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# Automating Windows 7 Installation for Desktop and VDI Environments

Greg Shields

# Introduction to Realtime Publishers

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by **Don Jones, Series Editor**

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Don Jones

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# Chapter 1: Installation Fundamentals: Automatically Deploying Windows 7 with Windows Deployment Services

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You've just been handed a new project to migrate your desktops to Windows 7. Congratulations! That's a big job; one that's sure to make you look good to your peers and your bosses—if you get it right.

Among IT projects, none so dramatically impacts users than a desktop operating system (OS) upgrade. With it, users get new icons and a new desktop look and feel, not to mention a few new ways of accomplishing their daily tasks. That's something they can see, feel, and touch. Completing an upgrade project successfully means doing so without a major interruption to the flow of your users' workday.

In contrast, doing a poor job means leaving a bad taste in the mouth of your business. That bad taste makes down-the-road upgrades that much more difficult to get approved. If your company can't see value in an OS upgrade—or if they see more pain than value—you'll surely be stuck at this OS version for far longer than you want. *And businesses have long, long memories.*

That's why this book exists. Although installing Windows the manual way requires as few as seven clicks and a bit of time, that manual method is rife with pain and trouble. Fully automating the installation of Windows 7 requires a bit more up-front effort, but the result is a more seamless process—that just works. Better yet, that same process will continue to benefit you for years to come, creating a platform for quickly refreshing computers whenever necessary. All you need is a project plan to get you started and a cookbook of step-by-step solutions to finish the job. You'll get exactly that in these pages.

In the next few chapters, I'll show you the steps required to automate Windows 7 installation, click-by-click. But we won't stop there. I'll dig deep into the ways in which that automated installation will fundamentally change how you do IT. You'll learn exactly how to automate Windows for an OS migration project, whether from Windows XP or Windows Vista. You'll even discover the steps to wrap your automated installation into a VDI infrastructure, enabling hosted virtual desktops to be provisioned automatically and on-demand. More importantly, you'll learn tips and tricks for layering the Windows OS, enabling you to fix common IT problems by simply rebuilding the user's computer—all the while maintaining their applications and user profile information.

Best, you'll learn how to do all of this using Microsoft's no-cost deployment solutions. Admittedly, these solutions might not be the slickest ones around, but they're free. In addition, they are overloaded with an alphabet soup of three- and four-character acronyms whose complexity makes them a "why bother" for many IT pros. But waded through the silly acronyms and the overly-complicated Microsoft documentation, and underneath it all is a powerful automated deployment solution. I'll help you navigate, showing you which features to use and which to avoid.

Keep this guide handy. In it are the step-by-step instructions you'll find yourself turning back to again and again as you fully automate one of the most time-consuming parts of your job: *Windows 7 installation*.

## Step One: Installing and Configuring Windows Deployment Server

Many authors might begin this discussion by explaining the complex file format Microsoft uses for Windows deployment. That format is called *Windows Imaging (WIM)* format. Like the GHO files from Symantec Ghost's days of yore, WIM files are those that contain your Windows 7 images.

That's really about all you need to know right now. I could spend pages talking about the intricacies of how it works (and actually will a bit later). But it's my belief that understanding WIM's format is less important at first than knowing what to do with it.

Thus, Step One in your exploration of automatically deploying Windows 7 starts by installing Microsoft's solution for *actually deploying Windows 7*. That solution is called Windows Deployment Services. Commonly shortened to just WDS, it is available as an installable role inside Windows Server 2008 R2.

### Note

WDS is also available in Windows Server 2003 and Windows Server 2008, but those versions don't include the capabilities you'll really want. Thus, this book's server side will focus exclusively on Windows Server 2008 R2.

Installing the WDS role is a very simple process that you complete in Server Manager. Start by right-clicking Roles to add the Windows Deployment Services role. Installing this role also installs two role services: Deployment Server and Transport Server. Both of these role services are required for WDS to function.

Once the WDS role is installed, you will complete an initial configuration to get started. Do so by right-clicking the server in the WDS console, and selecting Configure Server. The Configure Server wizard will query you for information in three areas:

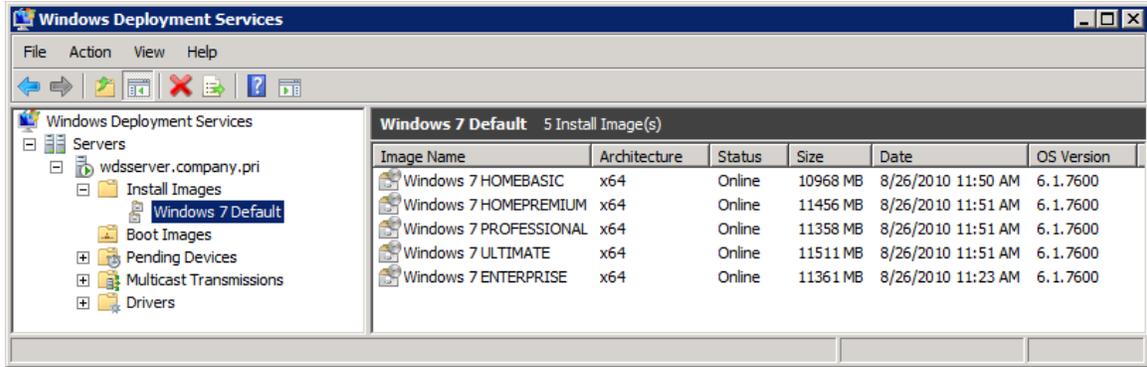
- **Remote installation folder location.** Your image files obviously need a storage location. These files will be large, measuring in the tens of gigabytes, and you'll eventually have more than one of them. For this first area, provide a path to a sufficiently-large local folder where you will be storing your image files. This path should not be the system partition.
- **PXE server initial settings.** Although it is possible to start a Windows 7 image deployment by booting the computer from a DVD or USB drive, you get the best automation by booting computers via the Preboot eXecution Environment (PXE). This "pixie booting" enables computers to automatically download an image from the network as they boot. Transferring Windows 7 images over the network can have a big impact on network performance (a topic I'll discuss in a minute), so for now, select the *Do not respond to any client computers* option. Don't worry, we'll be changing this option shortly.
- **Add Image Wizard.** The third query asks whether you want to add images to this server now. In this first chapter, I'll be showing you how to deploy default images that are right off the Windows media. Automating the customization of these images won't happen just yet. That comes later. For this first example, you'll install only the default configuration of Windows 7—just like what you get after a manual install from the DVD.

To get started, select the *Add images to the server now* check box, and click Finish. You'll be prompted for a file path. Insert your copy of the Windows 7 DVD into the drive, and supply the right path. The Add Image Wizard will ask you to create an image group. Do so, giving that group a friendly name. One or more images will be added to your server, depending on which version of the Windows 7 media you have. This process can take a few minutes, so grab a cup of coffee and meet me back here in 10.

## Stepping Back: What Can You Now Do?

So what can you do now? Right now, not much. What you've achieved at this point is the very beginning of your image deployment system. Remember your Ghost Server? On that server, you would create multicasting sessions to deploy images you specified to clients you connect. You're doing much the same here, except Microsoft's "Ghost Server" is accessed through the WDS console in Administrative Tools.

Figure 1.1 shows an example of what you might be seeing at this point. There, five install images have been uploaded to the server from the Windows 7 DVD media. Each image corresponds to one of the editions of Windows 7. The steps up to this point have uploaded another image as well. This image is called a boot image, and it is found in Figure 1.1's *Boot Images* folder.



**Figure 1.1: The WDS console.**

WDS uses two types of images to install Windows. The boot image has nothing to do with the OS you'll eventually install onto that computer. Rather, it is a miniature version of Windows called the Windows Preinstallation Environment (WinPE). You need WinPE just to boot the computer to which you'll eventually deploy an image. As it boots the computer, WinPE also loads other niceties, such as a lightweight Windows GUI for interacting with that computer. A network stack is also loaded, so you can conveniently transfer images over your LAN. WinPE is actually a tiny version of Windows, so some (though far from all) of your usual Windows commands will work with it. I'll talk more about WinPE later, but for now, be aware that the boot image is what starts this ball rolling.

The real juice with WDS comes in its install images, found in the Install Images folder in the console. You've just uploaded a set of install images right off the Windows 7 media. Yours might have a few less or more than mine, depending on where you got your media. One of these install images and a boot image is all you need to start automatically deploying Windows. *Really.*

#### Note

It's at this point where I should highlight how Microsoft's overly-complicated documentation can really confuse people. Reading it, you might discover that Microsoft wants you to PXE your machine to WDS using an Unattend.XML file built from WSIM in the WAIK after pre-staging your GUID inside the ADUC. Oh, and don't forget MDT (formerly BDD!), who's Deployment Workbench wraps around all this ridiculousness.

My response: *Hooey.* In attempting to define everything, Microsoft has inadvertently confused everything. Bear with me in this book because I intend to bootstrap you through those same services but without all the confusing alphabet soup.

So obviously that right-off-the-DVD image isn't terribly customized for your environment. All by itself, your computer won't have Office installed. It won't have any special drive partitioning. Any customizations you normally add to your "golden image" won't be on it. All those things are the topic in Chapter 2.

Before you start customizing your image, you need to know how to actually deploy an image. That's what we're about to do in step two.

## Step Two: Configuring WDS for Over-The-Network Image Deployment

I mentioned before that one mechanism to boot a computer is by using a DVD or USB hard drive. You can start that process by right-clicking a boot image, and selecting Create Discover Image (and then perform another dance of multiple steps I won't get into). The problem is that the manual method of booting computers is a process *you don't want to do*. It's not terribly automatic. So the much more exciting solution is to use PXE and your network. Before you start, however, check out this sidebar for an important warning about WDS and network bandwidth consumption.

### **A Warning about Over-the-Network Image Deployment**

Kicking off an over-the-network image deployment is a lot like turning on a fire hose of data through your network. Not properly segregated, that data hose can severely bog down entire sections of your LAN. For example, turning it on in a non-segregated network of a dozen computers can essentially shut down the network for everyone else until the installation is complete. Multicast domains can protect you from this situation, but they'll need to be specifically configured on your networking equipment.

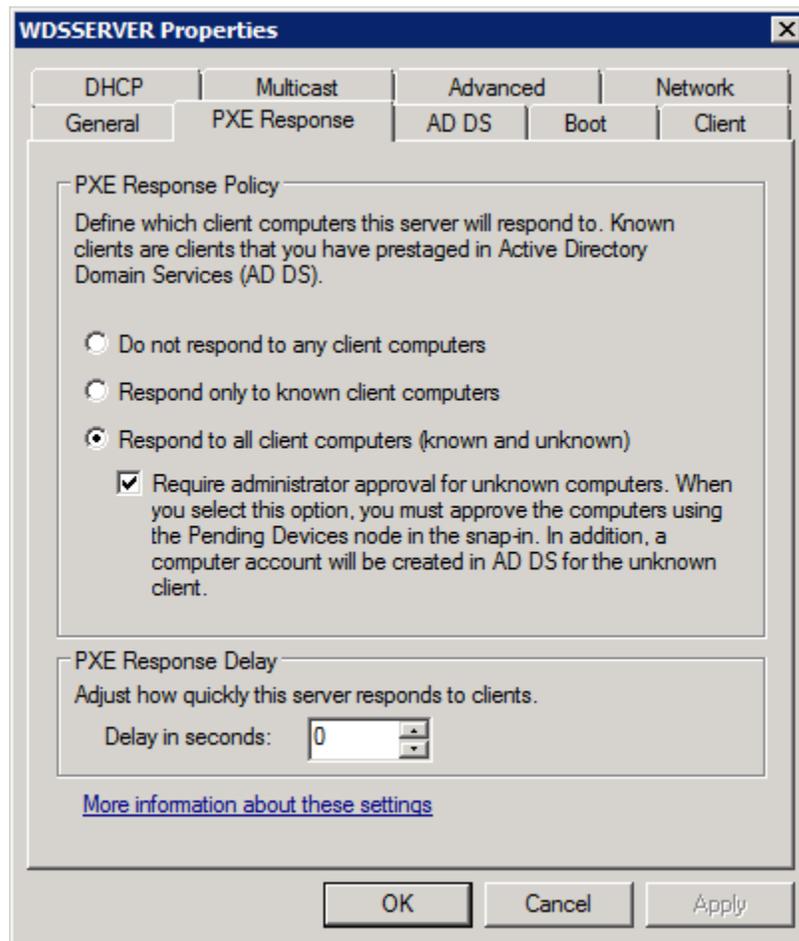
If you intend to use over-the-network image deployment, you might start by splitting off a little network subnet just for use in deploying computers. That subnet might include your WDS server and a few network connections for computers who need imaging. That way, you can learn about WDS' traffic and effects on your network equipment before you stage it throughout the rest of your network.

Let's get your WDS server ready for deploying default images across the network. Doing so requires two network services: PXE, which we've already discussed, and DHCP. PXE handles the very first bootstrapping step for the computer, directing it to the WDS server where it can find its boot image. DHCP is used to give those PXE clients an address and route them to the WDS server.

I'll show you a fairly open example of how to configure the two, and let you lock it down later as you see fit. Start this process by right-clicking your server name in the WDS console, and selecting Properties. If you've done everything correctly, you should see nine tabs in the resulting properties screen. You'll need to make changes in five of the tabs to get started.

## PXE Response Tab

The first tab where configuration is required is *PXE Response*, seen here in Figure 1.2. Any computer whose boot order has been configured to boot first from a network card will attempt to find a PXE server every time it boots. Obviously, this means that every time that computer starts, it will essentially be looking for a new OS vis-à-vis WDS. This is an OK thing, based on some other configurations you'll make shortly. But, as you can imagine, the default setting is for WDS to *not* respond to client computers.



**Figure 1.2: The PXE Response tab.**

To begin listening for PXE clients, change this setting to *Respond to all client computers (known and unknown)*. By setting the configuration in this way, any PXE client that attempts to connect to WDS will be heard and receive a response.

Notice also that *Require administrator approval for unknown computers* has been selected. Using WDS alone, administrator approval is a necessary evil because this action provides the mechanism to name new computers as their OS is installed. If you don't select this check box, computers will be given a default name that is based on the username of the individual who hits F12 and starts the installation. Virtually all of us use a special naming convention for our computers. So naming all your computers after yourself isn't a great solution.

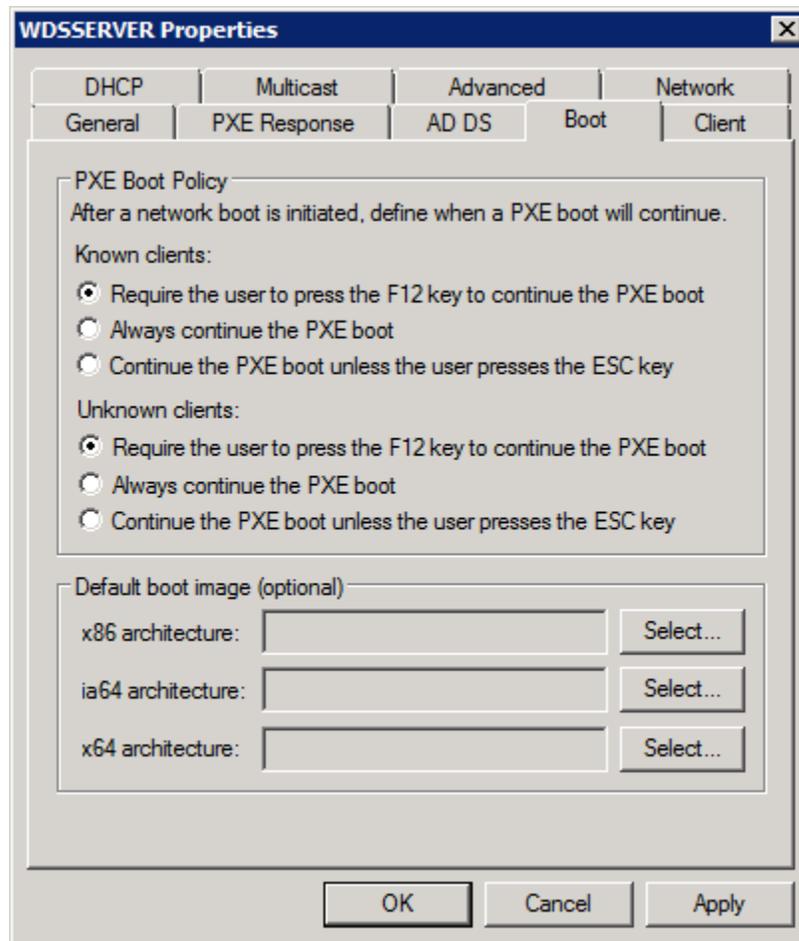
**Note**

Be aware that there's a missing piece in WDS' installation that causes this naming process to fail unless you make a small change to your Active Directory (AD) permissions. The problem exists because the process to name that computer and add its account token into AD happens using the server's AD authentication token and not your user token. You'll need to make this small change to enable the correct permissions: In Active Directory Users and Computers, right-click the domain, and then select Delegate Control. Change the object type to include computers, and add the computer object of the WDS server into the dialog box. Click Next. When prompted, select *Create a custom task* to delegate. Select *Only the following objects* in the folder. Next, select the Computer Objects check box, then *Create selected objects in this folder*. Click Next. In the Permissions box, select Write all Properties, and click Finish.

**Boot Tab**

As you can imagine, setting the previous tab to listen for every PXE boot could be a bad thing. "Connect every computer to WDS as it boots? Greg, are you nuts?"

Quite the opposite, my friends. You can still listen for every client but allow most of them to continue on through the regular boot process by forcing the user to hit the F12 key when the user is ready for an OS installation. You can setup this configuration on the Boot tab (see Figure 1.3). Notice that known and unknown clients are separated out, with each class of client being given one of three different options.



**Figure 1.3: The Boot tab.**

Hitting F12 presents a great way to automate. Think of how this might work: You recognize that a computer needs rebuilding. That computer's BIOS is already configured to boot first from its network card. Assuming that a transmission is ready for approval, all you need to do from the client is reboot and hit F12 to start the process. Every other computer passes by this situation after a few seconds on their way to a standard boot.

You'll also see in this figure that it is possible to specify a default boot image. This setting is optional for now, as you should at this point only have a single boot image (for at least one processor architecture) if not more. If you have more than one for each architecture, consider selecting one as the default.

## DHCP Tab

On the third tab of interest, you begin the process of setting up DHCP services (see Figure 1.4). The verbiage on this tab is a bit confusing. Allow me to translate. There are in fact three scenarios that can exist between WDS and DHCP:

- **WDS and DHCP are on the same subnet but on different servers.** This setup is the most-likely case. It is also the easiest, as there is nothing additional that you need to do. You can move to the next step.
- **WDS and DHCP are on the same server.** If your DHCP server is also your WDS server, select both of the offered check boxes. Move on.
- **WDS and DHCP are on different servers on different subnets.** This setup involves the most work. Select none of the check boxes. Then, in the DHCP console of your DHCP server, view the properties of each relevant DHCP scope. There, select the check boxes to enable scope options 66 and 67. You'll need to enter the fully-qualified domain name of your WDS server in the String Value box for option 66. Enter the name of your boot image into option 67. This name is typically *boot.wim*, although you can double-check the file name by viewing the properties of the boot image on the General tab.

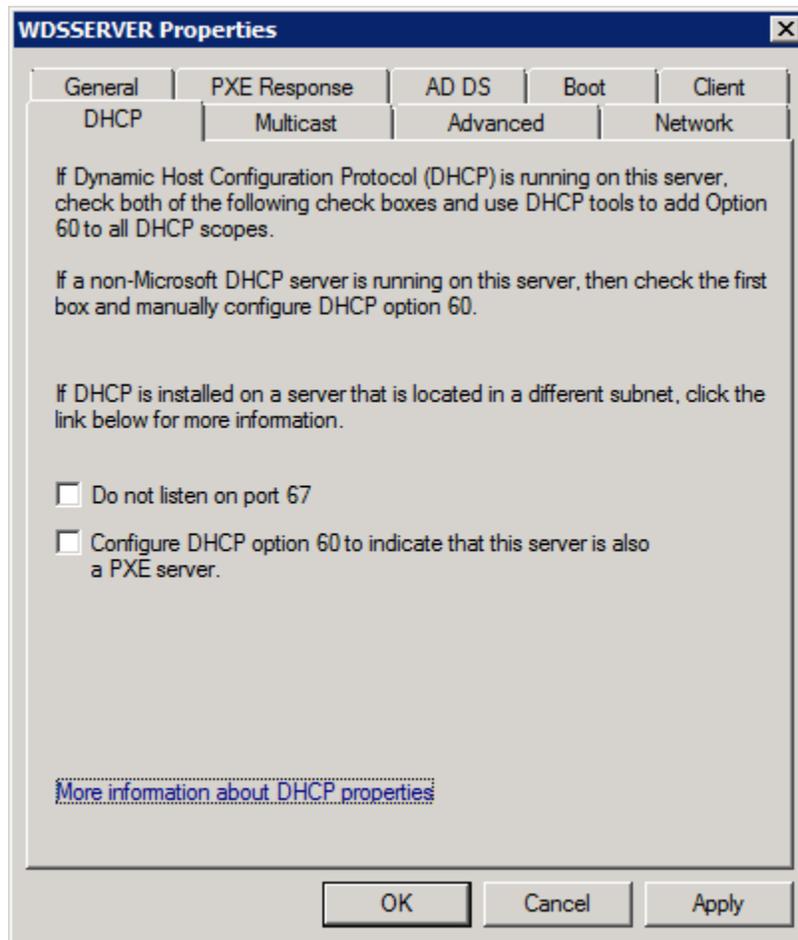
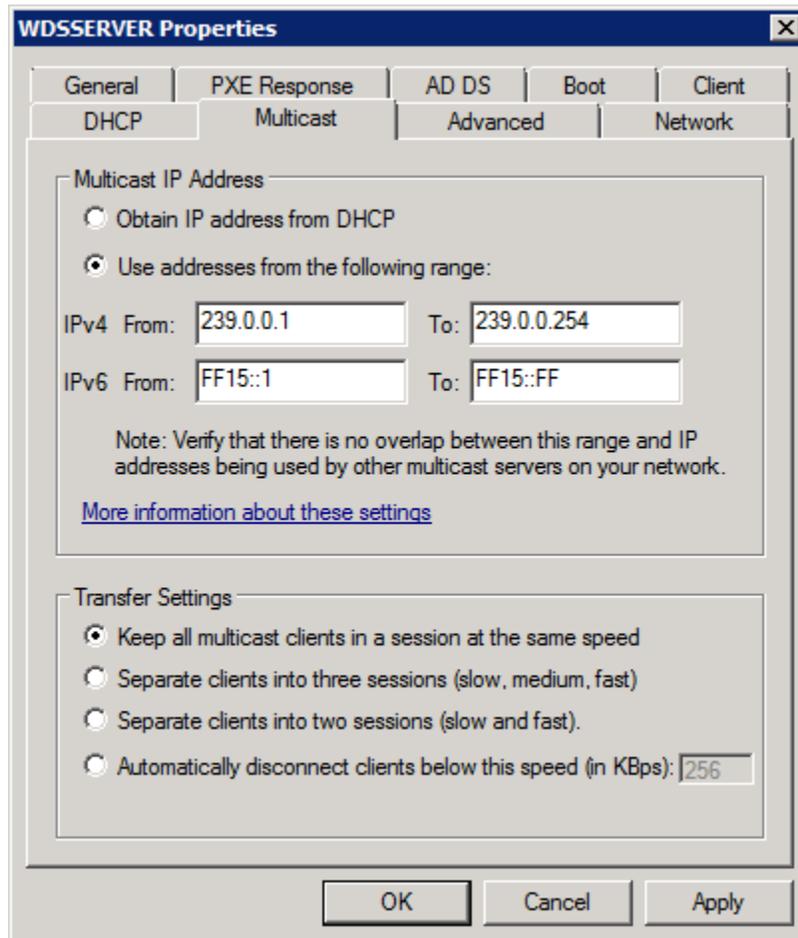


Figure 1.4: The DHCP tab.

## Multicast Tab

The Multicast tab (see Figure 1.5) has two sections you'll need to review. At the top, you can set the network addresses you'll use when multicasting. These addresses can either source from a static range or be distributed through DHCP. Depending on how your network is configured, these addresses may be different than the default settings. Consult your network settings (or your network administrator!) for your specific addresses.



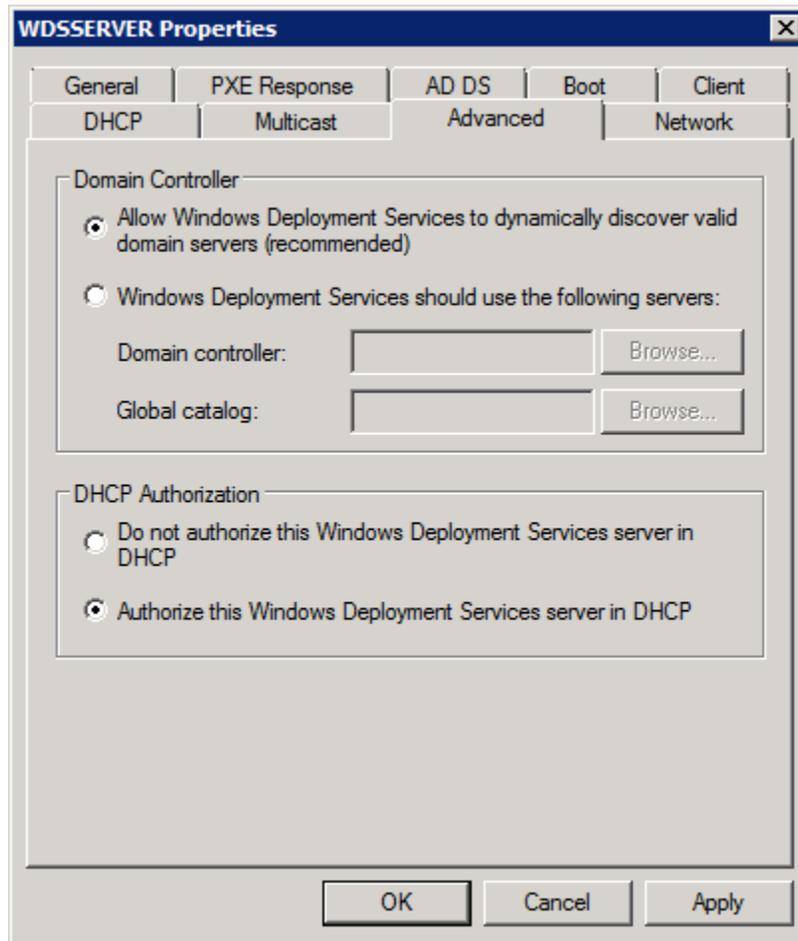
**Figure 1.5: The Multicast tab.**

The bottom section can be very important for speeding up the transmission of images to multiple clients at once. You can obviously imagine that some Windows computers are faster than others. Maybe they have faster processors or disks, or they've got a better connection to the LAN. One historical limitation of multicast is that its transmissions are always limited to the *slowest member of the group*.

That limitation hasn't changed. But what has changed is the ability to break apart a multicast transfer into multiple smaller transfers when slow machines cause slowdowns. In the Transfer Settings box, you can separate those clients. More multicast transmissions obviously means simultaneously duplicating that aforementioned fire hose of data. So be careful before you make any changes because you can really turn on the faucet here.

### Advanced Tab

Finally is the Advanced tab (see Figure 1.6). If you're using a Microsoft DHCP server, you'll need to click the radio button to *Authorize this Windows Deployment Services server in DHCP*. You can also specify a domain controller (as opposed to having WDS discover a local one), although doing so isn't common.



**Figure 1.6: The Advanced tab.**

## Step Three: Deploying Your First Windows 7 Image

You're now ready to deploy your first Windows 7 image over the network. Start this process by right-clicking Multicast Transmissions in the WDS console, and selecting *Create Multicast Transmission*. You'll have three areas to address:

- **Transmission name.** Each transmission requires its own name. Clients will use this name to identify which transmission they want to follow. Give the transmission a friendly name, and continue.
- **Image selection.** Your second selection will identify which image you want to transfer. Each image group contains one or more images. Select the one you're ready to deploy.
- **Multicast type.** Creating a multicast transmission only prepares it for clients. Once that transmission is prepared, it will sit in waiting for those clients based on the behaviors you set. As Figure 1.7 shows, you've got options. You can instruct the transmission to begin after a certain number of clients or amount of time passes. A much more powerful alternative is to simply tell the transmission to begin when the first client connects. Subsequent clients will join later, picking up the data at whatever point it is at, and finishing up where necessary. I particularly like this setting, as it gives me the most flexibility for starting transmissions and joining clients a bit later.

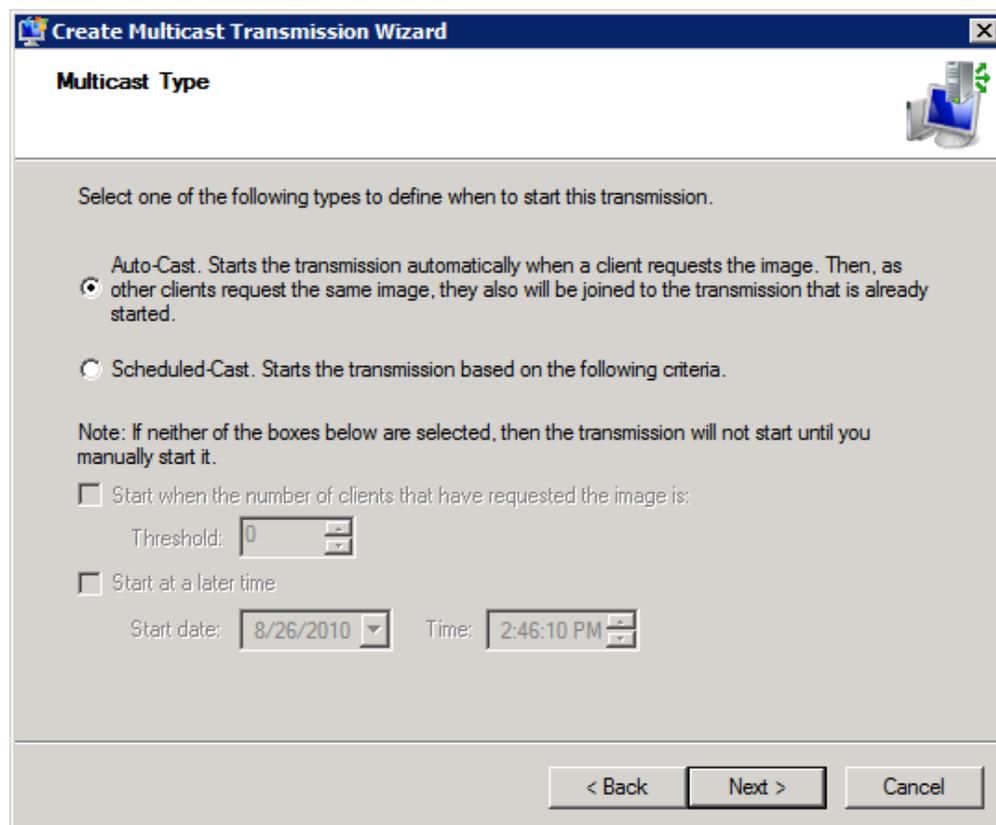


Figure 1.7: Multicast Type.

Finishing the wizard sets the multicast transmission to a Waiting status until the Multicast Type conditions are met. Now, ready a computer that needs an OS. Set its network boot order in the BIOS to boot from its NIC first. Then boot it, and hit F12 when prompted. If you've done everything correctly, the computer will boot and pause as it awaits approval for its pending OS installation request. Figure 1.8 shows how the boot screen will appear as the client waits. Note that this computer's pending request ID is set to 1.

```
Network boot from Intel E1000
Copyright (C) 2003-2008 VMware, Inc.
Copyright (C) 1997-2008 Intel Corporation

CLIENT MAC ADDR: 00 0C 29 A8 55 E6  GUID: 564D932A-154F-3317-9665-4C26B8A855E6
CLIENT IP: 192.168.0.38  MASK: 255.255.255.0  DHCP IP: 192.168.0.1
GATEWAY IP: 192.168.0.1

Downloaded WDSNBP...

Architecture: x64

The details below show the information relating to the PXE boot request for
this computer. Please provide these details to your Windows Deployment Services
Administrator so that this request can be approved.

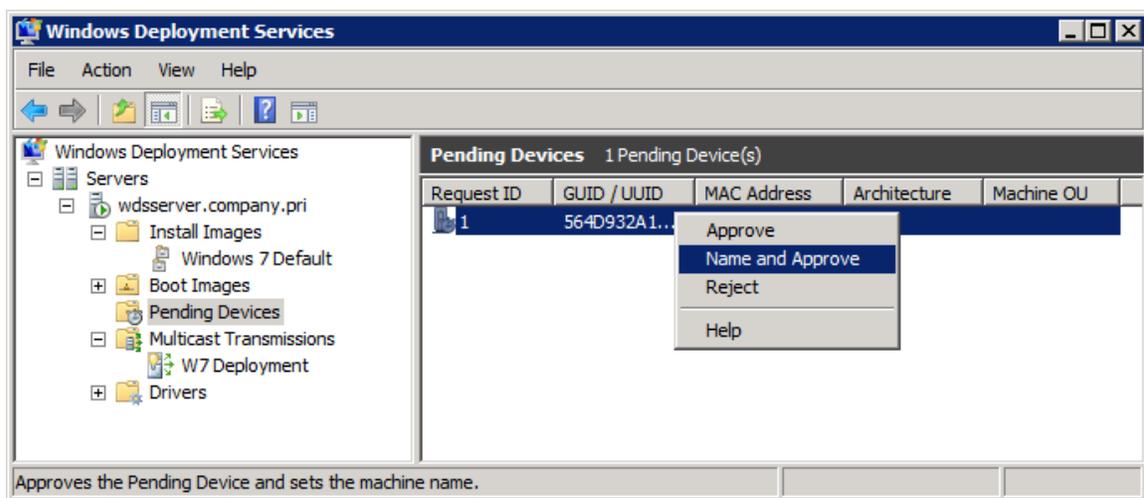
Pending Request ID: 1

Message from Administrator:

Contacting Server: 192.168.0.230....._
```

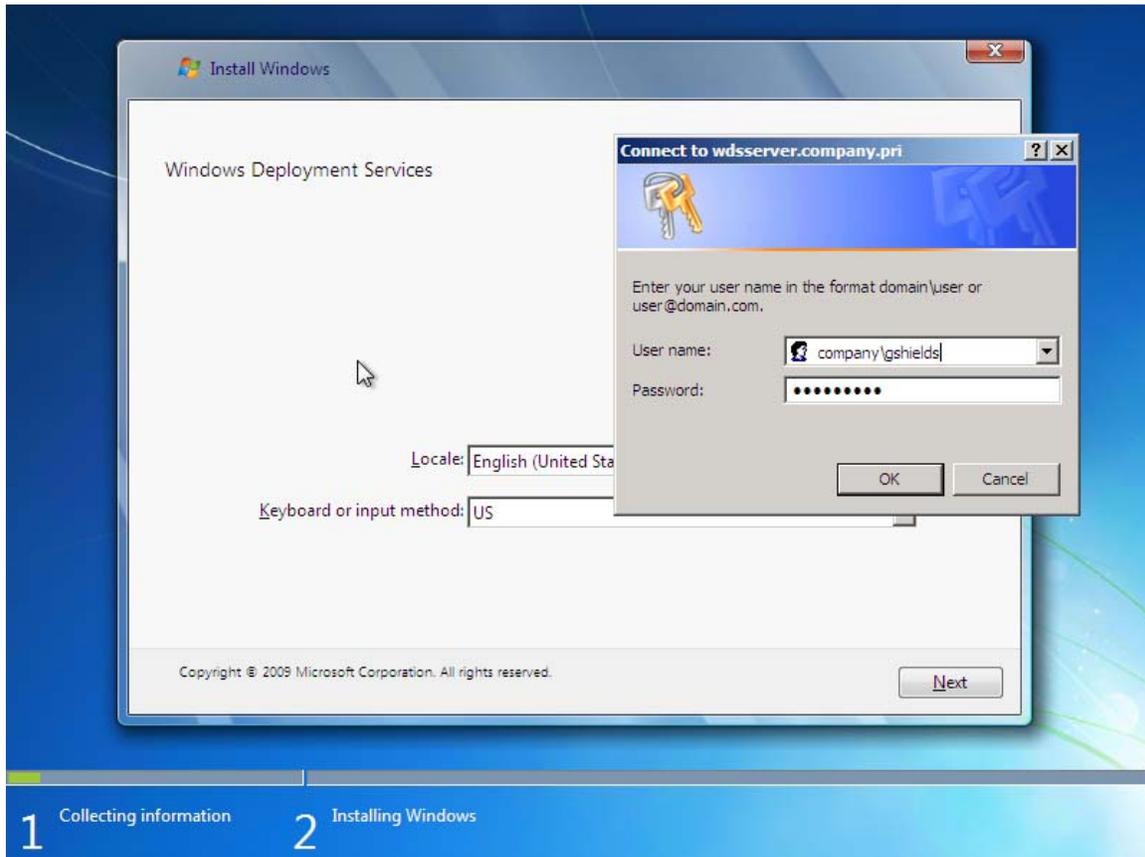
**Figure 1.8: Awaiting administrator approval.**

That same pending request ID number will be displayed in the WDS console under Pending Devices (see Figure 1.9). To approve the request and name the computer, right-click the appropriate request ID and choose *Name and Approve*. Enter a name for the computer into the resulting dialog box, and click OK. The installation will begin.



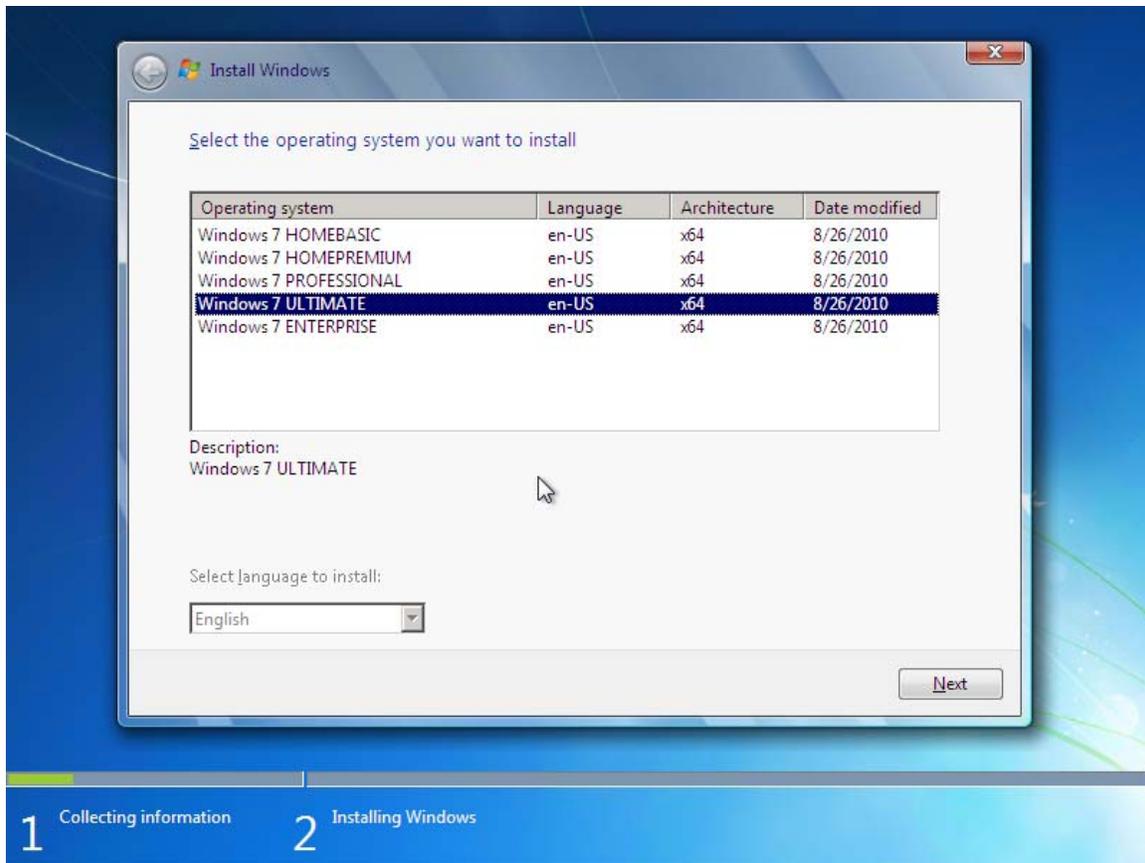
**Figure 1.9: Pending Devices.**

The client will download its boot image from the WDS server and present you with a screen that looks similar to Figure 1.10. As you can imagine, at this point *you don't have full automation just yet*. You'll learn about those steps in future chapters. But what you do have is a mini-setup screen for Windows 7. Figure 1.10 shows that the mini-setup screen needs a Locale and Keyboard as well as credentials to connect to the WDS server (in my case, `wdsserver.company.pri`).



**Figure 1.10: The boot image's setup screen.**

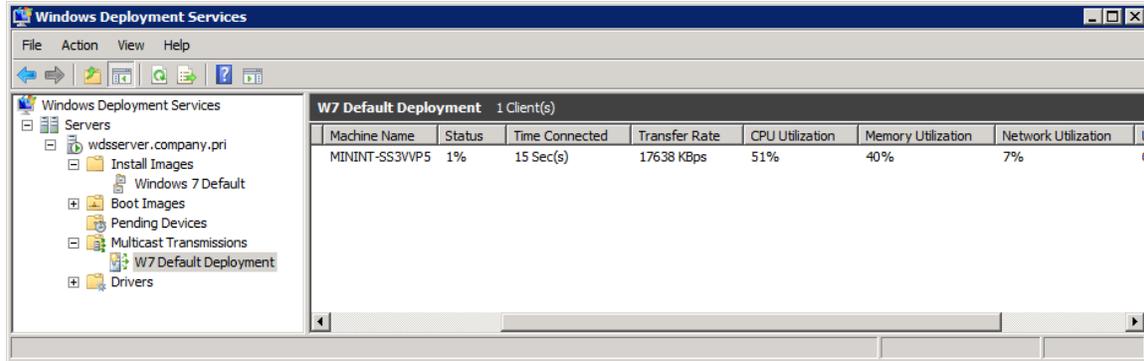
Entering those credentials brings you to Figure 1.11, where your selection of OS edition can be made. You should note an interesting behavior here. When you created the original multicast transmission, you identified an edition for distribution, yet on this screen you're allowed to choose any edition in the image group. That edition selection will become important down the road as you add automation pieces.



**Figure 1.11: Selecting an edition.**

This wizard's final screen (not shown here) provides a location to configure any disk partitions that will be used by this computer. Moving on from this screen begins the installation.

Monitoring the status of installations occurs back in the WDS console, where useful instrumentation data is presented for each client: name, IP address, time connected, status (as percent complete), and even CPU, memory, and network utilization statistics. I've scrolled Figure 1.12 a bit to the left to show some of its more interesting columns. This data is useful for identifying when one or more slow clients needs to be disconnected or reverted to its own multicast transmission. You can do so by right-clicking any running transmission, and selecting Disconnect or Bypass multicast.



**Figure 1.12: Client instrumentation for an active multicast transmission.**

Give your installation a few minutes to complete. As with a manual installation, the installation process will reboot the computer a few times and offer a few pop-up status screens. Once the installation is again ready for user input, you'll be presented with the post-installation configuration screen called Set Up Windows (see Figure 1.13).



**Figure 1.13: The Set Up Windows screen.**

You've seen the next set of screens before. They're pretty much the same configuration screens you see when you install Windows manually: setting a username and password, accepting the license agreement, configuring Windows Update, and setting the time and time zone.

## Just a Few Steps to Basic Automation

You've complete the few steps required to achieve basic automation, and there are just a few more to get you to even greater levels of automation. This first chapter has hopefully demystified some of the steps required to start automating the installation of Windows 7 with Microsoft's tools. If a default installation from the Windows 7 DVD media is all you're looking for, you can stop here and begin deploying clients.

But most of us would probably like just a few more of these processes taken off our plate. We don't want to deal with answering questions during WinPE's initial boot. We probably don't want to answer questions at the post-installation configuration screen either. If we have drivers that aren't part of the Windows DVD media, we want them added to our installation. And, most importantly, we want our initial installation to start with a set of applications like Microsoft Office and others.

All of these are valid requirements as well as completely feasible automations that you can add with just a bit more work. And all of these are topics explored in Chapter 2.

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