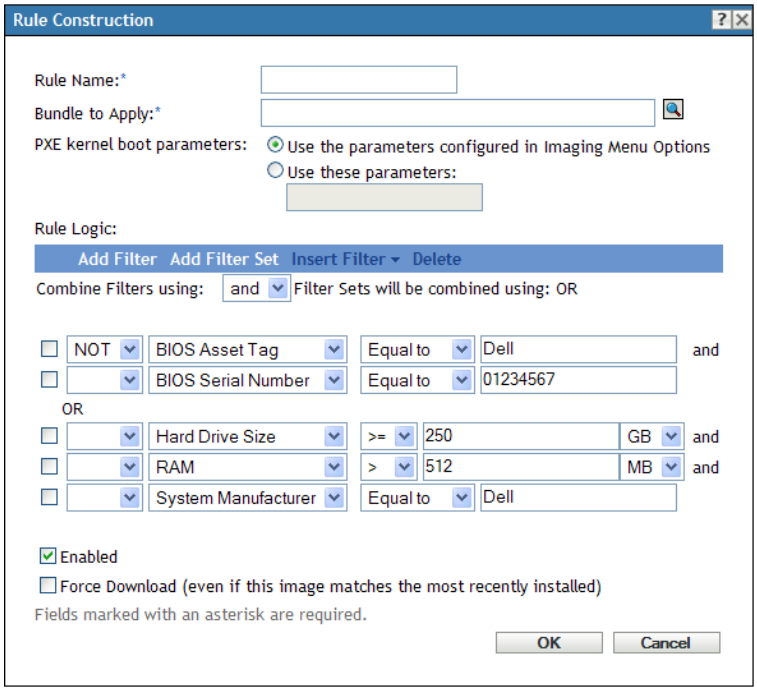
When devices assigned to this Bundle Group boot, they are imaged from the image contained in the Imaging bundle that is assigned to the group.

3.4.5 Assigning Bundles to Non-Registered Devices

1 In ZENworks Control Center, click *Configuration* in the left pane to display the *Configuration* tab, if it's not expanded, click *Management Zone Settings*.

2 Click *Device Management* to expand its listing, then select *Preboot Services*.

3 If necessary, expand the Device Imaging Work Assignment section, then click *Add* in the Hardware Rules section to open the Rules Construction dialog box:



4 In the *Bundle to Apply* field, browse for and select the desired Imaging bundle.

5 Fill in remaining the fields to configure the type of device that you want to image in the multicast session.

   For more information on the Rule Construction dialog box, see "Rule Construction Dialog Box" on page 74.

6 Click *Apply* at the bottom of the Preboot Services section to save the non-registered device settings.

   When devices fulfilling the requirements that you defined in these steps boot, they are imaged from the image contained in the selected Imaging bundle.

7 To enable the multicast session, continue with "Enabling or Disabling a Multicast Image Set Bundle" on page 116.

3.5 Editing Imaging Work

The Edit Imaging Work page allows you to view all images that are recently applied to the selected device, and the image that is currently assigned (known as its "effective" image).

To edit a server's or workstation's Preboot Services work:

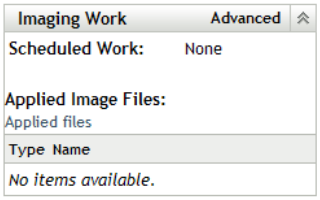
1 In ZENworks Control Center, click *Devices* in the left pane to display the Devices panel in the *Managed* tab.

2 In the *Name* column, click *Servers* or *Workstations* to display the devices.

3 Click a device.

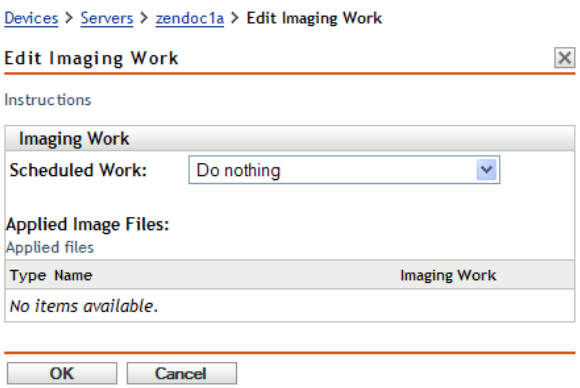
   The *Summary* tab should display. If not, select it.

4 In the Imaging Work section, click *Advanced* to start the Edit Imaging Work Wizard:



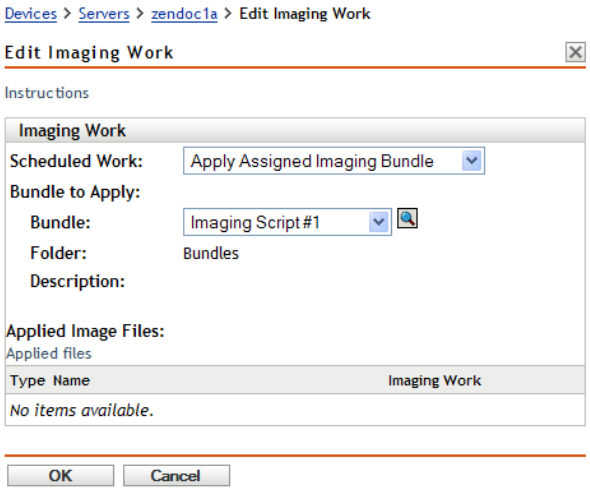
5 In the Imaging Work section, select one of the following from the drop-down list for the *Scheduled Work* field:

- **Do Nothing:** Review the image files:



The Applied Image Files section displays the image files most recently applied to this device.

- **Apply Assigned Imaging Bundle:** Select a bundle in the *Bundle* field:



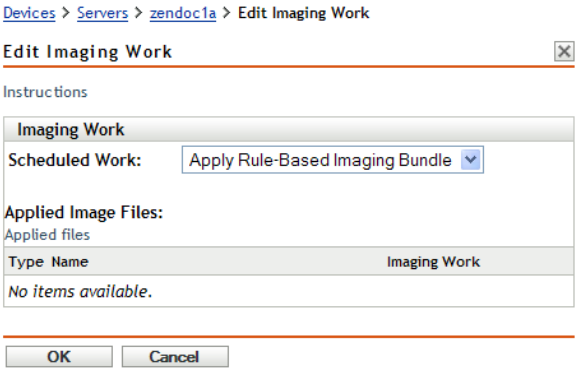
Bundle: Select or specify the bundle. Its bundle name, folder, and description are displayed.

The *Bundle* field displays the currently effective bundle. You can select the bundle to apply from the drop-down list, which changes the effective bundle for the device.

The next time the device boots, or when you manually apply a Imaging bundle (such as from a ZENworks imaging CD or DVD), the selected bundle is applied.

IMPORTANT: In order to have bundles to select, the administrator user that you are logged in as must have rights to modify devices and to apply bundles. For more information on administrator rights, see "Administrators" in the *ZENworks 10 Configuration Management System Administration Reference*.

- **Apply Rule-Based Imaging Bundle:** This assigns the device to be imaged if it matches any Imaging bundle that is based on rules.



- **Take an Image:** Fill in the fields:

  Server and Path of New Image File: Browse for or enter the full path to where you want the image file saved. This option is displayed only for the ZENworks Image format.

Image Compression: Select one:

- **Balanced:** Automatically balances compression between an average of the reimaging speed and the available disk space for the image file. This option is displayed only for the ZENworks Image format
- **Optimize for Speed:** Optimizes the compression to allow for the fastest reimaging time. Use this option if CPU speed is an issue. By default, this option is selected.
- **Optimize for Space:** Optimizes the compression to minimize the image file's size to conserve disk space. This can cause reimaging to take longer.

The image is taken the next time the device boots, or when you manually apply a Imaging bundle, such as from a ZENworks imaging CD or DVD.

6 Click *OK* to exit the wizard.

Your changes should be displayed in the Imaging Work panel for the device.

Preboot Actions

A

The *Actions* panel displays the action sets available for the bundle. Depending on the bundle type, the possible action sets are Install, Launch, Verify, Uninstall, Terminate, and Preboot. For example, if you select a Windows bundle, five actions sets are available. If you select an Imaging bundle, Preboot is the only action set available.

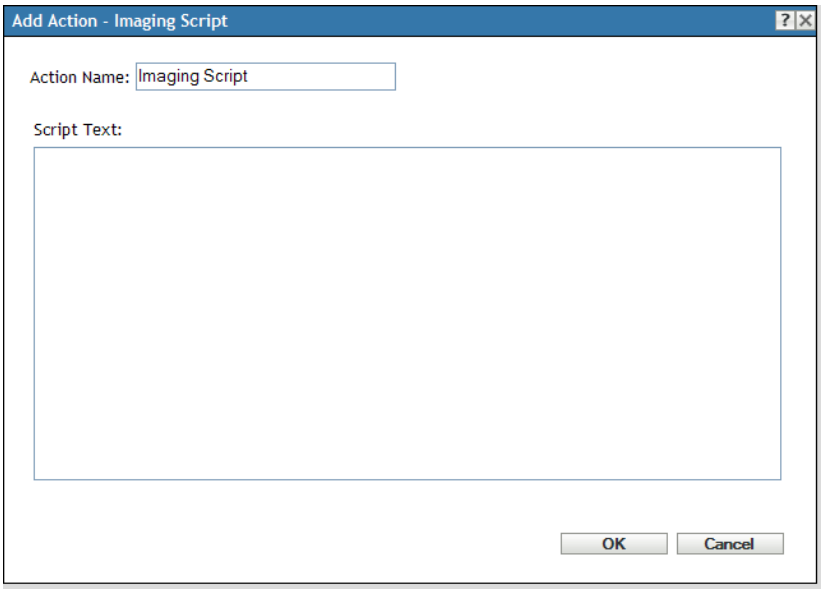
You can add an action to any of the available action sets. When you do so, that action is performed whenever the action set is applicable. For example, when you add an action to the Install action set, that action is performed whenever the bundle is installed.

The following sections contain information about the actions you can configure for the Preboot action set. For more information about the actions you can configure for the Install, Launch, Verify, and Terminate action sets, see "Actions" in the *ZENworks 10 Configuration Management Software Distribution Reference*.

- Section A.1, "Action - Imaging Script," on page 133
- Section A.2, "Action - Linked Application Bundle," on page 134
- Section A.3, "Action - Multicast Image Set," on page 135
- Section A.4, "Action - ZENworks Image," on page 136

A.1 Action - Imaging Script

Depending on which dialog box you accessed, you can either add a new Imaging Script action to the current bundle's Preboot actions, or edit an existing Imaging Script.



- Section A.1.1, "Adding a New Imaging Script," on page 134
- Section A.1.2, "Editing an Existing Imaging Script," on page 134

A.1.1 Adding a New Imaging Script

1. Specify a script name in the *Action Name* field.
2. Specify the text of the script in the *Script Text* field.

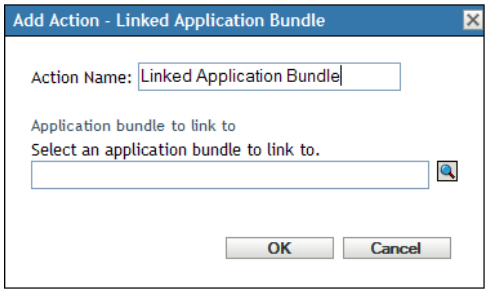
   The script is restricted to doing imaging work prior to the device's operating system startup.
3. Click *OK* to create the new script action.

A.1.2 Editing an Existing Imaging Script

1. In the *Action Name* field, edit the existing name as needed.
2. In the *Script Text* field, edit the existing script as needed.
3. Click *OK* to save the changes.

A.2 Action - Linked Application Bundle

Use the following dialog box to link an add-on image to the current Image bundle:



The add-on image is dynamically created from the linked application bundle when the imaging bundle is applied. However, you must create the add-on in the application bundle in order for this to work.

To link to the application bundle and create the add-on image in that bundle:

1. On the *Actions* tab of the Imaging bundle, then click *Add* in the Preboot section.
2. Specify a link name in the *Action Name* field.
3. In the *Select an Application Bundle to Link to* field, browse for and select the bundle.
4. Click *OK* to make the link.
5. If the add-on image has not yet been created in the linked application bundle, do the following:
   - **5a** Click *Bundles* in the left pane, click the desired Windows application bundle, then in the *Add-on Image File* field on the *Summary* tab, click *Create*.
   - **5b** In the Bundle Add-on Image Wizard, click *Add*.
   - **5c** Browse for and select an Imaging Server, then click *Finish*.

     The image of the application bundle is created and used when the Imaging bundle is applied to the devices.

A.3 Action - Multicast Image Set

Depending on which dialog box you accessed, you can either add a new Multicast Image Set action to the current bundle's Preboot actions, or edit an existing Multicast Image Set.

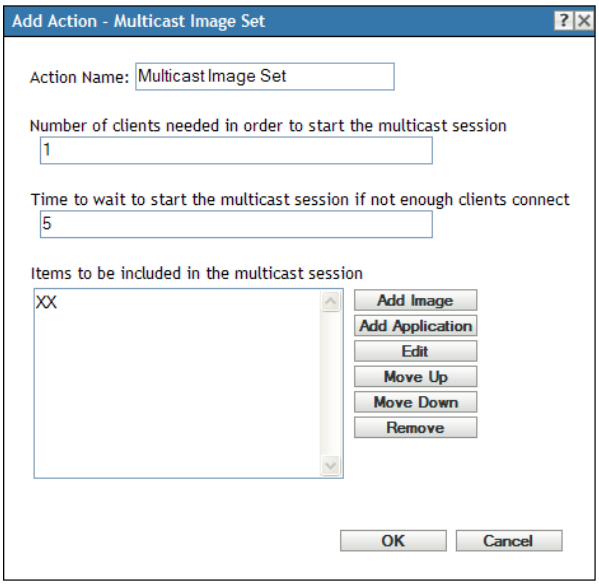
Multicast Image Set bundles use an image that was previously taken from a device and stored on an Imaging Server. The image is sent to multiple devices at one time to reimage them, rather than being sent one time for each device, thus saving on network bandwidth usage. For example, if you have 10 devices in the multicast session and the image is 3 GB in size, your network experiences 3 GB of network traffic to image all 10 devices. Without multicasting, the network experiences 30 GB of network traffic.

For multicasting to work properly, all routers and switches on the network must have their multicast features configured. Otherwise, multicast packets might not be routed properly.

A multicast session consists of all clients (devices) that are assigned to the Multicast Session Set bundle that are booting (joining), but must wait for a start trigger in order to complete booting. In other words, the boot processes for the devices can be held up until one of the triggers is encountered. You specify an elapsed time or number of clients entry as the trigger.

After a session has started, other devices that boot and that are assigned to this bundle do not become part of this session, but become part of the next session when it triggers.

There are two triggers (elapsed time or number of clients joining) that you can use to determine when to start the multicast session. The first trigger to be encountered starts the session. These triggers are useful if you want economy of scale in having multiple clients join, but you don't want to stall the session too long.



- Section A.3.1, "Adding a Multicast Image Set," on page 135
- Section A.3.2, "Editing a Multicast Image Set," on page 136

A.3.1 Adding a Multicast Image Set

1 Specify a multicast name in the *Action Name* field.

2 Specify the number of clients needed in order to start the multicast session.

3 Specify the time to wait before starting a multicast session if not enough clients have connected.

4 In the *Items to be Included in the Multicast Session* field, do the following as applicable:

- To add an image, click *Add Image*, then browse for and select the image file.
- To add an application, click *Add Application*, then browse for and select the application file.
- To edit an existing entry, select the entry, then click *Edit*.
- Use the *Move Up* and *Move Down* buttons to change the order of execution for the listed items.
- To remove an entry, select it, then click *Remove*. You can select and remove multiple items at a time.

5 Click *OK* to create the new multicast action.

A.3.2 Editing a Multicast Image Set

1 In the *Action Name* field, edit the existing name as needed.

2 If necessary, change the number of clients needed in order to start the multicast session.

3 If necessary, change the time to wait before starting a multicast session if not enough clients have connected.

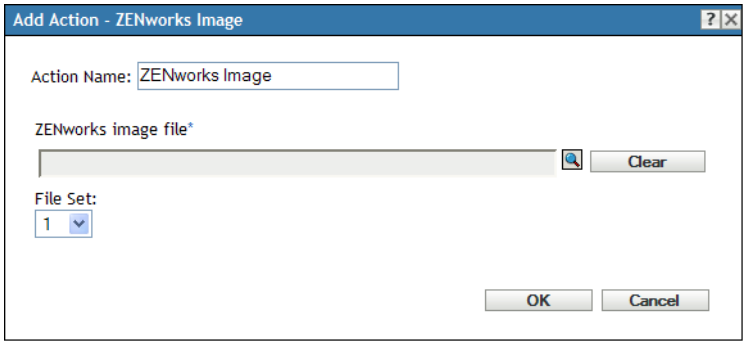
4 As necessary, edit the *Items to be Included in the Multicast Session* field.

You can add or remove items, edit existing items, or change their order of execution.

5 Click *OK* to save the changes.

A.4 Action - ZENworks Image

Depending on which dialog box you accessed, you can either add a new ZENworks Image action to the current bundle's Preboot actions, or edit an existing ZENworks image.



- Section A.4.1, "Adding a ZENworks Image," on page 137
- Section A.4.2, "Editing a ZENworks Image," on page 137

A.4.1 Adding a ZENworks Image

1. Specify an image name in the *Action Name* field.
2. In the *ZENworks Image File* field, browse for and select the image file.

   This image file must have the `.zmg` filename extension, meaning it is a valid ZENworks image file. It also must reside on a Primary Server in the Management Zone.
3. Select a number in the *File Set* field.

   For information on file sets, see Appendix B, “File Sets,” on page 139.
4. Click *OK* to create the new ZENworks Image action.

A.4.2 Editing a ZENworks Image

1. In the *Action Name* field, edit the existing name as needed.
2. In the *ZENworks Image File* field, browse for and select a different valid image file.
3. To change the file set, select a different number in the *File Set* field.

   For information on file sets, see Appendix B, “File Sets,” on page 139.
4. Click *OK* to save the changes.

File Sets

B

File sets allow you to create subsets of an image for applying to different devices. This is done by using a file set number that represents a version of the image where certain content is excluded.

When you create an Image bundle in ZENworks® Control Center, you must select a file set number. By default, file set 1 is selected. In Image Explorer you can exclude content from file sets. For example, if you create a bundle that includes file set 1, any content in Image Explorer that has file set 1 in the *Sets Excluded From* column is excluded from the bundle.

A separate image file is not created for a file set; instead, a file set contains internal attributes representing the excluded information. Even though a file set does not exist as a separate, physical image file, it is accessed as though it is, placing the image on the receiving device, minus the excluded files. The advantage this provides is that it allows you to create an image and modify it slightly for various devices, instead of creating separate images for each device.

An image has 10 possible file sets, labeled Set 1, Set 2, and so on. Each of the 10 file set numbers initially represents the original image. When you assign any file or directory in the image to a file set number (using Image Explorer), that file set number then represents a subset of the image, which you can select when creating an Image bundle.

Because there are only 10 file set numbers available, after you have assigned all 10 file set numbers to various files or directories in the image, you no longer have a file set that represents the full image. Therefore, reserve file set 1 as the image file set where no files or directories are excluded.

IMPORTANT: Because file sets only concern excluded files, any files added to the image through Image Explorer are added to all existing file sets. If you don't want new files included in a particular file set, you must use Image Explorer to exclude these new files from that file set.

Imaging Utilities and Components

C

The following sections provide reference information on Novell® ZENworks® Configuration Management imaging utilities, commands, and configuration settings.

- Section C.1, “Image Explorer (zmgexp),” on page 141
- Section C.2, “Novell ZENworks Configuration Management Imaging Agent (novell-ziswn),” on page 153
- Section C.3, “Image-Safe Data Viewer and Editor (zisview and zisedit),” on page 154
- Section C.4, “ZENworks Imaging Floppy Boot Disk Creator (zmediacreator),” on page 158
- Section C.5, “Imaging Configuration Parameters (settings.txt),” on page 158
- Section C.6, “Imaging Boot Parameter for PCMCIA Cards,” on page 161
- Section C.7, “Imaging Server,” on page 161

C.1 Image Explorer (zmgexp)

Use the Novell ZENworks Image Explorer utility to view or modify device images, create add-on images, compress image files, and split images.

- Section C.1.1, “Starting Image Explorer,” on page 141
- Section C.1.2, “Determining the Image Explorer Version,” on page 142
- Section C.1.3, “Image Explorer versus Windows Explorer,” on page 142
- Section C.1.4, “Opening an Image,” on page 142
- Section C.1.5, “Saving Image Changes and Exiting the Utility,” on page 142
- Section C.1.6, “Managing Image Properties,” on page 143
- Section C.1.7, “Image File Operations,” on page 144
- Section C.1.8, “Modifying Image Content,” on page 150
- Section C.1.9, “Creating a New Image File,” on page 152

C.1.1 Starting Image Explorer

There are no command line parameters for the Image Explorer utility.

1 To start Image Explorer, run the following file:

Windows:

installation_path\novell\zenworks\bin\preboot\zmgexp.bat

Linux: /opt/novell/zenworks/preboot/bin/zmgexp

C.1.2 Determining the Image Explorer Version

To determine which version of Image Explorer you are using:

1. Click *Help* > *About*.

C.1.3 Image Explorer versus Windows Explorer

Although ZENworks Imaging Explorer looks and functions like Microsoft Windows Explorer in most situations, some functionality differences exist between the two programs. The following describes the key differences between ZENworks Image Explorer and Microsoft Windows Explorer:

- **Replacing Files in an Image:** During the life cycle of an image, files might be deleted or updated through Image Explorer. When you replace an existing file in an image by using Image Explorer, the original file is not deleted from the image. Image Explorer purges only deleted files; it does not purge files that have been updated.

  When files are added to an image where the file already exists, Image Explorer appends the entry to the end of the image. When images are restored, all files that have been previously updated are sequentially restored.

  To avoid performance problems, you should manually delete and purge each instance of a duplicate file in order to have the duplicates purged from the image. In Windows Explorer, replaced files are automatically deleted.
- **Dragging Files from Image Explorer:** You cannot drag files from Image Explorer in order to extract them, which you can do in Windows Explorer. However, you can drag and drop files and folders into an image by using Image Explorer.

C.1.4 Opening an Image

1. Start Image Explorer.
2. Click  on the toolbar, browse for and select the image (`.zmg`) file, then click *Open*.

   For Windows, the default image location should open (`...\content-repo\images`).

   For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory to access the image file.
3. Browse for and select the image file.

   Large image files might take a few moments to open.

C.1.5 Saving Image Changes and Exiting the Utility

To save your changes when exiting the utility:

1. Click *File* > *Save* or *Save As*.

   For Windows, the default image location should open (`...\content-repo\images`).

   For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory for saving the file.

If you have a subdirectory structure under `images`, browse for the location to save the image file.

2 Click *File* > *Exit* to close the utility.

C.1.6 Managing Image Properties

You can view the properties of an image file or any item in its content, including modifying some of the properties:

- "Viewing and Modifying the Properties of the Image File" on page 143
- "Viewing the Properties of an Image File Item" on page 143
- "Changing a Partition's Size" on page 144

Viewing and Modifying the Properties of the Image File

1 Click *File* > *Open*.

For Windows, the default image location should open (`...\content-repo\images`).

For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory to access the image file.

2 Browse for and select the image file.

Large image files might take a few moments to open.

3 Select the top line of the opened image file.

This is the line that displays the path to the `.zmg` file.

4 Click *File* > *Properties*.

You can also right-click the top line, then select *Properties*.

5 (Optional) Fill in the fields:

Description: Specify useful information, such as its purpose or its important content.

Author: Specify the author of this version of the image.

Comments: Specify any information that is helpful.

6 Save the image file to save your properties changes.

7 To close the properties dialog box, click *OK*.

Viewing the Properties of an Image File Item

1 Click *File* > *Open*.

For Windows, the default image location should open (`...\content-repo\images`).

For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory to access the image file.

2 Browse for and select the image file.

Large image files might take a few moments to open.

3 Select a partition, directory, or file in the image.

For other information on a partition's properties, see Section , "Changing a Partition's Size," on page 144.

4 Click *File* > *Properties*.

You can also right-click the item, then select *Properties*.

5 To close the properties dialog box, click *OK*.

Changing a Partition's Size

You can change a partition's size for the next time the image is applied to a device. You can edit this value for base images only; you cannot edit this value for add-on images.

If the number that you specify in the *Original Size* text box exceeds the size of the target hard drive, ZENworks automatically uses the entire disk. Therefore, you can specify a value larger than exists on the target device.

However, if you specify a smaller disk space size than is on the target device, only that amount of disk space is used, so the remaining disk space is unused. For example, if you create a base image of a device with a 20 GB hard drive and you want to then place that image on a new device with a 60 GB hard drive, 40 GB of that drive is unused.

You cannot decrease the number in the *Original Size* text box to a smaller value that what is shown in the *Minimum Size* text box.

To modify the partition's size:

1 Click *File* > *Open*.

For Windows, the default image location should open (`...\content-repo\images`).

For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory to access the image file.

2 Browse for and select the image file.

Large image files might take a few moments to open.

3 Select a partition.

4 Click *File* > *Properties*.

You can also right-click the partition, then select *Properties*.

5 In the *Original Size* field, specify the new partition size.

6 Click *OK* to save the change.

This only saves the partition size change. You must save the image file for it to be in effect the next time the image is applied.

C.1.7 Image File Operations

You can do the following with an image file:

- "Compressing an Image File" on page 145
- "Splitting an Image" on page 146
- "Hiding and Removing Content in the Image File" on page 147
- "Configuring File Sets" on page 148

- "Extracting Content as Files" on page 149
- "Extracting Content as an Add-on Image" on page 149
- "Creating an Add-on Image" on page 150

Compressing an Image File

You can compress an uncompressed image (including images created by previous versions of ZENworks) by 40 to 60 percent of the original file size.

You can compress an image in two ways:

- "Compressing an Opened Image File" on page 145
- "Compressing an Unopened Image File" on page 146

Compressing an Opened Image File

Use this dialog box to set compression options so that it takes less time to restore the image file or less space to store the file on your Imaging server.

IMPORTANT: If you have used *Delete* to hide files in the image, they are removed from the image during compression.

To compress the image file:

1. Click *File* > *Open*.

   For Windows, the default image location should open (`...\content-repo\images`).

   For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory to access the image file.
2. Browse for and select the image file.

   Large image files might take a few moments to open.
3. Click *File* > *Compress Image*.
4. Fill in the fields:

   Image File to Compress: Specifies the name of the existing imaging file to compress.

   Save Compressed Image As: Click the browse button next to this field to specify the location and filename under which to save the image.

   Compression Level: Specify an image-compression level:

   - **Compress for Speed:** Takes the least amount of time to compress but creates the largest compressed image file.
   - **Balanced Compression:** Represents a compromise between compression time and image file size. This option is used by default when an image is created.
   - **Compress for Size:** Creates the smallest image file but takes longer to compress.
5. Click *Compress* to compress the image file, using the settings you specified.

Compressing an Unopened Image File

Use this dialog box to set compression options to quickly compress an image file without waiting for the file to fully load into Image Explorer.

To quickly compress an image file:

1. Click *Tools* > *QuickCompress*.
2. Fill in the fields:

   Image File to Compress: Specify or browse to an existing imaging file to compress.

   Save Compressed Image As: Specify the location and filename under which to save the image, or click the browse button next to this field to locate and select it.

   Compression Level: Specify an image-compression level:

   - **Compress for Speed:** Takes the least amount of time to compress but creates the largest compressed image file.
   - **Balanced Compression:** Represents a compromise between compression time and image file size. This option is used by default when an image is created.
   - **Compress for Size:** Creates the smallest image file but takes longer to compress.
3. Click *Compress* to compress the image file using the settings you specified.

Splitting an Image

You can split an image file into separate files so that you can span the entire image across several CDs or DVDs.

When you split a device image and span it across several CDs or DVDs, you are essentially creating a base image on the first CD or DVD. The remaining CDs or DVDs are add-on images.

Because images are split by placing individual files into different images, an image cannot be split if it contains any single file that is larger than the specified maximum file size.

To restore a device image that has been spanned across several CDs or DVDs you should restore the first CD or DVD before restoring the remaining CDs or DVDs containing the add-on images. For more information, see "Manually Restoring an Image on a Device" on page 101.

Restoring split Images is done using bundles, such as restoring a base plus add-ons. For more information, see "Creating an Add-On Image from Files in a File System" on page 101.

To split an image:

1. Click *Tools* > *Split Image*.
2. Fill in the fields:

   Image File to Split: Enter or browse to an existing base image file to split.

   Directory to Store Split Images: Specify the location and filename under which to save the split-image files, or click the browse button next to this field to locate and select it.

   The split-image files are named automatically. For example, if you enter `image.zmg` in the *Image File to Split* field, the first split-image file is named `image_base.zmg`, the second file is named `image_a1.zmg`, the third file is named `image_a2.zmg`, and so forth. The `image_base.zmg` file contains files that allow the device to boot to the operating system. The add-on images (`image_a1.zmg`, `image_a2.zmg`, etc.) contain additional files.

Maximum Split File Size _ MB: Specify the maximum size of each split-image file. Depending on the size of the original image and the number you enter in this field, ZENworks creates as many files as necessary to split the entire image into separate split-image files.

3 To split the image file into as many files as necessary, using the settings you specified, click *Split*.

Hiding and Removing Content in the Image File

You can hide a directory or file from being used when the image is applied to a device. You can also permanently remove hidden or excluded directories and files from an image file.

- "Hiding Directories or Files in the Image" on page 147
- "Unhiding Directories or Files in the Image" on page 147
- "Removing Hidden Directories and Files from the Image File" on page 148

Hiding Directories or Files in the Image

You can hide directories or files so that they are not used when the image is applied to a device. This enables you save their existence so that you can later unhide them to be applied to the imaged device.

1 Click *File* > *Open*.

For Windows, the default image location should open (`...\content-repo\images`).

For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory to access the image file.

2 Browse for and select the image file.

Large image files might take a few moments to open.

3 Select the directories and files to be hidden.

IMPORTANT: When editing a base image, do not hide BPB files or the device won't be able to boot the new operating system after receiving the image.

---

4 Click *Image* > *Delete*.

You can also right-click the selected directories and files, then select *Delete*.

Deleting a file in the Image Explorer merely marks it for deletion; it can still be retrieved. A file marked as deleted is not removed from the image until the image is purged; files and folders marked as deleted are not restored during imaging.

Unhiding Directories or Files in the Image

You can unhide directories or files so that they are available when the image is applied to a device.

1 Click *File* > *Open*.

For Windows, the default image location should open (`...\content-repo\images`).

For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory to access the image file.

2 Browse for and select the image file.

Large image files might take a few moments to open.

3 Select the directories and files that were previously hidden that you want to unhide.

4 Click *Image* > *Undelete*.

You can also right-click the selected directories and files, then select *Undelete*.

This makes them available in the image when it is applied to a device.

Removing Hidden Directories and Files from the Image File

To permanently remove hidden directories and files from the open image in order to create a different version of the image file:

1 Click *File* > *Open*.

For Windows, the default image location should open (`...\content-repo\images`).

For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory to access the image file.

2 Browse for and select the image file.

Large image files might take a few moments to open.

3 Click *File* > *Purge Files*.

4 Browse to the image filename or specify a new image filename, then click *OK*.

You can save over the original image file to make this modification, or create another version of the image with the hidden directories and files removed.

For Windows, the default image location should open (`...\content-repo\images`).

For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory for saving the file.

If you have a subdirectory structure under `images`, browse for the location to save the new image file.

Configuring File Sets

For information on file sets, see Appendix B, "File Sets," on page 139.

To configure a file set:

1 Click *File* > *Open*.

For Windows, the default image location should open (`...\content-repo\images`).

For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory to access the image file.

2 Browse for and select the image file.

Large image files might take a few moments to open.

3 Select the directories and files in the image that you want excluded from the image.

Ways that you can select content:

- Click a single file in the right pane.
- Use the Shift and Ctrl keys to select multiple files in the right pane.
- Individually select partitions and directories in the left pane. Any partition or directory that you select includes everything under it.

- Select a partition or directory in the left pane, then click *Edit* > *Select All* to select all files listed in the right pane. Subdirectories are not included.

4. Do one of the following to exclude the selected files and directories from the image:
   - Click *Edit* > *File Sets*, then select one of the options from *Exclude from Set 1* through *Exclude from Set 10*.

     You can also right-click your selection to access the *File Sets* menu options.
   - Click *Edit* > *File Sets* > *Edit* to open the File Sets dialog box, do the following as applicable, then click *OK* to exit the dialog box:
     - **Exclude Specific Items:** To exclude the selected directories and files from specific file set numbers, click the check box for each set number.

       This causes all selected directories and files to be excluded from the image for any Image bundle assigned to the specified file set numbers.
     - **Exclude All Items:** To exclude the selected directories and files from all file sets of this image, click *Exclude All*.

       This causes all selected directories and files to be excluded from the image for any Image bundle assigned to any file set number.
     - **Include All Items:** To clear all of the check boxes, click *Exclude None*.

       This allows all selected directories and files to be included in the image.

     You can also right-click your selection to access the *File Sets* menu options.

Extracting Content as Files

To extract a file or directory from the open image and copy it to a directory:

1. Click *File* > *Open*.

   For Windows, the default image location should open (`...\content-repo\images`).

   For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory to access the image file.
2. Browse for and select the image file.

   Large image files might take a few moments to open.
3. Click *File* > *Save*.

   If any changes have been made, this must be done before you can extract the information.
4. Click *File* > *Extract* > *As Files*.
5. Browse to and select a directory for the files, then click *OK*.

Extracting Content as an Add-on Image

To extract a file or directory from the open image as an add-on image:

1. Click *File* > *Open*.

   For Windows, the default image location should open (`...\content-repo\images`).

   For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory to access the image file.

2 Browse for and select the image file.

   Large image files might take a few moments to open.

3 Click *File* > *Save*.

   If any changes have been made, this must be done before you can extract the information.

4 Click *File* > *Extract* > *As Add-on Image*.

5 Specify the name and location of the new add-on image, then click *OK*.

Creating an Add-on Image

You can create an add-on image from existing directories and files on your system and add partitions to the new add-on image.

1 Click *File* > *New*.

2 To add a partition, click the root of the image, click *Image*, then click *Create Partition*.

   You cannot add a partition to an existing image.

3 Do any of the following to add content:

   - Browse to the directories and files you want the add-on image to contain, then drag or copy the directories and files into the right pane from your file browser.
   - Click *Image* > *Add Files* and select the files to be added.
   - Click *Image* > *Add Directory* and select the directories to be added.
   - Click the *Add Directory* icon and select the directories to be added.
   - Click the *Add File* icon and select the files to be added.

4 Click *File* > *Save As*, then specify the filename of the add-on image, including the `.zmg` filename extension.

   For Windows, the default image location should open (`...\content-repo\images`).

   For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory for saving the file.

   If you have a subdirectory structure under `images`, browse for where to save the new image file.

C.1.8 Modifying Image Content

You can modify the content of an image file in the following ways:

- “Adding Directories and Files” on page 150
- “Creating a New Directory” on page 151
- “Creating a New Partition” on page 151
- “Resizing a Partition” on page 151
- “Adding a Windows Registry File” on page 152

Adding Directories and Files

To add directories and files to the open image:

1 Click *File* > *Open*.

For Windows, the default image location should open (`...\content-repo\images`).

For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory to access the image file.

2. Browse for and select the image file.

   Large image files might take a few moments to open.

3. Do any of the following to add content:
   - Browse to the directories and files you want the add-on image to contain, then drag or copy the directories and files into the right pane from your file browser.
   - Click *Image* > *Add Files* and select the files to be added.
   - Click *Image* > *Add Directory* and select the directories to be added.
   - Click the *Add Directory* icon and select the directories to be added.
   - Click the *Add File* icon and select the files to be added.
4. Browse to and select the files or directory, then click *Add* or *OK*.

   You can select multiple files using the Shift and Ctrl keys.

5. Repeat these steps as necessary.

Creating a New Directory

To create a directory in the open image:

1. Click *File* > *Open*.

   For Windows, the default image location should open (`...\content-repo\images`).

   For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory to access the image file.

2. Browse for and select the image file.

   Large image files might take a few moments to open.

3. Browse to the partition or directory in the left pane where you want to create the directory, then click *Image* > *Create Directory*.

   You can also click the *New Directory* icon.

4. Specify the name of the directory, then click *OK*.

Creating a New Partition

New partitions cannot be created in an existing base or add-on image that you opened for editing. You can only create a new partition in a new image file. For more information, see “Adding Partitions” on page 152.

Resizing a Partition

You can resize the partitions in a base image, but not an add-on image. For more information, see “Changing a Partition’s Size” on page 144.

Adding a Windows Registry File

(Windows only) To add specific Windows registry settings that are to be applied after the open image is laid down:

1. Click *File* > *Open*.

   The default image location (`...\content-repo\images`) should open.

2. Browse for and select the image file.

   Large image files might take a few moments to open.

3. Select a partition.

4. Click *Image* > *Add Registry File*.

5. Select the registry (`.reg`) file that contains the settings, then click *Add*.

   The registry file is added to a fixed, known area of the partition and is applied by the ZENworks Imaging Windows Agent (ziswin) when the device reboots after receiving the image.

C.1.9 Creating a New Image File

Do the following to create a new image file:

- "Creating, Configuring, and Saving the New Image File" on page 152
- "Selecting New Image File Options" on page 152

Creating, Configuring, and Saving the New Image File

1. Click *File* > *New*.
2. Configure the new image file using the instructions in "Selecting New Image File Options" on page 152, then return to Step 3.
3. To save the new image file, click *Save As*.

   For Windows, the default image location should open (`...\content-repo\images`).

   For Linux, the file browser opens to the `.../content-repo` directory; you need to click the `/images` directory for saving the file.

   If you have a subdirectory structure under `images`, browse for where to save the new image file.

4. Specify an image filename, including the `.zmg` filename extension, then click *Save*.

Selecting New Image File Options

You can do the following in this new image file:

- "Adding Partitions" on page 152
- "Adding Content" on page 153
- "Configuring File Sets" on page 153

Adding Partitions

1. Select the top line of the new image file.

This is the line that will display the path to the new `.zmg` file when you save it.

2. Click *Image* > *Create Partition*.
3. Repeat Step 1 through Step 2 as necessary.
4. To add content to the partitions, continue with "Adding Content" on page 153.

Adding Content

1. See Section C.1.8, "Modifying Image Content," on page 150 for instructions on adding new content.
2. Continue with "Configuring File Sets" on page 153, or return to Step 3 in "Creating, Configuring, and Saving the New Image File" on page 152.

Configuring File Sets

1. See "Configuring File Sets" on page 148 for instructions on configuring file sets.
2. Return to Step 3 in "Creating, Configuring, and Saving the New Image File" on page 152.

C.2 Novell ZENworks Configuration Management Imaging Agent (novell-ziswn)

The Novell ZENworks client (which includes novell-ziswn) should be installed on devices where you want to apply images. For information on installing the client on your devices, see the "Installing the ZENworks Adaptive Agent" in the *ZENworks 10 Configuration Management Administration Quick Start*.

Installing the Configuration Management client automatically installs the Novell ZENworks Configuration Management Imaging Agent (novell-ziswn). Therefore, every Primary Server is an imaging server.

The Imaging Agent's purpose is to save certain device-unique data (such as IP addresses and host names) to an area on the hard disk that is safe from imaging. The Imaging Agent records this information when you install it on the device. Then the agent restores this information from the image-safe area after the device has been imaged. This allows the device to use the same network identity as before.

If a device is new and does not contain a unique network identity, the default settings that you have configured for the Management Zone are applied when you image the device using a Preboot Services Imaging bundle.

The data that the Imaging Agent saves to (or restores from) the image-safe area includes the following:

- Whether a static IP address or DHCP is used
- If a static IP address is used:
  - IP address
  - Subnet mask
  - Default gateway (router)
- DNS settings
  - DNS suffix

- DNS hostname
- DNS servers

Novell-ziswn usually runs automatically. However, if you want to run it manually, see "Understanding the Arguments" on page 170 for the command line arguments that can be used with the Imaging Agent.

C.3 Image-Safe Data Viewer and Editor (zisview and zisedit)

After booting a device from an imaging boot media (PXE, CD, DVD, or ZENworks partition), you can enter `zisedit` and `zisview` at the imaging maintenance mode prompt to edit and view the image-safe data for that device.

The following sections contain additional information:

- Section C.3.1, "Information Displayed by the Image-Safe Data Viewer," on page 154
- Section C.3.2, "Using the Image-Safe Data Viewer," on page 156
- Section C.3.3, "Using the Image-Safe Data Editor," on page 157

C.3.1 Information Displayed by the Image-Safe Data Viewer

After booting a device from an imaging boot media, enter `zisview` at the imaging maintenance mode prompt to view the image-safe data for that device.

The image-safe data viewer (`zisview`) displays the following information about the device:

Table C-1 *zisview Information*

Category	Information
Image-safe Data	◆ **Version:** The version number of the Novell ZENworks Configuration Management Imaging Agent (novell-ziswn). ◆ **Just Imaged Flag:** If this is set to False, the Imaging Agent reads data from Linux and writes it to the image-safe data store. If this is set to True, the Imaging Agent reads data from the image-safe data store and writes it to Linux. ◆ **Scripted Image Flag:** If this is set to True, the last imaging operation was a scripted image. If this is set to False, the last imaging operation was not a scripted image. ◆ **Last Base Image:** The last base image that was restored to the device. ◆ **Last Base Image Time:** The time stamp of the last base image that was restored to the device. ◆ **Last Base Image Size:** The size of the last base image that was restored to the device. ◆ **Last Base Image Address:** The IP address of the last base image that was restored to the device. ◆ **Script Checksum:** Displays the checksum value representing the last script run. The ZENworks Imaging Engine uses the checksum to prevent the same script from re-running on the device unless you specify in ZENworks Control Center that you want to rerun the same script.
Workstation Identity Information	If the device is a member of a Management Zone or there is image-safe data present: ◆ **Zone GUID:** The Management Zone that contains the device, if it has been imported. ◆ **Device GUID:** The Globally Unique Identifier of this computer's device. ◆ **Device Index:** The device identification number. If the device is not a member of a Management Zone and image-safe data is not present: ◆ **Workstation Tree:** The tree that contains the device, if it has been created in a tree. ◆ **Workstation DN:** The device's DN, if known. ◆ **Workstation ID:** The device identification number, if known. For all devices: ◆ **Win 9x Computer Name:** The computer name for the device. ◆ **Windows Workgroup:** The Microsoft network workgroup of the device. ◆ **Windows SID:** The Windows Security ID of the device, which is a unique number that identifies this device in Windows.

Category	Information
Network Information	◆ **DHCP:** Displays whether this device uses DHCP to obtain its IP address. ◆ **IP Address:** The static IP address that this device uses. ◆ **Gateway:** The gateway that this device uses. ◆ **Subnet Mask:** The subnet mask that this device uses.
Production DNS Information	◆ **DNS Servers:** The number of DNS nameservers used for DNS name resolution. ◆ **DNS Suffix:** The DNS context of the device. ◆ **DNS Hostname:** The DNS local hostname of the device. Use this field to change the computer name of the device.
Intel iAMT Information	◆ **iAMT Enterprise Name.**

C.3.2 Using the Image-Safe Data Viewer

To use `zisview`, enter any of the following commands at the imaging maintenance mode prompt:

Table C-2 *Data Viewer Commands*

Command	Explanation
`zisview`	Displays all image-safe data.
`zisview -z field`	Displays information about a specific field or fields. *field* is one or more field names separated by a space. *field* is not case sensitive. All of the following are valid field names (the corresponding minimum names that can also be entered on the command line follow each field name in parenthesis): JustImaged (J) ScriptedImage (SC) LastBaseImage (L) Zone GUID (T) Device GUID (ObjectDN) Device Index (N) Windows WorkGroup (WorkG) Windows SID (SI) WorkstationID (Works) DHCP (DH) IP (I) Gateway (Gateway) Mask (M) DNSServerCount (DNSServerC) DNSServer (DNSServer) DNSSuffix (DNSSu) DNSHostName (DNSH)

Command	Explanation
`zisview -s`	Creates a script that can be used to generate environment variables that contain all of the image-safe data fields.
`zisview -h`	Displays help for `zisview`.

C.3.3 Using the Image-Safe Data Editor

After booting a device from an imaging boot media, you can enter `zisedit` at the imaging maintenance mode prompt to change, clear, or remove information the image-safe data for that device.

To use `zisedit`, enter any of the following commands at the prompt:

Table C-3 *zisedit Commands*

Command	Explanation
`zisedit`	Displays a screen showing all of the image-safe data fields. You can add or change any of the information in the fields.
`zisedit` *`field=new_information`*	You can change the information for one field using this syntax, where *field* is any valid field name and *new_information* is the information you want this field to contain. *field* is not case sensitive. For example, enter `zisedit Mask=255.255.252.0` to enter this information in the *subnet mask* field. All of the following are valid field names (the corresponding minimum names that can also be entered on the command line are shown in parenthesis after each field name): JustImaged (J) ScriptedImage (SC) LastBaseImage (L) Zone GUID (T) Device GUID (ObjectDN) Device Index (N) Windows WorkGroup (WorkG) Windows SID (SI) WorkstationID (Works) DHCP (DH) IP (I) Gateway (Gateway) Mask (M) DNSServerCount (DNSServerC) DNSServer1 (DNSServer1) DNSSuffix (DNSSu) DNSHostName (DNSH)
`zisedit -c`	Clears all image-safe data fields.
`zisedit -r`	Removes the image-safe data store.

Command	Explanation
`zisedit -h`	Displays help for `zisedit`.

C.4 ZENworks Imaging Floppy Boot Disk Creator (zmediacreator)

You can use this utility to do the following:

- Create a floppy boot diskette to help devices that cannot boot from their CD or DVD to do so
- Manage the `settings.txt` file
- Create a Preboot Bootable Image (PBI)

The ZENworks Imaging Media Creator utility must run on a Windows device. Its executable is located on your Windows ZENworks Imaging Server at:
`installation_path``\novell\zenworks\bin\preboot\zmediacreator.exe`

For instructions on using the utility, see Section 2.2.3, "Configuring with ZENworks Imaging Media Creator," on page 41.

C.5 Imaging Configuration Parameters (settings.txt)

The `settings.txt` file contains parameters that control how the imaging boot process occurs. You should maintain the working copy of `settings.txt` at the root of the imaging boot device (CD or DVD, or ZENworks partition):

Windows: *`installation_path`*`\novell\zenworks\bin\preboot\`

Linux: `/opt/novell/zenworks/zdm/winutils/`

`Settings.txt` is a plain text file that contains various parameters, each on a separate line. Each parameter has the general format of PARAMETER=value. Lines that begin with a pound sign (#) signify comments and are ignored during the imaging boot process.

You can edit this file manually in a text editor, or by making configuration changes in the `zmediacreator.exe` utility (see Section C.4, "ZENworks Imaging Floppy Boot Disk Creator (zmediacreator)," on page 158).

IMPORTANT: If you manually edit the `settings.txt` file to provide any paths to executables, make sure that you provide the full path, or the executable might not run.

The format and function of each parameter in the `settings.txt` file are described in Table C-4:

Table C-4 *Settings.txt File Parameters*

Parameter	Specifies
PROMPT	Specifies whether to prompt for each configuration setting when you boot a device from the imaging boot media. If you leave this parameter commented out or set it to No, the device boots using the configuration settings specified in `settings.txt` and you can't override the settings when booting, unless you type `config` at the boot prompt before the operating system begins to load. If you set this parameter to Yes, you are automatically prompted for each configuration setting when booting.
MANUALREBOOT	Specifies whether you must reboot a device manually after it was booted from the imaging boot media in automatic mode. If the device was booted from the imaging boot media in manual mode, you must always reboot the device manually. If you boot a device from the imaging boot media and you let the boot process proceed in automatic mode, the ZENworks Imaging Engine starts and checks the Imaging Server to see if an imaging operation should be performed on the device. If so, it performs the imaging operation and quits. If not, it quits without doing anything. What happens next depends on how you set this parameter: ◆ If you leave it commented out or set it to No, you are prompted to remove the imaging boot media (if necessary) and press any key to reboot the device to the native operating system. ◆ If you set this parameter to Yes, the device doesn't reboot automatically, but instead displays the imaging maintenance mode prompt, allowing you to perform additional imaging-related tasks using the Linux menu or at the command line. This is helpful if you want to do things such as check the current partition information or the image-safe data before booting to the native operating system. Example: MANUALREBOOT=YES
PARTITIONSIZE	Specifies the number of megabytes to allocate to the ZENworks partition if you choose to create one locally on a device when you boot the device from the imaging boot media. The default size is 150 MB. The minimum partition size is 50 MB. The maximum size allowed is 2048 MB (2 GB). If you plan to store an image in the ZENworks partition, such as to enable the device to be restored to a certain state without connecting to the network, you might want to specify a larger size for this parameter. Example: PARTITIONSIZE=500
netsetup	If you are using DHCP, keep this option enabled. If you are using a specific IP address, replace "dhcp" with "1" and uncomment and configure the other three IP address lines (HostIP, netmask, and gateway). Example: netsetup=dhcp

Parameter	Specifies
HostIP	The IP address used by a device to communicate on the network when you boot the device from the imaging boot media, if a static IP address is needed. Example: HostIP=123.45.67.89 If you want DHCP to be used, leave this and the next two parameters commented out.
netmask	Specifies the subnet mask to be used by the device, if the device is using a static IP address. Example: netmask=255.255.252.0 If DHCP is being used, leave this parameter commented out.
gateway	Specifies the IP address of the gateway (router) to be used by the device, if the device is using a static IP address. Example: gateway=123.45.67.254 If DHCP is being used, leave this parameter commented out.
nameserver	Specifies the list of DNS name servers, by IP address, to use for resolving DNS domain names used on this device. Use a space to separate entries. Example: nameserver=123.45.6.7 123.45.6.9 If DHCP is being used, leave this parameter commented out.
domain	Specifies the list of DNS domain suffixes to be used to identify connections used by this device. Use a space to separate entries. For example: domain=example.novell.com example.xyz.org If DHCP is being used, leave this parameter commented out.

Parameter	Specifies
PROXYADDR	Specifies the IP address or full DNS name of the imaging (proxy) server to connect to when you boot a device from the imaging boot media in auto-imaging mode. Examples: PROXYADDR=123.45.67.89 PROXYADDR=imaging.xyz.com This parameter is used to set the PROXYADDR environment variable when the device is booted from an imaging boot media (other than PXE). The ZENworks Imaging Engine then reads this variable to determine which server to contact if it is running in automatic mode. Whether it is running in automatic or manual mode, the ZENworks Imaging Engine attempts to log the imaging results to the server specified in this variable. **IMPORTANT:** This parameter is set automatically when booting PXE and normally should not be modified in the copy of `settings.txt` that is used by PXE: Windows: *`installation_path`*`\novell\zenworks\share\tftp\boot\` Linux: `/srv/tftp/boot/`
export IMGCMD	Alters the behavior of automated imaging. If this variable is defined as a script (or a series of commands), then that script (or those commands) are executed instead of the usual `img -auto` command (see `/bin/imaging.s`).
netdevice=eth0	Selects a specific network adapter. If necessary, replace `eth0` with the correct interface.

C.6 Imaging Boot Parameter for PCMCIA Cards

When performing imaging work using CDs or DVDs, some computers (particularly laptops) with PCMCIA cards can hang during the boot process. By default, Configuration Management allows the loading of a PCMCIA driver when a device boots for imaging work. Although loading this driver does not normally cause problems, you can use a command line parameter to prevent it from loading.

To prevent the PCMCIA card manager from starting, enter the following at the imaging maintenance mode prompt when booting from a CD or DVD:

```
manual NoPCMCIA=1
```

C.7 Imaging Server

The Imaging Server is a software component of the Configuration Management server. It enables imaging clients to connect with the network to receive imaging services, including:

- Storage or retrieval of an image on a server

- Automatic imaging based on settings created in ZENworks Control Center
- Logging of the results of an imaging operation
- A multicast imaging session

Use the Imaging Server software to do the following:

- Section C.7.1, “Initiating the Imaging Processes,” on page 162
- Section C.7.2, “Viewing Information About Imaging Requests,” on page 171
- Section C.7.3, “Starting a Manual Multicast Session,” on page 172

C.7.1 Initiating the Imaging Processes

An Imaging Server service or daemon is initiated by running its executable at a command line, which in turn calls the program executable and uses the configuration set in the corresponding `.conf` file. You use these `.conf` files to set parameters, because scripts usually accept only arguments instead of parameters.

The following ZENworks services or daemons run the Imaging Server processes:

- “Novell-pbserv” on page 162
- “Novell-proxydhcp” on page 163
- “Novell-tftp” on page 165
- “Novell-zmgprebootpolicy” on page 168
- “Understanding the Arguments” on page 170

Novell-pbserv

Novell-pbserv provides imaging services to devices.

Novell-pbserv is started automatically when installing Configuration Management, or when rebooting the server.

- “Understanding the Novell-pbserv Components” on page 162
- “Configuring Novell-pbserv” on page 163

Understanding the Novell-pbserv Components

To initiate novell-pbserv, enter the following command:

Windows: *`installation_path`*`\novell\zenworks\bin\preboot\novell-pbserv.exe`

Linux: `/etc/init.d/novell-pbserv`

Table C-5 lists the arguments for this command, the executable it starts, and the configuration file it uses:

Table C-5 *Novell-pbserv Command Details*

Script Arguments:	start, stop, restart, force-reload, status, showpid (for descriptions of these arguments, see “Understanding the Arguments” on page 170)

Linux Executable:	`/opt/novell/zenworks/preboot/bin/novell-pbservd`
Linux Configuration File:	`/etc/opt/novell/zenworks/preboot/novell-pbserv.conf`
Windows Configuration File:	*`installation_path`*`\novell\zenworks\conf\preboot\novell-pbserv.conf`

Configuring Novell-pbserv

The novell-pbserv configuration file (`novell-pbserv.conf`), contains the following parameters:

Table C-6 *Novell-pbserv Parameters*

Parameter	Description
EnableLogging=YES	If YES, a log file is created for debug messages. This is the default. If NO, no log file is created for debug messages. The `novell-pbserv.log` file is created in: **Windows:** *`installation_path`*`\novell\zenworks\logs\preboot` **Linux:** `/var/opt/novell/log/zenworks/preboot`
IPAddress=	The IP address to be used by imaging for all communications. If nothing is entered, novell-pbserv attempts to detect an IP address. Can be used in a clustering environment to specify the IP address of the virtual server. Can also be used in a multiple-NIC environment to bind the Imaging Server to a specific IP address. By default, this is commented out.
LIBRARY_NAME=	Full path of the library to be loaded by the ZENWorks Imaging Service. If the library name is not specified, then by default `libzenimgweb.so` is loaded from the `/opt/novell/zenworks/preboot/lib` directory. By default, this is commented out.

Novell-proxydhcp

Novell-proxydhcp provides PXE devices with the information that they require to be able to connect to the ZENworks Preboot Services system.

Novell-proxydhcp is not started automatically when installing Configuration Management.

- “Understanding the Novell-proxydhcp Components” on page 163
- “Configuring novell-proxydhcp” on page 164

Understanding the Novell-proxydhcp Components

To initiate novell-proxydhcp, enter the following command:

Windows: *installation_path*\novell\zenworks\bin\preboot\novell-proxydhcp.exe

Linux: /etc/init.d/novell-proxydhcp

Table C-7 lists the arguments for this command, the executable it starts, and the configuration file it uses:

Table C-7 *Novell-proxydhcp Command Details*

Script Arguments:	start, stop, restart, force-reload, status, showpid, install (for descriptions of these arguments, see "Understanding the Arguments" on page 170)
Executable:	/opt/novell/bin/novell-proxydhcpd
Linux Configuration File:	/etc/opt/novell/novell-proxydhcp.conf
Windows Configuration File:	*installation_path*\novell\zenworks\conf\preboot\novell-proxydhcpd.conf

Configuring novell-proxydhcp

The novell-proxydhcp configuration file (novell-proxydhcp.conf), contains the following parameters.

Parameters that are not commented out, but contain no values, are given a default value.

Table C-8 *Novell-proxydhcp Parameters*

Parameter	Description
LocalDHCPFlag = 0	Indicates whether the DHCP server for this subnet resides on the same server as novell-proxydhcp. 0 (the default) means novell-proxydhcp is not running on the same server as the DHCP service. 1 means they are running on the same server. The Proxy DHCP server needs to behave slightly differently if it is loaded on the same server as the DHCP service.
LocalInterface = 10.0.0.1	Indicates the IP address to be used by the Proxy DHCP server. This setting is intended only for use on servers with multiple LAN interfaces. The IP address must be valid on the server. By default, this parameter is commented out.
NovellPolicyEngine = 10.0.0.1	The IP address of the server where a Novell Preboot policy engine is running. Most often, this is a ZENworks imaging service or daemon. If no value is specified, the Proxy DHCP assumes that the service or daemon is running on the same server. By default, this parameter is commented out.
NBPx86 = nvlnbp.sys	The name of the boot file this service will suggest for all x86 computers, such as nvlnbp.sys.

Parameter	Description
MenuTimeout = 2	The number of seconds the F8 menu is displayed before automatically choosing the first option, which is always this server and its default network bootstrap program (NBP). The default is 2 seconds.
ProxyLogLevel = 2	The value assigned here determines which events are entered in `novell-proxydhcp.log`. Specifying a high level in an active system can quickly fill the log. Valid values are: 0, 1, 2, 3, and 4. The default is 2. Each message from the Proxy DHCP server is assigned a priority level. If *ProxyLogLevel* is set to a value equal to or greater than a message's priority level, that message is entered in `novell-proxydhcp.log`. All other messages are ignored. Priority meaning: **0:** Critical information. Service start, stop, and critical events are logged. **1:** Warning information. Additionally, warning information is logged. **2:** Transaction information. All completed client transactions are logged. **3:** Request information. All client requests and Proxy DHCP requests received are logged, including ignored requests. If a request is ignored, the reason for ignoring it is also logged. **4:** Debugging information. All DHCP packets received and accepted are decoded and logged.
ProxyLogFile = *path*\novell-proxydhcp.log	The file where all log file entries are placed. The `novell-proxydhcp.log` file is created in: **Windows:** *`installation_path`*`\novell\zenworks\logs\preboot` **Linux:** `/var/opt/novell/log/zenworks/preboot` By default, this parameter is commented out.
ProxyLogFileSize = 15	The size of the *ProxyLogFile* file is controlled by the value of *ProxyLogFileSize*, where 15 is the default (in MB). When the log file exceeds the *ProxyLogFileSize* value, it is deleted and restarted.

Novell-proxydhcp is compliant with the following RFCs:

RFC 2131 - Dynamic Host Configuration Protocol
RFC 2132 - DHCP Options and BOOTP Vendor Extensions

Novell-proxydhcp is compliant with the Preboot Execution Environment (PXE) Specification v2.1 industry specification, published by Intel.

Novell-tftp

Novell-tftp provides TFTP services to imaging clients.

Novell-tftp is started automatically when installing Configuration Management, or when rebooting the server.

- "Understanding the Novell-tftp Components" on page 166

- “Configuring Novell-tftp” on page 166

Understanding the Novell-tftp Components

To initiate novell-tftp, enter the following command:

Windows: *`installation_path`*`\novell\zenworks\bin\preboot\novell-tftp.exe`

Linux: `/etc/init.d/novell-tftp`

Table C-9 lists the arguments for this command, the executable it starts, and the configuration file it uses:

Table C-9 *Novell-tftp Command Details*

Script Arguments:	start, stop, restart, force-reload, status, showpid (for descriptions of these arguments, see “Understanding the Arguments” on page 170)
Executable:	`/opt/novell/bin/novell-tftpd`
Linux Configuration File:	`/etc/opt/novell/novell-tftp.conf`
Windows Configuration File:	*`installation_path`*`\novell\zenworks\conf\preboot\novell-tftp.conf`

Configuring Novell-tftp

The novell-tftp configuration file (`novell-tftp.conf`), contains the following parameters for the Novell TFTP server.

Parameters that are not commented out, but contain no values, are given a default value.

Table C-10 *Novell-tftp Parameters*

Parameter	Description
TFTPInterface = 10.0.0.1	The IP address that is used for all TFTP communications. If a value is not given here, the service tries to detect one. This value is most useful for multihomed servers. By default, this parameter is commented out.

Parameter	Description
TransferBlockSize = 1428	This value determines the size of the data block used by the TFTP server to transmit and receive data to and from a client. Valid values are between 512 and 4428. For Ethernet networks, this value should be 1428. For token ring networks, this value can be 4428, but only if you are sure there are no Ethernet segments; otherwise, use 1428. Older TFTP clients might be restricted to 512 bytes, which was the original transfer block size before the adoption of RFC 2348. The Novell TFTP server is compatible with these clients. By default, this parameter is commented out.
TimeoutInterval = 1	This is the amount of time (in seconds) that the TFTP server waits for a client to acknowledge before resending a packet. However, because the TFTP server uses an adaptive algorithm to calculate the actual timeout interval, this value is only used as an initial value. It can increase or decrease, depending on the performance of the network. This value is only a default. It can be changed at the request of a client. See RFC 2349. Valid values are 1 through 60. By default, this parameter is commented out.
Linux -- TFTPDirectory = /srv/tftp	*TFTPDirectory* is the directory where the TFTP server can store and retrieve files. All paths submitted to the TFTP server by clients are assumed to be relative to this directory. Because TFTP has no security, you should not place files with sensitive information in this directory, and that you should place a space quota on it. The TFTP server does not load if this directory does not exist. By default, this parameter is commented out.
TFTPAllowWrites = 0	This tells the TFTP server whether to allow users to place new files on the server. Setting this variable to 0 (the default) makes the TFTP server more secure by not allowing users to place new files on the server. The other option is 1, which allows users to place new files on the server.
AllowOverwrites = 0	This tells the TFTP server whether to allow users to overwrite existing files on the server. Setting this variable to 0 (the default) makes the TFTP server more secure by not allowing users to overwrite files on the server. The other option is 1, which allows users to overwrite files on the server. TFTPAllowWrites must be set to 1 in order for the AllowOverwrites parameter to be recognized.

Parameter	Description
TFTPLogLevel = 2	The value assigned here determines which events are entered in `novell-tftp.log`. Specifying a high level in an active system can quickly fill the log. Valid values are: 0, 1, 2, 3, and 4. The default is 2. Each message from the TFTP server is assigned a priority level. If *TFTPLogLevel* is set to a value equal to or greater than a message's priority level, that message is entered in `novell-tftp.log`. All other messages are ignored. Priority meaning: **0:** Critical information. Service start, stop, and critical events are logged. **1:** Warning information. Only failed client transactions are logged. **2:** Transaction information. All completed client transactions are logged. **3:** Request information. All client requests and TFTP options are logged. **4:** Debugging information. All server events, including each packet received, are logged. By default, this parameter is commented out.
TFTPLogFile = *path*\novell-tftp.log	The file where all log file entries are placed. The `novell-tftp.log` file is created in: **Windows:** *`installation_path`*`\novell\zenworks\logs\preboot` **Linux:** `/var/opt/novell/log/zenworks/preboot` By default, this parameter is commented out.
TFTPLogFileSize = 15	The size of the log file is controlled by the value of *TFTPLogFileSize*, where 15 is the default (in MB). When the log file exceeds the *TFTPLogFileSize* value, it is deleted and restarted. By default, this parameter is commented out.

Novell-tftp is compliant with the following RFCs:

RFC 1350 -- THE TFTP PROTOCOL (REVISION2)
RFC 2347 - TFTP Option Extension
RFC 2348 - TFTP Blocksize Option
RFC 2349 - TFTP Timeout Interval and Transfer Size Options

Novell-zmgprebootpolicy

Novell-zmgprebootpolicy allows PXE devices to query the Configuration Management system for work to do and for Preboot Menu policies.

Novell-zmgprebootpolicy is started automatically when installing Configuration Management, or when rebooting the server.

- "Understanding the Novell-zmgprebootpolicy Components" on page 169
- "Configuring Novell-zmgprebootpolicy" on page 169

Understanding the Novell-zmgprebootpolicy Components

To initiate novell-zmgprebootpolicy, enter the following command:

Windows: *installation_path*\novell\zenworks\bin\preboot\novell-zmgprebootpolicy.exe

Linux: /etc/init.d/novell-zmgprebootpolicy

Table C-11 lists the arguments for this command, the executable it starts, and the configuration file it uses:

Table C-11 *Novell-zmgprebootpolicy Command Details*

Script Arguments:	start, stop, restart, force-reload, status, showpid (for descriptions of these arguments, see "Understanding the Arguments" on page 170)
Executable:	/opt/novell/zenworks/preboot/bin/novell-zmgprebootpolicyd
Linux Configuration File:	/etc/opt/novell/zenworks/preboot/novell-zmgprebootpolicy.conf
Windows Configuration File:	*installation_path*\novell\zenworks\conf\preboot\novell-zmgprebootpolicy.conf

Configuring Novell-zmgprebootpolicy

The novell-zmgprebootpolicy configuration file (novell-zmgprebootpolicy.conf), contains the following parameters.

Parameters that are not commented out, but contain no values, are given a default value.

Table C-12 *Novell-zmgprebootpolicy Parameters*

Parameter	Description
LocalInterface = 10.0.0.1	The IP address that is used by the Policy server. This setting is intended only for use on servers with multiple LAN interfaces. The address must be valid on the server. By default, this parameter is commented out.

Parameter	Description
PolicyLogLevel = 1	The value assigned here determines which events are entered in `novell-zmgprebootpolicy.log`. Specifying a high level in an active system can quickly fill the log. Valid values are: 0, 1, 2, 3, and 4. The default is 2. Each message from the novell-zmgprebootpolicy server is assigned a priority level. If *PolicyLogLevel* is set to a value equal to or greater than a message's priority level, that message is entered in `novell-zmgprebootpolicy.log`. All other messages are ignored. Priority meaning: **0:** Critical information. Service start, stop, and critical events are logged. **1:** Warning information. Only failed client transactions are logged. **2:** Transaction information. All completed client transactions are logged. **3:** Request information. All client requests are logged. **4:** Debugging information. All server events, including each packet received, are logged. By default, this parameter is commented out.
PolicyLogFile = *path*\novell-zmgprebootpolicy.log	The file where all log file entries are placed. The `novell-zmgprebootpolicy.log` file is created in: **Windows:** *`installation_path`*`\novell\zenworks\logs\preboot` **Linux:** `/var/opt/novell/log/zenworks/preboot` By default, this parameter is commented out.
PolicyLogFileSize = 15	The size of the log file is controlled by the value of *PolicyLogFileSize*, where 15 is the default (in MB). When the log file exceeds the *PolicyLogFileSize* value, it is deleted and restarted.
PrebootServer = 10.0.0.5	This field contains the address of the Imaging Server that should be used to resolve policies. By default, this parameter is commented out.
EnableAMTSupport = Yes	This feature is not currently supported in Novell ZENworks Configuration Management. This field enables or disables support for Intel's AMT technology. By default, this support is disabled by commenting out the parameter.

Understanding the Arguments

The following arguments are available for each of the Preboot Services daemons described above for Linux servers. Windows equivalents are noted.

Table C-13 *Script Arguments*

Argument	Function
start	For Linux, starts the daemon. Because novell-proxydhcp is optional, use this argument to start this service or daemon. However, this daemon does not automatically start when the server reboots. (See install below.) For Windows, open the Services dialog box, right-click the Novell service, then select *Start*.
start setjustimagedflag	(Linux only) For novell-ziswn only, sets the Just Imaged flag so that a device can be imaged by using its existing image safe data.
stop	For Linux, stops the daemon. For Windows, open the Services dialog box, right-click the Novell service, then select *Stop*.
restart	Stops and restarts the service or daemon if it is already running. For Windows, open the Services dialog box, right-click the Novell service, then select *Restart*.
force-reload	(Linux only) Causes the daemon's configuration file to be reloaded.
status	For Linux, displays the current status of the service or daemon. For example, if you enter `/etc/init.d/novell-pbserv status`, information similar to the following is returned: `Novell ZENworks Imaging Service running` On Windows, open the Services dialog box and review the *Status* column.

showpid	(Linux only) Displays the daemon's process ID.
	
	For example, if you enter `/etc/init.d/novell-pbserv showpid`, information similar to the following is returned:
	`Novell ZENworks Imaging Service running`
	`10211`

install	(Linux only) For novell-proxydhcp only, causes the daemon to be automatically loaded when the server boots.

C.7.2 Viewing Information About Imaging Requests

After the Imaging Server has started, you can view information about the status and results of the imaging requests that it has received from imaging clients. A statistical summary of these requests is shown on the server's command line. The statistics shown on this screen are explained below. All statistics are reset to zero if you restart the Imaging Server.

To view the multicast imaging information, at the server's command line enter:

Windows: `installation_path\novell\zenworks\bin\preboot\zmgcast.exe -status`

Linux: `/opt/novell/zenworks/preboot/bin/novell-zmgmcast -status`

The information in Table C-14 explains what is displayed:

Table C-14 *Imaging Request Statistics*

Statistic	Specifies
PXE Requests	The number of imaging requests of any kind that have been received by the Imaging Server since it was last started. This includes requests that failed, were denied, or were referred to other Imaging Servers. Information about each of these requests, such as the source, type, date/time, and results, is logged on the Imaging Server.
Images Sent	The number of images that the Imaging Server has sent to imaging clients since the Imaging Server was last started. This includes only images that were retrieved from this Imaging Server.
Images Received	The number of new images that have been received and stored on the Imaging Server since it was last started. This includes images that were received through client referrals.

C.7.3 Starting a Manual Multicast Session

At the imaging maintenance mode prompt, you can start a manual multicast session, see any sessions in progress, and delete sessions. For more information, see "Initiating a Multicast Session from Each Client" on page 119.

ZENworks Imaging Engine Commands

D

After booting a device from an imaging boot media, you can use the `img` command at the imaging maintenance mode prompt or use the ZENworks® Imaging Engine menu to do any of the following:

- Take an image of the device's hard disks
- Restore an image on the device's hard disks
- View or manipulate the device's hard disk partitions
- View the device's hardware configuration or image-safe data
- Display a menu from which you can also perform all of these tasks

Because the ZENworks Imaging Engine is a Linux application, the command syntax is case sensitive. The overall syntax is:

`img` *`mode`*

where *mode* is any of the mode commands described in the following sections:

- Section D.1, "Help Mode," on page 173
- Section D.2, "Automatic (Query for Work) Mode," on page 174
- Section D.3, "Make Mode," on page 175
- Section D.4, "Restore Mode," on page 181
- Section D.5, "Session Mode (Multicast Image Set)," on page 186
- Section D.6, "Partition Operations Mode," on page 189
- Section D.7, "ZENworks Partition Management Mode," on page 191
- Section D.8, "Dump Mode," on page 192
- Section D.9, "Information Mode," on page 193

Each mode command can be abbreviated to the first letter of its name. For example, `img -dump` can be abbreviated as `img -d`.

To access the ZENworks Imaging Engine menu and perform all of these tasks, enter `img` by itself. The ZENworks Imaging Engine menu is a character-based display where you can access the menu items by using the mouse or by using the Alt key with the highlighted menu option letters.

Exiting the ZENworks Imaging Engine menu returns you to the imaging maintenance mode prompt.

D.1 Help Mode

Use the `-help` mode command to get information about the `img` command if you don't have this documentation available.

In the ZENworks Imaging Engine menu, you can access help for legacy `img` commands by clicking *Help* > *Legacy Command-line Options*. The legacy commands still work, but the newer ZENworks Configuration Management commands introduce added functionality.

To use the Help mode:

- Section D.1.1, “Using the ZENworks Imaging Engine Menu for Help,” on page 174
- Section D.1.2, “Using the Imaging Maintenance Mode Prompt for Help,” on page 174

D.1.1 Using the ZENworks Imaging Engine Menu for Help

1. To display the ZENworks Imaging Engine menu, enter:
   `img`
2. Click *Help* to display the drop-down menu of help items.
3. Select a mode name to display the help for that mode command.

   The help includes the possible syntaxes for the command under SYNOPSIS and explanations for each command and parameter under OPTIONS.

D.1.2 Using the Imaging Maintenance Mode Prompt for Help

To display the help, enter:
`img -help mode`

where *mode* is the mode whose mode command you want help with.

Examples:

Table D-1 *Help Mode Commands and Parameters*

Example	Explanation
`img -help`	Displays a short description of all modes.
`img -help -m`	Displays information on how to use the Make mode.
`img -help -p`	Displays information on how to use the Partition mode.

D.2 Automatic (Query for Work) Mode

Use the `-auto` mode command to image the device automatically, based on any applicable Preboot Services default settings. The ZENworks Imaging Engine runs in this mode if you let the imaging boot process proceed without interruption, or if you type the command at the imaging maintenance mode prompt.

In this mode, the ZENworks Imaging Engine queries the Imaging Server specified in the PROXYADDR environment variable for any work to do. The Imaging Server checks the relevant Preboot Services default settings to determine what imaging tasks should be performed (if any), such as taking or restoring an image. It then instructs the ZENworks Imaging Engine to perform those tasks.

If any tasks involve storing or retrieving images with other Imaging Servers, the Imaging Server refers the ZENworks Imaging Engine to those servers to complete the tasks.

After the ZENworks Imaging Engine has completed its work, it communicates the results to the original Imaging Server, and the results are logged on it.

PROXYADDR is set in the `settings.txt` file on the CD or the ZENworks partition. It can be edited by using the `config` option when booting from the imaging CD. PROXYADDR can be the IP address, DNS name, or the name from the local `hosts` file.

If the `-auto` command is used when booted to the Manual Imaging mode, manual intervention might be required to complete some tasks, such as tasks contained in imaging scripts.

For information on configuring the settings that control what happens in this mode, see Section 2.4, "Configuring Preboot Services Defaults," on page 65.

To use the Automatic mode:

- Section D.2.1, "Using the ZENworks Imaging Engine Menu to Query for Work," on page 175
- Section D.2.2, "Using the Imaging Maintenance Mode Prompt to Query for Work," on page 175

D.2.1 Using the ZENworks Imaging Engine Menu to Query for Work

1. To display the ZENworks Imaging Engine menu, enter:
   `img`
2. Do any of the following:
   - On the menu bar, click *Imaging*, then click *Query for Work*.
   - Click *F9 Query for Work* on the task bar.
   - Press *F9*.

D.2.2 Using the Imaging Maintenance Mode Prompt to Query for Work

To use the automatic mode, enter:

```
img -auto
```

or

```
img -a
```

D.3 Make Mode

Use the `-make` mode command to take an image of the device and store it in a specified location. Normally, all partitions on the local hard disks are included in the image, but there are some exceptions noted in Table D-2 on page 177.

You can take an image of a device by using either the imaging maintenance mode prompt or by using the ZENworks Imaging Engine menu. For step-by-step instructions, see "Manually Taking an Image of a Device" on page 96. You can also use the Make Locally mode command to take an image of the device and store it in a partition on the local hard disk. For step-by-step instructions, see Section 3.1.3, "Setting Up Disconnected Imaging Operations," on page 106.

The image size corresponds to about half the size of the data in all of the device's partitions, except that the ZENworks partition and Compaq or Dell configuration partitions are always excluded. Devices with logical volumes (LVMs) are not supported for imaging.

The syntax of this mode depends on whether you store the image locally or on an Imaging Server (proxy).

The following sections contain additional information:

- Section D.3.1, “Make Locally,” on page 176
- Section D.3.2, “Make to Proxy,” on page 178

D.3.1 Make Locally

To use the Make Locally mode:

- “Using the ZENworks Imaging Engine Menu to Make an Image Locally” on page 176
- “Using the Imaging Maintenance Mode Prompt to Make an Image Locally” on page 177

Using the ZENworks Imaging Engine Menu to Make an Image Locally

1. To display the ZENworks Imaging Engine menu, enter:
   ```
   img
   ```
2. Click *Imaging* > *Make Image*.

   This displays the Make Image Wizard.
3. In the wizard, select *Local*, then click *Next*.

   The Make Local Image Wizard is displayed.
4. Fill in the fields:

   Path to Image Archive: Click *Browse* to select the location for the image file, or specify an existing path.

   Include Partitions: Click the check box for any partitions that you do not want to include in the image. By default, all partitions are selected.

   Compression: Specify any number from 0 to 9 where 0 means no compression, 1 means the least compression, and 9 means the most compression.
5. Click *Next* to continue.

   The next Make Image Wizard dialog box is displayed.
6. (Optional) Fill in the fields:

   Author: Specify who created the image file.

   Computer: Identify the computer where this image is being made.

   Image Description: Describe the image file’s content or purpose.

   Comments: Specify anything that might be helpful concerning this image.
7. Click *Next* to make the image.

   The ZENworks Imaging Engine Menu displays a progress bar while making image.
8. If the imaging process was successful, click *OK* in the Information dialog box, then click *Close* to return to a blank ZENworks Imaging Engine Menu display.

   If the imaging process was unsuccessful, determine and resolve the issue, then repeat these steps.

Using the Imaging Maintenance Mode Prompt to Make an Image Locally

Using the imaging maintenance mode prompt, the following example explains the syntax and available parameters that you can use with the "make locally" (`-makel`) mode command:

```
img -make -local local_filepath/filename.zmg
[-part=partition_number] [-comp=comp_level]
[-exclude=partition_number] [-include=partition_number]
```

where the [...] brackets indicate optional commands.

You can abbreviate `-make -local` as: `-m -local`, `-makel`, or `-ml`.

You can also abbreviate `-exclude` as `-x` and `-include` as `-I`.

For more information, see:

- "Command Details" on page 177
- "Examples" on page 178

Command Details

Table D-2 *Make Local Commands and Parameters*

Parameter	Specifies
local_filepath/*filename*.zmg	The image filename, including the `.zmg` extension (which is case sensitive), and any local path. However, the directories in the path must exist. If the file already exists, an error is given. You must use a different filename or delete the existing image file in order to use that filename.
-part=*partition_number* or -P=*partition_number*	The partition number of the local partition for where to store the image. It must be a primary partition. This partition is excluded from the image that is created. Be sure to specify an existing partition that has enough space to store the image file. Available partitions can be displayed using `img -dump`. If you omit the partition number from this parameter, or do not use this parameter, the image is stored in volatile RAM.
-comp=*comp_level*	*comp_level* is the amount of compression used when creating the image. Specify any number from 0-9. 0 means no compression. 1 is the same as *Optimize for Speed* and is used by default if you do not specify this parameter. 6 is similar to *Balanced*. 9 is the same as *Optimize for Space*, which provides the slowest performance.
-exclude=*partition_number* or -x=*partition_number* and -include=*partition_number* or -I=*partition_number*	The partition number of a local partition to exclude from the image or include in the image. You can repeat this parameter as needed to exclude or include multiple partitions. Available partitions can be displayed using `img -dump`. If you omit the exclude parameter, all partitions are included in the image except the one where the image is stored.

Examples

Table D-3 *Make Local Examples*

Example	Explanation
`img -makel /myimages/myimage.zmg`	Takes an image of all partitions and saves it to `myimages/myimage.zmg` in RAM.
`img -makel /myimages/myimage.zmg -x=2 -x=3`	Takes an image of all partitions except those in slots 2 and 3 and saves the image to `myimages/myimage.zmg` in RAM.

D.3.2 Make to Proxy

To use the Make Proxy mode:

- "Using the ZENworks Imaging Engine Menu to Make an Image on a Proxy" on page 178
- "Using the Imaging Maintenance Mode Prompt to Make an Image on a Proxy" on page 179

Using the ZENworks Imaging Engine Menu to Make an Image on a Proxy

1. To display the ZENworks Imaging Engine menu, enter:
   `img`
2. Click *Imaging* > *Make Image*.
   This displays the Make Image Wizard.
3. In the wizard, select *Server*, then click *Next*.
   The Make Server Image Wizard is displayed.
4. Fill in the fields:
   Server IP Address: Specify the IP address or DNS name of an Imaging Server. If you specified an Imaging Server for the `settings.txt` file when booting from the imaging CD, that Imaging Server's IP address is the default; otherwise, the IP address for the Imaging Server specified in the `settings.txt` file for the PROXYADDR variable is displayed.
   Path to Image Archive: Edit the default image filename (`archive.zmg`) as needed, replacing `/path` with any additional subdirectories that you have previously created under the `content-repo/images` directory.
   Include Partitions: Click the check box for any partitions that you do not want to include in the image. By default, all partitions are selected.
   Compression: Specify any number from 0 to 9 where 0 means no compression, 1 means the least compression, and 9 means the most compression.
5. Click *Next* to continue.
   The next Make Image Wizard dialog box is displayed.
6. (Optional) Fill in the fields:
   Author: Specify who created the image file.
   Computer: Identify the computer where this image is being made.
   Image Description: Describe the image file's content or purpose.

Comments: Specify anything that might be helpful concerning this image.

7 Click *Next* to make the image.

The ZENworks Imaging Engine Menu displays a progress bar while making image.

8 If the imaging process was successful, click *OK* in the Information dialog box, then click *Close* to return to a blank ZENworks Imaging Engine Menu display.

If the imaging process was unsuccessful, determine and resolve the issue, then repeat these steps.

Using the Imaging Maintenance Mode Prompt to Make an Image on a Proxy

Using the imaging maintenance mode prompt, the following example explains the syntax and available parameters that you can use with the "make to proxy" (`-makep`) mode command:

```
img -make -proxy added_filepath/filename.zmg -ip=IP_address
[-comp=comp_level] [-exclude=partition_number]
[-include=partition_number]
```

where the [...] brackets indicate optional commands.

You can abbreviate `-make -proxy` as: `-m -proxy`, `-makep`, or `-mp`.

If you specified an Imaging Server for the `settings.txt` file when booting from the imaging CD, that Imaging Server's IP address defaults; otherwise, the IP address for the Imaging Server specified in the `settings.txt` file for the PROXYADDR variable is displayed.

For more information, see:

- "Command Details" on page 180
- "Examples" on page 180

Command Details

Table D-4 *Make Proxy Commands and Parameters*

Parameter	Specifies
added_path/*filename*.zmg	The image filename, including a `.zmg` extension (which is case sensitive) and any added path. The Imaging engine automatically saves images to the default `images` directory on the Imaging Server: **Windows:** *installation_path*`\novell\zenworks\work\content-repo\images\` **Linux:** `/var/opt/novell/zenworks/content-repo/images/` If no folders are specified in the path (*added_path*), the image is created in this `images` directory. A forward slash is not needed at the beginning of any added path. You can create subdirectories under `images` for organizing your image files. However, any such subdirectories that you specify in the path must already exist when you use this command. ZENworks does not create the directories during imaging. If the image file itself already exists, the Imaging Server won't overwrite it unless you enable this behavior in ZENworks Control Center for the Imaging Server.
-ip=*IP_address*	The IP address or DNS name of an imaging server. If you do not use this parameter, the value for PROXYADDR is used.
-comp=*comp_level*	*comp_level* is the amount of compression used when creating the image. Specify any number from 0-9. 0 means no compression. 1 is the same as *Optimize for Speed* and is used by default if you do not specify this parameter. 6 is similar to *Balanced*. 9 is the same as *Optimize for Space*, which provides the slowest performance.
-exclude=*partition_number* or -x=*partition_number* and -include=*partition_number* or -I=*partition_number*	The partition number of a local partition to exclude from the image or include in the image. You can repeat this parameter as needed to exclude or include multiple partitions. Available partitions can be displayed using `img -dump`. If you omit either parameter, all partitions are included in the image.

Examples

Table D-5 *Make Proxy Examples*

Example	Explanation
`img -makep subdir1/myimage.zmg`	Takes an image of all partitions and saves the image to the Imaging Server.

Example	Explanation
`img -makep subdir1/myimage.zmg -x=2 -x=3`	Takes an image of all partitions except those in slots 2 and 3 and saves the image to the Imaging Server.

D.4 Restore Mode

Use the `-restore` mode command to retrieve an image from a specified location and restore it to a device.

You can restore an image of a device by using either the imaging maintenance mode prompt or by using the ZENworks Imaging Engine menu. For step-by-step instructions, see "Manually Taking an Image of a Device" on page 96. You can also use the Restore mode command to restore an image from a partition on a local hard disk. For step-by-step instructions, see Section 3.1.3, "Setting Up Disconnected Imaging Operations," on page 106.

Normally, if the image to be restored is a base image (one created previously by the ZENworks Imaging Engine), all existing partitions except the ZENworks partition and Dell or Compaq configuration partitions are removed from all local hard disks before the new image is restored. When the image is restored, the sizes of the original partitions from which the image was taken are preserved, if possible. If there is insufficient space, the last partition is shrunk to fit, unless this would result in data loss, in which case the ZENworks Imaging Engine denies the requested operation. If there is extra space left after all partitions in the image have been restored to their original sizes, that space is left unpartitioned.

If the image to be restored is an add-on image, or if it's a base image and you specify the a*partition*:p*partition* parameter, none of the existing physical partitions are removed. Instead, the appropriate partitions are merely updated with the files from the image, overwriting any existing file of the same name and location.

The syntax of this mode depends on whether you will retrieve the image from a local device or from an imaging (proxy) server, as explained in the subsections below:

- Section D.4.1, "Restore from Local," on page 181
- Section D.4.2, "Restore from Proxy," on page 183

D.4.1 Restore from Local

Use the `-restore -local` mode command to retrieve an image from a local device and restore it to the device. For more information, see Section 3.1.3, "Setting Up Disconnected Imaging Operations," on page 106.

To use the Help mode:

- "Using the ZENworks Imaging Engine Menu to Restore an Image Locally" on page 181
- "Using the Imaging Maintenance Mode Prompt to Restore an Image Locally" on page 182

Using the ZENworks Imaging Engine Menu to Restore an Image Locally

1. To display the ZENworks Imaging Engine menu, enter:
   `img`
2. Click *Imaging* > *Restore Image*.

This displays the Restore Image Wizard.

3 In the wizard, select *Local*, then click *Next*.

The Restore Local Image Wizard is displayed.

4 Fill in the fields:

Path to Image Archive: Click *Browse* to select the image file, or specify its full path and filename, including the `.zmg` filename extension.

File Set: The number of the image file set to be restored. Valid values are 1 through 10. File set 1 defaults. For information on file sets, see Appendix B, "File Sets," on page 139.

Options: Specify any advanced options. For more information, see Table D-6 on page 182.

5 Click *Next* to restore the image.

The ZENworks Imaging Engine Menu displays a progress bar while restoring image.

6 If the imaging process was successful, click *OK* in the Information dialog box, then click *Close* to return to a blank ZENworks Imaging Engine Menu display.

If the imaging process was unsuccessful, determine and resolve the issue, then repeat these steps.

Using the Imaging Maintenance Mode Prompt to Restore an Image Locally

Using the imaging maintenance mode prompt, the following example explains the syntax and available parameters that you can use with the "restore from local" (`-restorel`) mode command:

```
img -restore -local local_filepath/filename.zmg
[-part=partition_number] [-s=file_set] [-ap=advanced_options]
```

where the [...] brackets indicate optional commands.

You can abbreviate `-restore -local` as: `-r -local`, `-restorel`, or `-rl`.

For more information, see:

- "Command Details" on page 182
- "Examples" on page 183

Command Details

Table D-6 *Restore Local Commands and Parameters*

Parameter	Specifies
-restorel [-part=*partition_number*]	The partition number (as displayed by `img dump`) of the local partition to retrieve the image from. It must be a primary partition. This partition is not changed by the imaging operation.
local_filepath/*filename*.zmg	The filename of the image to retrieve, including the `.zmg` extension (case-sensitive) and the complete path from the root of the local partition.
-s=*fileset*	The number of the image file set to be restored. Valid values are 1 through 10. For information on creating file sets of an image, see Section 1.5.2, "Creating, Installing, and Restoring Standard Images," on page 31. If you omit this parameter, file set 1 is used.

Parameter	Specifies
-ap=*partition*:*partition*	A mapping between a partition in the image archive (a*partition*) and a target physical partition on the local machine (p*partition*). Use this parameter to selectively restore a specific part of the image to a specific local partition. **IMPORTANT:** If you use this parameter, none of the existing local partitions are removed, and only the target local partition is updated. The update process does not remove any existing files; however, any existing files of the same names are overwritten. If you want to remove all existing files from the target partition before updating it, first use the Partition Operations Mode to delete and recreate the partition. For a*partition*, use the partition number displayed for the source partition in the Image Explorer (zmgexp) utility. For p*partition*, use the partition number displayed by `img dump` for the target partition. The target partition must be a partition of a supported file system. You can repeat this parameter as needed to request multiple selective restorations in a single operation. In doing so, you can apply multiple parts of the image to a single local partition, but you can't apply the same part of an image to multiple local partitions in a single operation.

Examples

Table D-7 *Restore Local Examples*

Example	Explanation
`img -restorel / myimages/myimage.zmg -part=8`	Removes all existing local partitions except the one in slot 8, retrieves the image from `myimages/myimage.zmg` in slot 8, and restores the partitions and contents of that image on the available local writable devices (assuming there is sufficient local space and that slot 8 contains a partition).
`img -restorel / myimages/myimage.zmg`	Removes all existing local partitions, retrieves the image from `myimages/myimage.zmg` in the ZENworks partition, and restores the partitions and contents of that image on the available local writable devices (assuming there is sufficient space).
`img -restorel / myimages/myimage.zmg -s=2`	Removes all existing local partitions, retrieves the image from `myimages/myimage.zmg` in the ZENworks partition, and restores the partitions and contents of file set 2 of that image on the available local writable devices (assuming there is sufficient space).
`img -restorel / myimages/myimage.zmg -ap=a2:p1 -ap=a3:p1`	Retrieves the image from `myimages/myimage.zmg` in the ZENworks partition, updates local partition 1 with the data from partitions 2 and 3 of that image, and leaves the other local partitions unchanged (assuming there is sufficient space in local partition 1).

D.4.2 Restore from Proxy

Use the `-restore -proxy` mode command to retrieve an image from an imaging (proxy) server and restore it to the device. For more information, see "Manually Restoring an Image on a Device" on page 101.

To use the Help mode:

- "Using the ZENworks Imaging Engine Menu to Restore an Image from a Proxy" on page 184
- "Using the Imaging Maintenance Mode Prompt to Restore an Image from a Proxy" on page 184

Using the ZENworks Imaging Engine Menu to Restore an Image from a Proxy

1. To display the ZENworks Imaging Engine menu, enter:

   `img`

2. Click *Imaging* > *Restore Image*.

   This displays the Restore Image Wizard.

3. In the wizard, select *Server*, then click *Next*.

   The Restore Server Image Wizard is displayed.

4. Fill in the fields:

   Server IP Address: Specify the IP address or DNS name of an Imaging Server where the image you need is stored. If you specified an Imaging Server for the `settings.txt` file when booting from the imaging CD, that Imaging Server's IP address is the default; otherwise, the IP address for the Imaging Server specified in the `settings.txt` file for the PROXYADDR variable is displayed.

   Path to Image Archive: Click *Browse* to select the image file, or specify its full path and filename, including the `.zmg` filename extension. You can browse to select only the image files located in `%ZENWORKS_HOME%\content-repo\images\`, where `%ZENWORKS_HOME%` is the complete path of the ZENworks installation directory.

   File Set: The number of the image file set to be restored. Valid values are 1 through 10. File set 1 is the default. For information on file sets, see Appendix B, "File Sets," on page 139.

   Options: Specify any advanced options. For more information, see Table D-8 on page 185.

5. Click *Next* to restore the image.

   The ZENworks Imaging Engine Menu displays a progress bar while restoring image.

6. If the imaging process was successful, click *OK* in the Information dialog box, then click *Close* to return to a blank ZENworks Imaging Engine Menu display.

   If the imaging process was unsuccessful, determine and resolve the issue, then repeat these steps.

Using the Imaging Maintenance Mode Prompt to Restore an Image from a Proxy

Using the imaging maintenance mode prompt, the following example explains the syntax and available parameters that you can use with the "restore from proxy" (`-restorep`) mode command:

```
img -restore -proxy added_filepath/filename.zmg -ip=IP_address
[-s=set] [-b=bundle] [-ap=advanced_options]
```

where the [...] brackets indicate optional commands.

You can abbreviate `-restore -proxy` as: `-r -proxy`, `-restorep`, or `-rp`.

For more information, see:

- “Command Details” on page 185
- “Examples” on page 185

Command Details

Table D-8 *Restore Proxy Mode Commands and Parameters*

Parameter	Specifies
added_filepath/*filename*.zmg	The filename and added path of the image to retrieve, including the `.zmg` extension (case sensitive).
-s=*fileset*	The number of the image file set to be restored. Valid values are 1 through 10. For information on creating file sets of an image, see Section 1.5.2, “Creating, Installing, and Restoring Standard Images,” on page 31. If you omit this parameter, file set 1 is used.
-ap=*partition*:*partition*	A mapping between a partition in the image archive (a*partition*) and a target physical partition on the local machine (p*partition*). Use this parameter to selectively restore a specific part of the image to a specific local partition. **IMPORTANT:** If you use this parameter, none of the existing local partitions are removed, and only the target local partition is updated. The update process does not remove any existing files or overwrite any existing files of the same names if they are newer. If you want to remove all existing files from the target partition before updating it, first use the Partition Operations Mode to delete and re-create the partition. For a*partition*, use the partition number displayed for the source partition in the Image Explorer (zmgexp) utility. For p*partition*, use the partition number displayed by `img dump` for the target partition. The target partition must be a partition of a supported file system. You can repeat this parameter as needed to request multiple selective restorations in a single operation. In doing so, you can apply multiple parts of the image to a single local partition, but you can’t apply the same part of an image to multiple local partitions in a single operation.

Examples

Table D-9 *Restore Proxy Mode Examples*

Example	Explanation
`img -restorep subdir1/myimage.zmg`	Removes all existing local partitions, retrieves the image from `subdir1/myimage.zmg` on the Imaging Server, and restores the partitions and contents of that image on the available local writable devices (assuming there is sufficient local space).
`img -restorep subdir1/myimage.zmg -s=2`	Removes all existing local partitions, retrieves the image from `subdir1/myimage.zmg` on the Imaging Server, and restores the partitions and contents of file set 2 of that image on the available local writable devices (assuming there is sufficient local space).

Example	Explanation
`img -restorep subdir1/myimage.zmg -ap=a2:p1`	Retrieves the image from `subdir1/myimage.zmg` on the Imaging Server, updates local partition 1 with the data from partition 2 of that image, and leaves the other local partitions unchanged (assuming there is sufficient space in local partition 1).

D.5 Session Mode (Multicast Image Set)

Use the `-session` (Multicast Image Set) mode command to take an image of one device and restore it to multiple other devices simultaneously over the network in a single operation.

IMPORTANT: For multicasting to work properly, the routers and switches on the network must have multicast features configured. Otherwise, multicast packets might not be routed properly.

For multicasting to work, each participating device must boot from an imaging boot media and run the ZENworks Imaging Engine in this mode, as explained below. The device from which the image is taken is called the *master*, and the devices that receive the image are called *clients*.

You can start the multicast session from the Imaging Server (see "Initiating a Multicast Session from the ZENworks Imaging Server" on page 117). If you start the session this way, you specify an image file for multicasting rather than a device as the session master. Otherwise, if you start the session from a client device, you can specify one of the session clients as the session master. In that case, an image of the session master's hard drive is sent to the session clients. For more information, see "Initiating a Multicast Session from Each Client" on page 119.

To use the Help mode:

- Section D.5.1, "Multicasting Using the ZENworks Imaging Engine Menu," on page 186
- Section D.5.2, "Multicasting Using the Imaging Maintenance Mode Prompt," on page 187

D.5.1 Multicasting Using the ZENworks Imaging Engine Menu

1. To display the ZENworks Imaging Engine menu, enter:

   `img`

2. Click *Imaging* > *Multicast Session*.

   This displays the Multicast Wizard.

3. Fill in the fields:

   Session Name: Specify a unique name for the session.

   Session Role: Select whether this participant is the master or a client.

   One of the participants must be the master. It is the master who starts the session.

   For Session Master Only: To specify additional options, click the check box for the *Specify Additional Options* field to display the Multicast Wizard dialog box containing the options, then fill in the fields:

   - **Compression Level:** Select one. *Speed* provides the fastest, but least compression and *Size* provides the most compression, but more slowly.
   - **Automated Session:** To enable the session, click the check box for the *Enabled* field. Specify the minimum number of clients to join (the default is 5) or the minimum number

of minutes to transpire (the default is 5), or both, to provide the triggers for starting the session.

4 Click *Next* to continue.

The ZENworks Imaging Engine Menu is displayed with the *Abort Session* option. If you select this option to abort the multicast session, none of the clients queued for the session can be multicast-imaged because a master is required for a session to run.

If you enabled the session in Step 3, then when the number of clients or the timeout value is reached, the session begins.

5 If you did not enable the session in Step 3, you can click *Start Session* to enable it.

D.5.2 Multicasting Using the Imaging Maintenance Mode Prompt

Using the imaging maintenance mode prompt, the following example explains the syntax and available parameters that you can use with the `-session` mode command:

```
img -session name -master [-clients=count] [-timeout=minutes] [-throttle=time] [-comp=comp_level]
```

or

```
img -session name -client
```

where the [...] brackets indicate optional commands.

You can abbreviate `-session` as `-s` and `-master` as `-m`.

For more information, see:

- "Command Details" on page 187
- "Examples" on page 188

Command Details

Table D-10 *Session Mode Commands and Parameters*

Parameter	Specifies
name	The name of the multicast session. Each device joining the session uses the same value for this parameter. **IMPORTANT:** The name must be unique among concurrent multicast sessions. It is hashed by the ZENworks Imaging Engine to produce a Class D IP address for the multicast session. To facilitate troubleshooting (wire sniffing), all Configuration Management imaging multicast addresses start with 231. For example, the session name `mcast01` can produce the multicast address 231.139.79.72.

Parameter	Specifies
-master or -client	Specifies that this device is the session master or a client. There can only be one master designated for the session. If you omit these parameters, the ZENworks Imaging Engine waits for a user at one of the devices to press `m` to designate that device as the master. You must then press `s` at the master device to start the session.
-clients=*count*	The number of participating devices that must register in addition to the master before imaging begins. This option only applies to the device designated as the session master (where the `-m` parameter is used). The imaging session begins when: a) the final client has registered, b) you press `s` at the master device without waiting for all devices to register, or c) five minutes has passed since the last client has registered. If you omit this parameter, the ZENworks Imaging Engine waits for you to press `s` at the master device, which starts the imaging session. Thereafter, any devices attempting to register in the session are denied and queued for the next multicast session.
-timeout=*minutes*	The number of minutes the master device waits (without reaching the required registered clients) after the last client has registered before starting the imaging process. This option only applies to devices designated as session masters (where the `-m` parameter is used). If you omit this parameter, the default timeout is 5 minutes. The imaging process does not start until: a) the client value is reached, b) the timeout value has transpired, or c) you press `s` at the master device. After that, any clients attempting to register are denied and queued for the next multicast session.
-throttle=*time*	The number of micro-seconds to wait between master send packets. This is useful for throttling network traffic.
-comp=*comp_level*	The amount of compression used when creating the image. Specify any number from 0-9. 0 means no compression. 1 is the same as *Optimize for Speed* and is used by default if you do not specify this parameter; 6 is similar to *Balanced*; and, 9 is the same as *Optimize for Space*, which provides the slowest performance.

Examples

Table D-11 *Session Mode Examples*

Example	Explanation
`img -session mcast01`	Starts a multicast session named `mcast01`. Each successive device that issues this same command before imaging begins joins the session. Imaging doesn't start until you press `m` on one of the devices to designate itself as the master, then press `s` to start the imaging.

Example	Explanation
`img -session mcast01 -m`	Starts a multicast session named `mcast01` and designates this device as the master. Each successive device that issues `img -session mcast01` before the imaging begins joins the `mcast01` session as a client. Imaging doesn't start until you press `s` on the master device.
`img -session mcast01 -master -clients=5`	Starts a multicast session named `mcast01`. Each successive device that issues `img -session mcast01` before imaging begins joins the `mcast01` session as a client. Five other devices must register as clients before the session can begin, or five minutes must have elapsed since the last client registered. However, you can start the session from the master device without waiting for all devices to register by pressing `s`.
`img -session mcast01 -master -clients=5 -timeout=20`	Starts a multicast session named `mcast01`. Each successive device that issues `img -session mcast01` before the imaging begins joins the session. The session begins when either five other devices have registered as clients, or more than 20 minutes has elapsed since the last client registered. You can also press `s` to manually start the session at any time.

D.6 Partition Operations Mode

Use the partition mode command to activate (make bootable), add, or delete a partition on the device.

You can activate, add, or delete a partition by using either ZENworks Imaging Engine menu or the imaging maintenance mode prompt.

Using the imaging maintenance mode prompt, the following example explains the syntax and available parameters that you can use with the various partition mode commands:

```
img -pa partition_number

img -pc partition_number -type=type [-size=size] [-
cluster=cluster_size]

img -pd partition_number

img -pd -all
```

The Partition mode can be used in two ways:

- Section D.6.1, "Using the ZENworks Imaging Engine Menu to Partition," on page 189
- Section D.6.2, "Using the Imaging Maintenance Mode Prompt to Partition," on page 190

D.6.1 Using the ZENworks Imaging Engine Menu to Partition

1. Enter `img` to display the ZENworks Imaging Engine menu, then click *Partitioning*.
2. Click *Modify partitions* to open the Partition Wizard.
3. Select a partition.
4. Select an option:

Active: Select a partition that you want to activate (make bootable), then click *Active*.

Add: Opens the Create New Partition window. Click a partition type, partition size, and cluster size, then click *OK*.

Delete: Select a partition, then click *Delete*.

5 When finished, click *Done*.

For more information, see the table in Section D.6.2, "Using the Imaging Maintenance Mode Prompt to Partition," on page 190.

D.6.2 Using the Imaging Maintenance Mode Prompt to Partition

For more information, see:

- "Command Details" on page 190
- "Examples" on page 191

Command Details

Table D-12 *Partition Mode Commands and Parameters*

Operation	Action
-pc *partition_number type* [*size*] [cluster=*clusterSize*]	Creates a new partition, where: ◆ *partition_number* is the number of the partition slot (as displayed by `img dump`) in which to create the partition ◆ *type* is a keyword, a partition name, Extended, or a numerical value for the partition type, for example 0x0C (hexadecimal) or 11 (decimal) If you are creating an extended partition, you can create a logical drive inside of the extended partition. (See the next table for an example.) ◆ *size* is a valid size for the partition type in MB or a percentage If you omit this parameter, the largest valid size for the partition type is used, given the available unpartitioned space on the drive. If you give a percentage, include the % symbol; otherwise, the value is considered the size in MB. The new partition is recognizable by other operating systems, but must be formatted or have a base image restored to it before you can store files in it.
-pd *partition_number*	Deletes the partition from slot number *partition_number*. Use `img dump` to get the slot number.
-pd -all	Deletes all non-protected partitions.
-pa *partition_number*	Activates (make bootable) the partition in slot number *partition_number*. Use `img dump` to get the slot number.

Examples

Table D-13 *Partition Mode Examples*

Example	Explanation

`#img -pc 1 -type=ext2` or `#img -pc1 -type=ext2`
 	
`#img -pc 1 -type=ext2 -size=1000` or `#img -pc1 -type=ext2 -size=1000`
	Creates the ext2 partition in slot 1 using all of the available unpartitioned space on the drive.

`img -pc 5 -type=reiser -size=5671`	Creates a Reiser partition in slot 5 using 5,671 MB on the drive.
`img -pd 3` or `img -pd3`	Deletes the partition from slot 3.

`img -pc 2 -type=extended -size=2500`
 	
`img -pc 2 -type=reiser -size=500`
	Creates an extended partition with a 2500 ext2 logical drive and a 500 MB Reiser logical drive.

`img -pa 1` or `img -pa1`	Creates a active partition in slot 1.

D.7 ZENworks Partition Management Mode

Use the `-zenpart` mode command to enable, disable, or remove the installed ZENworks partition.

To use the Help mode:

- Section D.7.1, "Using the ZENworks Imaging Engine Menu to Manage a Partition," on page 191
- Section D.7.2, "Using the Imaging Maintenance Mode Prompt to Manage a Partition," on page 192

D.7.1 Using the ZENworks Imaging Engine Menu to Manage a Partition

1. To display the ZENworks Imaging Engine menu, enter:
   `img`
2. Click *Partitioning*, then click one of the following:

   Disable ZEN Partition: Disables the ZENworks partition.

   Enable ZEN Partition: Enables the ZENworks partition.

   Remove ZEN Partition: Removes the ZENworks partition.

   IMPORTANT: If you remove an installed ZENworks partition, you must immediately restore a base image with a valid non-grub MBR (Master Boot Record). If you do not, the device cannot boot properly.
3. Click *Imaging* > *Exit* to display the imaging maintenance mode prompt.
4. At the prompt, enter `grub.s` to make this change effective.

D.7.2 Using the Imaging Maintenance Mode Prompt to Manage a Partition

Using the imaging maintenance mode prompt, the following example explains the syntax and available parameters that you can use with the various ZENworks partition management mode commands:

```
img -zenpart operation
```

where *operation* is to disable, enable, or remove a ZENworks partition.

To manage a ZENworks partition:

1. From the imaging maintenance mode prompt, enter one of the following:

   ```
   img -zenpart -disable
   ```

   ```
   img -zenpart -enable
   ```

   ```
   img -zenpart -remove
   ```

   IMPORTANT: If you remove an installed ZENworks partition, you must immediately restore a base image with a valid non-grub MBR (Master Boot Record). If you do not, the device cannot boot properly.

2. Enter `grub.s` to make this change effective.

D.8 Dump Mode

The `-dump` mode command provides information about the device's hard drives and partitions.

To use the Dump mode:

- Section D.8.1, "Using the ZENworks Imaging Engine Menu to View Partition Information," on page 192
- Section D.8.2, "Using the Imaging Maintenance Mode Prompt to View Partition Information," on page 192

D.8.1 Using the ZENworks Imaging Engine Menu to View Partition Information

1. To display the ZENworks Imaging Engine menu, enter:

   ```
   img
   ```

2. Click *System information*, then click *Drive information*.

   Information concerning the hard drives and partitions is displayed.

D.8.2 Using the Imaging Maintenance Mode Prompt to View Partition Information

Using the imaging maintenance mode prompt, the following example explains the syntax and available parameters that you can use with the Dump (`-dump`) mode command:

```
img -dump [-geo]
```

where the `-geo` parameter is optional.

You can abbreviate `-dump -geo` as `-dg`.

For more information, see:

- "Command Details" on page 193
- "Examples" on page 193

Command Details

Table D-14 *Dump Mode Commands and Parameters*

Parameter	Action
-dump	Lists the existing partitions on all local hard drives. For each partition, the type, size, and slot number of the partition are given. The ZENworks partition and Dell or Compaq configuration partitions are not listed.
-geo	Displays additional information about the geometry (cylinders, heads, and sectors) and capacity of each hard drive.

Examples

Table D-15 *Dump Mode Examples*

Example	Explanation
`img -dump`	Lists the current partitions on all local writable devices.
`img -dump -geo`	Lists all hard drives, their geometry and capacity, and the current partitions on the writable devices.

D.9 Information Mode

Use the `-info` mode command to view the following:

- The data currently stored in the image-safe area on the device

  This data is saved by the Novell ZENworks Configuration Management Imaging Agent (novell-ziswn) during each device's session to ensure that it can be restored after the device is reimaged. If the device is new and doesn't have an operating system yet, an initial set of data is supplied from the default configuration for the ZENworks Management Zone, such as IP addresses.

- Information about the hardware devices on the device

  This information is detected during the imaging boot process. If the ZENworks Imaging Engine runs in auto-imaging mode, this information is sent to the Imaging Server to help determine which image to restore to the device, if necessary.

- Name of the base image that was last restored on the device

To use the Information mode:

- Section D.9.1, "Using the ZENworks Imaging Engine Menu to View Device Information," on page 194
- Section D.9.2, "Using the Imaging Maintenance Mode Prompt to View Device Information," on page 194

D.9.1 Using the ZENworks Imaging Engine Menu to View Device Information

1. To display the ZENworks Imaging Engine menu, enter:

   ```
   img
   ```

2. Click *System information*, then click *Detected Hardware* or *Image-Safe Data*.

   See Table D-16 for details.

D.9.2 Using the Imaging Maintenance Mode Prompt to View Device Information

1. Enter one of the following from the imaging maintenance mode prompt:

   ```
   img -info -hardware
   ```

   ```
   img -info -zisd
   ```

   You can abbreviate `-info` as `-i`.

For more information, see:

- "Command Details" on page 195
- "Examples" on page 195

Command Details

Table D-16 *Information Mode Commands and Parameters*

Menu item or parameter	Action
System Information > Detected Hardware *or* img -info *(from the imaging maintenance mode prompt)*	Lists the detected hardware devices on the device, including: ◆ CPU chipset ◆ System manufacturer ◆ Computer product name ◆ BIOS version ◆ BIOS asset tag ◆ BIOS serial number ◆ Video adapter ◆ Network adapter ◆ MAC address ◆ Sound card ◆ Hard drive controller ◆ Hard disk capacity ◆ Detected RAM ◆ Boot media
System Information > Image Safe Data *or* img -info -zisd *(from the imaging maintenance mode prompt)*	Lists the data currently stored in the image-safe area on the device. The items that comprise this data are listed in Section C.3, “Image-Safe Data Viewer and Editor (zisview and zisedit),” on page 154. In addition to the image-safe data, the last base image that was restored on the device is also listed.

Examples

Table D-17 *Information Mode Examples*

Example	Explanation
`img -info -hardware`	Lists the detected hardware devices on the device.
`img -info -zisd`	Lists the Configuration Management image-safe data currently stored on the device and the last base image that was restored.

Updating ZENworks Imaging Resource Files

E

In Novell® ZENworks® 10 Configuration Management, you can manually update ZENworks imaging resource files.

The following sections provide concepts on how the boot process works with ZENworks imaging, and instructions for updating imaging resource files:

- Section E.1, “The Linux Distribution for Imaging,” on page 197
- Section E.2, “Understanding Device Boot Processes in a ZENworks Imaging Environment,” on page 197
- Section E.3, “Understanding ZENworks Partitions and Command Line Parameters,” on page 199
- Section E.4, “Modifying ZENworks Imaging Resource Files,” on page 201
- Section E.5, “Adding or Updating LAN Drivers,” on page 206
- Section E.6, “Variables and Parameters,” on page 208
- Section E.7, “Troubleshooting Linux Driver Problems,” on page 209

E.1 The Linux Distribution for Imaging

ZENworks Imaging uses a small Linux distribution on the client device to perform imaging operations. The distribution shipping with ZENworks 10 is based on the SUSE® installation system, where SUSE Linux Enterprise Server (SLES) 10 SP1 boots to a small distribution to perform a YaST installation. ZENworks Imaging uses the same installation system found in SLES, but instead of starting a YaST installation, it starts a ZENworks Imaging session.

The PXE (Preboot Execution Environment) environment is an internally-developed PXE solution from Novell.

Using a stable Linux distribution based on SLES gives customers a distribution with the broadest range of stable drivers available. The hardware industry is continually introducing new and updated network and disk drivers, so it’s not always possible to provide the latest drivers in its software releases.

This section covers how to update Linux drivers using the new distribution. It deals with the imaging resource files that are based on the SLES distribution and ZENworks Preboot Services processing.

E.2 Understanding Device Boot Processes in a ZENworks Imaging Environment

The following provides a high-level overview of a Linux boot process and how ZENworks imaging affects it:

1. A boot loader program loads the Linux kernel and `initrd` (initial RAM drive) into memory.

The SLES-based imaging distribution uses `isolinux` as the boot loader for imaging CDs, a modified `pxelinux` for booting using PXE or when using a single diskette with the CD. If you have a ZENworks partition installed, it uses the grub program to boot alternately between the ZENworks partition and the installed operating system.

Following are the filenames and paths for Windows servers:

Files	When booting from a CD	When booting from PXE
Preboot Loader	`isolinux`	`pxelinux`
Linux Kernel Name	`\boot\i386\loader\linux`	*`installation_path`*`\novell\zenworks\share\tftp\boot\linux`
Initrd Filename	`\boot\i386\loader\initrd`	*`installation_path`*`\novell\zenworks\share\tftp\boot\initrd`

Following are the filenames and paths for Linux servers:

Files	When booting from a CD	When booting from PXE
Preboot Loader	`isolinux`	`pxelinux`
Linux Kernel Name	`/boot/i386/loader/linux`	`/srv/tftp/boot/linux`
Initrd Filename	`/boot/i386/loader/initrd`	`/srv/tftp/boot/initrd`

2. The Linux kernel starts running, does some device driver setup, then mounts the `initrd` file system.

   Regardless of which boot loader method is used, the main purpose is to set up the `initrd` file as a RAM drive, load the Linux kernel into memory, then turn control over to it with an indication to the Linux kernel of where to find `initrd`.
3. The Linux kernel turns control over to linuxrc, for performing initial hardware detection. When finished, control is returned to the Linux kernel.
4. The Linux kernel starts a background process (`/sbin/init`).

   After control is passed to the linuxrc program, control is never returned to the Linux kernel or passed on to the init process.

For more information on `linuxrc` and `zenworks.s`, review the following sections:

- Section E.2.1, “linuxrc,” on page 198
- Section E.2.2, “zenworks.s,” on page 199

E.2.1 linuxrc

When control is turned over to linuxrc (the filename in the `initrd` file is `init`), there are several processes it performs to get the system ready for the imaging process. Linuxrc is initially configured from the `linuxrc.config` file, which is located in the `initrd` file system. Additional configuration information for linuxrc can be placed in the `/info` file, but ZENworks does not normally use this file.

Linuxrc also loads a `root` file system, which is combined with the `initrd` file system that is set up by the boot loader. The `root` file system is located on an imaging CD as the file `/boot/i386/root`. For PXE booting, the `root` file system is stored on the ZENworks Imaging server as:

- **Windows:** `installation_path\novell\zenworks\share\tftp\boot\root`
- **Linux:** `/srv/tftp/boot/root`

Linuxrc attempts to locate and load the `settings.txt` file, either on the root of the imaging CD, or on the ZENworks Imaging server in the TFTP directory. From `settings.txt`, linuxrc reads and processes any parameters that pertain to itself, then copies `settings.txt` to the root (`/`) of the file system.

Linuxrc then also attempts to locate and load a file named `driverupdate`. It is usually located in the same directory as `root`. This file is used to update drivers and other files in the imaging distribution.

The `driverupdate` file is based on standard SUSE technology during a PXE boot. Because the network must be operating normally in order to obtain `driverupdate`, this file cannot update drivers for the active network device. However, other files and drivers can be updated by using the `driverupdate` file. For more information, see Section E.4.3, “Using the Driverupdate File Method,” on page 204.

E.2.2 zenworks.s

A normal SUSE installation for SUSE Linux or SLES boots to a small distribution to perform a YaST installation. ZENworks Imaging boots with the same installation system, but instead of starting a YaST installation, it starts the ZENworks Imaging process. Control is turned over to the ZENworks script `/bin/zenworks.s`, which is the main script file for ZENworks imaging processing. The script performs a certain number of setup tasks, then gives control to the appropriate script for the selected imaging process. For more information on the imaging process, see Section 1.4, “The Preboot Services Processes,” on page 23.

One of the setup tasks is to apply any update files. When booting from a CD, `zenworks.s` copies the `/addfiles` directory structure to the Linux file system. For more information, see Section E.4.1, “Adding Files to an Imaging Boot CD,” on page 201.

E.3 Understanding ZENworks Partitions and Command Line Parameters

The following sections provide an understanding of the ZENworks partition and imaging commands that are used when updating Linux drivers:

- Section E.3.1, “The ZENworks Partition,” on page 199
- Section E.3.2, “Command Line Parameters and Variables,” on page 200

E.3.1 The ZENworks Partition

The ZENworks partition is used to store the files required to load Linux into RAM, making the result similar to using a CD or PXE boot method. The ZENworks partition has a similar boot media layout as an imaging CD. It has a minimum size of 150 MB.

The files stored on the ZENworks partition are `linux`, `initrd`, and `root`, which are the same as the directories as on the imaging CD (see the tables in Section E.2, "Understanding Device Boot Processes in a ZENworks Imaging Environment," on page 197). In ZENworks, the boot loader is grub, which loads Linux as described under Section E.2, "Understanding Device Boot Processes in a ZENworks Imaging Environment," on page 197. The `driverupdate` and `settings.txt` files are searched for and loaded from the ZENworks partition.

If you need to modify the Linux files, you must modify the `initrd` or `root` file sets the same way as you would for other boot methods. For information, see Section E.4.2, "Adding Files to the Initrd or Root File Systems," on page 202.

E.3.2 Command Line Parameters and Variables

There are four types of command line parameters that can be used with the ZENworks imaging process. They are entered manually on the command line when booting from a CD or they can be placed in the `isolinux.cfg` file located in the `/boot/i386/loader` directory. The commands are also located in the `*.cfg` files for PXE and are located in the *`installation_path`*`\novell\zenworks\share\tftp` directory on the Windows Imaging Server and the `/srv/tftp` directory on the Linux Imaging Server.

- **Kernel Parameters:** The valid parameters for the Linux kernel are found in the `/Documentation/kernel-parameters.txt` file that is installed with the kernel source.

  Some devices have a faulty BIOS, where you must turn off ACPI processing for the kernel to load properly. To do this, use the kernel parameter acpi=off. For more information, see Novell Support (http://www.novell.com/support/search.do?cmd=displayKC&docType=kc&externalId=10099330&sliceId=&dialogID=1284337&stateId=1%200%20548668).

- **Linuxrc Parameters:** These parameters affect the way linuxrc detects hardware or sets hardware settings. They are described briefly in the `/usr/share/doc/packages/linuxrc/linuxrc.html` file in a Linux system.

  Linuxrc parameters can be found in the `/linuxrc.config` or `/info` files that reside in the `initrd` file system. Some parameters can be placed in the `settings.txt` file that is located on the root of the imaging CD or ZENworks partition, or in the `/srv/tftp/boot` file for PXE booting.

  Parameters that can be placed in the `settings.txt` file (the easiest file to edit) are limited. During PXE booting, parameters that affect the network are not processed from `settings.txt`, because by the time linuxrc loads the `settings.txt` file, the network is already set up. Network settings can be placed in the `settings.txt` file when booting from an imaging CD, because it is loaded early enough in the process to take effect.

- **ZENworks Variables:** Some environment variables affect the way imaging performs. They can be configured in any file, but should normally be configured in the `settings.txt` file.

  If you add variables to the `settings.txt` file that were not originally defined there, you must export the variable. For example, in the `settings.txt` file, enter:

  ```
  export IMGCMD="myscript"
  ```

  A list of all image engine or script variables is listed under Section E.6, "Variables and Parameters," on page 208.

- **Other Variables:** Environment variables that you might want in your script can be added in the same manner as described for the ZENworks variables.

E.4 Modifying ZENworks Imaging Resource Files

From time to time you might want to modify an imaging distribution by adding your own files. These can be additional programs, scripts, data files, or updated Linux drivers.

You can use the following methods to update imaging resource files:

- The easiest method is to edit the `settings.txt` file, which is located on the root of the imaging CD or in `/srv/tftp/boot` on the ZENworks Imaging Server for PXE booting.
- Where you are using a ZENworks partition, you can boot to the manual or maintenance mode, mount the ZENworks partition, then copy the modified `settings.txt` and the files in `initrd` or `root` to the mounted ZENworks partition.
- Another easy method is to edit the `.cfg` files located in `/srv/tftp` on the ZENworks Imaging Server for PXE booting. This method is only available for Linux Imaging Servers, because the configuration files are provided by Novell's version of PXE.
- You can modify files in the `initrd` or `root` file systems, but you need a Linux environment for performing the modification process. Files required during the initial setup (during linuxrc processing time), such as LAN drivers, must be placed in the `initrd` file system. Other files that are not needed until the `zenworks.s` script file takes control can be placed in the `root` file system (for example, an imaging script), or you can use the `driverupdate` file.

  This method is discussed in this section.

The following sections provide various methods for modifying imaging resource files:

- Section E.4.1, "Adding Files to an Imaging Boot CD," on page 201
- Section E.4.2, "Adding Files to the Initrd or Root File Systems," on page 202
- Section E.4.3, "Using the Driverupdate File Method," on page 204

E.4.1 Adding Files to an Imaging Boot CD

If you have files to add to an imaging boot CD so they can be available for use when you get to the actual imaging process (such as scripts, but normally not driver modules), you can copy the files to the `/addfiles` directory on the imaging CD. This is an easy way to insert your script or other files into the distribution without modifying the `initrd` or `root` file systems. However, these files are not available during the boot and module loading phases.

The imaging boot CD has a directory named `/addfiles` where you can add files. They should be placed below this directory in their proper directory names. They are then available in this directory structure during the imaging process.

An example of how you can add files:

1. If you want to execute your own script instead of the normal imaging process, create a script file named `myscript.s` and place it on the boot CD. For example, `/addfiles/bin/myscript.s`.

IMPORTANT: The script file must have proper LF line terminators that Linux requires, not the DOS CR and LF end-of-line characters. In other words, you cannot use `Notepad.exe` to create the script; you must use a text editor compatible with Linux, such as TextPad.

2 To place the following line in the `settings.txt` file, enter:

```
export IMGCMD="/bin/myscript.s"
```

When imaging is run, it runs `/bin/myscript.s` instead of using the normal `img -auto` command.

E.4.2 Adding Files to the Initrd or Root File Systems

This is the preferred method for updating imaging resource files, and must be performed in a Linux environment.

Before performing the procedures given below, make sure you have created backup copies of any files you plan to change, specifically the `/srv/tftp/boot/initrd` file. If you want to change the files on an imaging CD, you need an ISO editor or some other process for extracting and replacing the file in the `bootcd.iso` image file.

IMPORTANT: When updating or adding files and Linux drivers in the `initrd` or `root` file systems, document the changes you make. When you receive updated resource files from Novell, they do not contain your customized changes. If the kernel version has changed with the newer resource files from Novell, previously added drivers must be updated either by obtaining a new version from the manufacturer or recompiling the driver using the correct Linux kernel version source.

- "Adding to Initrd" on page 202
- "Adding to Root" on page 203

To add files to the `root` file system, you can also use the `driverupdate` file method described in Section E.4.3, "Using the Driverupdate File Method," on page 204.

Adding to Initrd

To modify the `initrd` file system:

1 Using a Linux device, create a working directory and change to that directory.

2 To copy initrd from the PXE server or the boot CD to the new working directory:

- For PXE, copy `/tftp/boot/initrd` to the Linux workstation's working directory.
- For the CD, extract `initrd` from the `/boot/i386/loader` directory on the boot CD, then copy the extracted `initrd` to the Linux workstation's working directory.

3 To rename `initrd` to `initrd.gz`, enter:

```
mv initrd initrd.gz
```

4 To unzip the `initrd.gz` file, enter:

```
gunzip initrd.gz
```

5 To create another working directory for use as a mount point in the subsequent steps, enter:

```
mkdir work
cd work
```

6 To extract `initrd` into the `/work` directory, enter:

```
cpio -idmuv <../initrd >/dev/null 2>&1
```

7 To copy your files or updated driver to the extracted `initrd` file system, enter:

```
cp /your_path/module.ko work/lib/modules/2.6.5-override-default/
initrd
```

where *your_path* is the path to the *module*`.ko` file and *module* is the name of the module.

Other files to be included in the `initrd` file system should be copied to the appropriate directory.

8 To re-package the `initrd` file system, enter:

```
cd work
find . | cpio --quiet -o -H newc > ../initrd
cd ..
```

9 To zip the new `initrd` file, enter:

```
gzip -v9c initrd > initrd.gz
```

10 To rename `initrd.gz` back to `initrd`, enter:

```
mv initrd.gz initrd
```

11 To copy the file back:

- For PXE, copy the updated `initrd` file to the `/tftp/boot` directory on the PXE server.
- For the CD, copy the updated `initrd` file to the `/boot/i386/loader` directory on the boot CD.

Adding to Root

To modify the `root` file system:

1 Using a Linux device, create a working directory and change to that directory.

2 To copy `initrd` from the PXE server or the boot CD to the new working directory:

- For PXE, copy `/tftp/boot/initrd` to the Linux workstation's working directory.
- For the CD, extract `root` from the `/boot/i386/` directory on the boot CD, then copy the extracted `root` to the Linux workstation's working directory.

3 To rename `root` to `root.gz`, enter:

```
mv root root.gz
```

4 To unzip the `root.gz` file, enter:

```
gunzip root.gz
```

5 To create another working directory for use as a mount point in the subsequent steps, enter:

```
mkdir work
```

6 To mount the `initrd` file system to the `/work` directory, enter:

```
mount -o loop root work
```

7 To copy your files or updated driver to the mounted `root` file system, enter:

```
cp /your_path/module.ko work/lib/modules/2.6.5-override-default/
initrd
```

where *your_path* is the path to the *module*`.ko` file and *module* is the name of the module.

Other files to be included in the `initrd` file system should be copied to the appropriate directory.

8. To unmount the `root` file system, enter:

   ```
   umount work
   ```

9. To zip the new `root` file, enter:

   ```
   gzip -v9c root > root.gz
   ```

10. To rename `root.gz` back to `root`, enter:

    ```
    mv root.gz root
    ```

11. To copy the file back:

    - For PXE, copy the updated `root` file to the `/tftp/boot` directory on the PXE server.
    - For the CD, copy the updated `root` file to the `/boot/i386/` directory on the boot CD.

E.4.3 Using the Driverupdate File Method

Another way to customize the Novell imaging distribution is to utilize the driver update mechanism that is built into all SUSE distributions. This entails modifying a file named `driverupdate` that is located in the `/srv/tftp/boot` directory on your Imaging Server or on the root (`/`) of an imaging boot CD.

This method is a little less intrusive than modifying the `initrd` or `root` file systems. You simply create an additional file that is incorporated into the imaging operating system during boot time.

There are three types of driver update operations that can be performed:

- Install the kernel modules or hardware drivers
- Install files and execute a script
- Simply place files into the operating system

This section describes how to install files and execute a script. For information on the other two methods, see "Tech Talk #3 - Spittin' Image" (http://www.novell.com/connectionmagazine/2005/11/tech_talk_3.html) in the *Novell Connection Magazine*. Specifically, see the "SUSE Linux Driver Updates" and "Adding files to the distro "root" file" sections in the article.

The example in this section takes the program "tree" that is not currently available in the imaging distribution and installs it at boot time.

The driver update mechanism seeks the `driverupdate` file, which contains a directory structure that mimics the directory structure in the operating system after a device has booted with the ZENworks distribution. If it is present, linuxrc downloads it during booting and incorporates it into the operating system dynamically.

The `driverupdate` file is a file system file that can be of any file system type, such as EXT3 or REISER. For simplicity, we'll use the CRAMFS file system in our example.

To place the tree program into the `driverupdate` file:

1. Create a working directory on your Imaging Server, such as `/work`.
2. If you are using the `driverupdate` file, download the `driverupdate.tgz` file into the `/work` directory, then untar it by entering:

```
mkdir work
cd work
wget http://www.novell.com/connectionmagazine/2005/11/download/
driverupdate.tgz
tar -xzvf driverupdate.tgz
```

The `driverupdate.tgz` file contains the same directory structure as is created in Step 3.

3 If you are manually creating the directories, create the following structure under the `/work` directory:

```
`-- linux
    `-- suse
        |-- i386-sles10
            |-- dud.config
            |-- inst-sys
                `-- lib
                `-- bin
            |-- adddir.s
```

The contents of the `dud.config` file should contain lines similar to those listed below. You should maintain the keywords by supplying your own data. However, you can use the listed values:

```
UpdateName:     ZENworks 10 Patch 1
UpdateID:       a37f92556e4dd99e
UpdatePriority: 100
```

The `adddir.s` file should be an executable script that contains the following lines:

```
echo "Processing: adddir.s" > /dev/tty3 2>&1
# driver update: add files to inst-sys
for i in /update/[0-9]*/inst-sys ; do
     [ -d "$i" ] && adddir "$i" /
done
# driver update: run update.pre scripts
for i in /update/[0?9]*/install/update.pre ; do
     echo "Processing: $i" > /dev/tty3 2>&1
     [ -x "$i" ] && "$i"
done
```

4 To copy the tree program into the `/bin` directory, enter:

```
cp /usr/bin/tree dirstruct/linux/suse/i386-9.2/inst-sys/bin/
```

5 To create the CRAMFS file, enter:

```
mkfs.cramfs work/ driverupdate
```

The CRAMFS file is required by the SUSE distribution.

6 To copy the `driverupdate` file into `/srv/tftp/boot`, enter:

```
cp driverupdate /srv/tftp/boot
```

7 Add the following lines to the end of the `/srv/tftp/boot/settings.txt` file:

```
# SUSE driver update
for i in /update/[0?9]*/install/adddir.s ; do
     [ -x "$i" ] && "$i"
     rm $i
done
```

This causes the `adddir.s` script to run, which creates soft links to all of the new files being copied.

These lines might already be present in the `settings.txt` file.

8 Reboot the PXE-enabled device.

You should see the text "ZENworks 10 Patch 1" at the imaging maintenance mode prompt after the operating system has booted.

9 Execute the tree program.

All of the files you place into the `driverupdate` file are now located under the `/update` directory in the operating system after booting. Then, the `adddir.s` script (or the code that you added to the `settings.txt` file in Step 7) creates soft links under the `root` file system that point to the corresponding files under the `/update` directory structure. You can verify this by running:

```
/# which tree
/bin/tree
/# ll /bin/tree
lrwxrwxrwx  1 root root 29 Aug 31 21:45 /bin/tree -> /update/000/inst-
sys/bin/tree
```

If you want to simply include a new hardware driver or kernel module in the imaging operating system, an easier process might be to copy the `.ko` file into the `/dirstruct/linux/suse/i386-9.2/modules/` directory. Then, the imaging operating system automatically loads any `.ko` files that are in this directory.

E.5 Adding or Updating LAN Drivers

As LAN card manufacturers develop and release new LAN adapters, they usually release new or updated drivers as well. Sometimes the new LAN card functions properly with an earlier driver, and sometimes the earlier driver does not recognize the new LAN card and refuses to load. Occasionally, the older driver does load, but the LAN card exhibits serious performance problems. To obtain the full performance capabilities of a new LAN card, you should use the new driver.

The following sections explain how to obtain or compile drivers:

- Section E.5.1, "Obtaining Drivers," on page 206
- Section E.5.2, "Building Drivers," on page 207

If you need to load your drivers with specific parameters, see Section E.5.3, "Loading Drivers with Parameters," on page 208.

E.5.1 Obtaining Drivers

New LAN drivers should be obtained from the manufacturer. Most LAN card manufacturers have drivers available for free downloading from their Web site. Some drivers are available from www.scyld.com/network, and the source to the Broadcom* BCM5700 driver can be downloaded from http://www.broadcom.com/drivers/downloaddrivers.php.

If a manufacturer has a binary driver compiled specifically for the kernel version used by ZENworks, you can obtain the driver and use one of the update methods to add the driver. ZENworks 10 is based on SLES 10 SP1, kernel version 2.6.16.46-0.12. If the driver is not for this specific version, you must obtain the source and compile it for this version. For more information, see Section E.5.2, "Building Drivers," on page 207.

E.5.2 Building Drivers

Nearly all Linux drivers are distributed in source code form and need to be compiled before they can be used. Follow the manufacturer's instructions included with the new driver to build the driver module. Many drivers can be built in such a way that they are built into the kernel itself; however, we recommend that LAN drivers be built as external kernel modules.

When building your LAN drivers, make sure that your build machine uses the same kernel as the imaging environment. If you have a LAN driver that doesn't load in your imaging environment, it usually means that you have a mismatch between your build environment and the imaging environment.

You can find the current kernel version of your Linux environment by using the following command:

```
uname -r
```

To build your drivers:

- "Obtaining the Linux Source Code Tree" on page 207
- "Compiling the Module" on page 207

Obtaining the Linux Source Code Tree

To compile a module, you need the Linux source code tree that contains the configuration matching the ZENworks kernel.

To use the Linux source code tree:

1. To obtain the necessary source code, download the `linux-2.6.16.46-0.12-pulsar.tgz` Linux source code tree file (http://download.novell.com/Download?buildid=co6fQyGvW1k~).
2. Unzip the tar file and install the source code tree in the `/usr/src` directory.

   For example, the tar file creates the following directories:

   ```
   /usr/src/linux-2.6.16.46-0.12
   /usr/src/linux-2.6.46-0.12-obj
   ```
3. To create a link to the source tree:
   - **3a** To change to the `/usr/src` directory, enter:

     ```
     cd /usr/src
     ```
   - **3b** If there is a Linux soft link in the directory, delete it.
   - **3c** Create the new Linux soft link, such as:

     ```
     ln -s linux-2.6.16.46-0.12 linux
     ```

After you have the Linux kernel source tree and soft link ready for compiling the module, continue with "Compiling the Module" on page 207.

Compiling the Module

To manually compile the module:

1. Install the source.

   Follow the manufacturer's instructions to install the source.

Normally, the module source is in a directory under `/usr/src`. Module source files usually come in the form of a gzipped tar file (`.tar.gz` or `.tgz`). The file might also be a bzipped file (`.bz2`).

2. To compile the source, change directories to the source.
3. When you have your module compiled for ZENworks, take the generated `.ko` module file (make sure you select the proper module name and not a work `.ko` file) and install it by using the driver update method or placing it in the `initrd` file system.

E.5.3 Loading Drivers with Parameters

If there is a module that you want to load during the linuxrc processing time, and if linuxrc does not recognize that it needs to be loaded or you want to specify the load parameters, you can enter a line in the `linuxrc.config` or `/info` file. This file then needs to be updated in the `initrd` file system.

You might need to load a LAN driver module with specific parameters. You can do this with a line like:

```
insmod="moduleName parm=xxx"
```

This type of line is most commonly used to load a LAN driver with specific parameters, such as full duplex or specific speed.

E.6 Variables and Parameters

The following sections describe the variables and parameters used in updating resource files:

- Section E.6.1, “Imaging Script Variables,” on page 208
- Section E.6.2, “Linuxrc Parameters Specified in Settings.txt,” on page 209
- Section E.6.3, “Image Engine Variables,” on page 209

E.6.1 Imaging Script Variables

The following environment variables are used in imaging scripts and must not be modified:

Table E-1 *Imaging Script Variables*

Variable	Definition
ACTIVEPARTITION	Device of the active OS partition.
CDBOOT	YES = Booted from a CD.
DISABLEZEN	1 = Disable the ZENworks partition.
ENABLEZEN	1 = Re-enable the ZENworks partition.
ZENDEVICE	Device name of the ZENworks partition.
ZENPARTBOOT	YES = Booted from ZENworks partition.

The following environment variables can be modified or set in the `settings.txt` file:

Table E-2 *Environment Variables*

Variable	Definition
HDPARM	NO = Do not set hdparm parameters.
IMGCMD	Imaging command to run instead of the `img -a` command.
MANUALREBOOT	YES = Do not automatically reboot.
PARTITIONSIZE	Size in MB to create the ZENworks partition.
PROXYADDR	IP/DNS address of the Imaging server.
PROMPT	Go to the imaging maintenance mode prompt after imaging is complete.

E.6.2 Linuxrc Parameters Specified in Settings.txt

Table E-3 *Linuxrc Parameters*

Variable	Definition
netsetup	dhcp = Use DHCP. 1 = Static IP.
HostIP	Static IP address to use.
NetMask	Network mask.
Gateway	Network gateway.
HostName	Host name to assign.
Nameserver	DNS name server.
Domain	Domain suffix.
NetDevice	ethx = Define which network device to configure.

E.6.3 Image Engine Variables

Table E-4 *Image Engine Variables*

Variable	Definition
DEVELOPER_LOG	“A” creates a verbose `imglog` debug file.
ZEN_IGNORE_GEO_MISMATCH	Ignore geometry device mismatches when restoring raw image formats.
NOABORTBUTTON	If defined, do not display the *Abort* button during imaging.

E.7 Troubleshooting Linux Driver Problems

- Section E.7.1, “Troubleshooting During the Boot Process,” on page 210

- Section E.7.2, “Troubleshooting at the Imaging Maintenance Mode Prompt,” on page 210

E.7.1 Troubleshooting During the Boot Process

While booting ZENworks imaging, there are several things that you can do to help troubleshoot if there is a problem:

- Press Esc to see the kernel messages. Usually, messages are shown for failures.
- Screen 3 (press Alt+F3) is used to show the progress of the linuxrc process. It lists progress results, what linuxrc is doing, which modules are loaded, and so on.
- Screen 4 (press Alt+F4) is used to show output from the modules during the linuxrc process.
- Screens 1 (press Alt+F1), 3, and 4 can be used to help determine which part of the process is failing or causing a problem.
- Screens 3 and 4 indicate which drivers are loaded.
- If a drive is loaded properly but fails in some way, view screen 4 to see if there is an outdated driver.

If the boot process fails, the first command line parameter to use is acpi=off.

E.7.2 Troubleshooting at the Imaging Maintenance Mode Prompt

When the prompt is displayed, there are a few tools that you can use to gather information about the hardware:

- **hwinfo:** This utility is used by linuxrc to load hardware. You can use `hwinfo -pci` to determine exactly what hardware was recognized.

  Pipe to “less,” because `hwinfo` can create a lot of output. For example, `hwinfo -pci | less`.

  If you need to contact Novell Support for help, you should capture the output from `hwinfo -pci` to a file for their use. You can gather the most information with this command:

  `hwinfo -pci -log /logfilename`

  where *`logfilename`* is the name of the file that you should send.

  You can then mount a device, such as a thumb drive or other USB device, and save the output file for later use. You might also be able to use FTP to save the file where it can be available.
- **ethtool:** This is a valuable tool (contained in a ZENworks distribution) that can be used to change the configuration on most Ethernet network devices. See the online help for information on using the ethtool utility.

Supported Ethernet Cards

F

Novell® ZENworks® Configuration Management provides the Ethernet card drivers contained in the Linux kernel (2.6) that ships with ZENworks 10.

To determine which Linux kernel you are using, enter `uname -r` at the bash prompt.

If your device or laptop computer uses a different card that is not supported, you must supply your own Ethernet driver.

Accessing IP Addresses for Devices Running Dual NICs

G

To automatically obtain an IP address for a device running dual NICs, you can modify the following files (one or both):

- **Windows:**

  installation_path\novell\zenworks\share\tftp\z_auto.cfg

  or

  installation_path\novell\zenworks\share\tftp\z_maint.cfg

- **Linux:**

  /srv/tftp/z_auto.cfg

  or

  /srv/tftp/z_maint.cfg

In these files, add the following line at the end of the *append* command:
`netdevice=eth0`

This eliminates the need to manually select a NIC's IP address.

Naming Conventions in ZENworks Control Center

H

When you name an object in the ZENworks® Control Center (folders, bundles, bundle groups, and so forth), ensure that the name adheres to the following conventions:

- The name must be unique in the folder.
- Depending on the database being used for the ZENworks database, uppercase and lowercase letters might not create uniqueness for the same name. The embedded database included with ZENworks Configuration Management is case insensitive, so Folder 1 and FOLDER 1 are the same name and cannot be used in the same folder. If you use an external database that is case-sensitive, Folder 1 and FOLDER 1 are unique.
- If you use spaces, you must enclose the name in quotes when entering it on the command line. For example, you must enclose bundle 1 in quotes (“bundle 1”) when entering it in the zman utility.
- The following characters are invalid and cannot be used: / \ * ? : " ' < > | ` % ~