# Contents

1 **Provisioning Services Product Overview** ................................................................. 7  
   Benefits for XenApp and other Server Farm Administrators ............................. 8  
   Benefits for Desktop Administrators ................................................................. 8  
   Provisioning Services Solution ........................................................................... 9  
   Product Licenses .................................................................................................. 10  
   Provisioning Services Product Infrastructure .................................................... 11  
      License Server ................................................................................................. 11  
      Provisioning Services Database ...................................................................... 12  
      Console ........................................................................................................... 12  
      Network Services ............................................................................................ 13  
      Farms .............................................................................................................. 13  
      Stores ............................................................................................................. 14  
      Sites ................................................................................................................ 15  
      Views ............................................................................................................... 18  
   Provisioning Services Administrator Roles ....................................................... 19  
   Product Utilities ................................................................................................... 19  
   Provisioning Services and Resources ............................................................... 20  
      Provisioning Services Documentation .......................................................... 20  
      Getting Service and Support ......................................................................... 22  
      Getting the Subscription Advantage ............................................................. 22  
      Locating the Citrix Developer Network .......................................................... 22  
      Participating in Citrix Education and Training ................................................ 23  

2 **Installing and Configuring Provisioning Services** ............................................. 25  
   Installation Wizards and Utilities ....................................................................... 26  
   Citrix Licensing .................................................................................................... 26  
   Provisioning Services Installation Wizard ......................................................... 26  
   Provisioning Services Console Wizard ............................................................... 26  
   Master Target Device Installation Wizard ......................................................... 26  
   Upgrade Wizard ................................................................................................... 26  
   Overview: Installation and Configuration Tasks .................................................. 27
## Contents

- Planning ........................................................................................................... 27  
  - Select and Configure the MS SQL Database ............................................. 27  
  - Configure Authentication ........................................................................... 30  
  - Review System Requirements .................................................................... 33  
  - Map out Your Farm ...................................................................................... 40  
- Getting Product Licensing .............................................................................. 40  
  - Installing the License Server ...................................................................... 41  
  - Installing Provisioning Services Server Software ..................................... 41  
  - Silent Product Software Install .................................................................. 43  
- Configuring the Farm ....................................................................................... 43  
  - Configuration Wizard Settings .................................................................... 44  
  - Starting the Configuration Wizard .............................................................. 44  
  - Network Topology ....................................................................................... 44  
  - Identify the Farm ......................................................................................... 45  
  - Identify the Database .................................................................................. 46  
  - Create a New Store for a New Farm ............................................................ 47  
  - Identify the Site ............................................................................................ 48  
  - Select the License Server ........................................................................... 48  
  - Configure User Account Settings ............................................................... 49  
  - Select Network Cards for the Stream Service ........................................... 49  
  - Configure Bootstrap Server ....................................................................... 50  
  - Running the Configuration Wizard Silently ............................................... 52  
    - Prerequisite ................................................................................................ 52  
    - To Create the ConfigWizard.ans File ....................................................... 53  
    - To Copy and Modify the ConfigWizard.ans File ..................................... 53  
    - To Run the ConfigWizard.exe Silently ..................................................... 53  
- Installing Provisioning Services Console Software ........................................ 54  
- Adding Additional Provisioning Servers ....................................................... 55  
- Managing Administrative Roles ................................................................. 55  
- Preparing a Master Target Device for Imaging .............................................. 56  
  - Preparing the Master Target Device's Hard Disk ....................................... 56  
  - Configuring a Master Target Device's BIOS ............................................. 57  
    - Configuring Network Adapter BIOS ....................................................... 57  
  - Installing Master Target Device Software ............................................... 58  
  - Installing Provisioning Services Target Device Software on a Windows Device 59  
- Creating vDisks Automatically ..................................................................... 59  
  - Using the Imaging Wizard to Create a New vDisk .................................... 60  
- Assigning vDisks to Target Devices ............................................................. 61  
- Uninstalling Product Software ..................................................................... 62
3 Installing and Configuring Embedded Target Devices...........................................65
   System Requirements..................................................................................66
   Installing Embedded Target Devices..........................................................66
   Un-installing an Embedded Target Device Package.....................................67
   Windows XP Embedded Build Overview....................................................67
   Setting Up Embedded Target Devices........................................................70

4 Upgrading a Provisioning Services Farm.......................................................73
   Upgrading the Database and Provisioning Servers.......................................75
   Upgrading the Database and the First Provisioning Server..........................75
   Upgrading Remaining Provisioning Servers in the Farm.................................75
   Upgrading vDisks by Re-imaging.................................................................76
   Automated Upgrade of vDisks.......................................................................76
      Automated Inline Upgrade.........................................................................0
      Automated Rolling Upgrade.....................................................................76
   Upgrading vDisks Manually..........................................................................78
      Image Back to Master Target Devices Hard Drive.....................................78
   Upgrading vDisks using Hyper-V.................................................................80

5 Managing Multiple Network Interface Cards.................................................83
   Requirements and Considerations for Manufacturer's NIC Teaming..............85
   Requirements and Considerations for Provisioning Services NIC Failover........85

6 Managing Bootstrap Files and Boot Devices................................................87
   Configuring the Bootstrap File From the Console.........................................88
      Configuring the Bootstrap File..................................................................90
   Using the Manage Boot Devices Utility.......................................................92
      Configuring Boot Devices.......................................................................93
Most enterprises struggle to keep up with the proliferation and management of computers in their environment. Each computer, whether it is a desktop PC, a server in a data center, or a kiosk-type device, must be managed as an individual entity. The benefits of distributed processing come at the cost of distributed management. It costs time and money to set up, update, support and ultimately decommission each computer. The initial cost of the machine is often dwarfed by operational costs.

Provisioning Services takes a very different approach from traditional imaging solutions by fundamentally changing the relationship between hardware and the software that runs on it. By streaming a single shared disk image (vDisk) rather than copying images to individual machines, Provisioning Services enables organizations to reduce the number of disk images that they manage, even as the number of machines continues to grow, simultaneously providing the efficiencies of a centralized management with the benefits of distributed processing.

In addition, because machines are streaming disk data dynamically and in real time from a single shared image, machine image consistency is ensured, while at the same time large pools of machines can completely change their configuration, applications, and even OS in the time it takes them to reboot.

Using Provisioning Services, any vDisk can be configured in Standard Image mode. A vDisk in Standard Image mode allows many computers to boot from it simultaneously; greatly reducing the number of images that must be maintained and the amount of storage that would be required. The vDisk is in read-only format and the image can not be changed by target devices.
Benefits for XenApp and other Server Farm Administrators

If you manage pool of servers that work as a farm, such as XenApp servers or web servers, maintaining a uniform patch level on your servers can be difficult and time consuming. With traditional imaging solutions you start out with a pristine golden master image, but as soon as a server is built with the master image, you now must patch the individual server along with all of the others. Rolling patches out to individual servers in your farm is not only inefficient, but it can also be unreliable. Patches often fail on an individual server and you may not realize you have a problem until users start complaining or the server has an outage. Once that happens, getting the server back into sync with the rest of the farm can be challenging and sometimes it can require a full re-imaging of the machine.

With Provisioning Services, patch management for server farms is simple and reliable. You start out managing your golden image and you continue to manage that single golden image. All patching is done in one place and then streamed to your servers when they boot-up. Server build consistency is assured because all your servers are using a single shared copy of the disk image. If a server becomes corrupted, simply reboot it and it's instantly back to the known good state of your master image. Upgrades are extremely fast. Once you have your updated image ready for production you simply assign the new image version to the servers and reboot them. In the time it takes them to reboot you can deploy the new image to any number of servers. Just as importantly, rollbacks can be done in the same manner so problems with new images will not take your servers or your users out of commission for an extended period of time.

Benefits for Desktop Administrators

As part of XenDesktop, desktop administrators have the ability to use Provisioning Services' streaming technology to simplify, consolidate, and reduce the costs of both physical and virtual desktop delivery. Many organizations are beginning to explore desktop virtualization. While virtualization addresses many of
the consolidation and simplified management needs of IT, deploying it also requires deployment of supporting infrastructure. Without Provisioning Services, storage costs can put desktop virtualization out of the budget. With Provisioning Services, IT can reduce the amount of storage required for VDI by as much as 90%. At the same time the ability to manage a single image rather than hundreds or thousands of desktops significantly reduces the cost, effort, and complexity for desktop administration.

Different types of workers across the enterprise need different types of desktops. Some require simplicity and standardization, while others require high performance and personalization. XenDesktop can meet these requirements in a single solution using FlexCast™ delivery technology. With FlexCast™, IT can deliver every type of virtual desktop - each specifically tailored to meet the performance, security and flexibility requirements of each individual user.

Not all desktops applications can be supported by virtual desktops. For these scenarios, IT can still reap the benefits of consolidation and single image management. Desktop images are stored and managed centrally in the datacenter and streamed out to physical desktops on demand. This model works particularly well for standardized desktops such as those in lab and training environments, call centers, and "thin client" devices used to access virtual desktops.

**Provisioning Services Solution**

Provisioning Services streaming technology allows computers to be provisioned and re-provisioned in real-time from a single shared-disk image. In doing so, administrators can completely eliminate the need to manage and patch individual systems. Instead, all image management is done on the master image. The local hard-disk drive of each system may be used for runtime data caching or, in some scenarios, removed from the system entirely, which reduces power usage, system failure rates, and security risks.

The Provisioning Services solution's infrastructure is based on software-streaming technology. After installing and configuring Provisioning Services components, a vDisk is created from a device’s hard drive by taking a snapshot of the OS and application image, and then storing that image as a vDisk file on the network. A device that is used during this process is referred to as a Master target device. The devices that use those vDisks are called target devices.
vDisks can exist on a Provisioning Server, file share, or in larger deployments, on a storage system that the Provisioning Server can communicate with (iSCSI, SAN, NAS, and CIFS). vDisks can be assigned to a single target device as Private Image Mode, or to multiple target devices as Standard Image Mode.

When a target device is turned on, it is set to boot from the network and to communicate with a Provisioning Server. Unlike thin-client technology, processing takes place on the target device (refer to Step 1 in the illustration that follows).

The target device downloads the boot file from a Provisioning Server (refer to Step 2), and then the target device boots. Based on the device boot configuration settings, the appropriate vDisk is located, then mounted on the Provisioning Server (refer to step 3). The software on that vDisk is streamed to the target device as needed. To the target device, it appears like a regular hard drive to the system.

Instead of immediately pulling all the vDisk contents down to the target device (as done with traditional or imaging deployment solutions), the data is brought across the network in real-time, as needed. This approach allows a target device to get a completely new operating system and set of software in the time it takes to reboot, without requiring a visit to a workstation. This approach dramatically decreases the amount of network bandwidth required by traditional disk imaging tools; making it possible to support a larger number of target devices on your network without impacting overall network performance.

**Product Licenses**

Product licenses are issued based on the product edition that you choose. For Citrix product licensing documentation, open the Citrix Knowledge Center, then select Licensing under the Knowledge Resources section. For licensing time out conditions, refer to **Getting Product Licensing** on page 40.
Provisioning Services Product Infrastructure

The Provisioning Service's infrastructure design directly relates to administrative roles within a Provisioning Services farm. The Provisioning Services administrator role determines which components that administrator can manage or view in the Console (for details, refer to 'Managing Administrator Roles' in the Provisioning Services Administrator's Guide).

There are several components that make up a Provisioning Services farm. The graphic that follows provides a high-level view of a basic Provisioning Services infrastructure and illustrates how Provisioning Services components might appear within that implementation.

The sections that follow provide a brief introduction to Provisioning Services components. For details on managing each component, refer to the appropriate chapter in the Provisioning Services Administrator's Guide.

License Server

The product license server is installed within the shared infrastructure or an existing Citrix licence server can be selected.

Note: The license server is selected when the Configuration Wizard is run on a Provisioning Server. All Provisioning Servers within the farm must be able to communicate with the license server.
Provisioning Services Database

The database stores all system configuration settings that exist within a farm. Only one database can exist within a farm and all Provisioning Servers in that farm must be able to communicate with that database. You may choose to leverage an existing SQL Server database or install SQL Server Express, which is free and available from Microsoft.

**Note:** The database server is selected when the Configuration Wizard is run on a Provisioning Server.

Console

The Console is a utility that is used to manage your Provisioning Services implementation. After logging on to the Console, you select the farm that you want to connect to. Your administrative role determines what you can view in the Console and manage in the farm (for details, refer to (for more details, refer to ‘Managing Consoles’ in the Provisioning Services Administrator’s Guide).

**Note:** The Console is installed as a separate component and is available from the product installation media. The Provisioning Services Console is an MMC (Microsoft Management Console) snap-in. MMC specific console features are not described in this document. Refer to Microsoft’s MMC documentation for detailed information.

When the Farm node is expanded at the highest level, the Provisioning Services Console window displays as follows:
The Action menu displays Provisioning Services tasks that can be performed on an object that is highlighted in the Console. The same tasks are available when you right-click on the object in the Console.

Tasks are object specific and can only be performed if the user has the appropriate role assigned (role-based administration). Your role determines what displays in the Console. For example, if you are a farm administrator, you can perform all tasks and see all objects in the farm. Device administrators can only perform device-collection management tasks on collections to which they have privileges. Administrator roles are described later in this chapter.

**Console Tree and Details Pane**

To view information about an object in the Details pane, click on the object or folder in the Tree pane. The Details pane provides information such as the object's name and a description of that object.

**Properties Menus**

To view or change an object's properties, right-click on the object, then select the **Properties** menu option. You can also highlight the object in the Console window, then select **Properties** from the Action menu options. The Properties dialog displays property settings in tabular format.

### Network Services

Network services include a DHCP service, Preboot Execution Environment (PXE) service, and a TFTP service. These service options can be used during the boot process to retrieve IP addresses, and locate then download the boot program from the Provisioning Server to the target device. Alternative boot options are also available (for network service details, refer to 'Managing Bootstrap Files and Boot Devices' in the Provisioning Services Administrator's Guide).

**Note:** Network services can be installed with the product installation (optional), and then configured when the Configuration Wizard is run. Existing network services within your infrastructure also be leveraged.

### Farms

A farm represents the top level of a Provisioning Services infrastructure. The farm is created when the Configuration Wizard is run on the first Provisioning Server that will be added to that farm. Farms provide a farm administrator with a method for managing all components within the farm, such as:

- Product licensing
- Farm properties
- Administrative roles
- Active Directory configurations
Provisioning Servers

vDisk images

Target devices

Target device collections

Sites

Stores

Views

**Note:** All sites within a farm share that farm’s Microsoft SQL database. The Console does not need to be directly associated with the farm because remote administration is supported on any Console that can communicate with that farm’s network.

The Farms on page 13 hierarchy in the Console consists of the following major components:

- **Stores** on page 14
- **Sites** on page 15
- **Views** on page 18

The hierarchy displays in the Provisioning Services Console as follows:

```plaintext
Provisioning Services Console
   Farm (FV5-2CD73074B4B32)
      Sites
      Views
      Stores
```

For more details, refer to ‘Managing Farms’ in the *Provisioning Services Administrator’s Guide*.

**Stores**

A farm contains one or more stores. A store is a logical name that is given to a physical or virtual vDisk storage location. The store name is the common name used by all Provisioning Servers within the farm.

**Example One**

The physical vDisk for Windows XP resides on a Provisioning Server local to a site. The logical name that is given to this physical location is the store.

**Store name (logical name):** bostonwinxp

**Physical path to the vDisk:** C:\vDisks\n
**Example Two**
The physical vDisk for Windows XP resides on a network share (FinanceVdisks) at the farm level.

Store name (logical name): financevdisks

Physical path to the vDisk for all Provisioning Servers in the farm is: \financeserver\financevdisks

Access or visibility to a store depends on the users administrative privileges:

- Farm administrators have full access to all stores within the farm.
- Site administrators have access to only those stores owned by the site. They can delete stores owned by the site but they can not modify store properties or add vDisks to the store.
- Device administrators and device operators have read-only access and can not view store information. Site Administrators may also have read-only access if that store exists at the farm level, or if that store belongs to another site.

Examples of store tasks that a Farm administrator is able to perform includes:

- Configuring store properties
- Creating or importing new vDisks
- Adding new vDisk Versions to the store

Sites

One or more sites can exist within a Farm. The first site is created with the Configuration Wizard is run on the first Provisioning Server in the farm. A site provides both a site administrator and farm administrator, with a method of representing and managing components within a site, which includes:

- Servers
- vDisk Pools
- vDisk Update Management components
- Device Collections
- Views

Sites are represented in the Console as follows:

Provisioning Servers
A Provisioning Server is any server that has Stream Services installed, which is used to stream software from vDisks, as needed, to target devices. In some implementations, vDisks reside directly on the Provisioning Server. In larger implementations, Provisioning Servers may get the vDisk from a shared-storage location on the network.

Provisioning Servers also retrieve and provide configuration information to and from the Provisioning Services Database. Provisioning Server configuration options are available to ensure high availability and load-balancing of target device connections.

For Provisioning Server details, refer to ‘Managing Provisioning Servers’ in the Provisioning Services Administrator’s Guide.

vDisk Pools

vDisk pools are the collection of all vDisks available to a site. There is only one vDisk pool per site.

vDisk Update Management

In the Console, the vDisk Update Management feature is used to configure the automation of vDisk updates using virtual machines. Automated vDisk updates can occur on a scheduled basis, or at any time that the administrator enforces the update directly from the Console. This feature supports updates detected and delivered from Electronic Software Delivery (ESD) servers, Windows updates, or other pushed updates.

When the Site node is expanded in the Console tree, the vDisk Update Management feature appears. When expanded, the vDisk Update Management feature includes the following managed components:

- Hosts
- vDisks
- Tasks

For details on using the vDisk Update Management feature, refer to ‘Automating vDisk Updates’ in the Provisioning Services Administrator’s Guide.

Device Collections

Device collections provide the ability to create and manage logical groups of target devices. A target device is a device, such as desktop computer or server, that boots and gets software from a vDisk on the network. A device collection could represent a physical location, a subnet range, or a logical grouping of target devices. Creating device collections simplifies device management by performing actions at the collection level rather than at the target-device level.

Note: A target device can only be a member of one device collection.

Device collections are created and managed by farm administrators, site administrators that have security privileges to that site, or device administrators that have security privileges to that collection. Device administrators can not modify the collection itself; only the devices within it. Device operators can only perform tasks on device collections that they are assigned to.

vDisks
vDisks exist as disk image files on a Provisioning Server or on a shared storage device. A vDisk consists of a VHD base image file, any associated properties files (.pvp), and if applicable, a chain of referenced VHD differencing disks (.avhd).

vDisks are assigned to target devices. Target devices boot from and stream software from an assigned vDisk image.

vDisk Modes

vDisk images are configured to be in Private Image mode (for use by a single device, read/write) or Standard Image mode (for use by multiple devices, read-only with various caching options).

vDisk Chain

Any updates to a vDisk base image may be captured in a versioned differencing disk, leaving the original base disk image unchanged. The following illustrates the basic relationship between a base disk and versions that referencing that base disk.

Each time a vDisk is to be updated, a new version of the VHD differencing disk can be created and the file name is numerically incremented, as captured in the table that follows.

<table>
<thead>
<tr>
<th>Version</th>
<th>VHD Filename</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Image</td>
<td>win7dev.avhd</td>
</tr>
<tr>
<td>Version 1</td>
<td>win7dev.1.avhd</td>
</tr>
<tr>
<td>Version 2</td>
<td>win7dev.2.avhd</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Version N</td>
<td>win7dev.N.avhd</td>
</tr>
</tbody>
</table>

Booting a vDisk

The method used to locate and boot from a vDisk on a server share is illustrated in the graphic that follows.
1. The target device begins the boot process by communicating with a Provisioning Server and acquiring a license.

2. The Provisioning Server checks the vDisk pool for vDisk information, which includes identifying the Provisioning Server(s) that can provide the vDisk to the target device and the path information that server should use to get to the vDisk. In this example, the vDisk shows that only one Provisioning Server in this site can provide the target device with the vDisk and that the vDisk physically resides on the Finance Server (shared storage at the farm level).

3. The Provisioning Server locates the vDisk on Finance Server, then streams that vDisk, on demand, to the target device.

**Views**

Views provide a method that allows you to quickly manage a group of target devices. Views are typically created according to business needs. For example, a view can represent a physical location, such as a building or user type. Unlike device collections, a target device can be a member of any number of views.

Views are represented in the Console as follows:

- Farm views can include any target device that exists in this farm. Site views can only include target devices that exist within that site.
**Provisioning Services Administrator Roles**

The ability to view and manage objects within a Provisioning Services implementation is determined by the administrative role assigned to a group of users. Provisioning Services makes use of groups that already exist within the network (Windows or Active Directory Groups).

All members within a group share the same administrative privileges within a farm. An administrator may have multiple roles if they belong to more than one group.

Groups are managed at the farm level through the Console’s Farm Properties dialog.

The following roles exist within a Provisioning Services farm:

- **Farm Administrator** - Farm administrators can view and manage all objects within a farm. Farm administrators can also create new sites and manage role memberships throughout the entire farm.

- **Site Administrator** - Site administrators have full management access to the all objects within a site. For example, a site administrator can manage Provisioning Servers, site properties, target devices, device collections, vDisks, vDisk pools, and local vDisk stores. A site administrator can also manage device administrator and device operator memberships.

- **Device Administrator** - Device administrators can perform all device-collection management tasks on collections to which they have privileges, including: view vDisk properties (read-only), assign or remove vDisks from a device, boot or shut down target devices, edit device properties, and send messages to target devices within a device collection to which they have privileges.

- **Device Operator** - Device operators can view target device properties (read-only), boot or shut down target devices, and send messages to target devices within a device collection to which they have privileges.

For details on administrator roles, refer to ‘Managing Administrators’ in the Administrator’s Guide.

**Product Utilities**

In addition, Provisioning Services includes several tools for use when configuring and managing a Provisioning Services deployment. After installing Provisioning Services software, the following tools become available:

- **Installation Wizard** - Use this wizard to install Provisioning Services components to create a Provisioning Servers and Master target devices.

- **Configuration Wizard** - Use this wizard to configure Provisioning-Server components, including network services, and database permissions. This wizard is installed during the Provisioning Services installation process.

- **Imaging Wizard** - On the master target device, run the Provisioning Services Imaging Wizard to create a vDisk file in the Provisioning Services database and then image to
that file without having to physically go to a Provisioning Server. This utility is installed during the target device installation process.

- Virtual Disk Status Tray - Use this target device utility to get target-device connection status and streaming statistical information. This utility is installed during the Provisioning Services target device installation process.

- XenDesktop Setup Wizard - Creates virtual machines (VMs), associates target devices to those VMs, assigns a shared vDisk to each target device, then adds all virtual desktops to the XenDesktop catalog.

- Streamed VM Setup Wizard - Creates VMs, associates target devices to those VMs, then assigns a shared vDisk to each target device. For use with vDisk update management.

- Virtual Host Connection Wizard - Adds a new virtual host connections to the vDisk Update Manager.

- Managed vDisk Setup Wizard - Adds new managed vDisks to the vDisk Update Manager.

- Update Task Wizard - Configures a new update task for use with vDisk Update Manager.

- Boot Device Manager - Use this utility to configure a boot device, such as a USB or CD-ROM, which then receives the boot program from the Provisioning Services.

- Upgrade Utilities - There are several upgrade methods available. The method you select depends on your network requirements.

- Programming Utilities - Provisioning Services provides programmers with a management application programming utility and a command line utility. These utilities can be accessed by all users. However, users can only use those commands associated with their administrator privileges. For example, a Device Operator is able to use this utility to get a list of all target devices that they have access to.

**Provisioning Services and Resources**

The following services and resources are available to support Provisioning Services.

- Provisioning Services Documentation
- Getting Service and Support
- Getting the Subscription Advantage
- Locating the Citrix Developer Network
- Participating in Citrix Education and Training

**Provisioning Services Documentation**

The following identifies the documentation that is available to support Provisioning Services. All supporting documentation assumes that Provisioning Services administrators are knowledgeable about networking components and administration, and that device operators are familiar with networking concepts.
The majority of product documentation is provided as Adobe Portable Document Format (PDF) files. To view, search, and print PDF documentation, you need to have Adobe Reader 5.0.5 with Search, or a more recent version. You can download these products for free from Adobe System’s Web site at http://www.adobe.com/

Most PDF product documentation, including knowledge-based topics and white papers, are accessible from the Citrix Knowledge Center, http://support.citrix.com/ or from Citrix eDocs at http://support.citrix.com/proddocs/index.jsp.

Citrix Product Licensing Documentation

For Citrix product licensing documentation, refer to Licensing Your Product under the Technologies section on Citrix eDocs (http://support.citrix.com/proddocs/index.jsp).

Release Notes

This document contains important product information and is intended to be read first. Contents include information on new product features, enhancements, and known product issues as well as late additions that were not included in the other product documentation.

The release notes are accessible from:

- Citrix Knowledge Center: http://support.citrix.com/
- Product installation CD-ROM, when the installation executable is run.

Programmer’s Guides

Administrator’s with the appropriate privileges can use any of the following guides to manage your implementation from command lines.

- MCLI Programmer’s Guide
- SOAP Server Programmer’s Guide
- PowerShell Programmer’s Guide

These guides are available as a PDF and can be accessed from the Citrix Knowledge Center: http://support.citrix.com/

Virtual Disk Status Tray Help

The Virtual Disk (vDisk) Status Tray help is available to aid in the management and troubleshooting of vDisks on target devices.

This help system is assessable from the Help menu on the Virtual Disk Status Tray.

Finding Additional Documentation

From the Help menu or product installation directory, the following additional documentation is available for optional Provisioning Services utilities:

- Boot Device Manager (BDM.chm)
- BOOTPTab Editor (bootptab-editor-help.chm)
- PXE (pxemap.chm)
Getting Service and Support

Citrix provides technical support primarily through the Citrix Solutions Advisors Program. Contact your supplier for the first-line support or check for your nearest Solutions Advisor. In addition to the Citrix Solutions Advisors Program, Citrix offers a variety of self-service, Web-based technical support tools from its Knowledge Center at: http://support.citrix.com/

The Knowledge Center feature includes:

- A knowledge base containing thousands of technical solutions to support your Citrix environment.
- An online product documentation library.
- Interactive support forums for every Citrix product.
- Blogs and communities.
- Access to the latest hotfixes and service packs.
- Security bulletins.
- Additional resources are available to customers with valid support contracts, including online problem reporting and tracking.
- Citrix Live Remote Assistance. Using Citrix’s remote assistance product, GoToAssist, a member of our support team can view your desktop and share control of your mouse and keyboard to get you on your way to a solution.

Another source of support, Citrix Preferred Support Services, provides a range of options that allows you to customize the level and type of support for your organization’s Citrix products.

Getting the Subscription Advantage

Subscription Advantage gives you an easy way to stay current with the latest server-based software functionality and information. Not only do you get automatic delivery of feature releases, software upgrades, enhancements, and maintenance releases that become available during the term of your subscription, you also get priority access to important Citrix technology information.

You can find more information on the Citrix Web site (http://www.citrix.com/) by selecting Subscription Advantage from the Support menu.

You can also contact your Citrix sales representative or a member of the Citrix Solutions Advisors Program for more information.

Locating the Citrix Developer Network

The Citrix Developer Network (CDN) is at: http://www.citrix.com/cdn/

This enrollment membership program provides access to developer toolkits, technical information, and test programs for software and hardware vendors, system integrators,
and corporate IT developers who incorporate Citrix computing solutions into their products.

Note: There is no cost associated with enrolling with the Citrix Developer Network.

 Participating in Citrix Education and Training

The following identifies the documentation that is available to support Provisioning Services. All supporting documentation assumes that Provisioning Services administrators are knowledgeable about networking components and administration, and that device operators are familiar with networking concepts.

The majority of product documentation is provided as Adobe Portable Document Format (PDF) files. To view, search, and print PDF documentation, you need to have Adobe Reader 5.0.5 with Search, or a more recent version. You can download these products for free from Adobe System’s Web site at: http://www.adobe.com/
Chapter 2

Installing and Configuring Provisioning Services

Topics:

• Installation Wizards and Utilities
• Overview: Installation and Configuration Tasks
• Planning
• Getting Product Licensing
• Installing Provisioning Services Server Software
• Configuring the Farm
• Installing Provisioning Services Console Software
• Adding Additional Provisioning Servers
• Managing Administrative Roles
• Preparing a Master Target Device for Imaging
• Creating vDisks Automatically
• Assigning vDisks to Target Devices
• Uninstalling Product Software

This chapter describes the Provisioning Services installation wizards that are included in the product software, and the installation and configuration procedures required to create a new Provisioning Services implementation.

Note: Provisioning Services product software and components are installed from the product CD-ROM or from the product download site.
Installation Wizards and Utilities

Citrix Licensing

CTX_Licensing.msi installs the Citrix licensing software on a server that can communicate with Provisioning Servers within your implementation.

Provisioning Services Installation Wizard

Run PVS_Server.exe or PVS_Server_x64.exe to install the following Provisioning Services’ components within a farm:

- Provisioning Services Stream Service
- Network Boot Services (optional)
- Configuration Wizard (runs after the installation wizard to configure installed components and creates the Provisioning Services database)
- Programming Utilities
- Boot Device Manager (BDM)

Note: Installing from a UNC path is not supported.

Provisioning Services Console Wizard

Run PVS_Console.exe or PVS_Console_x64.exe to install the Console, which also includes the Boot Device Management utility. The Console can be installed on any machine that can communicate with the Provisioning Services database.

Master Target Device Installation Wizard

For Windows: PVS_Device.exe or PVS_Device_x64.exe

Installs the target device software on a Master Target Device. The Master Target Device is used to create the ‘golden image,’ which is then saved to a vDisk file using the Imaging Wizard.

Upgrade Wizard

The Upgrade Wizard facilitates the automation of the upgrade process, and includes the following utilities:

- The UpgradeAgent.exe runs on the target device to upgrade previously installed product software.
The UpgradeManager.exe runs on the Provisioning Server to control the upgrade process on the target device.

Overview: Installation and Configuration Tasks

The following lists the installation and configuration tasks required to create a Provisioning Services implementation. These tasks are described in detail within this chapter.

1. Planning on page 27
2. Getting Product Licensing on page 40
3. Installing Provisioning Services Server Software on page 41
4. Configuring the Farm on page 43
5. Installing Provisioning Services Console Software on page 54
6. Adding Additional Provisioning Servers on page 55
7. Managing Administrative Roles on page 55
8. Preparing a Master Target Device for Imaging on page 56
9. Using the Imaging Wizard to Create a New vDisk on page 60
10. Assigning vDisks to Target Devices on page 61

Planning

The following planning procedures must be completed prior to installing and configuring Provisioning Services:

- Select and Configure the MS SQL Database on page 27
- Configure Authentication on page 30
- Review System Requirements on page 33
- Map out Your Farm on page 40

Select and Configure the MS SQL Database

Select one of the following MS SQL 2005, MS SQL 2008, MS SQL 2008R2 Server editions to use for the Provisioning Services Database:

- SQL Server Express Edition
- SQL Server Workgroup Edition
- SQL Server Standard Edition
- SQL Server Enterprise Edition
Note: In some production environments, the database administrator may prefer to create the Provisioning Services database. In this case, provide the MS SQL database administrator with the file that is created using the DbScript.exe utility. This utility is installed with the Provisioning Services software.

Database Sizing

To estimate the size of the database, estimate the size of each table individually, and then add those values. The size of a table depends on if the table has indexes, and the type of indexes. To estimate the database size refer to: [http://msdn.microsoft.com/en-us/library/ms187445.aspx](http://msdn.microsoft.com/en-us/library/ms187445.aspx), or estimate the size using an existing database as a sample, and then calculate how much room it takes for each record in each table (based on this average, a new value can be determined based on the number of records expected). For example:

**Initial Size and Growth**

When the database is created, its initial size is 20 MB with a growth size of 10MB.

The database log initial size is 10 MB with a growth size of 10%.

**Base Amount**

The Base amount that will not change is 112 KB; it is made up of the items below:

- The DatabaseVersion record requires approximately 32 KB.
- The Farm record requires approximately 8 KB.
- The DiskCreate record requires approximately 16 KB.
- The Notifications requires approximately 40 KB.
- The ServerMapped record requires approximately 16 KB.

**Variable Amount Based On Objects**

The following tables can get large if additional items are included:

- **Access and Groupings**
  - Each user group that has access to the system requires approximately 50 KB.
  - Each Site record requires approximately 4 KB.
  - Each collection that holds Devices requires approximately 10 KB.

- **FarmView**
  - Each FarmView requires approximately 4 KB.
  - Each FarmView/Device relationship requires approximately 5 KB.

- **SiteView**
  - Each SiteView requires approximately 4 KB.
  - Each SiteView/Device relationship requires approximately 5 KB.

- **Device**
• Each Device requires approximately 2 KB.
• Each DeviceBootstrap requires approximately 10 KB.
• Each Device/Disk relationship requires approximately 35 KB.
• Each Device/Printer relationship requires approximately 1 KB.
• Each Device/Personality requires approximately 1 KB.
• Each DeviceStatus when a Device is booted requires approximately 1 KB.
• Each DeviceCustomProperty requires approximately 2 KB.

• Disk
  • Each unique Disk requires approximately 1 KB.
  • Each DiskVersion requires approximately 3 KB.
  • Each DiskLocator requires approximately 10 KB.
  • Each DiskLocatorCustomProperty requires approximately 2 KB.

• Server
  • Each Server requires approximately 5 KB.
  • Each ServerIP requires approximately 2 KB.
  • Each ServerStatus when a Server is booted requires approximately 1 KB.
  • Each ServerCustomProperty requires approximately 2 KB.

• Store
  • Each Store requires approximately 8 KB.
  • Each Store/Server relationship requires approximately 4 KB.

• Disk Update
  • Each VirtualHostingPool requires approximately 4 KB.
  • Each UpdateTask requires approximately 10 KB.
  • Each DiskUpdateDevice requires approximately 2 KB.
  • Each DiskUpdateDevice/Disk relationship requires approximately 35 KB.
  • Each Disk/UpdateTask relationship requires approximately 1 KB.

Variable Change Size
The amount that gets larger as changes are made are listed below:

• Each Task (Disk Verison Merge) that has been processed requires approximately 2 KB.

• If auditing is turned on, each change made by the administrator in the Console, MCLI or PowerShell PVS interface requires approximately 1 KB.

Database Mirroring
To use the MS SQL Server’s database mirroring feature within your farm:

**Note:** For Provisioning Services to support MS SQL database mirroring, the database needs to be properly configured with **High-safety mode with a witness (synchronous)**.

1. Run the Configuration Wizard, then select the **Create farm** option.
2. Configure the mirroring database by following Microsoft’s instructions.
3. Re-run the Configuration Wizard, then select the **Join existing farm** option.
4. On the Existing Farm dialog, select the checkbox next to **Specify database mirror failover partner**. Enter the database server and instance name of the database mirror failover partner and, if necessary, an optional TCP port.

**Note:** Refer to **Configuring the Farm** on page 43 for details.

### Configure Authentication

Provisioning Services uses Windows authentication. All Provisioning Services components, including the Configuration Wizard and services that access the database, must run in the context of the logged-in user.

Services, such as the Stream Process and SOAP Server, need to have the user specifically configured with minimal privileges.

**Note:** Provisioning Services supports Windows authentication as is recommended by Microsoft. Microsoft SQL Server authentication is not supported, except when running the Configuration Wizard.

### Configuration Wizard User Permissions

The following MS SQL permissions are required for the user that is running the Configuration Wizard:

- `dbcreator`; required for creating the database
- `securityadmin`; required for creating the SQL logins for the stream and soap services

If the user does not have sufficient SQL privileges, a dialog prompts for a SQL Server user that has the appropriate permissions (`dbcreator` and `securityadmin`).

If using MS SQL Express in a test environment, you can choose to provide the user that is running the Configuration Wizard `sysadmin` privileges (the highest database privilege level).

**Note:** Alternatively, if the database administrator has provided an empty database, the user running the Configuration Wizard must be the owner of the database and have the "View any definition permission" (these settings are set by the database administrator when the empty database is created).
Service Account Permissions

The user context for the Stream and Soap services requires the following database permissions:

- db_datareader
- db_datawriter
- execute permissions on stored procedures

**Note:** The Configuration Wizard assigns these permissions provided the user has securityadmin permissions.

In addition, the service user must have the following system privileges:

- Run as service
- Registry read access
- Program Files\Citrix\Provisioning Services
- Read/write access to any vDisk location

Determine which of the following supported user accounts the Stream and Soap services will run under:

- Network service account
  Minimum privilege local account that authenticates on the network as computers domain machine account
- Specified user account (required when using a Windows Share)
  Workgroup or domain user account
- Local system account (for use with SAN)
- To support KMS licensing, the Soap Server user account must have the 'Perform volume maintenance tasks' (SeManageVolumePrivilege) privilege
- If using Personal vDisks with XenDesktop, the Soap Server user account must have XenDesktop Full administrator privileges.

Because authentication is not common in workgroup environments, minimal privilege user accounts must be created on each server, and each instance must have identical credentials (i.e. password).

**Caution:** Installing SQL Server and Provisioning Services on the same server can cause poor distribution during load balancing. It is highly recommended that they do not co-exist on the same server.

Determine the appropriate security option to use in this farm (only one option can be selected per Farm and the selection you choose impacts Role Based Administration).

- **Use Active Directory groups for security** (default); select this option if you are on a Windows Domain running Active Directory. This option enables you to leverage Active Directory for Provisioning Services administration roles.
**Note:** Windows 2000 Domains are no longer supported.

- **Use Windows groups for security:** select this option if you are on a single server or in a Workgroup. This option enables you to leverage the Local User/Groups on that particular server for Provisioning Services administration roles.

**Note:** Console users do not directly access the database.

Minimum permissions required for additional Provisioning Services functionality include:

- Provisioning Services XenDesktop Setup Wizard, Streamed VM Setup Wizard, and ImageUpdate service
  - vCenter, SCVMM, and XenServer minimum permissions
  - A XenDesktop controller exists with permissions for the current user.
  - A Provisioning Services Console user account is configured as a XenDesktop administrator and it has been added to a PVS SiteAdmin group or higher.
  - When creating new accounts in the Console, the user needs the Active Directory Create Accounts permission. To use existing accounts, Active Directory accounts have to already exist in a known OU for selection.
  - If using Personal vDisks with XenDesktop, the Soap Server user account must have XenDesktop Full administrator privileges.

- AD account synchronization
  - Create, Reset, and Delete permissions

- vDisk
  - Privileges to perform volume maintenance tasks

**Kerberos Security**

By default, the Provisioning Services Console, Imaging Wizard, PowerShell snap-in and MCLI use Kerberos authentication when communicating with the Provisioning Services SOAP Service in an Active Directory environment. Part of the Kerberos architecture is for a service to register (create a service principal name, SPN) with the domain controller (Kerberos Key Distribution Center). The registration is essential as it allows Active Directory to identify the account that the Provisioning Services SOAP service is running in. If the registration is not performed, the Kerberos authentication will fail and Provisioning Services will fall back to using NTLM authentication.

The Provisioning Services SOAP Service will register every time the service starts and unregister when the service stops. However, there are times when the registration will fail because the service user account does not have permission. By default, the Network Service account and domain administrators have permission while normal domain user accounts do not. There are a few possible workarounds:

1. Use a different account that has permissions to create SPNs.
2. Assign permissions to the service account.
<table>
<thead>
<tr>
<th>Account Type</th>
<th>Permission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Account</td>
<td>Write Validated SPN</td>
</tr>
<tr>
<td>User Account</td>
<td>Write Public Information</td>
</tr>
</tbody>
</table>

3. Create the SPNs manually using the `SETSPN.EXE` tool included with Windows 2008 or distributed with the Windows Support Tools included on the Windows 2003 operating system disk. As an administrator, run the following commands:

- `setspn -a PVSSoap/<hostname> <username>`
- `setspn -a PVSSoap/<fully qualified domain name> <username>`

**Note:** If the service account is ever changed, the SPNs will need to be removed and new ones created for the new account. To remove the SPNs, run the following commands:

- `setspn -d PVSSoap/<hostname> <username>`
- `setspn -d PVSSoap/<fully qualified domain name> <username>`

---

## Review System Requirements

Verify that the following hardware and software requirements are met.

**Provisioning Server OS Requirements**

**Operating Systems**
Provisioning Services English on English, Japanese, German, French, Spanish, Simplified Chinese, Traditional Chinese, Korean, and Russian versions of operating systems are supported

- Windows Server 2003 SP2 (32 or 64-bit); all editions
- Windows Server 2008 (32 or 64-bit); all editions
- Windows Server 2008 R2 and Windows Server 2008 R2 SP1; Standard, DataCenter, and Enterprise editions

**Provisioning Server System Requirements**

In most implementations, there is a single vDisk providing the standard image for multiple target devices. The more target devices using the same vDisk image, the less vDisks need to be created; making vDisk management easier. In order to have a single vDisk, all target devices must have certain similarities to ensure that the OS has all of the drivers it requires to run properly. The three key components that should be consistent are the motherboard, network card, or video card.

Disk storage management is very important because a Provisioning Server can have many vDisks stored on it, and each disk can be several gigabytes in size. Your streaming performance can be improved using a RAID array, SAN, or NAS.
Processor
Intel or AMD x86 or x64 compatible; 2 GHz minimum; 3 GHz preferred; 3.5 GHz Dual Core/HT or similar for loads greater than 250 target devices.

Memory
Minimum of 2 GB RAM; 4 GB preferred; 4 GB is required for a larger number of vDisks (greater than 250).

Hard Disk and Storage
There must be enough space on the hard disk to store the vDisks. For example, if you have a 15 GB hard drive, you can only create a 14 GB vDisk.

Additional requirements depend on several factors such as:
Hard disk capacity requirement of the operating system and applications running on a target device. It is recommended to add 20% on the base size of the final installed image.

Private Image Mode - number of target devices using a vDisk in Private Image mode (vDisks in Private Image mode should be backed up daily)

Standard Image Mode - number of target devices using a vDisk in Standard Image mode.

Note: Best practices include making a copy of every vDisk created.

Windows 2003 and 2003 x64; minimum of 250 MB on the application drive.

Minimum Common Storage Sizes
- 250 MB for the database
- 5 GB on a clean Windows system
- 15 GB per vDisk for Vista Class images (estimated)

Additional space per vDisk based on additional significant applications loaded.

Network Adapter
Static IP

Minimum 100 MB Ethernet, 1 GB Ethernet preferred; Dual 1 GB Ethernet for more than 250 target devices.

Note: Two NICs often perform better than a single dual-ported NIC.

Required Software
The Provisioning Server install program requires the installation of Windows PowerShell 2.0 on each server.

Network Requirements
UDP and TCP Port Requirements
Provisioning Server to Provisioning Server Communication
Each Provisioning Server must be configured to use the same ports (UDP) in order to communicate with each other (uses the Messaging Manager). At least five ports must exist in the port range selected. The port range is configured on the Stream Services dialog when the Configuration Wizard is run.

**Note:** If configuring for a high availability (HA), all Provisioning Servers selected as failover servers must reside within the same site. HA is not intended to cross between sites.

The first port in the default range is UDP 6890 and the last port is 6909.

**Provisioning Servers to Target Device Communication**

Each Provisioning Server must be configured to use the same ports (UDP) in order to communicate with target devices (uses the StreamProcess). The port range is configured using the Console’s Network tab on the Server Properties dialog.

The default ports include:

UDP 6910, 6911, 6912, 6913, 6914, 6915, 6916, 6917, 6918, 6919, 6920, 6921, 6922, 6923, 6924, 6925, 6926, 6927, 6928, 6929 and 6930.

**Login Server Communication**

Each Provisioning Server that will be used as a login server must be configured on the Stream Servers Boot List dialog when the Configuration Wizard is run.

The default port for login servers to use is UDP 6910.

**Console Communication**

The Soap Server is used when accessing the Console. The ports (TCP) are configured on the Stream Services dialog when the Configuration Wizard is run.

The default ports are TCP 54321 and 54322 (Provisioning Services automatically sets a second port by incrementing the port number entered by 1; 54321 + 1).

If this value is modified, the following command must be run.

For Powershell: MCLI-Run SetupConnection

For MCLI: MCLI Run SetupConnection

**Note:** Refer to the Provisioning Server Programmers Guides for details.

**TFTP Communication**

The TFTP port value is stored in the registry:

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\BNTFTP\Parameters Port
The TFTP port defaults to UDP 69.

**TSB Communication**

The TSB port value is stored in the registry:

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\PVSTSB\Parameters Port

The TSB port defaults to UDP 6969.

**Port Fast**

Port Fast must be enabled.

**Network Card**

PXE 0.99j, PXE 2.1 or later.

**Network Addressing**

DHCP

**Target Device Requirements**

**Note:** Dual boot vDisk images are not supported.

Target devices are identified by the operating system that runs on that device. The following table lists the supported operating systems for target devices.

**Windows Target Device**

(32 or 64 bit)

Provisioning Services English on English, Japanese, German, French, Spanish, Simplified Chinese, Traditional Chinese, Korean, and Russian versions of operating systems are supported.

- Windows Server 2003 SP1 (32 or 64-bit); all editions
- Windows Server 2008 (32 or 64-bit); all editions
- Windows Server 2008 R2 and Windows Server 2008 R2 SP1:
  - Standard
  - DataCenter
  - Enterprise
- Windows XP Professional (32 or 64-bit)
- Windows Vista (32 or 64-bit):
  - Business
  - Enterprise
  - Ultimate (retail licensing)
Note: The Ultimate edition of Windows Vista is only supported in Private Image mode.

Windows 7 and Windows 7 SP1 (32 or 64-bit):
- Enterprise
- Professional
- Ultimate

Note: The Ultimate edition of Windows 7 is only supported in Private Image mode.

Licensing Key Considerations

Windows Vista Business, Windows Enterprise, Windows 7, and Windows Server 2008 and Server 2008 R2 are deployed with either Key Management Server (KMS) or with Microsoft Multiple Activation Key (MAK) volume licensing keys. Windows Office 2010 is deployed with KMS.

Note: In order for MAK licensing to work, the Volume Activation Management Tool (VAMT) must be installed on all login servers within a farm. This tool is available from http://www.microsoft.com/downloads/en/details.aspx?FamilyID=ec7156d2-2864-49ee-bfcb-777b898ad582&displaylang=en.

Both Private and Standard Image Modes support MAK and KMS.

Volume licensing is configured within the vDisk image when the Imaging Wizard is run on the Master target device. Volume licensing is configured for the vDisk file on the Microsoft Volume Licensing tab, which is available from the Consoles' vDisk File Properties dialog.

Supported File System Types
- NTFS

Provisioning Services Console Requirements

Processor
- Minimum 1 GHz, 2 GHz preferred

Memory
- Minimum 1 GB, 2 GB preferred

Hard Disk
- Minimum 500 MB

Operating System
- Windows Server 2003 (32 or 64-bit); all editions
- Windows Server 2008 (32 or 64-bit); all editions
- Windows Server 2008 R2; Standard, DataCenter and Enterprise Editions
- Windows XP Professional (32 or 64-bit)
- Windows Vista (32 or 64-bit)
• Business
• Enterprise
• Ultimate (retail licensing)

Other
Required:
MMC 3.0
Windows PowerShell 2.0
Optional: Adobe Acrobat Reader highly recommended.

XenDesktop Setup Wizard
• vCenter, SCVMM, and XenServer minimum permissions.
• A XenDesktop controller exists with permissions for the current user.
• One or more configured XenDesktop hosts with identical templates exist.
• A Device Collection has been created in the Provisioning Services Site.
• The vDisk that will be assigned to each VM must be in standard mode.
• A Provisioning Services Console user account is configured as a XenDesktop administrator and it has been added to a PVS SiteAdmin group or higher.
• When creating new accounts in the Console, the user needs the Active Directory Create Accounts permission. To use existing accounts, Active Directory accounts have to already exist in a known OU for selection.
• If using Provisioning Services with XenDesktop, the Soap Server user account must have XenDesktop Full administrator privileges.
• Template VM Requirements:
  • Boot order: Network/PXE first in list (as with physical machines)
  • Hard disks: If using local write cache, an NTFS formatted disk large enough for the cache must exist. Otherwise, no hard disks are required
  • Network: Static MAC addresses. If using XenServer, address cannot be 00-00-00-00-00
• System Center Virtual Machine Management (SCVMM) servers require that PowerShell 2.0 is installed and configured for the number of connections. The number of required connections for an SCVMM server should be greater than or equal to the number of hosted hypervisors used by the setup wizard for virtual machine cloning. For example: to set connections to 25 from a Powershell prompt, run: winrm set winrm/config/winrs @\{MaxShellsPerUser="25"\}winrm set winrm/config/winrs @\{MaxConcurrentUsers="25"\}.
• For Microsoft SCVMM to work with XenDesktop, the user must run the following PowerShell command; set-ExecutionPolicy unrestricted on SCVMM.
For Microsoft SCVMM, please verify that the MAC address for the template is not 00-00-00-00-00-00 before attempting to clone the template. If necessary, use the template properties dialog to assign a MAC address.

If using multiple NICs, the XenDesktop wizard assumes that the first NIC is the Provisioning Services’ NIC, and therefore changes it in accordance with the virtual machine network in the DDC. This is the first NIC listed in the virtual machines properties.

If running a vCenter server on alternate ports, the following registry modifications must be made in order to connect to it from Provisioning Services:

- Create a new key HKLM\Software\Citrix\ProvisioningServices\PlatformEsx
- Create a new string in the PlatformEsx key named ‘ServerConnectionString’ and set it to ‘http://[0]:PORT#/sdk’

Note: If using use port 300, ServerConnectionString= http://{0}:300/sdk

Streamed VM Setup Wizard Requirements
- One or more hypervisor hosts exist with a configured template.
- A Device Collection exists in the Provisioning Services Site.
- A vDisk in Standard Image mode exists, to be associated with selected VM template.
- Template VM Requirements:
  - Boot order: Network/PXE first in list (as with physical machines)
  - Hard disks: If using local write cache, an NTFS formatted disk large enough for the cache must exist. Otherwise, no hard disks are required
  - Network: Static MAC addresses. If using XenServer, address cannot be 00-00-00-00-00-00
- The Provisioning Services Console user account was added to a PVS SiteAdmin group or above.
- If using Active Directory, when creating new accounts in the Console, the user needs the Active Directory Create Accounts permission. To use existing accounts, Active Directory accounts have to already exist in a known OU for selection.

Supported ESD Servers for vDisk Update Management
- WSUS Server - 3.0 SP2
- System Center Configuration Management (SCCM) - SCCM ConfigMgr 2007 SP2, SCCM 2012

Supported Hypervisors
- XenServer 5.6 SP2, XenServer 6.0
Map out Your Farm

Before attempting to install and configure Provisioning Services, it is important to first map out your farm and note the information that will be requested during the installation and configuration process.

Complete the sections that follow to create a map of your farm.

Provisioning Services Database

Only one database is associated with a farm. You can choose to install the Provisioning Services database software on:

- An existing SQL database; if that machine can communicate with all Provisioning Servers within the farm.
- A new SQL Express database machine, created using the SQL Express software, which is free from Microsoft.

Database server

Host Name:

Instance Name:

License server

Host Name:

Vendor Daemon / license server port:

Getting Product Licensing

The Citrix License Server must be installed on a server within the farm that is able to communicate with all Provisioning Servers within the farm.

Consider the following options when deciding which server to use as the license server:

- Single System: Same system as Provisioning Services; for evaluations, test labs, or implementations with one Citrix product.
- Stand-alone: Separate system that has an existing license server installed; for larger implementations or implementations using multiple Citrix products.
- Point to an existing license server.

Licensing Grace Periods
There are three types of grace periods provided by Citrix Licensing. Provisioning Services implements these grace periods as follows:

- **Out of Box Grace Period (OOBGP)** is 30 days (720 hours): If Provisioning Services is installed prior to either installation of a Citrix License Server or the allocation of valid product edition licenses for XenApp, XenDesktop, XenServer, Essentials for Hyper-V or Provisioning Services for Datacenters, it will provision unlimited systems for a period of 30 days (96 hours is standard across most Citrix products prior to Provisioning Services 6.0 and XenDesktop 5 SP1). If this grace period lapses, provisioning sessions that are already running will continue to run, but any new or restarted provisioning sessions will be subject to the ‘No Valid License Grace Period’ message on the provisioned client.

- **License Server Connectivity Outage Grace Period** is 30 days (720 hours): If connectivity to the Citrix License Server is lost, Provisioning Services will continue to provision systems for a period of 30 days (720 hours; this is standard across most Citrix products). If this grace period lapses, provisioning sessions that are already running will continue to run, but any new or restarted provisioning sessions will be subject to the ‘No Valid License Grace Period’ message on the provisioned client.

- **No Valid License Grace Period for Clients** for 5.6 = 3 hours, 5.6 SP1 = 96 hours: If Provisioning Services cannot obtain a valid license for a provisioning session, a warning dialog displays on the provisioned system, but the session is allowed to continue running for the period of time as indicated above. When this grace period lapses, each affected session is shut down. This grace period may apply in the following scenarios:
  - No valid edition licenses for XenApp, XenDesktop, XenServer, Essentials for Hyper-V or Provisioning Services are available.
  - Licenses are available, but have expired (applies to Evaluation, NFR, and Internal Use license).
  - The SA Expiration date of the licenses precedes the release date of the version of Provisioning Services that is being used.

### Installing the License Server

Download or run CTX_Licensing.msi from the Product Installation CD-ROM.

**Note:** If Provisioning Services is installed after the license server or if new licenses are added, the Stream Service must be restarted.

For product licensing documentation, open Citrix eDocs, expand the **Technologies** section, and then select **Licensing Your Product**.

### Installing Provisioning Services Server Software

Install any Windows service packs, drivers, and updates before installing the Provisioning Services software.
Complete the steps that follow to install the services and applications required to create a Provisioning Server.

1. Click on the appropriate platform-specific install option. The Provisioning Services Welcome window appears.

2. Click Next. The Product License Agreement appears.

3. Scroll to the end to accept the terms in the license agreement, then click Next to continue. The Customer Information dialog appears.

4. Optionally, type or select your user name and organization name in the appropriate text boxes, then click Next. The Destination Folder dialog appears.

5. Click Change, then enter the folder name or navigate to the appropriate folder where the software should be installed, or click Next to install Provisioning Services to the default folder. The Setup Type dialog appears.

6. Select the radio button that best describes the installation to perform:
   - Complete - Installs all components and options on this computer (default).
   - Custom - Choose which components to install and where to install those components.

   **Note:** Installing the Network Boot Services does not activate them. If uncertain about the need for any of these services, choose the Complete installation option.

7. Click Next.

8. If you select Complete, the ‘Ready to Install the Program’ dialog appears.
   If you selected Custom, the ‘Custom Setup’ dialog appears. This dialog provides a ‘Feature Description’ text box that provides a description for the selected component as well as the space required to install that component.

   - Expand each component icon and select how that component is to be installed.

   - After making component selections, click Next. The ‘Ready to Install the Program’ dialog appears. Or, click Cancel to close the wizard without making system modifications.

9. On the ‘Ready to Install the Program’ dialog, click Install to continue with the installation process (the installation may take several minutes).
10. The ‘Installation Wizard Completed’ message displays in the dialog when the components and options are successfully installed.

**Note:** The Installation Wizard can be re-run to install additional components at a later time, or re-run on a different computer to install select components on a separate computer.

11. Click **Finish** to exit the Installation Wizard. The Provisioning Services Configuration Wizard automatically opens.

**Note:** Although Provisioning Services does not require that you restart the server after installing the product software, in some instances, a Microsoft message may appear requesting a restart. If this message appears, complete Configuring the Farm on page 43 using the Configuration Wizard, before restarting the server. If this message appears and the server is not restarted, the removable drive may not appear.

**Silent Product Software Install**

Target devices, Provisioning Servers, and Consoles can be silently installed to a default installation directory using the following command:

```
<Installer Name>.exe /s /v"/qn"
```

Or, use the following to set a different destination:

```
<Installer Name>.exe /s /v"/qn INSTALLDIR=D:\Destination"
```

**Configuring the Farm**

Run the Configuration Wizard on a Provisioning Server when creating a new farm, adding new Provisioning Servers to an existing farm, or reconfiguring an existing Provisioning Server.

When configuring a Provisioning Server, consider the following:

- All Provisioning Servers within a farm must share the same database to locate vDisks for target devices on shared storage devices within the farm. If that shared storage device is a Windows network share, refer to configuration information described in the Administrator’s Guide, Managing Network Components section. If that shared storage device is a SAN, no additional configuration is necessary.

- To properly configure the network services, be sure that you understand network service options and settings.

**Note:** If all Provisioning Servers in the farm share the same configuration settings such as site and store information, consider Running the Configuration Wizard Silently on page 52.
Configuration Wizard Settings

Before running the Configuration Wizard, be prepared to make the following selections:

**Note:** The Configuration Wizard can also be run silently on servers that share similar configuration settings. For details, refer to Running the Configuration Wizard Silently on page 52.

- Network Topology on page 44
- Identify the Farm on page 45
- Identify the Database on page 46
- Identify the Site on page 48
- Select the License Server on page 48
- Select Network Cards for the Stream Service on page 49
- Configure Bootstrap Server on page 50

**Note:** If errors occur during processing, the log is written to a ConfigWizard.log file, which is located at:

- C:\ProgramData\Citrix\Provisioning Services for 2008 and newer.
- C:\Documents and Settings\All Users\Application Data\Citrix \Provisioning Services for 2003.

Starting the Configuration Wizard

The Configuration Wizard starts automatically after Provisioning Services software is installed. The wizard can also be started by selecting:

1. Start->All Programs->Citrix->Provisioning Services->Provisioning Services Configuration Wizard
2. After starting the Configuration Wizard, click Next to begin the configuration tasks that follow.

**Note:** When running the Configuration Wizard, the tasks that appear depend on the network service options that are selected and the purpose for running the wizard.

Network Topology

Complete the network configuration steps that follow.

1. Select the network service to provide IP addresses
Note: Use existing network services if possible. If for any reason existing network services can not be used, choose to install the network services that are made available during the installation process.

To provide IP addresses to target devices, select from the following network service options:

- If the DHCP service is on this server, select the radio button next to one of the following network services to use, then click Next:
  - Microsoft DHCP
  - Provisioning Services BOOTP service
  - Other BOOTP or DHCP service
- If the DHCP service is not on this server, select the radio button next to The service is running on another computer, then click Next.

2. Select the network service to provide PXE boot information

Each target device needs to download a boot file from a TFTP server.

Select the network service to provide target devices with PXE boot information:

- If you choose to use this Provisioning Server to deliver PXE boot information, select The service that runs on this computer, then select from either of the following options, then click Next:
  - Microsoft DHCP (options 66 and 67)
  - Provisioning Services PXE Service
- If Provisioning Services will not deliver PXE boot information, select The information is provided by a service on another device option, then click Next.

Identify the Farm

Note: When configuring the farm, the combination of the database name and farm name cannot exceed 54 characters. Exceeding this limitation may cause the farm name to display truncated in the Existing Farms screen.

Select from the following farm options:

- Farm is already configured
  Select this option to reconfigure an existing farm, then continue on to the “Configure user account settings” procedure. This option only appears if a farm already exists.

- Create farm
  i. On the Farm Configuration dialog, select the Create Farm radio button to create a new farm, then click Next.
ii. Use the Browse button to browse for existing SQL databases and instances in
the network, or type the database server name and instance. Optionally, enter
a TCP port number to use to communicate with this database server.

iii. To enable database mirroring, enable the Specify database mirror failover
partner option, then type or use the Browse button to identify the failover
database server and instance names. Optionally, enter a TCP port number to
use to communicate with this server.

   Note: Refer to Database Mirroring in the Provisioning Services Administrator’s
   Guide for more information.

iv. Click Next to continue on to the “Identify the Database on page 46” procedure.

   • Join existing farm

      i. On the Farm Configuration dialog, select the Join Existing Farm radio button to
         add this Provisioning Server to an existing farm, then click Next.

      ii. Use the Browse button to browse for the appropriate SQL database and
          instance within the network.

      iii. Select the farm name that displays by default, or scroll to select the farm to join.

          Note: More than one farm can exist on a single server. This configuration is
          common in test implementations.

      iv. To enable database mirroring, enable the Specify database mirror failover
          partner option, then type or use the Browse button to identify the failover
database server and instance names. Optionally, enter a TCP port number to
use to communicate with this server.

          Note: Refer to Database Mirroring in the Provisioning Services Administrator’s
          Guide for more information.

      v. Click Next.

vi. Select from the following site options, then click Next:

      • Existing Site: Select the site from the drop-down menu to join an existing site.

      • New Site: Create a site by typing the name of the new site and a collection.

      Continue on to Configure User Account Settings on page 49 procedure.

**Identify the Database**

Only one database exists within a farm. To identify the database, complete the steps
that follow.

1. Select the database location

   If the database server location and instance have not yet been selected, complete
the following procedure.
a. On the Database Server dialog, click **Browse** to open the SQL Servers dialog.

b. From the list of SQL Servers, select the name of the server where this database exists and the instance to use (to use the default instance, SQLEXPRESS, leave the instance name blank). In a test environment, this may be a staged database.

| Note: | When re-running the Configuration Wizard to add additional Provisioning Servers database entries, the Server Name and Instance Name text boxes are already populated. By default, SQL Server Express installs as an instance named ‘SQLEXPRESS’. |

c. Click **Next**. If this is a new farm, continue on to the “Defining a Farm” procedure.

2. To change the database to a new database
   a. On the old database server, perform a backup of the database to a file.
   b. On the new database server, restore the database from the backup file.
   c. Run the Configuration Wizard on each Provisioning Server.
   d. Select **Join existing farm** on the Farm Configuration dialog.
   e. Enter the new database server and instance on the Database Server dialog.
   f. Select the restored database on the Existing Farm dialog.
   g. Select the site that the Server was previously a member of on the Site dialog.
   h. Click **Next** until the Configuration Wizard finishes.

3. Define a farm.
   
   Select the security group to use:
   
   • **Use Active Directory groups for security**
   
   | Note: | When selecting the Active Directory group to act as the Farm Administrator from the drop-down list, choices include any group the current user belongs to. This list includes Builtin groups, which are local to the current machine. Avoid using these groups as administrators, except for test environments. Also, be aware that some group names may be misleading and appear to be Domain groups, which are actually Local Domain groups. For example: ForestA.local/Builtin/Administrators. |
   
   • **Use Windows groups for security**
   
   4. Click **Next**.
   
   Continue on to the “Selecting the license server” procedure.

---

**Create a New Store for a New Farm**

A new store can be created and assigned to the Provisioning Server being configured:
Note: The Configuration Wizard only allows a server to create or join an existing store if it is new to the database. If a server already exists in the database and it rejoins a farm, the Configuration Wizard may prompt the user to join a store or create a new store, but the selection is ignored.

1. On the New Store page, name the new Store.
2. Browse or enter the default path (for example: C:\PVSStore) to use to access this store, then click Next.

If an invalid path is selected, an error message appears. Re-enter a valid path, then continue. The default write cache location for the store is located under the store path for example: C:\PVSStore\WriteCache.

Identify the Site

When joining an existing farm, identify the site where this Provisioning Server is to be a member, by either creating a new site or selecting an existing site within the farm. When a site is created, a default target device collection is automatically created for that site.

- Create a new site
  i. On the Site page, enable the New Site radio button.
  ii. In the Site Name text box, type the new site name where this Provisioning Server is to be a member.
  iii. In the Collection Name, accept the default collection, Collection, or create a new default collection name to associate with this Provisioning Server, then click Next.

- Select an existing site
  i. On the Site page, enable the Existing Site radio button. (The default site name is Site.)
  ii. Select the appropriate site from the drop-down list, then click Next.
  iii. Create a new store or select an existing store on the Store page, then click Next.

Select the License Server

Note: When selecting the license server, ensure that all Provisioning Server’s in the farm are able to communicate with that server in order to get the appropriate product licenses.
1. Enter the name (or IP address) and port number of the license server (default is 27000). The Provisioning Server must be able to communicate with the license server to get the appropriate product licenses.

2. Optionally, select the checkbox Validate license server version and communication to verify that the license server is able to communicate with this server and that the appropriate version of the license server is being used. If the server is not able to communicate with the license server, or the wrong version of the license server is being used, an error message displays and does not allow you to proceed.

3. Click **Next** to continue on to the “Configure user account settings” procedure.

## Configure User Account Settings

The Stream and Soap services run under a user account.

1. On the User Account dialog, select the user account that the Stream and Soap services will run under:
   - **Specified user account** (required when using a Windows Share; workgroup or domain user account)
     Type the user name, domain, and password information in the appropriate text boxes.
   - **Local system account** (for use with SAN)

2. Select the checkbox next to the Configure the database for the account option, if you selected Specified user account, which adds the appropriate database roles (Datareader and Datawriter) for this user.

3. Click **Next**, then continue on to the “Selecting network cards for the Stream Service” procedure.

## Select Network Cards for the Stream Service

**Note:** If multiple network adapters are selected, they must be configured with the same IP subnet address. For example: IP subnet: 100.100.10.x; IP subnet mask 255.255.255.0

1. Select the checkbox next to each of the network cards that the Stream Service can use.

2. Enter the base port number that will be used for network communications in the First communications port: text box.

**Note:** A minimum of 20 ports are required within the range. All Provisioning Servers within a farm must use the same port assignments.
3. Select the Soap Server port (default is 54321) to use for Console access, then click Next.

Continue on to the “Selecting the bootstrap server” procedure.

**Configure Bootstrap Server**

Complete the steps that follow to identify the bootstrap server and configure the bootstrap file location.

**Note:** Bootstrap configurations can be reconfigured by selecting the Configure Bootstrap option from the Provisioning Services Action menu in the Console.

1. Select the bootstrap server.

To use the TFTP service on this Provisioning Server:

a. Select the **Use the TFTP Service** option, then enter or browse for the boot file.

   The default location is:

   C:\Documents and Settings\All Users\ProgramData\Citrix\Provisioning Services\Tftpboot

   If a previous version of Provisioning Services was installed on this server, and the default location is:

   C:\Program Files\Citrix\Provisioning Services\TftpBoot

   You must run the Configuration Wizard to change the default location to:

   C:\Documents and Settings\All Users\ProgramData or ApplicationData\Citrix\Provisioning Services\Tftpboot

   If the default is not changed, the bootstrap file can not be configured from the Console and target devices will fail to boot; receiving a ‘Missing TFTP’ error message.

b. Click **Next**.

2. Select Provisioning Servers to use for the boot process:

a. Use the **Add** button to add additional Provisioning Servers to the list, the **Edit** button to edit existing information, or **Remove** to remove the Provisioning Server from the list. Use the **Move up** or **Move down** buttons to change the Provisioning Server boot preference order.

   The maximum length for the server name is 15 characters. Do not enter FQDN for the server name.

   In an HA implementation, at least two Provisioning Servers must be selected as boot servers.

b. Optionally, highlight the IP address of the Provisioning Server that target devices will boot from, then click **Advanced**. The Advanced Stream Servers Boot List appears.

   The following table describes advanced settings that you can choose from. After making your selections, click **OK** to exit the dialog, then click **Next** to continue.
Table 2-1. Advanced Stream Servers Boot List

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbose Mode</td>
<td>Select the Verbose Mode option if you want to monitor the boot process on the target device (optional) or view system messages.</td>
</tr>
<tr>
<td>Interrupt Safe Mode</td>
<td>Select Interrupt Safe Mode if you are having trouble with your target device failing early in the boot process. This enables debugging of target device drivers that exhibit timing or boot behavior problems.</td>
</tr>
<tr>
<td>Advanced Memory Support</td>
<td>This setting enables the bootstrap to work with newer Windows OS versions and is enabled by default. Only disable this setting on older XP or Windows Server OS 32 bit versions that do not support PAE, or if your target device is hanging or behaving erratically in early boot phase.</td>
</tr>
</tbody>
</table>
| Network Recovery Method       | **Restore Network Connections**— Selecting this option results in the target device attempting indefinitely to restore its connection to the Provisioning Server.  
Note: Because the Seconds field does not apply, it becomes inactive when the Restore Network Connections option is selected.  
**Reboot to Hard Drive**— (a hard drive must exist on the target device) Selecting this option instructs the target device to perform a hardware reset to force a reboot after failing to re-establish communications for a defined number of seconds. The user determines the number of seconds to wait before rebooting. Assuming the network connection can not be established, PXE will fail and the system will reboot to the local hard drive. The default number of seconds is 50, to be compatible with HA configurations. |
| Logon Polling Timeout         | Enter the time, in milliseconds, between retries when polling for |
Provisioning Servers. Each Provisioning Server is sent a login request packet in sequence. The first Provisioning Server that responds is used. In non-HA configurations, this time-out simply defines how often to retry the single available Provisioning Server with the initial login request. This time-out defines how quickly the round-robin routine will switch from one Provisioning Server to the next in trying to find an active Provisioning Server. The valid range is from 1,000 to 60,000 milliseconds.

| Login General Timeout | Enter the time-out, in milliseconds, for all login associated packets, except the initial login polling time-out. This time-out is generally longer than the polling time-out, because the Provisioning Server needs time to contact all associated servers, some of which may be down and will require retries and time-outs from the Provisioning Server to the other Provisioning Servers to determine if they are indeed online or not. The valid range is from 1,000 to 60,000 milliseconds. |

C. Verify that all configuration settings are correct, then click Finish.

Running the Configuration Wizard Silently

Run the Configuration Wizard silently to configure multiple Provisioning Servers that share several of the same configuration settings such as the farm, site, and store locations.

Prerequisite

The Configuration Wizard must first be run on any Provisioning Server in the farm that has the configuration settings that will be used in order to create the Provisioning Services database and to configure the farm.

The basic steps involved in the silent configuration of servers within the farm include:

- Create a ConfigWizard.ans file from a configured Provisioning Server in the farm.
- Copy the ConfigWizard.ans file onto the other servers within the farm, and modify the IP address in the ConfigWizard.ans file to match each server in the farm.
**To Create the ConfigWizard.ans File**

1. Run the ConfigWizard.exe with the /s parameter on a configured server.
2. When selecting farm settings on the Farm Configuration page, choose the **Join existing farm** option.
3. Continue selecting configuration settings on the remaining wizard pages, then click **Finish**.
4. Copy the resulting ConfigWizard.ans file from the Provisioning Services Application Data directory. The location for this directory varies depending on the Windows version. For Windows 2003, use `\Documents and Settings\All Users\Application Data\Citrix\Provisioning Services`. For Windows 2008 and Windows 2008 R2, use `\ProgramData\Citrix\Provisioning Services`.

**To Copy and Modify the ConfigWizard.ans File**

1. For each server that needs to be configured, copy the ConfigWizard.ans file to the Provisioning Services Application Data directory.
2. Edit the `StreamNetworkAdapterIP=` so that is matches the IP of the server being configured. If there is more than one IP being used for Provisioning Services on the server, add a comma between each IP address.

**To Run the ConfigWizard.exe Silently**

To configure servers, run the ConfigWizard.exe with /a parameter on each server that needs to be configured.

**Note:** To get the list of valid ConfigWizard parameters:

1. Run the ConfigWizard.exe with the /? parameter.
2. Open the resulting ConfigWizard.out file from the ConfigWizard.ans file from the Provisioning Services Application Data directory.
3. Scroll down to the bottom of the file to view all valid parameters.

**Note:** To get the list of valid ConfigWizard.ans commands with descriptions:

1. Run the ConfigWizard.exe with the /c parameter.
2. Open the resulting ConfigWizard.out file from the ConfigWizard.ans file from the Provisioning Services Application Data directory.
3. Scroll down to the bottom of the file to view all valid parameters.
Installing Provisioning Services Console Software

The Provisioning Services Console can be installed on any machine that can communicate with the Provisioning Services database.

**Note:** The Console installation requires Windows Powershell 2.0. The Console installation includes the Boot Device Management utility.

1. Run the appropriate platform-specific install option; `PVS_Console.exe` or `PVS_Console_x64.exe`.
2. Click **Next** on the Welcome screen. The Product License Agreement appears.
3. Accept the terms in the license agreement, then click **Next** to continue. The Customer Information dialog appears.
4. Type or select your user name and organization name in the appropriate text boxes.
5. Enable the appropriate application user radio button, then click **Next**. The Destination Folder dialog appears.
6. Click **Change**, then enter the folder name or navigate to the appropriate folder where the software should be installed, or click **Next** to install the Console to the default folder. The Setup Type dialog appears.
7. Select the radio button that best describes the installation to perform:
   - **Complete** - Installs all components and options on this computer (default).
   - **Custom** - Choose which components to install and where to install those components.
8. Click **Next**.
9. If you select **Complete**, the ‘Ready to Install the Program’ dialog appears.
   If you selected **Custom**, the ‘Custom Setup’ dialog appears. This dialog provides a ‘Feature Description’ text box that provides a description for the selected component as well as the space required to install that component.
   - Expand each component icon and select how that component is to be installed.
   - After making component selections, click **Next**. The ‘Ready to Install the Program’ dialog appears. Or, click **Cancel** to close the wizard without making system modifications.
10. On the ‘Ready to Install the Program’ dialog, click **Install** to continue with the installation process (the installation may take several minutes).
11. The ‘Installation Wizard Completed’ message displays in the dialog when the components and options are successfully installed.
Adding Additional Provisioning Servers

To add additional Provisioning Servers, install the Provisioning Services software on each server that is to be a member of the farm. Run the Provisioning Services Installation Wizard, then the Configuration Wizard on each server.

Note: The maximum length for the server name is 15 characters. Do not enter FQDN for the server name.

When the Configuration Wizard prompts for the site to add the server to, choose an existing site or create a new site.

After adding Provisioning Servers to the site, start the Console and connect to the farm. Verify that all sites and servers display appropriately in the Console window.

Managing Administrative Roles

The ability to view and manage objects within a Provisioning Server implementation is determined by the administrative role assigned to a group of users. Provisioning Services makes use of groups that already exist within the network (Windows or Active Directory Groups). All members within a group will share the same administrative privileges within a farm. An administrator may have multiple roles if they belong to more than one group.

The following administrative roles can be assigned to a group:

- Farm Administrator
- Site Administrator
- Device Administrator
- Device Operator

After a group is assigned an administrator role through the Console, if a member of that group attempts to connect to a different farm, a dialog displays requesting that a Provisioning Server within that farm be identified (the name and port number). You are also required to either use the Windows credentials you are currently logged in with (default setting), or enter your Active Directory credentials. Provisioning Services does not support using both domain and workgroups simultaneously.

When the information is sent to and received by the appropriate server farm, the role that was associated with the group that you are a member of, determines your administrative privileges within this farm. Group role assignments can vary from farm to farm.
Preparing a Master Target Device for Imaging

A Master Target Device refers to a target device from which a hard disk image is built and stored on a vDisk. Provisioning Services then streams the contents of the vDisk created from the Master Target Device to other target devices.

- Preparing the Master Target Device's Hard Disk on page 56
- Configuring a Master Target Device's BIOS on page 57
- Configuring Network Adapter BIOS on page 57
- Installing Master Target Device Software on page 58

Preparing the Master Target Device's Hard Disk

The Master Target Device is typically different from subsequent target devices because it initially contains a hard disk. This is the hard disk that will be imaged to the vDisk. If necessary, after imaging, the hard disk can be removed from the Master Target Device.

In order to support a single vDisk, that is shared by multiple target devices, those devices must have certain similarities to ensure that the operating system has all required drivers. The three key components that must be consistent include the:

- Motherboard
- Network card, which must support PXE
- Video card

However, the Provisioning Services Common Image Utility allows a single vDisk to simultaneously support different motherboards, network cards, video cards, and other hardware devices.

If target devices will be sharing a vDisk, the Master Target Device serves as a ‘template’ for all subsequent diskless target devices as they are added to the network. It is crucial that the hard disk of Master Target Device be prepared properly and all software is installed on it in the proper order:

**Note:** Follow the instructions below after installing and configuring the Provisioning Server and creating target devices.

Software must be installed on the Master Target Device in the order that follows:

1. Windows Operating System
2. Device Drivers
3. Service Packs Updates
4. Target Device Software

Applications can be installed before or after the target device software is installed. If target devices will be members of a domain, and will share a vDisk, additional
configuration steps must be completed (refer to Managing Domain Accounts in the Administrator’s Guide, before proceeding with the installation).

| Note: Dual boot vDisk images are not supported. |

## Configuring a Master Target Device's BIOS

The following steps describe how to configure the target devices system’s BIOS and the BIOS extension provided by the network adapter, to boot from the network. Different systems have different BIOS setup interfaces - if necessary, consult the documentation that came with your system for further information on configuring these options.

1. If the target device BIOS has not yet been configured, re-boot the target device and enter the system’s BIOS setup. (To get to BIOS setup, press the F1, F2, F10 or Delete key during the boot process. The key varies by manufacturer).

2. Set the network adapter to **On with PXE**.

   | Note: Depending on the system vendor, this setting may appear differently. |

3. Configure the target device to boot from **LAN** or **Network first**. Optionally, select the Universal Network Driver Interface; **UNDI first**, if using a NIC with Managed Boot Agent (MBA) support.

   | Note: On some older systems, if the BIOS setup program included an option that permitted you to enable or disable disk-boot sector write protection, ensure that the option is disabled before continuing. |

4. Save changes, then exit the BIOS setup program.

5. Boot the target device from it's hard drive over the network to attach the vDisk to the target device.

## Configuring Network Adapter BIOS

This procedure is only necessary for older systems.

1. Re-boot the Master Target Device.

2. Configure the network adapter’s BIOS extension through setup.

   During the system boot, the network adapter’s BIOS extension will present an initialization message similar to the following: Initializing Intel ® Boot Agent Version 3.0.03 PXE 2.0 Build 078 (WfM 2.0) RPL v2.43

   Enter the network adapter’s BIOS extension. (Consult the network adapter’s documentation.) The key combination for entering the network adapter’s BIOS extension varies by manufacturer. For example, to enter the Intel Boot Agent setup screen, type Ctrl+$.

   A screen similar to the following appears:
3. Change the boot order to **Network first, then local drives**.
4. Save any changes, and exit the setup program. In the Intel Boot Agent, typing F4 saves the changes.

Alternatively, a device can be configured to provide IP and boot information (boot file) to target devices using the Manage Boot Devices utility.

**Installing Master Target Device Software**

**Note:** It is recommended that you read the Release Notes document before installing target-device software. Before installing the product software on a Master Target Device, turn off any BIOS-based-virus protection features. To include anti-virus software on the vDisk image, be sure to turn the anti-virus software back on prior to running the Imaging Wizard.

Provisioning Services target device software must be installed on a Master Target Device prior to building a vDisk image.

Provisioning Services target device software components include:

- **Provisioning Services Virtual Disk**, which is the virtual media used to store the disk components of the operating system and applications.
- **Provisioning Services Network Stack**, which is a proprietary filter driver that is loaded over the NIC driver, allowing communications between the target devices and the Provisioning Server.
- **Provisioning Services SCSI Miniport Virtual Adapter**, which is the driver that allows the vDisk to be mounted to the operating system on the target device.
- **Provisioning Services Imaging Wizard**, use to create the vDisk file and image the Master Target Device.
- **Virtual Disk Status Tray Utility**, to provide general vDisk status and statistical information. This utility includes a help system.
- **Target Device Optimizer Utility**, used to change target device setting to improve performance.

Provisioning Services target device software is available for 32-bit and 64-bit Windows operating systems.
Installing Provisioning Services Target Device Software on a Windows Device

1. Boot the Master Target Device from the local hard disk.
2. Verify that all applications on the device are closed.
3. Double-click on the appropriate installer. The product installation window appears.
4. On the Welcome dialog that displays, click Next, scroll down to the end, then accept the terms of the license agreement.
5. Click Next to continue, the Customer Information dialog appears.
6. Type your user name and organization name in the appropriate text boxes.
7. Select the appropriate install user option. The option you select depends on if this application will be shared by users on this computer, or if only the user associated with this computer should have access to it.
8. Click Next, the Destination Folder dialog appears.
9. Click Next to install the target device to the default folder (C:\Program Files\Citrix Provisioning Services). Optionally, click Change, then either enter the folder name or navigate to the appropriate folder, and then click Next, then click Install. The installation status information displays in the dialog.

**Note:** The installation process may take several minutes. While the installation process is running, you can click Cancel to cancel the installation and roll-back any system modifications. Close any Windows Logo messages that appear.

10. The 'Installation Wizard Completed' message displays in the dialog when the components and options have successfully been installed. Close the wizard window. If both .NET 3.0 SP1 or newer is installed and Windows Automount is enabled, the Imaging Wizard will start automatically by default (for details, refer to Using the Imaging Wizard to Create a New vDisk on page 60).

**Note:** If a Windows reboot request message displays before the imaging process completes, ignore the request until imaging completes successfully.

11. Reboot the device after successfully installing product software and building the vDisk image.

Creating vDisks Automatically

A vDisk image can be created automatically using the Using the Imaging Wizard to Create a New vDisk on page 60.
Using the Imaging Wizard to Create a New vDisk

Use the Imaging Wizard to automatically create the base vDisk image from a master target device.

**Prerequisites**

- Enable Windows Automount on Windows Server operating systems.
- Disable Windows Autoplay.
- Verify adequate free space exists in the vDisk store, which is approximately 101% of used space on the source volumes.
- Make note of which NIC(s) the master target device was bound to when the Provisioning Services software was installed on the target device. This information is necessary during the imaging process.

**Note:** If a Windows reboot request message displays before the imaging process completes, ignore the request until imaging completes successfully.

**Imaging**

The Imaging Wizard prompts for information that allows for connecting to the farm as well as information necessary to set the appropriate credentials/Active Directory and licensing information to apply to this particular vDisk.

1. From the master target device's Windows Start menu, select Citrix>Provisioning Services>Imaging Wizard. The wizard's Welcome page appears.
2. Click Next. The Connect to Farm page appears.
3. Enter the name or IP address of a Provisioning Server within the farm to connect to and the port to use to make that connection.
4. Use the Windows credentials (default), or enter different credentials, then click Next. If using Active Directory, enter the appropriate password information.
5. On the Microsoft Volume Licensing page, select the volume license option to use for target devices or select None if volume licensing is not being used:
   - None
   - Key Management Service (KMS)

**Note:** Additional steps are required to implement KMS licensing after the vDisk image is created. Refer to Managing Microsoft KMS Volume Licensing in the Administrator's Guide for details.

- Multiple Activation Key (MAK)
6. Select to create a new vDisk (default), or use an existing vDisk by entering that vDisks name, then click **Next**.

7. If the create new vDisk option was selected, the New vDisk dialog displays.
   a. Enter a name for the vDisk
   b. Select the Store where this vDisk will reside
   c. Select the vDisk format from the appropriate drop-down menus. If the VHD format is Dynamic, from the **VHD block size** drop-down, select the block size as either 2 MB or 16 MB.
   d. Click **Next**, then define volume sizes on the Configure Image Volumes page.

8. Click **Next**
   The Add Target Device page appears.

9. Select the target device name, the MAC address associated with one of the NICs that was selected when the target device software was installed on the master target device, and the collection to add this device to. Click **Next**.
   If the target device is already a member of the farm, the Existing Target Devices page appears.

10. Click **Next**.
    Summary of Farm Changes appears.

11. Optional. Select to optimize the vDisk for use with Provisioning Services.

12. Verify all changes, then click **Finish**.
    A confirmation message displays.

13. Click **Yes** on the confirmation message to start the imaging process.

---

### Assigning vDisks to Target Devices

A vDisk can be assigned to a single target device or to all devices within a target device collection. If a target device has more than one vDisk assigned to it, a list of vdisks displays at boot time allowing the user to select the appropriate vDisk to boot.

**Note:** If one or more versions exist for a vDisk, the version target devices use in Production is either the highest numbered production version or an override version. For details refer to 'Accessing a vDisk Version' in the Administrator's Guide. For Maintenance and Test devices, the State of any non-production versions are labeled.

**Assigning vDisks to a target device**

vDisks can be assigned to a single target device using:

- Drag-and-drop
Target Device Properties dialog

**Note:** A vDisk cannot be assigned to a target device using drag-and-drop if that target device was assigned a personal vDisks using the XenDesktop Wizard. A message dialog displays if a vDisk is dragged and dropped onto a collection that contains one or more target devices that use personal vDisks. The dialog provides the option to continue by acknowledging that the vDisk being assigned will only be assigned to those devices that are not currently assigned a personal vDisk. Also, target devices that use personal vDisks cannot inherit the properties of a target device that doesn't use a personal vDisk (copy/paste).

To assign a vDisk, using drag-and-drop, to one or all target devices within a collection:

1. In the Console tree, expand the vDisk Pool within a given site or expand Stores to display the vDisk to be assigned in the right pane of the window.
2. Left-click and hold the mouse on the vDisk, then drag and drop it onto the target device or onto the collection.

To assign one or more vDisks to a single target device from the Target Device Properties dialog:

1. In the Console tree, expand the Device Collections folder, then click on the collection folder where this target device is a member. The target device displays in the details pane.
2. Right-click on the target device, then select **Properties**. The Target Device Properties dialog appears.
3. On the General tab, select the boot method that this target device should use from the **Boot from** drop-down menu options.
4. On the vDisks tab, select the **Add** button within the **vDisk for this Device** section. The Assign vDisks dialog appears.
5. To locate vDisks to assign to this target device, select a specific store or server under the **Filter** options, or accept the default settings, which includes **All Stores** and **All Servers**.
6. In the **Select the desired vDisks** list, highlight the vDisk(s) to assign, then click **OK**, then **OK** again to close the Target Device Properties dialog.

**Uninstalling Product Software**

Removing the software from your system requires that you uninstall both the Provisioning Server and target device components.

**Uninstalling the Provisioning Services**

1. On the Provisioning Server, open the system’s Control Panel. From the Windows Start menu, select Settings, and then click Control Panel.
2. Double click on the Add/Remove Programs icon.
3. Use Add/Remove Programs from the control panel to uninstall the product software.

Uninstalling Windows Target Device Software

1. Set the system BIOS to boot from the original hard drive.
2. Re-boot the target device directly from the hard drive.
3. On the target device, open the system’s Control Panel.
4. Double-click on the Add-Remove Programs icon.
5. Use Add-Remove Programs from the control panel to uninstall the product software.

Uninstalling the Console

1. On a machine in which the Console is installed, open the system’s Control Panel. From the Windows Start menu, select Settings, and then click Control Panel.
2. Double click on the Add/Remove Programs icon.
3. Use Add/Remove Programs from the control panel to uninstall the product software.
Chapter 3

Installing and Configuring Embedded Target Devices

Topics:

• System Requirements
• Installing Embedded Target Devices
• Un-installing an Embedded Target Device Package
• Windows XP Embedded Build Overview
• Setting Up Embedded Target Devices

Using the Provisioning Services components described in this chapter, it is possible to create Windows XP Embedded operating system images that can boot from a vDisk.

Note: This feature is for Windows XP Embedded developers. This document assumes that you are familiar with the Microsoft Windows Embedded Studio tools including Target Designer and the Component Database Manager. For more information on the Microsoft Windows Embedded tools, please refer to the documentation provided with the Microsoft Windows Embedded Studio.

Embedded Target Device consists of the following components:

• ProvisioningservicesTargetDeviceSupport.sld - The Server Level Definition (SLD) file defines the components that will be incorporated into the Windows XP Embedded database for use in the XP Embedded operating systems.

• ProvisioningservicesRepository - Contains all of the files used in the ProvisioningservicesTargetDeviceSupport.sld, including Provisioning Services’ drivers and installation utilities. These files are included in an XP Embedded build containing Provisioning Services components.
System Requirements

- Windows XP Embedded with the latest service pack.
- In order to build Windows XP Embedded operating systems, Microsoft Windows Embedded Studio must first be installed.
- The target device must meet the Windows XP Embedded system requirements. It is recommended that a Windows XP Embedded operating system be built first on the desired embedded target device to ensure OS compatibility and to resolve any OS specific issues (such as driver requirements).
- Each embedded target device must also meet the target device requirements outlined in the Provisioning Services Installation Guide.
- A local drive must exist on a target system during the initial XP Embedded operating system build process. This is necessary to allow Microsoft’s First Boot Agent to run and finish your XP Embedded image setup. Once the image is complete and the XP Embedded disk image has been copied to the vDisk on the Provision Server or on shared network storage, the local disk can be removed (if desired).
- The maximum size of the vDisk is 2 terabytes.

Installing Embedded Target Devices

Installation of Embedded Target Device components is done through the Provisioning Services Installation Wizard.

1. Close all Windows and Embedded Studio tools that may be open (Target Designer and/or Component Designer).
2. When the Provisioning Services Installation Wizard is run, components used to build Provisioning Services into an XP Embedded operating system are installed by default. Run the Component Database Manager from the Microsoft Start menu.
3. Select Programs>Microsoft Windows Embedded Studio.
4. Select the Database tab, and then click the Import button.
5. On the Import SLD screen, point the SLD file field to the ProvisioningServicesTargetDeviceSupport.sld in the destination directory created by the Provisioning Services installation. Select the desired root destination (typically there is only one choice), and then click the Import button to start the importing process.
6. Exit the Component Database Manager.

The Embedded Target Device support components will now be available in Target Designer under the Software: System: Network & Communication component group. The Embedded Target Device support macro component causes all necessary Provisioning Services’ components to be included during dependency checking.
Un-installing an Embedded Target Device Package

1. Select **Start** > **Programs** > **Microsoft Windows Embedded Studio**.
2. Select the Package tab.
3. Under Available Packages, select the **Provisioning Services Embedded Target Device** package, then click the **Delete Package** button.
4. A Confirmation Delete Package dialog appears, displaying all Provisioning Services components. Check the **Delete all Provisioning Services Database files** option, and click **Yes**.
5. Select the Group tab.
6. Under Available Dependency Groups, select **Provisioning Services Component Group**, then click the **Delete Dependency Group** button.
7. Go to **Control Panel** > **Add/Remove Programs**, select **Provisioning Services**, and click **Change/Remove** to uninstall the program.

Windows XP Embedded Build Overview

To fully understand how Provisioning Services gets incorporated into a Windows XP Embedded operating system, it is first necessary to understand how a Windows XP Embedded operating system is built. The illustration below outlines the major phases of a Windows XP Embedded operating system build process.

**Note:** For more information on building an XP Embedded operating systems, refer to the *Windows XP Embedded Platform* documentation provided with the Windows Embedded Studio tools.
Chapter 3  Installing and Configuring Embedded Target Devices

1. Build XP Embedded OS and include Citrix Provisioning services
2. Transfer Embedded Image to Target Device
3. FBA runs on first boot
4. Boot into full OS
5. Explorer Shell
6. Automatically run BNSsetup.bat
7. System automatically reboots into an XP Embedded target system running Citrix Provisioning services
8. vDisk appears
9. Execute BNImage Utility
10. 'Virtual ready' XP Embedded Image has been created
Provisioning Services installation occurs in two phases. Phase one occurs when the operating system is built with Target Designer. All necessary files and non-device-specific components are installed in the target operating system.

Phase two occurs the first time the Windows XP Embedded operating system boots. At this time, all device-specific installation steps are performed. This second phase cannot occur until after the First Boot Agent has completed and the full operating system is up and running.

**Note:** If automatic installation was turned off to remove the dependence on the Explorer shell component, it will be necessary to manually run the second phase of the installation process.

Once the XP Embedded Image with Provisioning Services support is fully up and running, it can be imaged onto the embedded target device’s vDisk, after which the embedded target device can be booted virtually.

**Note:** Provisioning Services require that at least one of the target systems have a physical disk for the creation of the initial XP Embedded operating system. After the operating system is built and transferred to a vDisk, the target system’s physical disk can be removed (if desired).
Setting Up Embedded Target Devices

1. Transfer the built XP Embedded Image to the XP Embedded partition on the embedded target device.
1. **Note:** The embedded target device must be configured to be bootable by XP Embedded. To do this, run the BootPrep utility provided by Microsoft. For more information on preparing target media to boot Windows XP Embedded, refer to “Building a Run-Time Image” in the Microsoft Windows XP Embedded Help.

2. Change your embedded target device’s BIOS setting to boot Network first, then boot the embedded target device.

3. The XP Embedded Image will run through the Microsoft’s First Boot Agent (FBA), and complete the setup of the XP Embedded Operating system.

**Note:** By including the "Network Command Shell" component, the embedded target device can be configured to use a static IP address from the command line (using netsh.exe). For more information on the Network Command Shell, refer to the following web page: http://www.microsoft.com/technet/prodtechnol/winxppro/proddocs/netsh.asp

If the XP Embedded Image was created with Automatic installation turned off, or with a shell other than the Explorer Shell, Provisioning Services installation will have to be completed manually. This can be done by running `bnSetup.bat` located in the C:\Program Files\Citrix\Provisioning Services directory. If the command prompt component (CMD - Windows Command Processor) was not included in the build, you may have to run the commands in the batch file manually.

**Note:** The batch file `BNSetup.bat` will reboot your system.

4. Prepare your embedded target device. Once the XP Embedded Operating system is completely up and running an additional local disk appears on the device. This disk is the vDisk associated with the embedded target device and is actually located on a Provisioning Server.
Chapter 4

Upgrading a Provisioning Services Farm

Topics:

- **Upgrading the Database and Provisioning Servers**
- **Upgrading vDisks by Re-imaging**
- **Upgrading vDisks using Hyper-V**

**Note:** This release supports upgrading from 5.1 SP1, 5.1 SP2, 5.6, 5.6 SP1, 6.0.

Before attempting to upgrade a Provisioning Services farm:

- Select a maintenance window that has the least amount of traffic.
- Backup the Provisioning Services database.
- Backup all vDisks.

Upgrading from a previous Provisioning Services farm requires completing the following procedures:

1. Upgrade the first Provisioning Server, which upgrades the Provisioning Services database. For details, refer to **Upgrading the Database and Provisioning Servers** on page 75.

2. Upgrade the remaining Provisioning Servers within the farm. For details, refer to **Upgrading Remaining Provisioning Servers in the Farm** on page 75.

3. Upgrade Consoles. The Console is a separate executable that can be installed on upgraded servers (PVS_Console.exe or PVS_Console_64.exe). Remote Consoles can be upgraded at any time.

4. Upgrade vDisks using the Hyper-V method or the Reverse Imaging method. For details, refer to **Upgrading vDisks by Re-imaging** on page 76 or upgrade using **Upgrading vDisks using Hyper-V** on page 80. (Both methods include the steps necessary to upgrade the master target device software).

**Caution:** If upgrading a Provisioning Services vDisk within a XenDesktop deployment, the Provisioning Services master target device software must be upgraded before upgrading the XenDesktop VDA software.

Upgrade Utilities
The Upgrade Wizard facilitates the automation of the upgrade process, and includes the following utilities:

- The UpgradeAgent.exe runs on the target device to upgrade previously installed product software.
- The UpgradeManager.exe runs on the Provisioning Server to control the upgrade process on the target device.
Upgrading the Database and Provisioning Servers

In a Provisioning Services farm, the database is upgraded at the same time that the first Provisioning Server is upgraded. After the database and the first server in the farm are upgraded, the remaining servers within the farm can be upgraded.

Upgrading the Database and the First Provisioning Server

Note: While upgrading the database on the first Provisioning Server, the Console may become temporarily unavailable for a short period of time. However, the farm continues to run normally and any changes made during the database upgrade process are captured.

To upgrade:

1. Uninstall Provisioning Services software from a Provisioning Server in the farm (for details, refer to Uninstalling Product Software on page 62). This step also uninstalls the Console.

2. To upgrade the server and database, run the new version of the server software on the server.

   Note: Alternatively, the database can be upgraded by running the upgrade script, which is produced by the database administrator using DbScript.exe. Running the upgrade script against the database eliminates the need to grant high-level permissions to Provisioning Services Administrators.

3. Install the Console on this server or on a server that will be used to manage the farm (for details on installing the Console, refer to Installing Provisioning Services Server Software on page 41).

4. On the Configuration Wizard (if the wizard does not start automatically after completing the product installation, start it now), select the option to join a farm that is already configured. Running the wizard starts the services (for details, refer to Configuring the Farm on page 43).

Upgrading Remaining Provisioning Servers in the Farm

Complete the same procedure that was performed on the first server on each of the remaining servers in the farm.
Note: The database upgrade is ignored because the database was upgraded when the first server was upgraded.

**Upgrading vDisks by Re-imaging**

Unlike traditional software packages, target devices can not be uninstalled while running from a vDisk. vDisks can only be uninstalled while the operating system is running on a physical hard disk so that the vDisk storage and network driver stack can be properly shut down. The upgrade method that you choose will depend on your existing Provisioning Services implementation and network requirements.

Upgrade vDisks re-imaging methods include:

- Automated Upgrade of vDisks on page 76
- Upgrading vDisks Manually on page 78

While the manual upgrade method is the most reliable approach for all types of Provisioning Services deployments, it is also the most labor intensive and time consuming of the methods.

A set of upgrade script utilities are included to streamline and automate the process. *UpgradeAgent.exe* and *UpgradeManager.exe* are the proxies to run on target devices and Provisioning Servers that were installed from previous product releases. This agent facilitates the upgrade automation.

**Automated Upgrade of vDisks**

Note: The Automated Inline Upgrade method was deprecated in the 6.0 release.

**Automated Rolling Upgrade**

The automated rolling upgrade method converts vDisks to the current Provisioning Server vDisk format. This upgrade method does not require Provisioning Server deployment downtime, but it does require that a new dedicated Provisioning Server co-exist, side-by-side with a pervious version of the server.

Prerequisites:

- Both the previous version of the server and the new server are dedicated machines.
- The vDisk is from a previous version and has not been upgraded.
- The vDisk can boot from a previous version of the server.
- If both the previous and new versions of the servers are on the same network subnet, there should be only one PXE/TFTP service on the network.

Upgrading using the automated rolling upgrade process

On existing Provisioning Servers:
1. Change the target device’s vDisk to Private Image Mode, then PXE boot the target device from that vDisk.

2. The Upgrade Manager requires RPC communication over the network. If there is a firewall on this server, set firewall to allow TCP port 6901.

On the new Provisioning Server:

1. Create a new vDisk with the same name, but of equal or larger size than the original vDisk. Preformat the new vDisk by mounting it from the Provisioning Server Console, formatting it, and then unmounting it.

2. The Upgrade Manager requires RPC communication over the network. If there is a firewall on this server, set firewall to allow TCP port 6901. Do not turn on DHCP/PXE services if this server is on the same network subnet as previous servers.

On the Master Target Device:

1. Depending on the target device platform, run either: PVS_UpgradeWizard.exe or PVS_UpgradeWizard_x64.exe.

2. Copy the matching version of the UpgradeManager.exe to the product installation directory.

3. Run Upgrade Manager on the Provisioning Server to be upgraded.

4. Copy UpgradeManager.exe to the new Provisioning Server installation directory.

5. Run UpgradeManager.exe on the new Provisioning Server.

6. Specify a local account with Administrator privileges to AutoLogon. This local account can not have empty password.

7. Specify a partition to which reverse imaging clones data. The original hard drive, which the vDisk was cloned from, is recommended. If this is a new hard drive, follow the Upgrading vDisks Manually on page 78 procedure to initialize the hard drive.

8. Specify the previous Provisioning Server IP address, and a user account and password to connect to UpgradeManager.exe. This account cannot have an empty password.

9. Specify the newer Provisioning Server IP address, and a user account and password to connect to UpgradeManager.exe. This account cannot have an empty password.

10. Click OK and the UpgradeConfig performs a sanity check on various parameters. If everything passes, you are prompted to reboot to start the upgrade process.

11. The upgrade script automates the steps performed during the Manual Upgrade procedure. The machine reboots several times during the process, and then displays a message when the upgrade has completed successfully. The script pauses and prompts you after the reverse imaging and uninstallation steps. This is the time to switch the target device to the new Provisioning Server network.

   - If both the previous and new Provisioning Servers are on the same network, turn off PXE and TFTP services on the previous Provisioning Server, then turn on PXE and TFTP services on the new Provisioning Server. Alternatively, use DHCP.
Reservation to create an exception for this target device and change DHCP option 66 Boot Server Host Name to point to the new Provisioning Server.

- If the servers are on different networks, now is the time to swap the network cable to connect the target device to the new network.

12. After all vDisks have been upgraded, setup the PXE and TFTP services on the new Provisioning Server permanently, to serve new target devices.

### Upgrading vDisks Manually

This section describes how to upgrade Provisioning Server vDisks manually.

Use the manual upgrade as a universal approach to upgrading vDisks, or if any of the following are true:

- The vDisk has gone through a number of modifications in Private Image mode
- The original hard drive is no longer available

Some of the imaging tasks performed during a manual upgrade are automated by the Upgrade script that is used in the Automated Upgrade method (for details on the Automated method, refer to Automated Upgrade of vDisks on page 76. The manual upgrade method includes completing the tasks defined in Image Back to Master Target Devices Hard Drive on page 78.

### Image Back to Master Target Devices Hard Drive

There are two procedures that allow you to image a vDisk back to a hard drive. The procedure you select depends on the state of the disk drive you are imaging to. Select one of the following procedures:

- **Image Back to Master Target Devices Hard Drive** on page 78
  
  Use the original hard drive from which the vDisk was created (recommended method).

- **Image back using an unformatted, uninitialized hard-disk drive** on page 79
  
  Use an unformatted, uninitialized hard-disk drive.

### Image Back to the Original Hard Drive from Which the vDisk was Created

1. Boot from the vDisk in Private or Shared Image Mode.

2. From Windows Administrative Tools, select the **Computer Management** menu option. The **Computer Management** window appears.

3. In the tree, under Storage, select **Disk Management**.

4. Note the partition letter of the active partition of the original hard disk. If new, format the disk before continuing.

5. Run the Image Builder utility on the target device. This utility is located at \Program Files\Citrix\Provisioning Services\BNImage.exe
6. Specify the drive letter of the newly created partition (or the original boot HDD partition) as the **Destination Drive**. The destination drive should point to the vDisk first partition by default.

7. Proceed cloning the hard drive image to the vDisk Destination Drive.

8. To connect the vDisk to the Provisioning Server, from the Console, set the target device to boot from the hard drive, then PXE boot the target device. If this step is not completely properly, the Provisioning Server will not be able to connect with the vDisk.

9. Uninstall the product software (for details, refer to Uninstalling Product Software on page 62).

**Image back using an unformatted, uninitialized hard-disk drive**

1. Boot from the vDisk in Private Image Mode.

2. From Windows Administrative Tools, select the **Computer Management** menu option. The Computer Management window appears.

3. In the tree, under Storage, select **Disk Management**.

4. Create a new primary partition, as the first partition, assign a drive letter to it, and then format the partition.

5. Right-click on the newly created partition, then choose **Mark Partition as Active**.

6. Delete the boot.ini.hdisk file from the root of the vDisk.

7. Run the Image Builder utility on the target device. This utility is located at \Program Files\Citrix\Provisioning Services\BNImage.exe.

8. Specify the drive letter of the newly created partition (or the original boot HDD partition) as the **Destination Drive**. The destination drive should point to the vDisk first partition by default.

9. Proceed cloning the hard drive image to the vDisk Destination Drive.

10. To connect the vDisk to the Provisioning Server, from the Console, set the target device to boot from the hard drive, then PXE boot the target device. If this step is not completely properly, the Provisioning Server will not be able to connect with the vDisk.

11. Uninstall the product software (for details, refer to Uninstalling Product Software on page 62).

**Install Master Target Device Software**

Complete the following steps to install the latest product software on the Master Target Device.

1. Run the new Provisioning Server Target Device installer on the target device.

2. PXE boot the target device.
Imaging the Hard Drive

Complete the following steps to image the target device's hard drive on to the vDisk file:

1. Run the Image Builder utility on the target device. This utility is located at \Program Files\Citrix\Provisioning Services\BNImage.exe.

2. Specify the drive letter of the newly created partition (or the original boot HDD partition) as the Destination Drive. The destination drive should point to the vDisk first partition by default.

3. Proceed cloning the hard drive image to the vDisk Destination Drive.

Boot from the vDisk

Using the Console, set the target device on the Provisioning Server to boot from vDisk first, then reboot the target device. The new target device should now be running the new vDisk image.

Upgrading vDisks using Hyper-V

Before upgrading using Hyper-V, review the following requirements:

- Hyper-V must be installed (Hyper-V does not need to be installed on the Provisioning Server).
- General Hyper-V knowledge.

This section describes how to upgrade Provisioning Server vDisks using Microsoft Hyper-V as the mechanism to install new versions of the Provisioning Service drivers and other target device components. Using this method, neither physical media nor imaging and reimaging is required. This method greatly simplifies the upgrade process and reduces the number of tasks you must complete.

1. Un-install previously installed Provisioning Services server software.
2. Install newer version of Provisioning Services server software.
3. Copy the newly created or existing VHD file to the Hyper-V server.
4. Create a new virtual machine in the Hyper-V Manager.
5. During the creation steps, attach the existing newvDisk.vhd instead of using a new VHD.
6. Go into the properties of the newly created Hyper-V virtual machine (Action panel > Settings) and remove the Network adapter. Go to Add Hardware and add the Legacy NIC.
7. Go to the Legacy NIC and attach it to the physical system's NIC.
8. Boot the virtual machine.
9. Let the system install the new drivers, then reboot if prompted.
10. Un-install Provisioning Services target device software, then reboot.

11. Optional: Install Hyper-V's Integration Services. This is only necessary when the resulting VHD must be bootable in both physical and virtual systems. While the virtual machine is on, go to Action, then choose Insert Integration Services set up disk and install.

12. Install Provisioning Services target device software.

13. Go to Provisioning Services installation directory (default is: C:\Program Files\Citrix \Provisioning Services).


15. Choose to bind Provisioning Services to the inactive NIC (the physical NIC from the original target device).

16. Shutdown the virtual machine.

17. Go to the virtual machine’s properties (Action panel>Settings), then set it to boot to the legacy NIC first.

18. Transfer the VHD (newvDisk.vhd) back to the Provisioning Server.

19. From the Provisioning Service’s Console:
   a. Add the VHD to the Provisioning Services database using the Add existing vDisk menu option.
   b. Add the Hyper-V virtual machine to the list of the target devices.
   c. Associate the vDisk with the appropriate target devices.
   d. Set the vDisk to Standard Image Mode

20. Boot the physical target device (assuming this is set to PXE first), then the Hyper-V virtual machine.

The original vDisk is now upgraded and a common image between the physical and virtual machines has also been created.
Managing Multiple Network Interface Cards

Topics:

- Requirements and Considerations for Manufacturer's NIC Teaming
- Requirements and Considerations for Provisioning Services NIC Failover

Provisioning Services provides the ability to run redundant networks between the servers and the target devices. This requires that both the servers and the target devices be equipped with either multi-port NICs or multiple NICs.

Multiple NICs on the target device may be configured into a virtual team by using Manufacturer's NIC teaming drivers, or into a failover group using the Provisioning Services NIC failover feature.

NIC Teaming and NIC Failover features provide resilience to NIC failures that occur after the system is up and running. It is only after the OS has loaded that the actual NIC Team or NIC Failover group is established. If NIC failure occurs after being established:

- the NIC Teaming feature allows the system to continue to function because the virtual MAC address is the same as the physical MAC address of the primary boot NIC.
- the NIC Failover feature allows the system to continue to function because it automatically fails over to another NIC that was previously configured for this system.

For more details, refer to Requirements and Considerations for Manufacturer's NIC Teaming on page 85).

Note: When a machine powers up, the BIOS goes through the list of available boot devices and the boot order of those devices. Boot devices can include multiple PXE-enabled NICs. Provisioning Services uses the first NIC in the list as the primary boot NIC. The primary boot NIC's MAC address is used as the lookup key for the target device record in the database. If the primary boot NIC is not available at boot time, Provisioning Services will not be able to locate the target device record in the database (a non-primary NIC may be able to just process the PXE boot phase). Although a workaround would be to add a separate target device entry for each NIC on each system, and then maintain synchronization for all entries, it is not recommended (unless
the successful startup of a system is considered as critical as the continued operation of the system that is already running).
Requirements and Considerations for Manufacturer's NIC Teaming

Provisioning Services supports Broadcom and Intel NIC teaming drivers. A vDisk that is built after configuring NIC teaming can run Standard or Private Image Mode.

**Note:** Broadcom NIC Teaming Drivers v9.52 and 10.24b are not compatible with Provisioning Services target device drivers.

1. The targets operating system must be a server-class operating system, such as Microsoft Windows 2003 or 2008.
2. The new virtual team NIC MAC address has to match the physical NIC that performs the PXE boot.
3. OEM NIC Teaming software should be installed and configured prior to the Target Device software.
4. Configure NIC teaming and verify that the selected teaming mode is expected by the application and the network topology. It should expose at least one virtual team NIC to the operating system.
5. During the Master Target Device installation process, Provisioning Services target device client drivers need to bind to the new virtual team NIC MAC address. If all physical NICs have been teamed up to a single virtual NIC, then the Provisioning Services installer will automatically choose the virtual NIC silently, without prompting.
6. If changes are required, Provisioning Services Target Device software must be uninstalled before making changes to the teaming configuration, and then reinstalled after those changes are complete.
7. Changes to teaming configurations on a Master Target Device that has target device software installed, may result in unpredictable behavior.

Requirements and Considerations for Provisioning Services NIC Failover

A Provisioning Services target device or Provisioning Server may be configured to support failover between multiple NICs. This feature will work with any brand or a mixture of different brands of NICs and is available in both Standard and Private Image Mode.

1. The PXE boot NIC is considered the primary target device MAC address, which is stored in the Provisioning Services database.
2. The failover group of NICs is defined when running the Provisioning Services target device installer on the Master Target Device. If the machine has more than one NIC, the user is prompted to select the NICs that the Provisioning Services drivers
bind to. Select all the NICs that participate in NIC failover. Alternatively, in Provisioning Services 5.1 or later, run `bindcfg.exe`, which is located in the installation directory, to selectively bind NICs post installation.

3. A target device will only failover to NICs that are in the same subnet as the PXE boot NIC.

4. In the event that the physical layer fails, such as when a network cable is disconnected, the target device fails over to the next available NIC. The failover timing is essentially instantaneous.

5. The NIC failover feature and Provisioning Services HA feature compliment each other, and provide network layer failover support. If the failure occurs in the higher network layer, then the target device fails over to the next Provisioning Server, subject to HA rules.

6. If a NIC fails and the target device is rebooted, the next available NIC from the failover group will be used. Therefore, these NICs must be PXE capable and PXE enabled.

7. If a virtual NIC (teamed NICs) is inserted into the failover group, the vDisk becomes limited to Private Image Mode. This is a limitation imposed by the NIC teaming drivers.

8. Load balancing is not supported in the NIC failover implementation.
Chapter 6

Managing Bootstrap Files and Boot Devices

Topics:

• Configuring the Bootstrap File From the Console
• Using the Manage Boot Devices Utility

The following information is detailed in this chapter:

• Configuring the Bootstrap File From the Console on page 88
• Using the Manage Boot Devices Utility on page 92
Configuring the Bootstrap File From the Console

For the Provisioning Server to start a target device, a boot file is downloaded by the Provisioning Services's MBA or PXE-compliant boot ROM, when the device is turned on. This file must be configured so that it contains the information needed to communicate with the Provisioning Servers. The Configure Bootstrap dialog is used to define the IP addresses for up to four Provisioning Servers in the boot file.

Note: For alternative boot methods, refer to Using the Manage Boot Devices Utility on page 92.

The Configure Bootstrap dialog field descriptions are as follows:

General Tab: Configure Bootstrap

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bootstrap File</td>
<td>The currently selected boot file displays. If you want to select a different boot file to configure, click the Add button or Read Servers from Database button.</td>
</tr>
<tr>
<td>IP Settings</td>
<td>The IP Address, Subnet Mask, Gateway, and Port for up to four Provisioning Servers, which will perform login processing.</td>
</tr>
<tr>
<td>Add button</td>
<td>Click the Add button to add a new Provisioning Server to the file. Up to four Provisioning Servers may be specified for Provisioning Servers.</td>
</tr>
<tr>
<td>Edit button</td>
<td>Highlight an existing Provisioning Server from the list, then click the Edit button to edit this server’s IP settings.</td>
</tr>
<tr>
<td>Remove button</td>
<td>Select an existing Provisioning Server from the list, then click the Remove button to remove this server from the list of available Provisioning Servers.</td>
</tr>
<tr>
<td>Move Up and Move Down buttons</td>
<td>Select an existing Provisioning Server, and click to move up or down in the list of Provisioning Servers. The order in which the Provisioning Servers appear in the list determines the order in which the Provisioning Servers are accessed should a server fail.</td>
</tr>
<tr>
<td>Read Servers from Database button</td>
<td>To populate the boot file with the Stream Service IP settings already configured in the database, click the Read Servers from Database button. This removes any existing settings before populating the list from the database.</td>
</tr>
</tbody>
</table>

Target Device IP: Configure Bootstrap
| **Use DHCP to retrieve target device IP** | Select this option to retrieve target device IP; default method. |
| **Use static target device IP** | Selecting this method requires that a primary and secondary DNS and Domain be identified. |

**Server Lookup: Configure Bootstrap**

| **Use DNS** | Select this option to use DNS to find the server. The host name displays in the Host name textbox. If this option is selected and the Use DHCP to retrieve Device IP option is selected (under Device IP Configuration settings), your DHCP server needs to provide option 6 (DNS Server).  
Note: If using HA, specify up to four Provisioning Servers for the same Host name on your DNS server. |
| **Use Static IP** | Use the static IP address of the Provisioning Server from which to boot from. If you select this option, click Add to enter the following Provisioning Server information, then click OK to exit the dialog:  
- IP Address  
- Subnet Mask  
- Gateway  
- Port (default is 6910)  
Note: If using HA, enter up to four Provisioning Servers. If you are not using HA, only enter one. Use the Move Up and Move Down buttons to sort the Provisioning Servers boot order. The first Provisioning Server listed will be the server that the target device attempts to boot from. |

**Options Tab: Configure Bootstrap**

| **Verbose Mode** | Select the Verbose Mode option if you want to monitor the boot process on the target device (optional) or view system messages. |
| **Interrupt Safe Mode** | Select Interrupt Safe Mode if you are having trouble with your target device failing early in the boot process. |
| **Advanced Memory Support** | This setting enables the bootstrap to work with newer Windows OS versions and is enabled by default. Only disable this setting on older XP or Windows Server OS 32 bit versions that do not support PAE, or if your... |
| Network Recovery Method                                      | Restore Network Connections — Selecting this option results in the target device attempting indefinitely to restore its connection to the Provisioning Server.  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reboot to Hard Drive — (a hard drive must exist on the target device) Selecting this option instructs the target device to perform a hardware reset to force a reboot after failing to re-establish communications for a defined number of seconds. The user determines the number of seconds to wait before rebooting. Assuming the network connection can not be established, PXE will fail and the system will reboot to the local hard drive. The default number of seconds is 50, to be compatible with HA configurations.</td>
</tr>
</tbody>
</table>
| Login Polling Timeout                                       | Enter the time, in milliseconds, between retries when polling for Provisioning Servers. Each Provisioning Server is sent a login request packet in sequence. The first Provisioning Server that responds is used. In non-HA systems, this time-out simply defines how often to retry the single available Provisioning Server with the initial login request.  
|                                                             | This time-out defines how quickly the round-robin routine will switch from one Provisioning Server to the next in trying to find an active Provisioning Server. The valid range is from 1,000 to 60,000 milliseconds. |
| Login General Timeout                                        | Enter the time-out, in milliseconds, for all login associated packets, except the initial login polling time-out. This time-out is generally longer than the polling time-out, because the Provisioning Server needs time to contact all associated servers, some of which may be down and will require retries and time-outs from the Provisioning Server to the other Provisioning Servers to determine if they are indeed online or not. The valid range is from 1,000 to 60,000 milliseconds. |

**Configuring the Bootstrap File**

1. In the Console, highlight the Servers folder in the tree, or highlight a Provisioning Server, then select **Configure bootstrap** from the Action menu. The Configure Bootstrap dialog appears.  

Select the boot file that was copied to the directory you selected during the Provisioning Server setup.
Important:
If a previous version of Provisioning services was installed on this server, you must change the default location from:

C:\Program Files\<Citrix or OEMname>\Provisioning Services

to:

C:\Documents and Settings\All Users\Application Data\<Citrix or OEMname>\Provisioning services\Tftpboot

If the default is not changed, the bootstrap file can not be configured from the Console and target devices will fail to boot; receiving a ‘Missing TFTP’ error message.

Note: If you installed the Console on a separate machine, select the path of the remote Provisioning Server (which has boot services installed).

2. Click Read DB. When the Stream Service starts, it creates a record in the database with its own IP address. There is only one Stream Service option record per database. If the service is bound to multiple IP addresses, multiple records appear in the database. The Read DB function chooses only one IP address from each Provisioning Server. This function can also be used to populate the boot file with the Stream Service IP settings already configured in the database.

3. Choose from the following options:
   - Select the Verbose Mode option if you want to monitor the boot process on the target device (optional). This enables system messaging on the target device.
   - Select Interrupt Safe Mode if the target device hangs early in the boot process.
   - Select Advanced Memory Support option to enable the bootstrap to work with newer Windows OS versions (enabled by default). Only disable this setting on older XP or Windows Server OS 32 bit versions that do not support PAE, or if your target device is hanging or behaving erratically in early boot phase.

4. Select from the following Network Recovery Methods:
   - Restore Network Connections - Selecting this option results in the target device attempting indefinitely to restore its connection to the Provisioning Server.
   - Reboot to Hard Drive - Selecting this option instructs the target device to perform a hardware reset to force a reboot after failing to re-establish communications for a defined number of seconds. The user determines the number of seconds to wait before rebooting. Assuming the network connection can not be established, PXE will fail and the system will reboot to the local hard drive. The default number of seconds is 50. Click the Browse button to search for and select the folder created in Step 1, or enter a full path or UNC name.

Note: If the partition containing the vDisks is formatted as a FAT file system, a message displays a warning that this could result in sub-optimal performance. It is
recommended that NTFS be used to format the partition containing the vDisks. Do not change the address in the Port field.

⚠️ Caution: All boot services (PXE, TFTP) must be on the same NIC (IP). But the Stream Service can be on a different NIC. The Stream Service allows you to bind to multiple IPs (NICs).

5. Configure the following:

Login Polling Timeout

Enter the time, in milliseconds, between retries when polling for servers. Each server is sent a login request packet in sequence. The first server that responds is used. This timeout simply defines how often to retry the single available server with the initial login request. This timeout defines how quickly the round-robin routine will switch from one server to the next, in trying to find an active server. The valid range is from 1,000 to 60,000 milliseconds.

Login General Timeout

Enter the time-out, in milliseconds, for all login associated packets, except the initial login polling time-out. The valid range is from 1,000 to 60,000 milliseconds.

6. Click OK to save your changes.

Using the Manage Boot Devices Utility

The Manage Boot Devices Utility provides an optional method for providing IP and boot information (boot device) to target devices; as an alternative to using the traditional DHCP, PXE, and TFTP methods. Using this method, when the target device starts, it obtains the boot information directly from the boot device. With this information, the target device is able to locate, communicate, and boot from the appropriate Provisioning Server. After the user is authenticated, the Provisioning Server provides the target device with its vDisk image.

Supported Boot Devices

The following boot devices are supported in this release:

Note: The Boot Device Management utility is not supported on operating systems older than, and including, Windows 2000. Wireless NICs are not supported.

- USB
- CD-ROM (ISO)
- Hard Disk Partition

⚠️ Caution:
When an entire hard drive is selected as boot device, all existing disk partitions are erased and re-created with a single active partition. The targeted partition is reserved as a boot device and cannot be used by the operating system or data.

When a hard disk partition is selected as boot device, the selected disk partition data is deleted and set as an active partition. This active partition becomes the boot device.

Boot devices are configured using the Boot Device Management utility. The Manage Boot Devices utility is structured as a wizard-like application, which enables the user to quickly program boot devices.

After installing the boot device, complete the procedures that follow.

**Configuring Boot Devices**

- The vDisk must already be formatted and ready before the BDM.exe is run.
- If using the target device hard disk drive as the boot device, copy BDM.exe from the product installation directory on the server, into the product installation directory on the target device.
- The target device settings in the Console should be set to boot from the vDisk but the actual device should be set to boot from hard disk first.

1. From C:\Program Files\Citrix\Provisioning Services product installation directory, run BDM.exe. The **Boot Device Management** window opens.
2. Under Server Lookup, select the radio button that describes the method to use to retrieve Provisioning Server boot information:
   - Use DNS to find the Provisioning Server from which to boot from. If this option is selected and the Use DHCP to retrieve Device IP option is selected (under Device IP Configuration settings), your DHCP server needs to provide option 6 (DNS Server)

   **Note:** The boot device uses Host name plus DHCP option 15 (Domain Name, which is optional) as the fully qualified domain name (FQDN) to contact the DNS server to resolve the IP address.

   If using HA, specify up to four Provisioning Servers for the same Host name on your DNS server.

   - Use the static IP address of the Provisioning Server from which to boot from. If you select this option, click **Add** to enter the following Provisioning Server information, then click **OK** to exit the dialog:
     - IP Address
     - Port (default is 6910)

   If using HA, enter up to four Provisioning Servers. If you are not using HA, only enter one. Use the Move Up and Move Down buttons to sort the Provisioning
Servers boot order. The first Provisioning Server listed will be the server that the target device attempts to boot from.

3. Click **Next**. The Set Options dialog appears.

4. Configure the following local boot options, then click **Next**:
   - **Verbose Mode**; enable/disables the displaying of extensive boot and diagnostic information that is helpful when debugging issues.
   - **Interrupt Safe Mode**; enable/disable for debugging issues, which is sometimes required for drivers that exhibit timing or boot behavior problems.
   - **Advanced Memory Support**; enables/disables the address extensions, to match your operating system settings. Select this option to enable the bootstrap to work with newer Windows OS versions (enabled by default). Only disable this setting on older XP or Windows Server OS 32 bit versions that do not support PAE, or if your target device is hanging or behaving erratically in early boot phase.
   - **Network Recovery Method**; select to attempt to restore the network connection or to reboot from a hard drive if the target device loses connection to the Provisioning Server, and how long (in seconds) to wait to make this connection.
   - **Login Polling Timeout**; in general, it is recommended that you start values of one second for each of the polling and general timeouts. You should extend these when using 3DES encryption. You should further extend the timers based upon workload. A reasonable setting for 100 target devices running triple DES in the network would be three seconds.
   - **Login General Timeout**; a reasonable setting for 100 target devices running triple DES in the network would be ten Seconds for the General Timeout.

5. On the Burn the Boot Device dialog, configure the target device IP. If the **Use DNS to find the Server** option is selected and your DHCP service does not provide option 6 (DNS Server), then enter the following required information (note that the server name must be less than 16 characters length and the domain name less than 48 characters in length):
   - Primary DNS Server Address
   - Secondary DNS Server Address
   - Domain Name

6. Configure the **Boot Device** properties.
   - **Add an active boot partition**. Check this option to add a boot partition. **Note**: A boot partition is required if booting from the device's hard drive (for example, when selecting a XENPVDISK boot device with small partition or partition offset).
   - Select the boot device from the list of devices.
   - If a partition offset size is set, a confirmation message displays to confirm the destination size. Type **Yes** (case sensitive) to continue.

7. If applicable, configure **Media Properties**.
8. Click **Burn**. A message appears to acknowledge that the boot device was successfully created. If selecting ISO format, use your CD burning software to burn the ISO image.

9. Click **Exit** to close the utility.

10. Boot the target device and enter the BIOS Setup. Under the Boot Sequence, move the boot device to the top of the list of bootable devices. Save the change, then boot the target device.

After the boot device is programmed, a target device boot sequence can be configured using the Console's Target Device Disk Properties dialog. These boot behaviors are used after a target device connects to a Provisioning Server. The Console allows multiple vDisk images to be assigned to a target device. The way in which these vDisks boot depends upon the selected boot behavior.

When configuring the BIOS to work with the boot device (either USB or ISO image), it is imperative that the NIC PXE option is enabled. The PXE boot option is required in order for the NIC Option ROM to stay resident in memory during the pre-boot process. This way, UNDI will be available to the boot device to properly initialize the NIC. Otherwise, the “API not found” message would be displayed by the boot device.