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DOCUMENTATION  
BEST PRACTICES  
ARTICLE



# **ALTIRIS®** **Deployment Solution™ 6.5 Hardware Independent Imaging v4**



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Hardware independent imaging enables you to automate rapid deployment of a standard image across multiple types of hardware. This can greatly simplify and reduce the time needed to set up new computers.

However, standardizing your image presents several challenges, including gathering 3rd party drivers, providing mass storage drivers, and determining the correct Hardware Abstraction Layer for your hardware.

Altiris Deployment Server provides several tools to simplify and automate the capture and deployment of standard images across your organization.

This document outlines one method to use Deployment Solution to create and deploy a hardware independent image, and focuses on using Windows XP as the OS for the base of the image.

Using the framework outlined in this document, you can automate and enhance the standard imaging process for your company.

## Requirements

- Altiris Deployment Solution 6.0 or later. An evaluation version of the latest version of Deployment Solution is available at <http://www.altiris.com/Download.aspx>.
- A working understanding of Microsoft Sysprep (See [Appendix A: Sysprep](#) (page 16)). Sysprep from a Windows 2003 Server CD-Rom is currently the best version to use and is compatible with Windows XP.
- Windows Volume license and the corresponding key for the operating system.
- Access to the driver files needed to configure the hardware used in your organization. (Gathering drivers is discussed in detail in this document).
- Hardware Abstraction Layers (HALs) - You most likely need a copy of the Advanced Configuration and Power Interface Hal (halacpi.dll) and the ACPI Uniprocessor Hal (halaacpi.dll), and any additional HAL files that might be specific to your computers.
- A source computer that can be used to create your image.

## Configuring a Source Computer

Choose a standard computer model with no unique or custom configurations to be the source computer from which you create your generic images.

This computer is prepared with a scripted Windows install in the following section:

- [Stage 1 - Perform a Scripted Install on the Source Computer](#) (page 5)

It is important that you do not add the source computer to your corporate domain. Sysprep can add an imaged computer to your corporate domain if you choose, but for initial image creation leave the source computer off of the domain.

Do not configure any hardware that isn't absolutely necessary. If the operating system was unable to plug and play your hardware, leave it uninstalled. Leaving undetected hardware uninstalled makes it easier to deploy the image.

If you want to specify the local administrator password in sysprep then you will need to leave the password blank when setting up the image.

## Stage 1 - Perform a Scripted Install on the Source Computer

The first stage is to create a clean source computer with the OS installed. The goal is to implement a consistent, easily repeatable process for future efforts.

The source computer can also be set up using the normal installation process without using a scripted install.

### Extract the Deploy.cab Files

Under the Deployment share create a new directory titled sysprep. Extract the contents of the deploy.cab to the following directory:

```
\\dsserver\express\sysprep
```

Replace dsserver with the name of the computer hosting your Deployment server.

### Creating the Unattended.txt File

The MS Setup Manager Wizard, setupmgr.exe found in deploy.cab, should be used to generate the initial unattend.txt file to be used in the scripted installs of Windows XP.

1. Execute setupmgr.exe from the sysprep directory created in the previous section.
2. Select the appropriate options (Create new, Unattended setup, XP Professional, Fully Automated).
3. Select Setup from CD. This avoids the unnecessary step of copying files from the CD to a network share. The Deployment Solution wizard will be used to perform this operation in a future step.
4. Pre-accept the license agreement.
5. Under General Settings > Name and Organization - Fill out both fields.
6. Under General Settings > Product Key - Enter your Volume license key for XP Professional.
7. Optional: Under General Settings > Time Zone - Pick the appropriate zone.
8. Under Network Settings > Computer Name - Enter an appropriate name such as 'SourceXP' and click the Add button.
9. Under Network Settings > Administrator Password - Enter the desired password. The Encrypted password may option may be used.
10. Do not alter the default network configuration, as DHCP is preferred during the build process.
11. When finished, save the configuration file to the same source directory as the setupmgr executable (\\dsserver\express\sysprep\unattend.txt).

## Creating the i386 Source Directory for the Scripted Install

Before starting this task, obtain the OS install media such as the Windows XP Pro Corporate install CD (or at least the i386 directory from the CD). To expedite the build process, it is recommended that OS media include a slipstreamed version of the current service pack. Slipstreamed hotfixes are not recommended, due to inability to insert them in the Add/Remove programs registry.

By creating a scripted OS install procedure, mistakes in the imaging process can be greatly reduced via automation of clean OS builds.

Next, we will use the Deployment Console to copy the files from the OS installation media to the Deployment Server (you will be prompted during the creation of a Scripted OS Install job).

1. From the Deployment Console, create a new job and pick an appropriate job name such as 1. SOSI XPSP2.
2. Click the Add button, and choose the Scripted OS Install option.
3. Choose Windows for the install type.
4. Choose Windows XP Professional, and the desired OS language (English).
5. When prompted, browse to the target i386 directory containing the winnt.exe file. The DS console will then copy the files from the source path to the X:\Altiris\Express\Deployment Server\Deploy\WinOS001\i386 directory on the DS server.
6. Accept the default FAT16 image file for the initial partitioning. The C: partition will be converted to NTFS during the OS installation, and can be resized during the final image restoration phase.
7. Check the box to import an existing unattended.txt file.
8. Select the UserData tab, and enter a valid MS Key for WinXP Pro OS on the ProductID line. You may cut and paste the value from the ProductKey line below it. Remember to press the Enter key afterwards, as the SOSI wizard will sometimes discard inputted values without the key press.
9. Accept the default acient install script that will be added to the [Commands] section.
10. Accept the default Deployment agent settings.
11. Accept the summary, and click Finish.
12. If the install media didn't already contain SP2, slipstream the current service pack onto the i386 source directory. For example:

```
WindowsXP-KB835935-SP2-ENU.exe /  
integrate:X:\Altiris\Express\Deployment  
Server\Deploy\WinOS001\i386
```
13. If you are using PXE, enable PXE booting on the source computer (a BIOS setting). Otherwise, you need to create bootable media or an automation partition to boot the source computer into the automation environment. See the automation chapters in the Deployment Solution guide.
14. Using the DS console, assign the new SOSI task to the target source computer. You might need to reboot the computer to kickoff the install job.

After the OS has been installed, Aclient will be loaded on the computer. The Aclient icon will not display if the computer's network card does not match one of the network drivers included in the XP OS.

## Stage 2 - Optimize the Source Computer

After the OS has been installed, some basic configuration tasks can be performed to customize the final image, enhance the security, and to reduce the size of the source image file. Internet access for the source computer will be required to complete this step.

1. Test the computer for network connectivity. If necessary, use a USB drive or CD-ROM to install the necessary network driver.
2. Run Windows Update to apply all critical OS patches that were not included in the latest service pack. Certain patches will have dependencies (.Net install), and will require a reboot before prior to continuing to apply patches. Revisit the Windows Update site after each reboot until no new critical patches are identified.
3. Optionally install and configure applications that will be common to all computers that are likely to receive the image.

You might need to experiment in your environment to determine which, if any, software applications you want to bundle in your image. Including software can reduce the time needed later to install applications, but it might require frequent updates to your standard image as software changes.

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### Important

Do not pre-install the NS Altiris Agent, as this might cause duplicate GUID problems in the NS database. If bandwidth constraints are a concern, place the agent installation files in the image and force execution of them from within the sysprep file or a Deployment script after the image restoration.

---

4. Reduce disk space by turning off System Restore. Select the properties of My Computer > System Restore tab > check the Turn off System Restore on all drives box. Click Apply to finish the process.

By default, System Restore is re-enabled by sysprep after the computer is restored from an image.

5. Reduce disk space by turning off the swap file. Select the properties of My Computer > Advanced > Performance > Settings button > Virtual memory > Select the C: drive > Select the "No paging file" radio button. Click the Set button. Click OK to finish the process. Reboot when prompted.

By default, the page file is re-enabled by sysprep after the computer is restored from an image.

6. Make changes to the Windows Security Center as necessary:
  - a. Disabling or modifying the Firewall (Start > Control Panel > Firewall) and Firewall warning (Start > Control Panel > Security Center > Left pane "Change the way Security Center alerts me" > uncheck Firewall).
  - b. Antivirus warning: (Start > Control Panel > Firewall) and Firewall warning (Start > Control Panel > Security Center > Left pane "Change the way Security Center alerts me" > uncheck Antivirus).

- c. Automatic Updates (Start > Control Panel > Automatic Updates) and Automatic Updates warning (Start > Control Panel > Security Center > Left pane "Change the way Security Center alerts me" > uncheck Automatic Update.

It is possible to implement many of these settings as part of the sysprep file, but that is beyond the scope of this document.

Make any final configurations or modifications to the operating system or installed applications. Some customers will add a private administrative user account during this step. If the desired administrative account will not be the same for all divisions of a company, instead use a DS script to create the account after restoring the image.

Reboot the computer after all installations are complete. This computer is now ready to be used as a source for Hardware Independent Images.

## Stage 3 - Sysprep

### Token Replacement Overview

By using the token replacement feature of Deployment Solution, the first reboot portion of the sysprep process can be customized to implement the desired configuration for a newly re-imaged computer.

Tokens are variables evaluated against specific fields in the Deployment Server database. So, for example, if you have a computer named "testbox1" and you wanted to dynamically copy and rename a text document called "test.txt" to be named after this computer you would create a script in the Deployment Server console with the following text.

```
copy c:\test.txt c:\%COMPNAME%.txt
```

By substituting the file name with %COMPNAME% you are telling Deployment Server to take the name of the computer this script is assigned to, and use that as the new file name.

Current shipping versions of Deployment Server contain a limited token replacement model - limited because it consists of a small, defined set of tokens that correlate to specific values in the eXpress SQL database. For example: %COMPNAME% and %OSTYPE%. A full list of the available tokens is contained in the product user guide.

At the request of many customers, a number of tokens have been added to the set to expand its functionality, but Altiris has decided to make it so any customer can instantly have all the tokens they need via user-defined tokens. User Defined Tokens work just like standard tokens, but carry with them the ability to be evaluated against any field in the Deployment Server Database.

For more information on using custom tokens, see [Appendix C: Defining Custom Tokens](#) (page 20).

### Create the Tokenized Sysprep.inf File

From within the newly created sysprep folder:

1. Execute setupmgr.exe and select the sysprep setup for Windows XP Professional.
2. Choose a fully automated installation.
3. Populate the final screen with the appropriate settings for the environment.

4. Under General Settings > Name and Organization fill in both fields.
5. Under General Settings > Product Key - Enter a Volume license key for XP Professional.
6. Optional: Under Network Settings > Computer Name - Enter an appropriate name such as %COMPNAME%. This is an optimization that will take advantage of virtual computer entries in the DS console.
7. When finished, save the configuration file to the same source directory as the setupmgr executable (\\dsserver\express\sysprep\sysprep.inf).
8. Make the following changes to the sysprep.inf file:

- a. Add the following lines under the [Unattended] section to enable dynamic injection of driver files that will not be purged after the sysprep process completes. The second line will avoid the prompt to approve installation of unsigned hardware drivers.

```
OemPnPDriversPath=drivers\audio;drivers\net;drivers\video;drivers\chipset;drivers\modem;drivers\misc1;drivers\misc2
DriverSigningPolicy = Ignore
```

- b. Optional: Change the [UserData] section to include a DS token for the User Name. This field must then be populated on the computer's DS icon before restoring an image.

```
FullName="%USER_NAME%"
```

- c. Optional: Change the [UserData] section to include a DS token for the Computer's Name. This field must then be populated on the computer's DS icon before restoring an image.

```
ComputerName=%COMPNAME%
```

- d. Optional: Change the [Identification] section to include a DS token for the correct domain to join. This field must then be populated on the computer's DS icon before restoring an image. The specified domain admin account must be able to join computers to all possible domains.

```
[Identification]
JoinDomain="%NETBIOSDOMAIN%"
DomainAdmin=domainname\domainadmin
DomainAdminPassword=password1234
```

For additional security, create a separate domain account and grant this account only rights to join computers to a domain, and no additional privileges (no interactive login, no filesystem rights, and so on).

- e. Enable the Build Mass Storage option. This step is becoming increasingly necessary for newer hardware. For desktops, mass storage is primarily concerned with RAID devices and SATA hard drives, however certain motherboard chipsets without these functions enabled might still require this step.

```
[Sysprep]
BuildMassStorageSection = Yes
[SysprepMassStorage]
```

---

**Note**

It is mandatory that the section header [SysprepMassStorage] be added, otherwise the generation process will fail.

---

- f. For the first run, it is necessary to use sysprep to generate the SysprepMassStorage section. Afterwards the new content can be simply added to the bottom of the sysprep.inf file. The content can be obtained by making a copy of the c:\sysprep\sysprep.inf file to an alternative location on the target computer. Alternatively, copy the contents from the sample found in Appendix C. In either case, set the BuildMassStorageSection to No afterwards.

## Creating the Sysprep DS Job

1. From the DS console, create a new job titled 2. Sysprep Prepare.
2. Add two tasks to the job:
  - a. Add a Copy File from .\sysprep to c:\sysprep. Select the Copy directory button.
  - b. Add a Run Script - The script will contain a single line:

```
C:\sysprep\sysprep.exe -mini -quiet -reseal -noreboot
```

Select the Run this script in Windows radio button.

---

**Note**

The sysprep process scrubs the network card from the registered hardware list on the target computer. This prevents the DS client from communicating the completion status of the sysprep job back to the DS server. Because of this, it is not possible to script a reboot task, or successfully stage the follow up imaging task without manual intervention (deleting the sysprep prepare task).

---

## Executing the Sysprep Preparation Job

1. Assign the 2. Sysprep prepare job to the source computer and enable the run immediately schedule.

The sysprep portion of the process will take between 15 and 30 minutes. Imaging will take between 10 to 90 minutes depending upon the amount of disk space consumed on the source computer. When completed the computer should power off.

If the sysprep prepare process stops after 2-3 minutes, then the operation has failed. Reboot the computer, and re-execute the sysprep prepare job.

For troubleshooting purposes, the sysprep process will be invalidated (and will have to be re-launched) if the computer is allowed to reboot to Windows, prior to being imaged.

## Stage 4 - Capture the Image

### Creating the Imaging Capture DS Job

1. From the DS console, create a new job titled 3. Sysprep Capture.
2. Add the following two tasks to the job:

- a. Add a Create Image.\sysprepXP.  
Click the Advanced button.  
Select the Do not boot to Windows checkbox.

---

**Note**

Because the DS agent will be unable to contact the DS server after the first portion of sysprep is executed, it is necessary to start the imaging process from DOS, rather than letting the DS agent remove certain configuration data prior to rebooting to PXE mode.

---

## Kicking off the Imaging Job

1. The source computer should have completed the sysprep executable, but the status will not show up on the DS console. View the computer to confirm that a minimized DOS window is no longer open.
2. On the DS console, delete the 2. sysprep prepare job from the source computer.
3. Assign the 3. Sysprep Capture job to the computer.
4. Reboot the source computer, and ensure it boots to PXE - Managed PC mode. Do not allow the computer to reboot to Windows, as this will invalidate the sysprep prepare step.
5. After the source computer has been imaged, it will reboot to Windows. Do not be alarmed at the error messages or prompts resulting from the tokenized keywords (%comname%) inserted in the sysprep file.

## Replacing HALs in a Captured Image

See [Appendix B: HAL Overview](#) (page 18) for additional information on HALs.

Now that you have captured your image there is only one step left in making the image hardware independent. Because the image itself may not contain the proper HAL.dll file for the destination hardware you will have to evaluate this post image deployment time, but before reboot.

If you are booting into a Windows PE environment to facilitate in your image deployment then you can query the PE registry to determine which HAL was loaded for PE and the copy in the correct HAL into the destination using a utility such as FIRM. Registry value to query: HKLM\SYSTEM\ControlSet001\Enum\Root\ACPI\_HAL\0000\HardwareId. The value should either be acpiapic\_up for Uniprocessor HAL type or acpicpic\_up for the Advanced Configuration and Power Interface HAL.

If you are not using WinPE, you might need to set up deployment jobs that group your destined computers into collections that are specific to the HAL, so a post image task could use FIRM to copy in the proper HAL.dll.

## Stage 5 - Prepare for Image Restoration

### Gathering System Drivers

You might notice that with newer computers there are fewer and fewer drivers that are built into the operating system.

There are several factors that contribute to this, but the bottom line is that we need to be able to tell the operating system where the drivers are for these newer hardware devices.

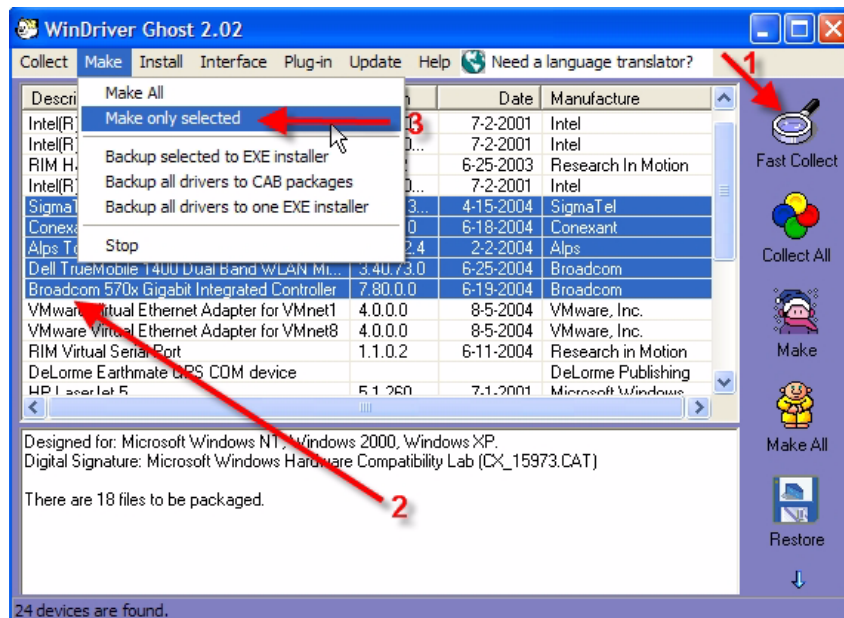
One of the ways that you can do this is to include a drivers folder in your image that has all of the drivers needed by your organization. Another option, demonstrated in the next section, uses WinDriver Ghost to gather drivers from each system then uses a script and the Altiris FIRM utility to detect and copy the necessary drivers to each system before configuration.

## Using WinDriver Ghost and FIRM to Gather and Dynamically Add Drivers

Traditionally, drivers for each hardware model must be re-downloaded from the computer manufacture / hardware manufacture, extracted, tested, and then placed on a shared network access point. To expedite the image creation process, a driver extraction utility can be used on existing computers.

WinDriver Ghost (shareware) provides detection, backup and restoration of hardware device drivers currently on a target computer. <http://www.tucows.com/preview/335784.html>.

1. Run WinDriver Ghost on each available computer model that will be used as an image restoration target. Choose Fast Collect from the icon menu on the left.
2. Shift-select each desired driver.
3. Choose Make > Make only selected from the menu bar.



When prompted (at the bottom of the window), specify a destination to save the drivers to on the local computer.

Next, copy the contents of each device named folder to the appropriate device type folder on the express share. For example, see the following table:

c:\drivers\Broadcom 570x Gigabit Integrated Controller	\\dsserver\express\drivers\Optiplex123\nic
c:\drivers\MOBILITY RADEON 9000	\\dsserver\express\drivers\Optiplex123\video

The Model folder name should correspond to the model name of the computer. A separate folder is required for each model in the environment.

A mapping from this friendly name to the actual model number (as determined by DS) will be performed in a DS Firm script in a later step.

The model number can be identified by reviewing the Client's properties > Hardware > model number for the target model computer within the DS console.

A directory structure for each model to be used for image restoration should be created. The directory structure belongs at \\dsserver\express\drivers. Review the partial illustration above. A best practice is to create an empty template directory structure, and make a copy for each model. The directory structure should match the OemPnPDriversPath option in the sysprep.inf file.

```
OemPnPDriversPath=drivers\audio;drivers\net;drivers\video;drivers\chipset;drivers\modem;drivers\misc1;drivers\misc2
```

The drivers from these folders are dynamically copied using FIRM in the next section.

## Creating the DS Job to Restore the Image

1. Create a new job titled 4. Restore sysprep image.
2. Add the first task to restore the image.
3. Add a DOS script task as discussed below:
4. Create a virtual computer entry if necessary, populate with the MAC address and any items for which you embedded tokenized keywords in the sysprep.inf file.

---

### Note

Do not test the image restoration on the source computer if possible, this will greatly increase the troubleshooting time if things don't go perfectly.

---

The script in the following table will:

- Copy the sysprep.inf file to the Express\temp folder.
- Rename the file to the unique id that DS has for the computer.
- Tokenize the file.
- Copy that tokenized file to the target computer's c:\sysprep folder and rename it to sysprep.inf.
- Purge the Altiris DS client's configuration file on the target computer (if it exists).
- Use comparison logic to determine which set of drivers should be transferred to the computer's c:\drivers directory hierarchy. The script below must be modified to include an if statement for each model number in the environment that will be imaged.

```

REM token replacement on the inf file
REM the next line, ReplaceTokens, is a reserved keyword, the REM
statement is so DOS will ignore the command

REM ReplaceTokens .\sysprep\sysprep.inf .\temp\%ID%.inf

Firm copy .\temp\%ID%.inf prod:sysprep\sysprep.inf

REM get rid of the old aclient.cfg file

firm delete prod:aclient.cfg

REM This section would normally be devoted to injecting model
specific drivers

echo Hardware Model number is %#!computer@model_num%

if "%#!computer@model_num%"=="0K5148" goto DIM2400
if "%#!computer@model_num%"=="0G5611" goto GX280
if "%#!computer@model_num%"=="0C7195" goto GX280
if "%#!computer@model_num%"=="0F4491" goto I4600
if "%#!computer@model_num%"=="0T9369" goto I4600

REM If we didn't find a match, just exit
goto Exit

:DIM2400
firm -recurse copy .\drivers\Dim2400 prod:\drivers
goto Exit

:GX280
firm -recurse copy .\drivers\GX280 prod:\drivers
goto Exit

:I4600
firm -recurse copy .\drivers\I4600 prod:\drivers
goto Exit

:D600
firm -recurse copy .\drivers\D600 prod:\drivers
goto Exit

:Exit
exit

```

---

**Note**

When modifying the script, ensure that the exact model number of the computer is used to ensure the driver files are successfully transferred to the newly imaged computer.

---

5. Customize the script above to reflect the model names and model numbers in the environment.
6. Create a new DS job named "image", and paste the contents of the modified script into the job.

7. Test deploy the imaging job.

## Optional Additional Imaging Tasks

The following tasks are typically performed in a production environment, but are not covered in this document.

Prior to re-imaging the computer:

- Capturing a PCT.

After re-imaging the computer:

- Restoring the PCT.
- Installing the NSclient via DS, auto-configuring NS to push the client upon being added to the domain, or manually deploying the NS client.

# Appendix A: Sysprep

Sysprep is a Microsoft-provided utility that performs the following functions:

- Ensures the uniqueness of the security identifier (SID) for each target system.
- Configures an installation to start the Mini-Setup Wizard upon next reboot. Mini-Setup includes resetting the plug and play database back to a factory state.
- Pre-processes sections of Sysprep.inf before the computer shuts down. (If, for example, you have specified different mass storage controllers in the SysprepMassStorage section of the answer file, or configured Sysprep 2.0 or later to build this section for you, this section will be processed at this time.)
- Issues a shutdown command to Windows once Sysprep has successfully performed its initial tasks. (This is automatic for Sysprep 1.1 [Windows 2000] and optional for Sysprep 2.0 [Windows XP].)

There are several versions of Sysprep available from Microsoft:

- Version 1.0 is included with the Windows 2000 Product CD (Will not support other Mass Storage Devices).
- Version 1.1 is the current version for use with the Windows 2000 operating system, and does support the changing of the Mass Storage Device.
- There is a newer version (2.0) that ships with Windows Server 2003, and it is also intended for use with Windows XP SP2. This is the version that is recommended for use with Windows XP or later operating systems.

The version of Sysprep that you use **MUST** be compatible with the Windows operating system you are currently imaging.

- Using this Microsoft provided utility ensures Microsoft's support of the imaged operating system. The sole restriction to use of a hardware independent image is that the HAL (Hardware Access Layer) is not changed from what the setup program detected on the source computer.

The most common differences in HAL are due to the presence of single or multiple processors (SMP), and if the computer's hardware is or isn't ACPI capable. A common symptom of an incompatible HAL is the failure of the OS to boot, and/or blue screen errors during the Windows startup.

- A tremendous amount of information is available from Microsoft on Sysprep usage. Administrators are encouraged to consult this documentation to learn more about its function and available options.

## Tools Contained in Sysprep

- Sysprep.exe - the command-line tool that prepares the hard disk on the source computer for duplication.
- Sysprep.inf - an optional answer file that is used to automate the Mini-Setup process of an imaged computer. You can use Setup Manager, a tool available on the Windows 2000/XP/2003 CD, to help create the Sysprep.inf file
- Setupcl.exe - a tool that regenerates new security identifiers (SID) for the computer. This tool cannot be invoked directly, and must reside in the same folder as sysprep.exe. Both Sysprep.exe and Setupcl.exe are required and are mutually dependent.

- Setupmgr.exe - a GUI tool used to generate the initial sysprep.inf file.

## **Where can I get Microsoft Sysprep?**

For Windows 2003, the newest version of Sysprep can be found on the Windows 2003 server media under Support\Tools\deploy.cab (The required files are extracted from this cab file)

For Windows 2000, Sysprep 1.1 can be downloaded from <http://www.microsoft.com/downloads/details.aspx?FamilyID=0c4bfb06-2824-4d2b-abc1-0e2223133afb&DisplayLang=en>

## Appendix B: HAL Overview

A hardware abstraction layer is a component of an operating system that functions something like an API. (In strict technical architecture, hardware abstraction layers reside at the device level, a layer below the standard API level.) It allows programmers to write applications and game titles with all the device-independent advantages of writing to an API, but without the large processing overhead that APIs normally demand.

In order for an image to be successfully deployed to a computer the HAL must be compatible. If you build your image on a computer that uses the ACPI Uniprocessor PC HAL then that image will work fine on all computers that can properly negotiate this HAL. However, if you try to put this image on a computer that can only use the Advanced Configuration and Power Interface HAL then the OS will fail to load.

To truly make a hardware independent image that can span all of your client computing hardware you'll need to make certain that you have properly placed the right HAL into the image. Most all of today's desktops and laptops use one of two HALs:

- "Advanced Configuration and Power Interface HAL - halacpi.dll
- "ACPI Uniprocessor PC HAL - halaacpi.dll

These different HAL files are renamed to hal.dll and placed in %systemroot%\system32\HAL.dll. You can't have multiple HALs configured in your image, so you'll need to make this determination post image deployment, but prior to booting into the newly deployed image.

To determine which HAL the computer uses go to Device Manager and under the Computer Node you can see which HAL is being used. The driver that the HAL references is always labeled as HAL.dll in the %systemroot%\system32 folder, but if you view the properties of this file you can see what the Internal Name is.

To place the HAL into the image you can use the FIRM utility that ships with Altiris Deployment Solution. This utility allows you to copy files into partitions that the environment has yet to assign a drive letter or recognize yet.

Example: At the root of the drivers folder I would have two files: halacpi.dll and halaacpi.dll. I would deploy my corporate image and then use FIRM to copy in the proper HAL.dll i.e.

```
Firm.exe copy prod:drivers\halacpi.dll prod:windows\system32\HAL.dll.
```

See the next section for an example. For more information on FIRM and its uses see the product documentation for Deployment Solution

### Sample Script to Update HALs Using WinPE

The following is a sample batch file that can be run within the PE Shell to determine which HAL was loaded and then copy the proper HAL from a stored location in the Drivers folder.

```
@ECHO OFF
```

```
:HAL
```

```
REM Lets query the registry to see what hal is used.
```

```
REM First hal to check for is the Advanced Configuration and Power  
Interface Hal
```

```

REG QUERY HKLM\SYSTEM\ControlSet001\Enum\Root\ACPI_HAL\0000 /v
HardwareId |Find /I /C "acpipic_up"

REM Found the hal lets move down to ACPI

IF %ERRORLEVEL% EQU 0 GOTO ACPI

REM Hal not found lets check the next value

REM Second hal to check for is the Uniprocessor Hal

REG QUERY HKLM\SYSTEM\ControlSet001\Enum\Root\ACPI_HAL\0000 /v
HardwareId |Find /I /C "acpiapic_up"

REM Found the hal lets move down to AACPI

IF %ERRORLEVEL% EQU 0 GOTO AACPI

GOTO :NOHAL

:ACPI

REM Copy in the correct HAL
%SystemDrive%\Programs\Rdeploy\Firm copy prod:drivers\halacpi.dll
prod:Windows\System32\HAL.dll

GOTO END

:AACPI

REM Copy in the correct HAL

%SystemDrive%\Programs\Rdeploy\Firm copy prod:drivers\halaacpi.dll
prod:Windows\System32\HAL.dll

GOTO END

:NOHAL

ECHO Can not find the appropriate HAL to use. Leaving as is.

:END

ECHO Process finished successfully.

EXIT

```

# Appendix C: Defining Custom Tokens

## Previous Syntax

The previous token syntax consisted of:

`%{token name}%` - where `{token name}` was the name of the token (in all caps).

## Examples

`%COMPNAME%`

## New Syntax

Two new syntaxes are now available, the first is for simple queries, the second is intended for complex SQL queries.

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### Note

Both the OLD and NEW formats are supported in the DS engine.

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`%[#][^]!{table name}@{column name}%`

`#` = flag to indicate that this is a user defined token

`^` = flag to indicate that this is a Global token. All tokens by default will be looked up using the "computer ID" of the system for which the tokens are being replaced. The Global identifier tells the DS engine NOT to use the computer ID, but instead to use the first value found in the specified table and column.

`!` = specifies that the following text is the table name in the eXpress DB. This field is required for ALL user-defined tokens.

`@` = specifies that the following text is the column name in the table. This is also a required field for ALL user-defined tokens.

`%[#][*]{ "SQL query statement" }%`

`#` = flag to indicate that this is a user defined token

`*` = flag to indicate that the following text is a SQL query

## Examples

The best way to illustrate the new model is with a few examples

`%COMPNAME%`

This uses the old syntax model. This token will be replaced with the computer name of the system for which the token is being replaced.

`%#!computer@name%`

This uses the new syntax model to accomplish the same thing as the above example. The `"#"` sign indicates that it is a user defined token. The `"!"` sign indicates that the desired value is in the "computer" table in the eXpress DB. The `"@"` sign indicates that the desired value is in the "name" column.

When the DS engine processes this token, it will look in the "computer" table for the target system's computer ID value. When found, it will look in the "name" column for the record and replace the token with the contents of this column field.

**%#!database\_info@schema\_version%**

Notice that this token uses the "^" flag (global flag). When the DS engine process this token, it will look in the "database\_info" table for a column labeled "schema\_version" and replace the token with the contents of this column. IT DOES NOT USE THE COMPUTER ID OF THE TARGET SYSTEM - hence the token is considered "GLOBAL" because it will be the same value for all systems.

**%#"select name from computer where computer\_id = {ID}"%**

Notice that this token uses the SQL query syntax method to extract the computer's name from the DB. The "#" sign indicates that this is a user defined token. The "\*" sign indicates that a standard SQL syntax SQL query follows. The SQL query is framed within quotes (" ") for readability and parsing.

When the DS engine processes this token, it will take the text between the quotes (" "), look for "{ID}". If it exists, it will replace it with the computer's ID number, then use the resulting string as a SQL query.

The eXpress DB is case sensitive; hence, when specifying tables and columns in a SQL query, the names MUST be lower case (i.e. "computer\_id").

In addition, the computer ID specifier "{ID}" is case sensitive and must be used exactly as specified here.

## Appendix D: Sample Tokenized Sysprep File

```
;SetupMgrTag
[Unattended]
    OemSkipEula=Yes
    InstallFilesPath=C:\sysprep\i386

OemPnPDriversPath=drivers\audio;drivers\net;drivers\video;drivers\
chipset;drivers\modem;drivers\misc1;drivers\misc2
    DriverSigningPolicy = Ignore

[GuiUnattended]
    AdminPassword="2totango"
    EncryptedAdminPassword=NO
    OEMSkipRegional=1
    OEMDuplicatorstring=03242005
    TimeZone=40
    OemSkipWelcome=1

[UserData]
    ProductKey=XXXXX-XXXXX-XXXXX-XXXXX-XXXXX
    FullName="%USER_NAME%"
    OrgName="Your Company, Inc."
    ComputerName=%COMPNAME%

[RegionalSettings]
    LanguageGroup=1

[Identification]
    JoinDomain="%NETBIOSDOMAIN%"
    DomainAdmin=domainname\domainadmin
    DomainAdminPassword=password1234

[Networking]
    InstallDefaultComponents=Yes

[Sysprep]
    BuildMassStorageSection = No

[SysprepMassStorage]
*pn0a00=c:\windows\inf\machine.inf
*pn0a01=c:\windows\inf\machine.inf
*pn0a04=c:\windows\inf\machine.inf
*pn0a03=c:\windows\inf\machine.inf
pci\cc_0604=c:\windows\inf\machine.inf
pci\cc_0601=c:\windows\inf\machine.inf
pci\cc_0602=c:\windows\inf\machine.inf
pci\cc_0600=c:\windows\inf\machine.inf
pci\cc_0500=c:\windows\inf\machine.inf
root\ftdisk=c:\windows\inf\machine.inf
```

```
root\swenum=c:\windows\inf\machine.inf
root\update=c:\windows\inf\machine.inf
root\mssmbios=c:\windows\inf\machine.inf
root\dmio=c:\windows\inf\machine.inf
lptenum\microsofttrawport958a=c:\windows\inf\machine.inf
root\rdpdr=c:\windows\inf\machine.inf
root\rdp_mou=c:\windows\inf\machine.inf
root\rdp_kbd=c:\windows\inf\machine.inf
*pnpp0000=c:\windows\inf\machine.inf
*pnpp0001=c:\windows\inf\machine.inf
*pnpp0003=c:\windows\inf\machine.inf
*pnpp0004=c:\windows\inf\machine.inf
*pnpp0100=c:\windows\inf\machine.inf
...[additional drivers omitted]
```

```
[sysprepcleanup]
Service=isapnp
Service=pci
Service=ftdisk
Service=swenum
Service=update
Service=mssmbios
Service=dmio
Service=rdpdr
Upperfilter=mouclass
Service=TermDD
Upperfilter=kbdclass
Upperfilter=ALIM1541
Upperfilter=AMDAGP
Upperfilter=AGP440
Upperfilter=AGPCPQ
Upperfilter=SISAGP
Upperfilter=VIAAGP
Service=aha154x
Service=sparrow
Service=adpu160m
Service=aic78u2
Service=aic78xx
Service=dpti2o
Service=cpqarray
Service=sym_hi
Service=mraid35x
Service=perc2
Lowerfilter=perc2hib
Service=hpn
Service=symc8xx
Service=sym_u3
Service=symc810
Service=ql10wnt
Service=ql1080
Service=ql1240
Service=ql1280
Service=ql12160
Service=i2omp
```

Service=cd20xrnt  
Service=cbidf  
Service=dac2w2k  
Service=dac960nt  
Service=asc3550  
Service=asc  
Service=asc3350P  
Service=ABP480N5  
Service=amsint  
Service=ini910u  
Service=ultra  
Service=pciide  
Service=atapi  
Service=aliide  
Service=cmdide  
Service=intelide  
Service=viaide  
Service=toside