



AUTOMATED DEPLOYMENT TOOLS FOR MICROSOFT WINDOWS 7 AND WINDOWS SERVER 2008 R2

By Syama Poluri

The Microsoft® Windows® 7 and Windows Server® 2008 R2 operating systems introduce multiple enhancements for automated OS installations—helping administrators to ensure fast, stable, consistent deployments across the organization and accelerate return on investment for new IT resources.

Rapid, accurate deployment of new systems can be essential to accelerating return on investment for IT assets while controlling costs under tight budget constraints. To help ensure that they can meet deployment goals, many IT organizations turn to automated deployment solutions that enable them to remotely deploy and manage large numbers of servers.

The Microsoft Windows Vista®, Windows 7, Windows Server 2008, and Windows Server 2008 R2 operating systems have introduced new ways of creating, modifying, and leveraging unattended installation processes compared with the previous Windows 2000 Server and Windows Server 2003 operating systems. Administrators can take advantage of features such as a consolidated answer file, the Windows System Image Manager (Windows SIM) tool, and the Windows Automated Installation Kit (Windows AIK) to automate OS installations and help ensure fast, stable, consistent deployments across the organization. (For more information on Windows AIK, see the “Getting started with Windows 7 image deployment” sidebar in this article.)

INSTALLATION TYPES AND CONFIGURATION

Traditionally, the Windows 2000 Server and Windows Server 2003 operating systems used 16-bit text-mode environments for the initial setup phase, with later setup processes using a graphical user interface (GUI) mode. Windows Server 2008 and Windows Server 2008 R2 deprecated the text-mode phase in favor of the Windows Preinstallation Environment (WinPE), a minimal

Microsoft Win32® deployment environment. Nearly all Windows Server 2008 R2 setup tools run in WinPE.

In Windows Server 2008 and Windows Server 2008 R2, Windows Setup now includes several features designed to provide faster and more stable installations compared with previous versions:

- **Accelerated installations and upgrades:** The image-based setup (IBS) technology in Windows Setup is designed to help administrators install and upgrade operating systems faster and more easily than they could previously. They can perform a clean installation by deploying the OS image to a destination system, or perform rapid, simplified upgrades by installing a new image onto an existing installation while maintaining existing settings.
- **Enhanced stability and consistency:** The IBS technology uses Windows Imaging (WIM) files to help increase the stability and consistency of OS installations.
- **Simplified image management:** Windows Server 2008 R2 images are now stored in a single WIM file, each of which can store multiple OS instances. The ability to store different OS versions in a single image, rather than keeping them as separate files, is one of the major enhancements in Windows Server 2008 R2, helping to reduce setup times and facilitating automated OS deployments.
- **Streamlined installation:** Windows Setup is optimized for the manufacturing and deployment scenarios used by original equipment manufacturers

(OEMs) and large organizations, and is designed to take less time and require fewer tasks to complete compared with previous OS versions.

- **Consolidated answer file:** The Windows 7 and Windows Server 2008 R2 setup architecture consolidates the unattend.txt, winbom.ini, cmdlines.txt, and sysprep.inf files used in Windows XP, Windows 2000 Server, and Windows Server 2003 into a single XML file, typically named unattend.xml. Previously, each answer file was used to automate certain setup phases; with the unattend.xml file, different sections of the file are parsed during different configuration passes.

Windows Setup supports two installation types: custom and upgrade. The key difference between the two is that an upgrade requires an existing server installation and saves the preferences and settings from that installation, while a custom installation does not. Both types use the following basic setup phases:

1. **WinPE or downgrade OS:** Partitions the disk, copies the image to the disk, and processes the answer file
2. **Online configuration:** Processes configuration settings to make an installation specific to that hardware
3. **Windows Welcome:** Applies additional answer file settings from the oobe.xml file (a content file that can be used alone or in conjunction with an unattend.xml file) and launches Windows Welcome

The online configuration phase includes seven configuration passes:

1. **windowsPE:** This pass configures WinPE options and basic Windows Setup options, which can include setting the product key and configuring a disk. If drivers are needed to enable WinPE to access the local disk or a network, administrators can use this configuration pass to add drivers to the

GETTING STARTED WITH WINDOWS 7 IMAGE DEPLOYMENT

The Microsoft Windows Automated Installation Kit (Windows AIK) is a logical place to start for IT administrators tasked with developing automated processes and images for Windows 7 deployments on new or existing systems in the field. The version of the kit tailored for Windows 7 (see Figure A) is delivered as an ISO image; to install the kit, administrators must first burn the image to a blank DVD. If they are working from an existing Windows 7 client, the ability to burn ISO images is already natively built into the OS—so there is no longer a need for a third-party tool.

After the kit is installed, administrators can access a comprehensive range of documentation and sample files as well as the Windows System Image Manager tool (see Figure 2). The documentation provides step-by-step details to enable development of a network-installable Windows 7 image, including building an answer file, building a reference installation, creating bootable Windows Preinstallation Environment (WinPE) media, migrating the installation files to a network share, and testing the deployment process over the network.

The Windows 7 version of Windows AIK is available for download at go.microsoft.com/fwlink/?linkid=136976.



Figure A. Microsoft Windows Automated Installation Kit setup

2. **offlineServicing:** This pass applies updates and packages to an OS image, including software fixes, language packs, and security updates. During this pass, administrators can also add drivers to an image before that image is installed and begins processing the

out-of-box device drivers during Windows Setup.

3. **specialize:** This pass creates and applies system-specific information such as network settings, international settings, and domain information.
4. **generalize:** This pass enables administrators to minimally configure the sysprep /generalize command as well as other settings that must persist

on the reference image. The `sysprep /generalize` command removes system-specific information such as unique system identifiers (SIDs) from the image. This pass runs only if the `sysprep /generalize` command is run.

5. **auditSystem:** This pass processes unattended settings while the OS is running in the system context, before a user logs in to the system in audit mode; it runs only if the system is booted into audit mode.
6. **auditUser:** Processes unattended settings after a user logs in to the system in audit mode; as with the `auditSystem` pass, this pass runs only if the system is booted into audit mode.
7. **oobeSystem:** This pass applies settings before Windows Welcome starts.

Figure 1 shows the relationship between the configuration passes and the valid passes for different executable files.

IMAGE-BASED SETUP AND MANAGEMENT

The IBS technology in Windows 7 and Windows Server 2008 R2 provides a unified process designed to work across virtually all deployment scenarios. It can perform clean OS installations and upgrades for both client and server systems, and allows hardware abstraction layer (HAL)-independent image deployment and offline image servicing.

Windows Setup and System Image Manager

Windows Setup is based on IBS and works with unattended installation answer files to automate online OS installations and customizations. The OS installation DVD can automatically launch Windows Setup, or administrators can explicitly specify an answer file by using the `setup.exe /unattend:filename` command to start an automated setup process, where `filename` is the local or Universal Naming Convention (UNC) path for the answer file.

Administrators can use the Windows SIM tool to create, open, and manage answer files and add components and packages to specific configuration passes (see Figure 2). This tool is designed to help administrators create answer files quickly, view all configurable components, and add third-party drivers and applications to a specific answer file. Administrators can also use the tool to validate answer file settings against an existing image.

In Windows Vista and Windows Server 2008, administrators needed to create one OS reference image per OS edition, and then test those images with each possible hardware configuration. In Windows 7 and Windows Server 2008 R2, administrators can now change a lower edition of an OS image to a higher edition through either an offline or online process—enabling them to create a single lower-edition reference image that can be deployed across the organization as either the lower edition or as a higher edition. For example, a Windows Server 2008 R2 Standard image can be dynamically changed to Windows Server 2008 R2 Enterprise or Datacenter using the appropriate product key.¹

Virtual machines with native boot

Previously, Microsoft virtual hard disk (.vhd) files could be used only to boot an OS in the hypervisor environment as a guest OS. In Windows Server 2008 R2, .vhd files can now run directly on the designated hardware without other virtual machines or hypervisors.

Administrators can take advantage of the `diskpart.exe` and `diskmgmt.msc` disk management tools to create and mount the .vhd images, and the `bcdboot.exe` and `bcdedit.exe` setup tools to configure boot configuration data to allow a boot manager to boot a .vhd image. Administrators who are managing multiple OS images can use the same image-management tools to create, deploy, and maintain .vhd images to be installed on designated hardware or on a virtual machine.

Windows Recovery Environment

The Microsoft Windows Recovery Environment (WinRE) is an extensible recovery platform based on WinPE that enables administrators to repair an OS installation in case of corruption or boot failure. In Windows Server 2008, WinRE was included only on the OS DVD media, but in Windows 7 and Windows Server

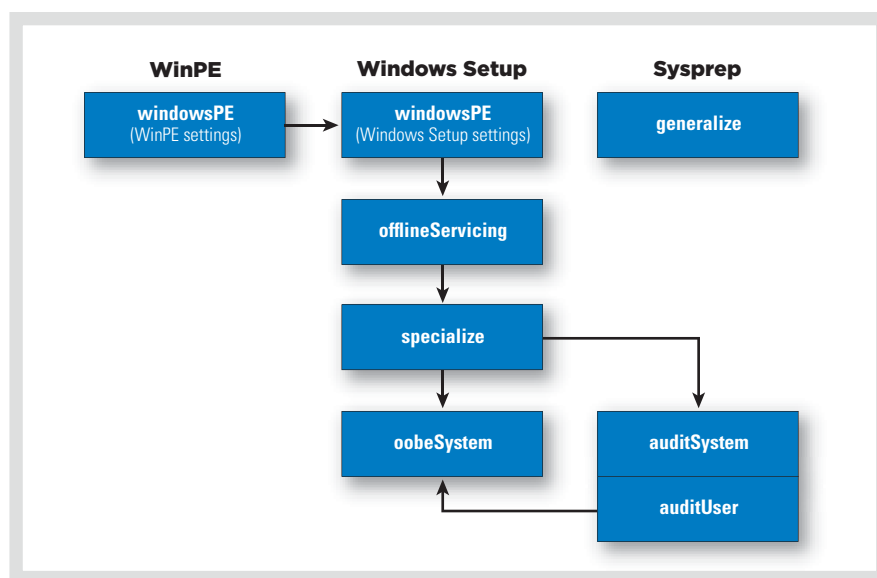


Figure 1. Windows Setup configuration passes for different executable files

¹For more information, refer to the Deployment Image Servicing and Management (DISM) tool's Set-Edition command option.

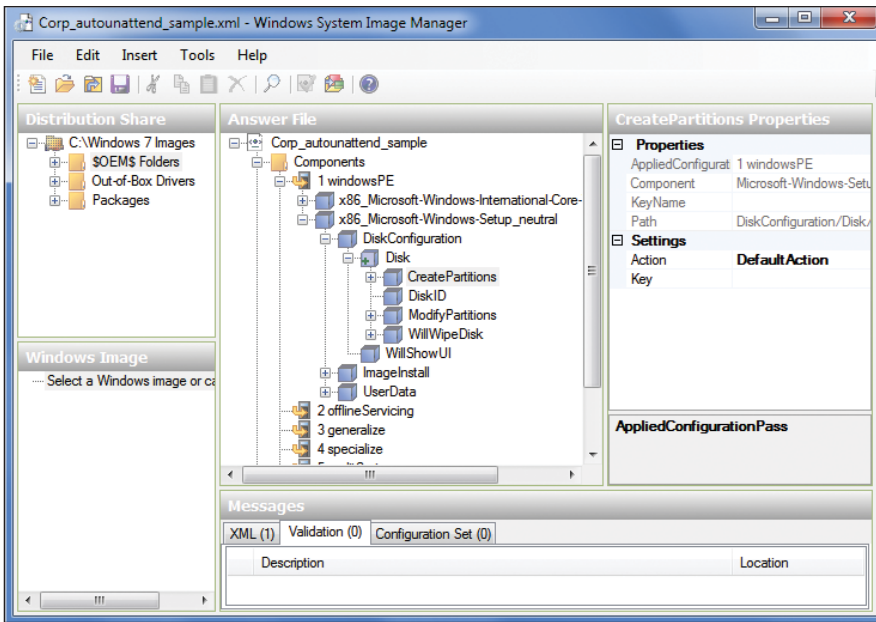


Figure 2. Microsoft Windows System Image Manager interface

2008 R2, it can be preinstalled on a system's hard drive as well as on the installation media. If WinRE is preinstalled on the hard drive and the system fails to start, the system can automatically fail over to the WinRE environment. The WinRE repair tool can then automate the diagnosis and repair processes.

AUTOMATION AND UNATTENDED INSTALLATIONS

The unattended installation answer file—typically named `unattend.xml`—is a key component in the Windows 7 and Windows Server 2008 R2 setup automation process, enabling administrators to specify disk configurations, default OS settings, and the addition of drivers, software updates, and other applications. Administrators can use Windows SIM to create and validate answer files. Each OS component includes settings that can be used to create an answer file, and each setting in a given component is listed in its own individual topic; if an element contains a value, all valid value types are described. The file is organized by setup phase and OS component.

Answer file search order

Because reboots are required during setup, a copy of the answer file is cached on the system. If administrators have not specified an answer file, then at the start of each configuration pass Windows Setup searches for the file in several places, including the location of a previously cached answer file and the root of a drive. If an answer file is found in one of the valid locations but includes no settings for the current configuration pass, the file is ignored.

Windows Setup identifies and logs available answer files based on an implicit search order, and then uses the file with the highest precedence. After identifying an answer file, Windows Setup validates the file and caches it on the system. Valid answer files are cached to the `$Windows.-BT\Sources\Panther` directory during the `windowsPE` and `offlineServicing` passes. After the OS installation is extracted to the hard drive, the file is then cached to `%WINDIR%\panther`.²

Sysprep

The sysprep tool prepares OS installations for imaging, auditing, and delivery.

Imaging, also called duplication, enables administrators to capture customized images for reuse throughout an organization. Administrators can also use sysprep to remove system-specific data such as an SID from an image; after removing this information, they can then capture that image and deploy it on multiple systems. In the Windows Server 2008 R2 sysprep architecture, each OS component can define sysprep actions to enable component settings to be specialized for specific systems during the IBS process.

RAPID, ACCURATE SYSTEM DEPLOYMENT

Automated OS installation offers a key way to ensure rapid, accurate system deployment, particularly in large environments. By understanding and utilizing the enhancements available in Microsoft Windows 7 and Windows Server 2008 R2—including the consolidated answer file, driver deployment tools, and Windows SIM interface for unattended installations—administrators can streamline server deployment processes across the organization to help accelerate return on investment for new IT resources. [u](#)

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²For more information on answer file search order, visit [technet.microsoft.com/en-us/library/cc749415\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/cc749415(WS.10).aspx).