Microsoft

Configuring Windows® 8

Training Guide

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Introduction

This training guide is designed for information technology (IT) professionals who support or plan to support Windows 8 and are ramping up on the latest technology. It is assumed that before you begin using this guide, you have at least an entry-level understanding of Microsoft Windows and common Internet technologies.

This book covers some of the topics and skills that are the subject of the Microsoft certification 70-687 exam. If you are using this book to complement your study materials, you might find this information useful. This book is designed to help you in the job role; it might not cover all exam topics. If you are preparing for the exam, you should use additional study materials to bolster your real-world experience. For your reference, a mapping of the topics in this book to the exam objectives is included in the back of the book.

By using this training guide, you will learn how to do the following:

- Install Windows 8 on a new computer or upgrade to Windows 8 from an earlier version of Windows
- Share network resources, including printers and file storage space on a Windows 8 client
- Navigate the new Windows 8 user interface and perform common administrative tasks in both the new and the earlier interfaces
- Manage the Windows 8 client-side Hyper-V virtualization software
- Configure and manage Internet Explorer 10
- Manage and troubleshoot hardware device drivers
- Secure the Windows 8 operating system environment

System requirements

The following are the minimum system requirements your computer needs to meet to complete the practice exercises in this book. To minimize the time and expense of configuring physical computers for this training guide, it's recommended that you use Hyper-V, which is a feature of Windows Server 2008, Windows Server 2008 R2, Windows 8, and Windows Server 2012. You can use other virtualization software instead, such as Windows Virtual PC or VirtualBox. If you do not have a way to create a virtual environment, have two physical PCs capable of running Windows 8 so that you can take full advantage of the training in this guide.

NOTE **REQUIREMENTS FOR A FULL TEST OF HYPER-V**

If you want to test the Hyper-V feature in Windows 8 fully, you must use a physical computer that supports Second Level Address Translation or a visualization platform that allows other virtualization platforms to run inside it. Such platforms include VMware Workstation 8 or higher and VMware Fusion 4 or higher.

Hardware requirements

This section presents the hardware requirements for Hyper-V, the hardware requirements if you are not using virtualization software, and the software requirements.

Virtualization hardware requirements

If you choose to use virtualization software, you need only one physical computer to perform the exercises in this book. That physical host computer must meet the following minimum hardware requirements:

- x64-based processor that includes both hardware-assisted virtualization (AMD-V or Intel VT) and hardware data execution protection. (On AMD systems, the data execution protection feature is called the No Execute or NX bit. On Intel systems, this feature is called the Execute Disable or XD bit.) These features must also be enabled in the BIOS. (You can run Windows Virtual PC without Intel-VT or AMD-V.)
- 4.0 GB of RAM (more is recommended)
- 120 GB of available hard disk space
- DVD-ROM drive
- Internet connectivity

Physical hardware requirements

If you choose to use physical computers instead of virtualization software, use the following list to meet the minimum hardware requirements of the practice exercises in this book:

- Three personal computers, each with a 1-GHz processor, 512 MB of RAM, network card, video card, and DVD-ROM drive
- At least 25 GB of disk space available on each computer
- All three computers physically connected to each other and to the Internet

Software requirements

The following software is required to complete the practice exercises:

- Windows 8. You can download an evaluation edition of Windows 8 at *http://technet.microsoft.com/en-us/windows/windows-8.aspx*.
- The Windows Assessment and Deployment Kit (Windows ADK) for Windows 8. You can find an overview of Windows ADK at *http://technet.microsoft.com/en-us/library/hh824947.aspx*, and the download is available at *http://www.microsoft.com/en-us/download/details.aspx?id=30652*.
- A web browser such as Internet Explorer 8 or later.

Practice setup instructions

Most of the practice exercises in this training guide require only a single computer, but for full testing, a second computer is often useful. For example, after you learn how to create a file share, you can then test your work by browsing to that file share from the other computer.

Acknowledgments

The authors would like to thank a number of people who helped in the creation of this Training Guide.

SCOTT LOWE

As is the case with everything I do, I dedicate this work to my beautiful wife, Amy, and my life-enriching, wonderful children, Ryan and Isabella. Without you, none of this would matter.

I also thank my coauthors, Derek Schauland and Rick Vanover, for their tireless efforts in getting this work to print.

DEREK SCHAULAND

This project has been one of the largest single writing projects that I have taken on, and although it was quite a bit of work to get to this point, we got it done. I have a newfound understanding of the work that goes into the certification process; for me, no longer is it about exams as much as it is about the entire process, from learning content all the way to the test.

I thank my wife Laura for encouraging me to keep going even when activities were popping up all the time. I also thank my friends and other family members for continuing to show interest in how the writing was going. It amazes me how much this helps the focus stick.

Last but certainly not least, I thank my fellow authors, Scott Lowe and Rick Vanover. Without the two of you, this project wouldn't have crossed my radar.

Thank you for the amazing opportunity.

RICK VANOVER

Rick dedicates his work in this book to his wife Amie and daughter Rilee.

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CHAPTER 3

Handling hardware and device drivers

Hardware and software are linked. Windows 8 is an operating system that unlocks the power of hardware; it's the hardware that people manipulate to do their work. This chapter discusses the components that enable hardware devices in Windows 8.

Some of the lessons in this chapter assume that, as an enterprise IT pro, you are already familiar with how to use Group Policy. This book does not go into detail about how to create Group Policy, but it does provide guidance on how administrators can use individual Group Policy settings to accomplish goals across the organization.

Lessons in this chapter:

- Lesson 1: Managing drivers **79**
- Lesson 2: Managing hardware devices **104**
- Lesson 3: Managing enterprise hardware policies **107**

Before you begin

To complete the practice exercises in this chapter, you will need:

- A USB device

Lesson 1: Managing drivers

Drivers are the software components that enable hardware to work in Microsoft Windows; device drivers enable communication between the operating system and hardware devices.

Remember these facts as you work with device drivers:

- Drivers are just software components.
- Not all drivers are created equal.
- Driver issues can be a support difficulty.
- Poorly written drivers can create system instability.

As an IT administrator in the enterprise, you will have to deal with installing hardware, updating driver software, and troubleshooting driver-related hardware issues.

After this lesson, you will be able to:

- Effectively use Device Manager to troubleshoot driver issues.
- Understand the purpose of the Driver Verifier utility and how to use it.
- Gather information from System Information to aid in troubleshooting.
- Update driver software to enable new features and close security holes.

Estimated lesson time: 60 minutes

Driver installation methods

Drivers can be added to a Windows system in a number of ways. The most common method is through the installation of Windows 8. During installation, drivers are installed for all the devices that are present.

- **Windows Update** In some cases, new drivers are installed or updated through regular Windows updates. As new drivers become available—particularly from Microsoft—they are delivered through the Windows Update process.
- **Hardware installation disc** Many devices ship with a hardware installation CD that includes all the drivers and software necessary to enable the device to operate. Just place the installation media into the CD-ROM drive of the computer and follow the installation instructions that came with the device.

  In some cases, device installation instructions require you to run the installation CD before you install the hardware so that the drivers are ready when the device is ultimately installed.
- **Internet download** As the age of the optical drive comes to an end, most companies also make driver and software downloads, which replace the antiquated CD, available on their websites. However, downloads are just new media for a new century. Otherwise, the installation process is the same as it is when using an installation disc.
- **Pre-staging drivers** In many organizations, administrators pre-stage drivers by installing all the drivers that someone might need before deploying a new computer. You learn more about pre-staging drivers in this chapter in the “Adding device drivers to the Driver Store” section.

Driver types

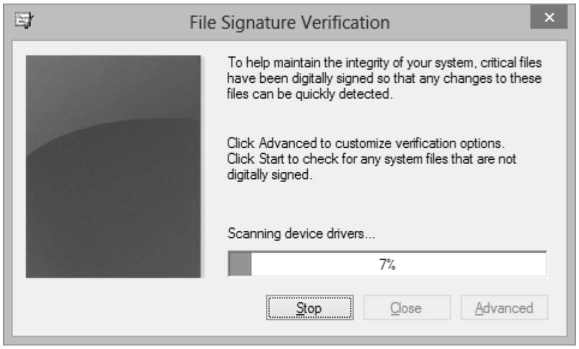
Two kinds of drivers are available: signed and unsigned. A signed driver carries with it a digital signature that verifies the publisher of the driver and ensures that the driver file has not undergone unauthorized modification, so it is less likely that someone has added malicious code to the driver file that could compromise the security of the system.

> ***IMPORTANT*** **DRIVER SIGNING IS NOT A CURE-ALL**
>
> **Although driver signing improves the overall security of the system, it's important to remember that driver signing alone will not fix every security issue. It's still possible for bad code to be introduced in a driver before the signing process or for an unauthorized entity to attain access to driver signing. Either way, use caution, even with signed drivers.**

An unsigned driver does not carry any guarantee that the company that issued it is legitimate, and there is no guarantee that the driver file has not been tampered with. Unsigned drivers are more likely to carry a driver file containing malware or be untrustworthy.

Remember that user-mode device drivers operate at a high level in the operating system with user rights. Kernel-mode drivers can create a major security issue.

You can use the Sigverif.exe utility to determine whether the files and drivers on a computer have been signed. To use Sigverif.exe, type **sigverif.exe** at a command prompt to open the Signature Verifier utility. Click Start to begin the scanning process. The utility displays the scanning progress, as shown in Figure 3-1.


File Signature Verification

To help maintain the integrity of your system, critical files have been digitally signed so that any changes to these files can be quickly detected.

Click Advanced to customize verification options.
Click Start to check for any system files that are not digitally signed.

Scanning device drivers...

FIGURE 3-1 The File Signature Verification process

Using Device Manager

In Windows 8, Device Manager is the utility that manages driver software, which includes updating and configuring drivers. If you've used Device Manager in previous versions of Windows, you will already be familiar with Device Manager as it appears in Windows 8. If you're new to managing hardware and drivers in Windows, this section introduces you to Device Manager.

IMPORTANT **WINDOWS 8 AND WINDOWS RT ARE MANAGED DIFFERENTLY**

This chapter discusses managing a full Windows 8 installation on x86 hardware. Devices that use Windows RT are not managed by using the techniques described here. Instead, those devices are managed by using an upcoming version of Windows InTune or by using System Center 2012 Configuration Manager Service Pack 1. These services are expected to be available soon.

Opening Device Manager

You can open Device Manager in Windows 8 in a number of ways. The first method involves using the hotspot in the lower-left corner of the desktop. When you move your mouse pointer to that location or tap it, a small representation of the Start screen appears, as shown in Figure 3-2.

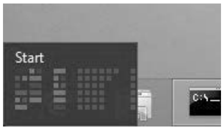


FIGURE 3-2 The hotspot in the lower-left corner of the desktop

On this miniature rendition of the Start screen, right-click or tap and hold to open the Power Users menu shown in Figure 3-3. The Device Manager tool appears on this menu.

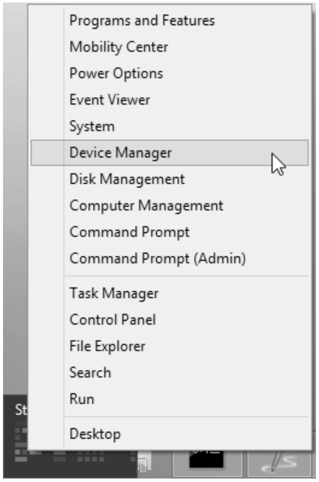


FIGURE 3-3 Power Users menu to access Device Manager

You can also open Device Manager by selecting the Settings charm from the Windows desktop and then selecting Control Panel. When Control Panel opens, start typing **Device Manager** in the Search box. Any items in Control Panel that match what you've typed will be displayed. In Figure 3-4, you can see that one of the first items that appears is Device Manager. To open it, click or tap Device Manager.

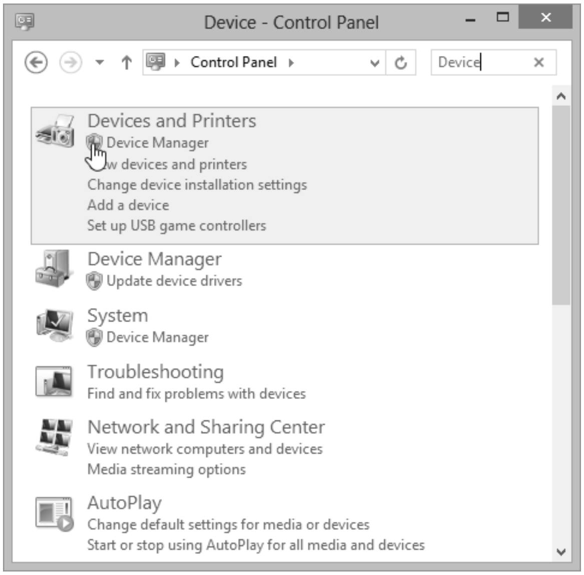

Device - Control Panel
Control Panel
Device
Devices and Printers
Device Manager
w devices and printers
Change device installation settings
Add a device
Set up USB game controllers
Device Manager
Update device drivers
System
Device Manager
Troubleshooting
Find and fix problems with devices
Network and Sharing Center
View network computers and devices
Media streaming options
AutoPlay
Change default settings for media or devices
Start or stop using AutoPlay for all media and devices

FIGURE 3-4 Opening Device Manager from Control Panel

A third way to open Device Manager is to open a command prompt and run the **devmgmt.msc** command. A fourth way is to open the Power Users menu, tap or click Run, type **devmgmt.msc**, and then tap or click OK.

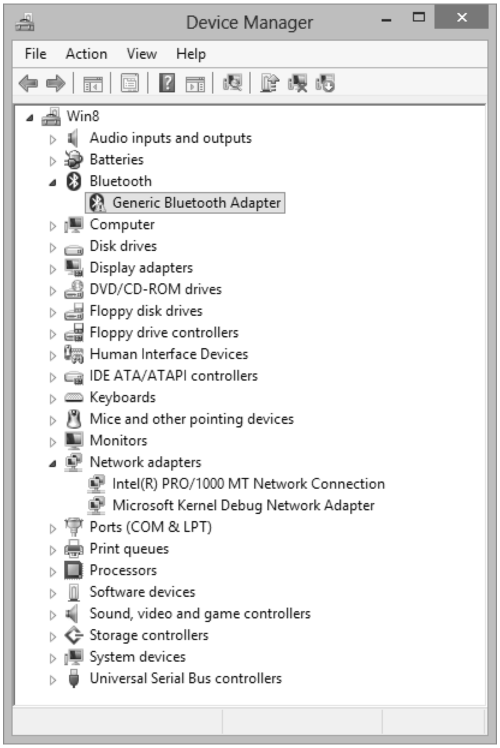
When you have opened Device Manager, you can perform a number of device-related and driver-related tasks, including the following:

- Viewing the status of a device
- Finding the version of a particular driver
- Updating a driver
- Reinstalling a driver
- Rolling back a driver to a previous version
- Enabling or disabling a device

You learn about these actions in this chapter.

Viewing device and driver information

The Device Manager window (Figure 3-5) is organized in a tree view with the computer name at the top of the window and individual device categories nested beneath.



- Win8
  - Audio inputs and outputs
  - Batteries
  - Bluetooth
    - Generic Bluetooth Adapter
  - Computer
  - Disk drives
  - Display adapters
  - DVD/CD-ROM drives
  - Floppy disk drives
  - Floppy drive controllers
  - Human Interface Devices
  - IDE ATA/ATAPI controllers
  - Keyboards
  - Mice and other pointing devices
  - Monitors
  - Network adapters
    - Intel(R) PRO/1000 MT Network Connection
    - Microsoft Kernel Debug Network Adapter
  - Ports (COM & LPT)
  - Print queues
  - Processors
  - Software devices
  - Sound, video and game controllers
  - Storage controllers
  - System devices
  - Universal Serial Bus controllers

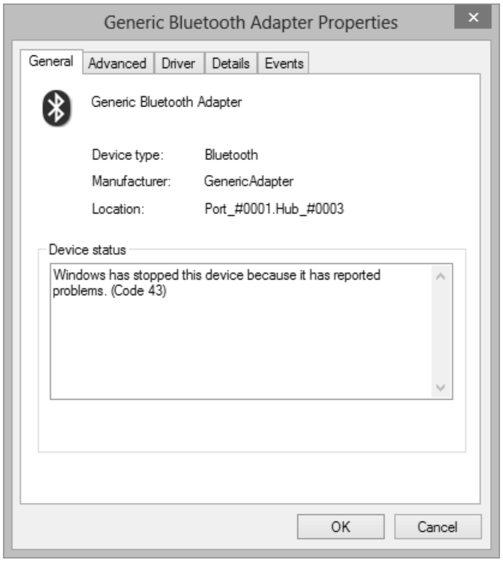
FIGURE 3-5 Device Manager in Windows 8

To view the details about a particular device, expand the appropriate hardware node and double-click or double-tap the device. This opens the Properties page for the device, like the one shown in Figure 3-6. There are several tabs; the tabs that you see depend on the particular device you open. The common tabs are as follows:

- General
- Advanced
- Driver
- Details
- Events

THE GENERAL TAB

The General tab provides you with a quick overview of the device, which includes the current status of the selected device. In Figure 3-6, you can see that this particular device is not functional because Windows automatically stopped the device due to too many errors.



Generic Bluetooth Adapter Properties

Generic Bluetooth Adapter

Device type: Bluetooth
Manufacturer: GenericAdapter
Location: Port_#0001.Hub_#0003

Device status

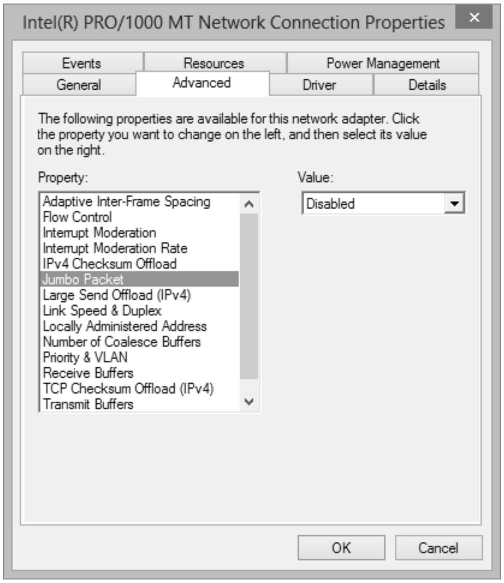
Windows has stopped this device because it has reported problems. (Code 43)

FIGURE 3-6 Properties for a failing Bluetooth device

THE ADVANCED TAB

Jumbo Packet in this configuration refers to the adopted standard Jumbo Frames technology. See this URL for more information: *http://www.ethernetalliance.org/wp-content/uploads/2011/10/EA-Ethernet-Jumbo-Frames-v0-1.pdf*.

If there are advanced configurable properties for the device, they appear on the Advanced tab, as shown in Figure 3-7. For the network adapter shown in this figure, there are advanced settings that control exactly how the device will behave on the network. In this case, Jumbo Packet is disabled. To enable it, select Enabled from the Value drop-down list. Available values change to whatever is appropriate for the selected property.



The following properties are available for this network adapter. Click the property you want to change on the left, and then select its value on the right.

Property:

- Adaptive Inter-Frame Spacing
- Flow Control
- Interrupt Moderation
- Interrupt Moderation Rate
- IPv4 Checksum Offload
- Jumbo Packet
- Large Send Offload (IPv4)
- Link Speed & Duplex
- Locally Administered Address
- Number of Coalesce Buffers
- Priority & VLAN
- Receive Buffers
- TCP Checksum Offload (IPv4)
- Transmit Buffers

Value: Disabled

FIGURE 3-7 The Advanced tab in the Properties page for a network adapter

THE DRIVER TAB

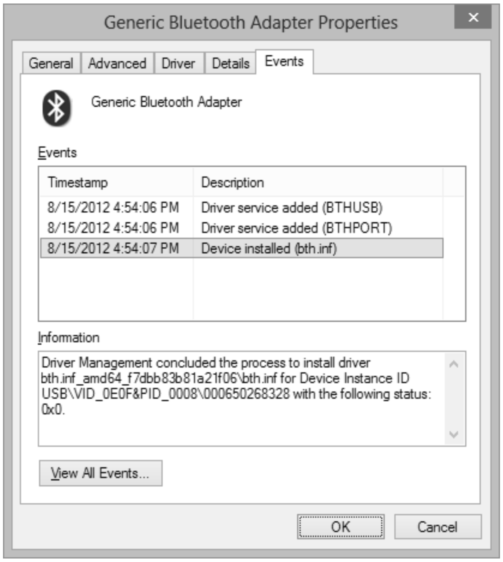
The Driver tab includes all the items necessary to fully manage the driver software for the selected device. You learn more about this tab in the “Managing drivers” section later in this chapter.

THE DETAILS TAB

You find information about the hardware on the Details tab. Every hardware device has information associated with it. There can be just a little information or quite a lot of information.

THE EVENTS TAB

The Events tab provides you with a list of system events associated with the device. In Figure 3-8, three events associated with the Bluetooth adapter have taken place. By clicking the View All Events button in this window, the Event Viewer opens and displays the events in context with other system operations. Not every device has an Events tab.



Generic Bluetooth Adapter

Events

Timestamp	Description
8/15/2012 4:54:06 PM	Driver service added (BTHUSB)
8/15/2012 4:54:06 PM	Driver service added (BTHPORT)
8/15/2012 4:54:07 PM	Device installed (bth.inf)

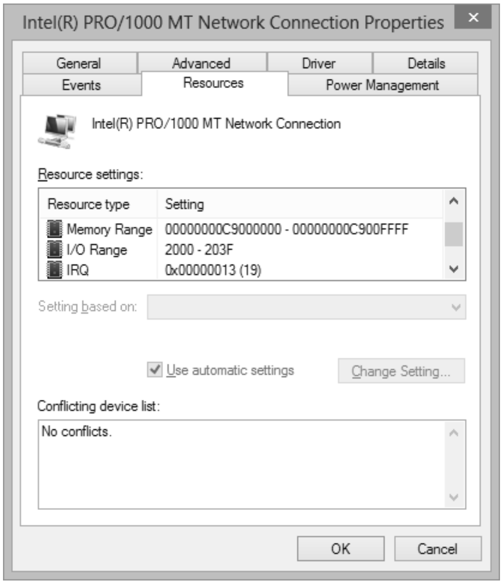
Information

Driver Management concluded the process to install driver bth.inf_amd64_f7dbb83b81a21f06\bth.inf for Device Instance ID USB\VID_0E0F&PID_0008\000650268328 with the following status: 0x0.

FIGURE 3-8 The Events tab for the Bluetooth adapter

THE RESOURCES TAB

Early in the days of information technology (pre–Windows 95), technology professionals had to configure each component's resource settings manually to ensure that there were no resource conflicts and that all devices had the resources they needed to operate. In Figure 3-9, you can see the resources the hardware device is using.



Intel(R) PRO/1000 MT Network Connection

Resource settings:

Resource type	Setting
Memory Range	00000000C9000000 - 00000000C900FFFF
I/O Range	2000 - 203F
IRQ	0x00000013 (19)

Setting based on:

☑ Use automatic settings

Conflicting device list:

No conflicts.

FIGURE 3-9 Resources in use by the selected device

The resource types include Memory Range, I/O Range, and IRQ.

- Most devices require some memory. The Memory Range setting on the Resources tab identifies the memory location the hardware device is using.
- The I/O Range setting is reserved and helps the hardware device communicate with the system.
- The IRQ stetting is for the *Interrupt Request line (IRQ)*. A system has a predefined number of IRQs available. An IRQ provides a device that can interrupt system operations to service the needs of the configured hardware device.

If it is necessary to change a device's default configuration, clear the Use Automatic Settings check box and tap or click Change Setting; you can then provide new information for the device.

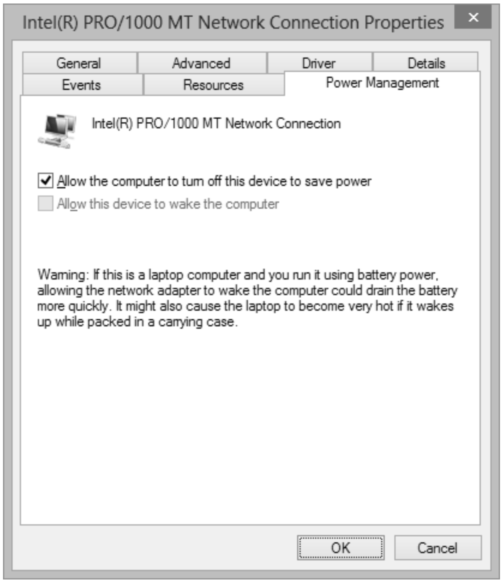
REAL WORLD **THE DEFAULT DEVICE CONFIGURATION IS ALMOST ALWAYS FINE**

Although there was a day when administrators manually modified all the settings you just learned about, those days are all but over. In almost every situation, devices are added to Windows with a default configuration that just works. Today's systems have evolved to a point that resource assignments are usually automatic. However, for troubleshooting purposes, you should have at least a basic understanding of these items in the event that you do find a system that is experiencing some kind of conflict requiring manual resolution.

Managing drivers

You can manage the power of some devices to reduce the amount of electricity they use. This can lower power bills and is especially useful for extending the battery life of a portable device. In Figure 3-10, note that there is an Allow The Computer To Turn Off This Device To Save Power check box. Clear the check box to prevent the system from turning off this device.

At times, the computer will go to sleep but can be awakened through various means such as opening a laptop lid or pressing the power button or a key on the keyboard. For devices that can wake up the computer to perform operations, the Allow This Device To Wake The Computer check box can also be selected.


Intel(R) PRO/1000 MT Network Connection Properties

Intel(R) PRO/1000 MT Network Connection

☑ Allow the computer to turn off this device to save power

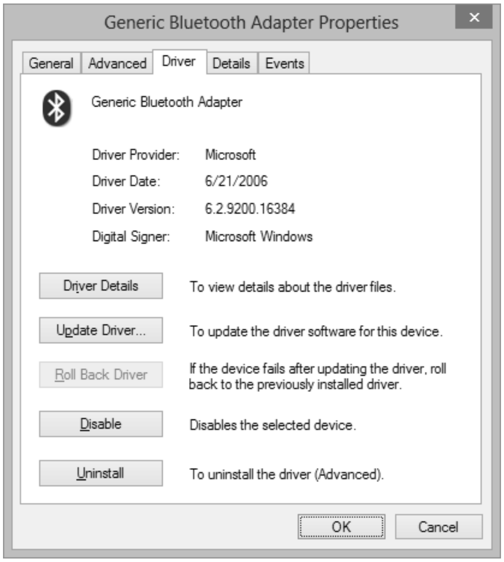
□ Allow this device to wake the computer

Warning: If this is a laptop computer and you run it using battery power, allowing the network adapter to wake the computer could drain the battery more quickly. It might also cause the laptop to become very hot if it wakes up while packed in a carrying case.

FIGURE 3-10 Power management configuration for the network adapter

As mentioned previously, the Driver tab (Figure 3-11) contains a number of options for managing the drivers associated with a device. On this tab, you can get some details about the driver in use, including the name of the company that provided the driver, the date that the driver was last updated, the driver version, and the name of the company that digitally signed the driver.

Perhaps the most important details here are the driver provider and driver version data. When you’re troubleshooting an issue related to hardware, you will want to ensure that you’re using the latest drivers that are available for the device. This is generally considered the first troubleshooting step for hardware problems.



Generic Bluetooth Adapter Properties

Generic Bluetooth Adapter

Driver Provider: Microsoft
Driver Date: 6/21/2006
Driver Version: 6.2.9200.16384
Digital Signer: Microsoft Windows

To view details about the driver files.

To update the driver software for this device.

If the device fails after updating the driver, roll back to the previously installed driver.

Disables the selected device.

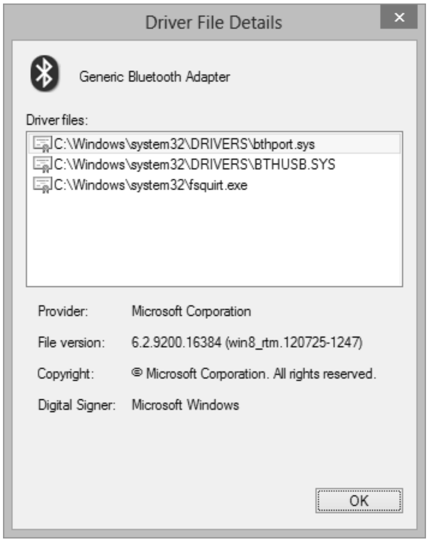
To uninstall the driver (Advanced).

FIGURE 3-11 Driver information for the Bluetooth adapter

A number of options are available on the Driver tab, but this section focuses on just three. The Disable and Uninstall options are self-explanatory.

DRIVER DETAILS

Select Driver Details to display information about the driver associated with the currently selected device. Like the Driver tab, this informational page displays the driver version. It also shows you all the files that are associated with the driver. In Figure 3-12, you can see that the Bluetooth adapter has three files associated with it.



Driver File Details

Generic Bluetooth Adapter

Driver files:

```
C:\Windows\system32\DRIVERS\bthport.sys
C:\Windows\system32\DRIVERS\BTHUSB.SYS
C:\Windows\system32\fsquirt.exe
```

Provider: Microsoft Corporation
File version: 6.2.9200.16384 (win8_rtm.120725-1247)
Copyright: © Microsoft Corporation. All rights reserved.
Digital Signer: Microsoft Windows

FIGURE 3-12 File information for the selected driver

UPDATE DRIVER

You learned that a first troubleshooting step is often ensuring that a device's driver files are the most current ones available. Here's how you update a driver:

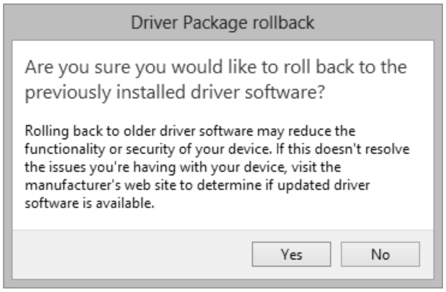
1. On the Driver tab, tap or click Update Driver.
2. Decide how the driver should be updated and select one of the following options:
   - Search Automatically For Updated Driver Software Selecting this option instructs Windows to search both your local computer and the Internet for new drivers.
   - Browse My Computer For Driver Software If you've manually downloaded an updated driver for a hardware device, choose this option to direct Windows to the download location and install the updated driver software.
3. When you complete these steps, the new driver is installed, and the version number is updated.

> ***REAL WORLD*** **DRIVER INSTALLATION PACKAGES**
>
> **For some hardware, it might be necessary to use Driver Manager to install updated drivers. However, for many hardware devices, hardware vendors provide installation packages that make the driver update process a bit easier. This is especially true for graphics cards vendors such as Nvidia and BFG, who release new update packages on a regular basis. For these kinds of hardware, when you download the update package from the vendor and run the installation package, the drivers are also updated.**

ROLL BACK DRIVER

As is the case with any software package, bad code or security flaws can occasionally be introduced in drivers that create system instability or that compromise system security. In these cases, you might find it necessary to revert to an earlier driver that worked.

This is the reason that the driver rollback feature exists in Device Manager on the Driver tab. If it is necessary to revert to a previous driver, Windows warns you (Figure 3-13) that you might experience problems, including reduced security and functionality. It's recommended that you roll back a driver only if you're experiencing a driver-related hardware issue.



Driver Package rollback

Are you sure you would like to roll back to the previously installed driver software?

Rolling back to older driver software may reduce the functionality or security of your device. If this doesn't resolve the issues you're having with your device, visit the manufacturer's web site to determine if updated driver software is available.

FIGURE 3-13 Roll back a driver only if necessary

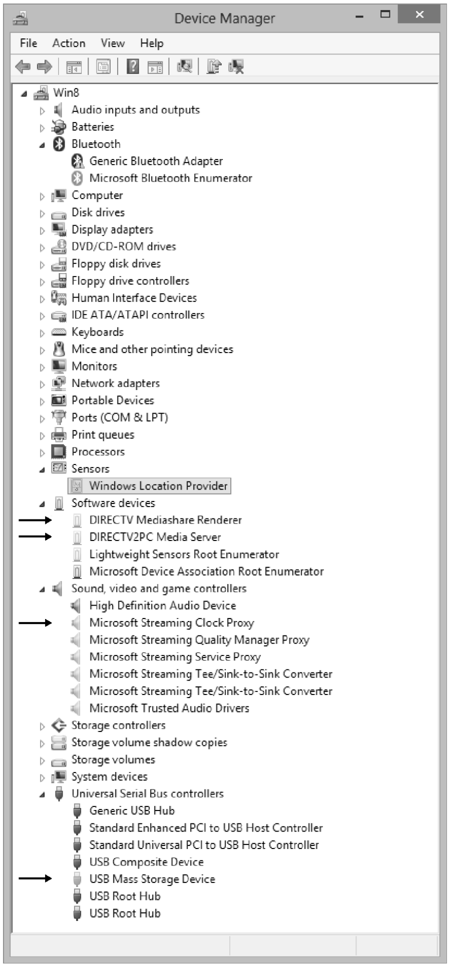
Displaying hidden devices

In some troubleshooting scenarios, you might want to display devices that the system has marked as hidden in the registry. By default, Device Manager does not display information for hidden devices.

To enable Device Manager to display devices that are marked as hidden:

1. Open Device Manager.
2. From the View menu, choose Show Hidden Devices.

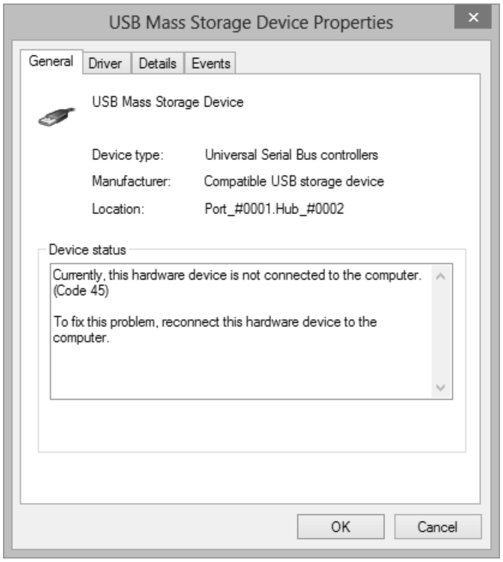
In Figure 3-14, note that the Device Manager view now includes a number of additional nodes and devices that did not appear before. Although it might be difficult to see, the hidden devices are displayed in a dimmed font in the Device Manager view.



```
Win8
  Audio inputs and outputs
  Batteries
  Bluetooth
    Generic Bluetooth Adapter
    Microsoft Bluetooth Enumerator
  Computer
  Disk drives
  Display adapters
  DVD/CD-ROM drives
  Floppy disk drives
  Floppy drive controllers
  Human Interface Devices
  IDE ATA/ATAPI controllers
  Keyboards
  Mice and other pointing devices
  Monitors
  Network adapters
  Portable Devices
  Ports (COM & LPT)
  Print queues
  Processors
  Sensors
    Windows Location Provider
  Software devices
    DIRECTV Mediashare Renderer
    DIRECTV2PC Media Server
    Lightweight Sensors Root Enumerator
    Microsoft Device Association Root Enumerator
  Sound, video and game controllers
    High Definition Audio Device
    Microsoft Streaming Clock Proxy
    Microsoft Streaming Quality Manager Proxy
    Microsoft Streaming Service Proxy
    Microsoft Streaming Tee/Sink-to-Sink Converter
    Microsoft Streaming Tee/Sink-to-Sink Converter
    Microsoft Trusted Audio Drivers
  Storage controllers
  Storage volume shadow copies
  Storage volumes
  System devices
  Universal Serial Bus controllers
    Generic USB Hub
    Standard Enhanced PCI to USB Host Controller
    Standard Universal PCI to USB Host Controller
    USB Composite Device
    USB Mass Storage Device
    USB Root Hub
    USB Root Hub
```

FIGURE 3-14 Hidden devices shown slightly dimmed

After you are able to view hidden devices, you can manage them as you would any other device. When you select a hidden device, you can see why the device is hidden. In Figure 3-15, note that the device is hidden from Device Manager because it's not currently connected to the computer. This is often the case for USB mass storage devices, which include portable thumb drives.



USB Mass Storage Device

Device type: Universal Serial Bus controllers

Manufacturer: Compatible USB storage device

Location: Port_#0001.Hub_#0002

Device status

Currently, this hardware device is not connected to the computer. (Code 45)

To fix this problem, reconnect this hardware device to the computer.

FIGURE 3-15 A device not currently connected to the computer

Using the System Information utility

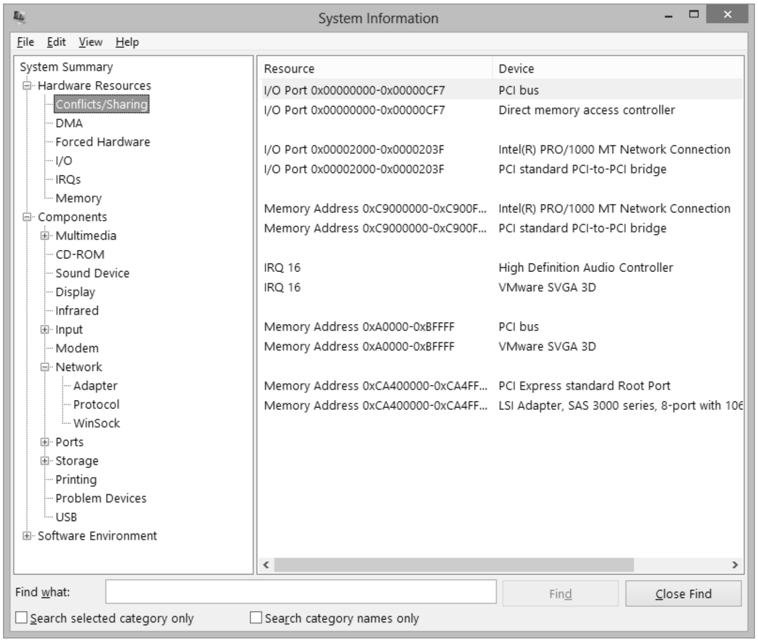
The Device Manager utility provides you with a way to view and manipulate your hardware and the enabling software drivers. It's a read/write utility in that you can make changes to the system. However, that might be more than you need. Sometimes, you just need to view a lot of information all at once, even if you cannot make changes to the information. That's where the System Information utility is useful.

The System Information utility displays a plethora of information about your system that is read-only. You can't change any of the information. By using this utility, you can view details about hardware resources, system components, and the software environment.

To access the System Information utility, type **msinfo32** on the Start screen, and then tap or click the resulting entry.

Viewing conflicting or shared resources

With Device Manager, identifying resource conflicts or identifying devices that are sharing resources requires you to open details for every device. In the System Information utility, identifying these situations is as easy as selecting System Summary, Hardware Resources, and then Conflicts/Sharing. As you can see in Figure 3-16, the System Information utility makes it easier to see this information.



Resource	Device
I/O Port 0x00000000-0x00000CF7	PCI bus
I/O Port 0x00000000-0x00000CF7	Direct memory access controller
I/O Port 0x00002000-0x0000203F	Intel(R) PRO/1000 MT Network Connection
I/O Port 0x00002000-0x0000203F	PCI standard PCI-to-PCI bridge
Memory Address 0xC9000000-0xC900F...	Intel(R) PRO/1000 MT Network Connection
Memory Address 0xC9000000-0xC900F...	PCI standard PCI-to-PCI bridge
IRQ 16	High Definition Audio Controller
IRQ 16	VMware SVGA 3D
Memory Address 0xA0000-0xBFFFF	PCI bus
Memory Address 0xA0000-0xBFFFF	VMware SVGA 3D
Memory Address 0xCA400000-0xCA4FF...	PCI Express standard Root Port
Memory Address 0xCA400000-0xCA4FF...	LSI Adapter, SAS 3000 series, 8-port with 106

FIGURE 3-16 Viewing resource sharing and conflict information

Note that resource sharing and conflicts are not necessarily bad things. A number of years ago, administrators had to make sure that resource sharing never occurred, but modern systems use limited system resources much more efficiently by sharing these resources when it makes sense to do so.

System Information highlights

So much information is available in this utility that it's not possible to show everything in just a few pages. Take the time to review the System Information utility and get familiar with it. It contains a lot of information that you will find useful. Highlights of the utility are shown in Table 3-1.

TABLE 3-1 The System Information utility

Path	Description
Components, Network, Adapter	Displays a list of all the network adapters installed in the system along with all the configuration information related to each adapter, including IP address, DHCP lease information, adapter model, and MAC address
Components, Problem Devices	Displays a list of the devices that are currently experiencing some kind of problem and that need attention

Path	Description
Software Environment, Network Connections	Displays a list of network resources to which the local system is connected
Software Environment, Running Tasks	Displays a list of all running tasks along with the full path to the related executable, the process ID, software version, and size
Software Environment, Environment Variables	Displays a list of all the environment variables that have been created on the system

Discovering the Driver Verifier utility

Starting with Windows 2000, Windows has included a Driver Verifier utility intended for use by advanced users in troubleshooting particularly vexing driver-related issues. The Driver Verifier utility helps determine root cause for driver-related issues, including problems related to:

- Drivers that experience memory-based issues
- Poorly written drivers
- Drivers that cause the system to fail

IMPORTANT **POTENTIAL PERFORMANCE ISSUES**

The Driver Verifier utility can create system instability and performance issues. Use this tool with care and only after fully reviewing the documentation so that you are confident that you understand what is happening. The system is likely to fail more often while the Driver Verifier utility is collecting information and generating dump files that can be analyzed later.

Initializing a new Driver Verifier configuration requires you to restart your system for the configuration changes to take effect.

Table 3-2 lists the standard tests the Driver Verifier utility can perform.

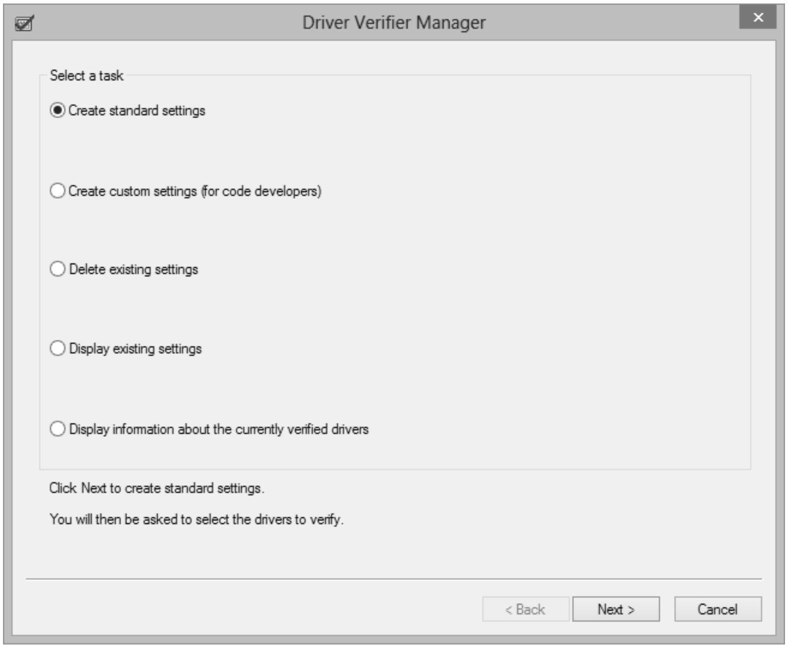
TABLE 3-2 Standard tests

Test	Description
Special pool	When activated, selected driver memory is pulled from a special pool, which is monitored for memory overruns, memory underruns, and memory that is accessed after it is freed.
Pool tracking	A method for detecting memory leaks. Ensures that a driver returns all its memory after it is unloaded.
Force IRQL checking	Places a driver under pressure in an attempt to make the driver access paged memory at the wrong IRQL. (Interrupt Request Level is the priority of an interrupt request.)
I/O verification	Monitors the way a driver handles I/O to detect illegal or inconsistent use of I/O routines.

Test	Description
Deadlock detection	Detects whether the driver has the potential to cause a deadlock. A deadlock occurs when two or more threads conflict over a resource, thwarting execution.
DMA checking	Detects a driver's improper use of Direct Memory Access (DMA) buffers, adapters, and map registers.
Security checks	Enables Driver Verifier to look for common situations that can result in driver-based security vulnerabilities.
Force pending I/O requests	Ensures that pending I/O requests are handled.
Low resources simulation	Tests a driver's ability to cope with low-resource situations, which can create resource contention issues.
IRP logging	Monitors a driver's use of IRPs (I/O request packets).
Miscellaneous checks	Many common items create driver instability. This category catches these common items.
Invariant MDL checking for stack	Monitors how the driver handles invariant MDL buffers across the driver stack.
Invariant MDL checking for driver	Monitors how the driver handles invariant MDL buffers per driver.
Power framework delay fuzzing	Helps identify driver errors for drivers that use the system's power framework.
DDI compliance checking	Determines whether the driver interacts correctly with the Windows kernel.

You can use the Driver Verifier utility in one of two ways. If you want to use the tool from a command line, type **verifier** followed by a valid verifier command. If you want to use a GUI-based version of the tool, type **verifier** from a command line. In this section, you learn about the GUI-based tool.

1. At a command prompt, type **verifier** to open the Driver Verifier Manager (GUI-based tool), as shown in Figure 3-17.



Select a task

● Create standard settings

○ Create custom settings (for code developers)

○ Delete existing settings

○ Display existing settings

○ Display information about the currently verified drivers

Click Next to create standard settings.

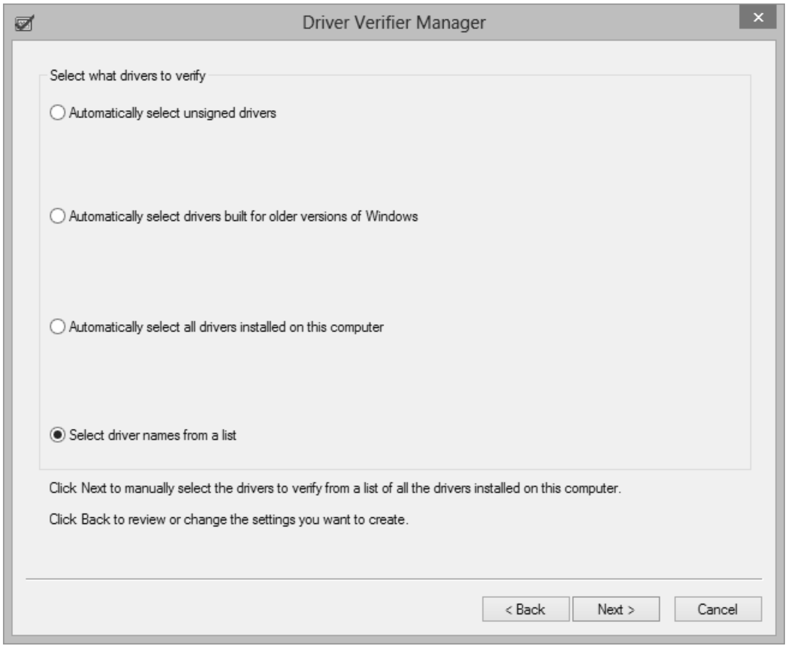
You will then be asked to select the drivers to verify.

FIGURE 3-17 The Driver Verifier utility

The available tasks are:

- **Create Standard Settings** This task selects a standard set of options and then asks you to select the drivers that are to be verified.
- **Create Custom Settings** With this task, you choose the Driver Verifier tests that should be run against the drivers you choose.
- **Delete Existing Settings** This task deactivates any Driver Verifier settings that are in place. It’s important to remember that Driver Verifier settings remain in place until you actively delete them.
- **Display Existing Settings** This task displays the settings that will be activated and the list of drivers that will be affected.
- **Display Information About The Currently Verified Drivers** This task displays information about the actions Driver Verifier is performing.

2. Select the Create Standard Settings option and tap or click Next. The Driver Verifier Manager displays the page, shown in Figure 3-18, on which you identify which drivers you want to verify.



Select what drivers to verify

○ Automatically select unsigned drivers

○ Automatically select drivers built for older versions of Windows

○ Automatically select all drivers installed on this computer

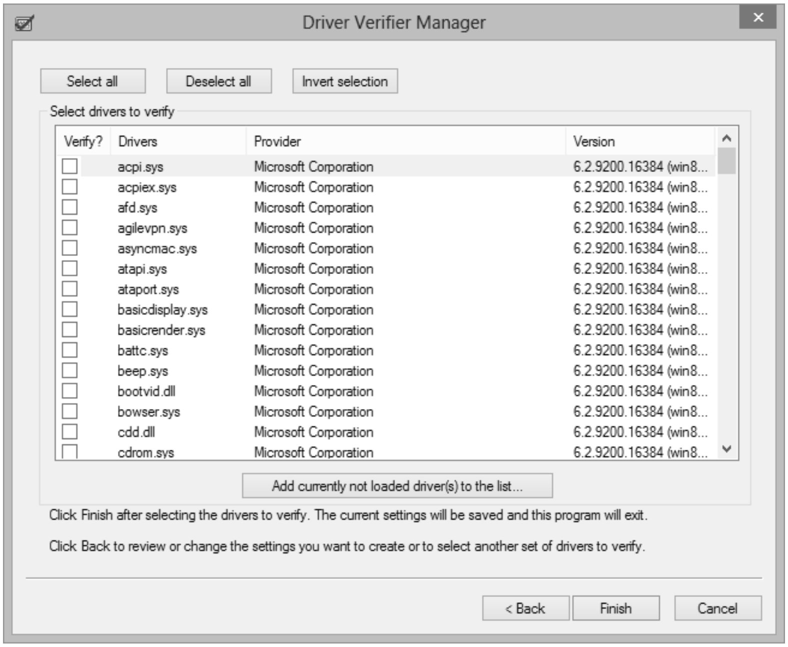
● Select driver names from a list

Click Next to manually select the drivers to verify from a list of all the drivers installed on this computer.

Click Back to review or change the settings you want to create.

FIGURE 3-18 Choosing the drivers that are to be verified

3. Select the Select Driver Names From A List option and tap or click Next. Driver Verifier Manager displays the page shown in Figure 3-19.



Select drivers to verify

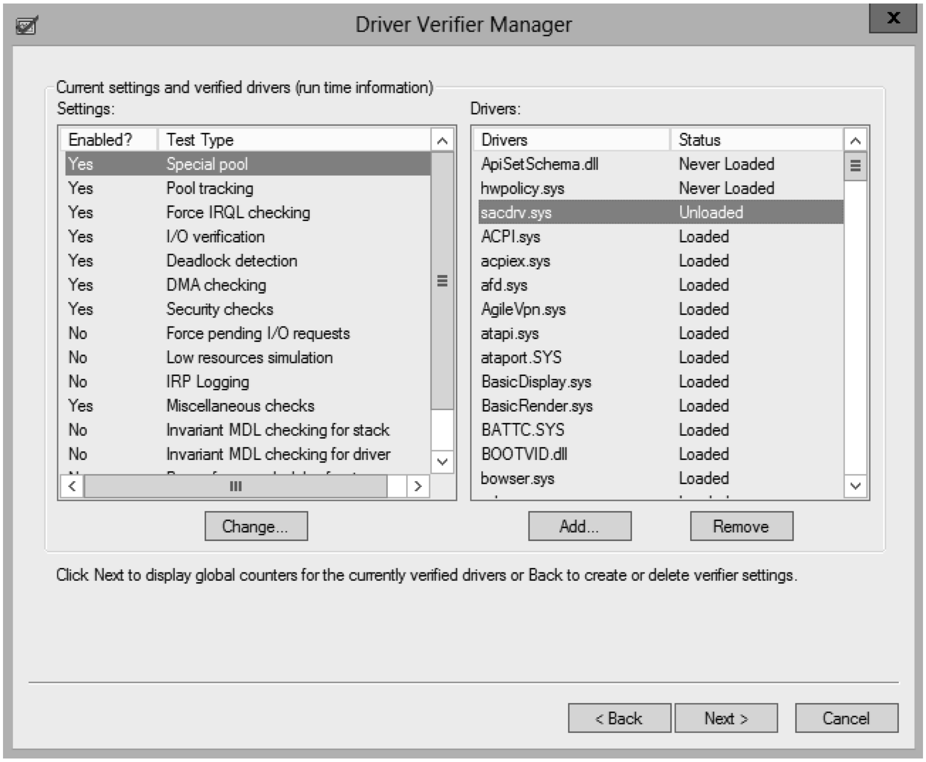
Verify?	Drivers	Provider	Version
□	acpi.sys	Microsoft Corporation	6.2.9200.16384 (win8...
□	acpiex.sys	Microsoft Corporation	6.2.9200.16384 (win8...
□	afd.sys	Microsoft Corporation	6.2.9200.16384 (win8...
□	agilevpn.sys	Microsoft Corporation	6.2.9200.16384 (win8...
□	asyncmac.sys	Microsoft Corporation	6.2.9200.16384 (win8...
□	atapi.sys	Microsoft Corporation	6.2.9200.16384 (win8...
□	ataport.sys	Microsoft Corporation	6.2.9200.16384 (win8...
□	basicdisplay.sys	Microsoft Corporation	6.2.9200.16384 (win8...
□	basicrender.sys	Microsoft Corporation	6.2.9200.16384 (win8...
□	battc.sys	Microsoft Corporation	6.2.9200.16384 (win8...
□	beep.sys	Microsoft Corporation	6.2.9200.16384 (win8...
□	bootvid.dll	Microsoft Corporation	6.2.9200.16384 (win8...
□	bowser.sys	Microsoft Corporation	6.2.9200.16384 (win8...
□	cdd.dll	Microsoft Corporation	6.2.9200.16384 (win8...
□	cdrom.sys	Microsoft Corporation	6.2.9200.16384 (win8...

Click Finish after selecting the drivers to verify. The current settings will be saved and this program will exit.

Click Back to review or change the settings you want to create or to select another set of drivers to verify.

FIGURE 3-19 Selecting the drivers that are to be verified

4. Select the drivers you want to verify and then tap or click Finish.
5. You will probably have to restart your system. After the computer restarts, load the Driver Verifier GUI again. Choose Display Information About The Currently Verified Drivers and click Next. Driver Verifier Manager presents the current settings and verified drivers, including the status of every driver, as shown in Figure 3-20.



Driver Verifier Manager

Current settings and verified drivers (run time information)

Settings:

Enabled?	Test Type
Yes	Special pool
Yes	Pool tracking
Yes	Force IRQL checking
Yes	I/O verification
Yes	Deadlock detection
Yes	DMA checking
Yes	Security checks
No	Force pending I/O requests
No	Low resources simulation
No	IRP Logging
Yes	Miscellaneous checks
No	Invariant MDL checking for stack
No	Invariant MDL checking for driver

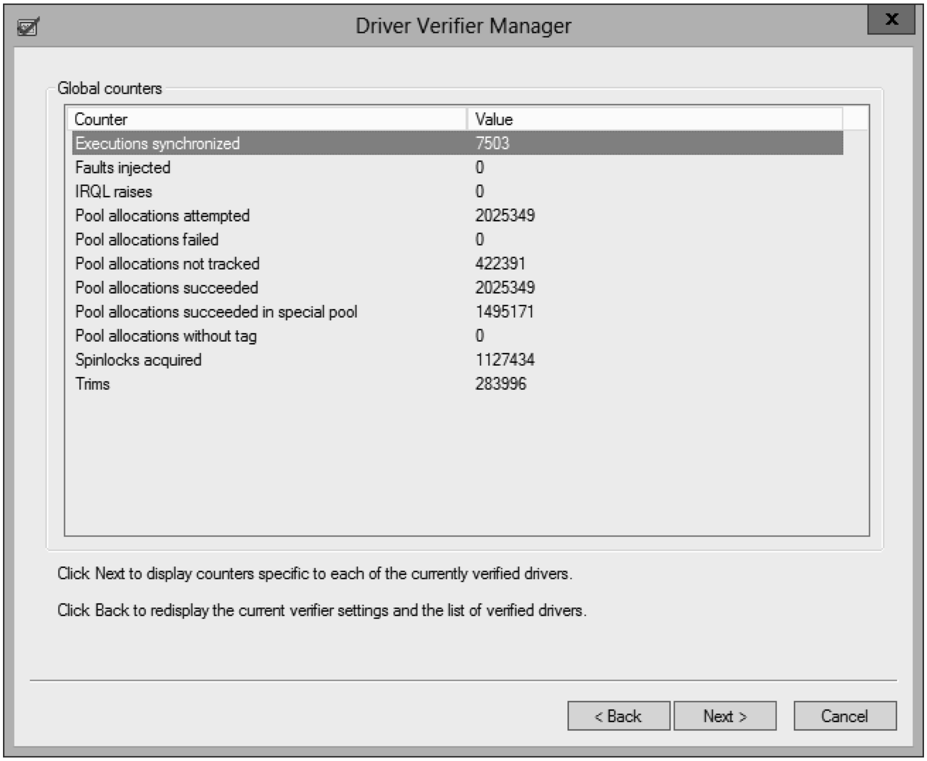
Drivers:

Drivers	Status
ApiSetSchema.dll	Never Loaded
hwpolicy.sys	Never Loaded
sacdrv.sys	Unloaded
ACPI.sys	Loaded
acpiex.sys	Loaded
afd.sys	Loaded
AgileVpn.sys	Loaded
atapi.sys	Loaded
ataport.SYS	Loaded
BasicDisplay.sys	Loaded
BasicRender.sys	Loaded
BATTC.SYS	Loaded
BOOTVID.dll	Loaded
bowser.sys	Loaded

Click Next to display global counters for the currently verified drivers or Back to create or delete verifier settings.

FIGURE 3-20 Driver Verifier Manager running and loading drivers

6. To view the global counter information for the verified drivers, click Next to see the global counter information, as shown in Figure 3-21.



Driver Verifier Manager

Global counters

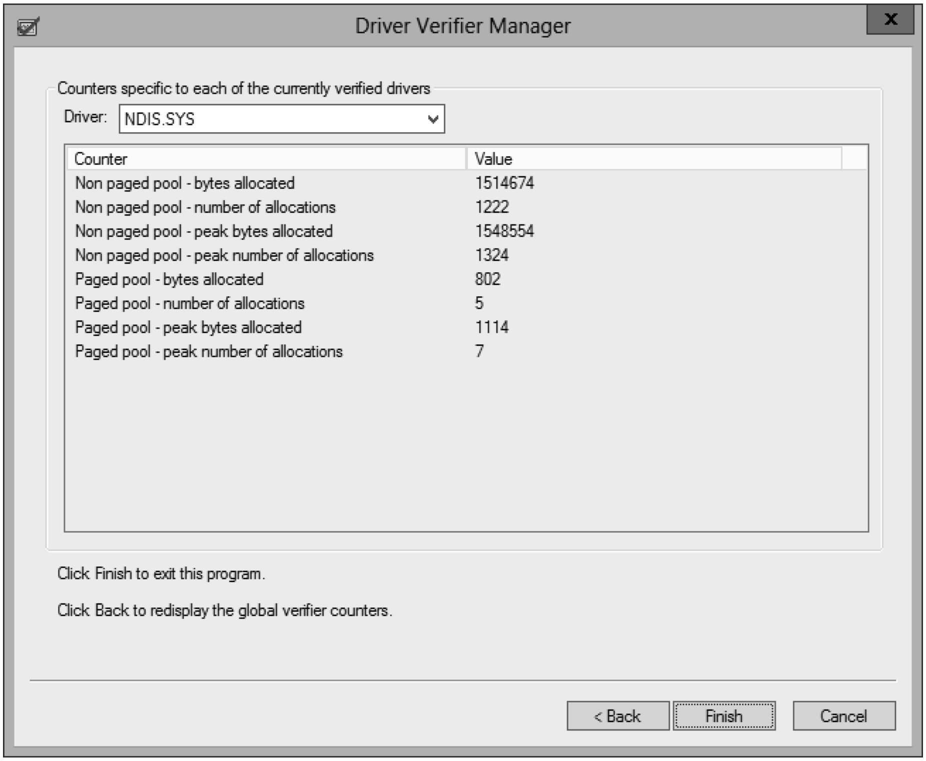
Counter	Value
Executions synchronized	7503
Faults injected	0
IRQL raises	0
Pool allocations attempted	2025349
Pool allocations failed	0
Pool allocations not tracked	422391
Pool allocations succeeded	2025349
Pool allocations succeeded in special pool	1495171
Pool allocations without tag	0
Spinlocks acquired	1127434
Trims	283996

Click Next to display counters specific to each of the currently verified drivers.

Click Back to redisplay the current verifier settings and the list of verified drivers.

FIGURE 3-21 The Driver Verifier Manager global counters page

7. Click Next to move to the page, shown in Figure 3-22, on which you can select an individual driver to view its specific information. In Figure 3-22, the NDIS.SYS driver—which is linked to the networking component—is the selected driver, and its counter information is displayed.



Counters specific to each of the currently verified drivers

Driver: NDIS.SYS

Counter	Value
Non paged pool - bytes allocated	1514674
Non paged pool - number of allocations	1222
Non paged pool - peak bytes allocated	1548554
Non paged pool - peak number of allocations	1324
Paged pool - bytes allocated	802
Paged pool - number of allocations	5
Paged pool - peak bytes allocated	1114
Paged pool - peak number of allocations	7

Click Finish to exit this program.

Click Back to redisplay the global verifier counters.

FIGURE 3-22 Driver Verifier Manager details for NDIS.SYS

8. Click Finish.

MORE INFO **DRIVER VERIFIER UTILITY FACTS**

To learn more about the Driver Verifier utility, review these resources, which go into great detail about how this utility operates and how to interpret the results:

- *http://support.microsoft.com/kb/244617*
- *http://msdn.microsoft.com/en-us/library/windows/hardware/ff545470(v=vs.85).aspx*

Make sure you understand that the driver utility only helps you track down a problem, not necessarily resolve it. Most driver issues identified by the driver utility must be rewritten to be fixed. Because you probably won't have the source code for the driver, you must work with the vendor to fix the driver, download a new driver, or use a different hardware device.

Adding device drivers to the driver store

In an enterprise environment, it can be important to preinstall drivers on a computer before deploying it in the organization. It's not uncommon for desktop administrators to make sure that all the drivers that a user would need are preloaded on the system. By doing so, when a user plugs in a supported device, the drivers are available and the device works for the user without any difficulty.

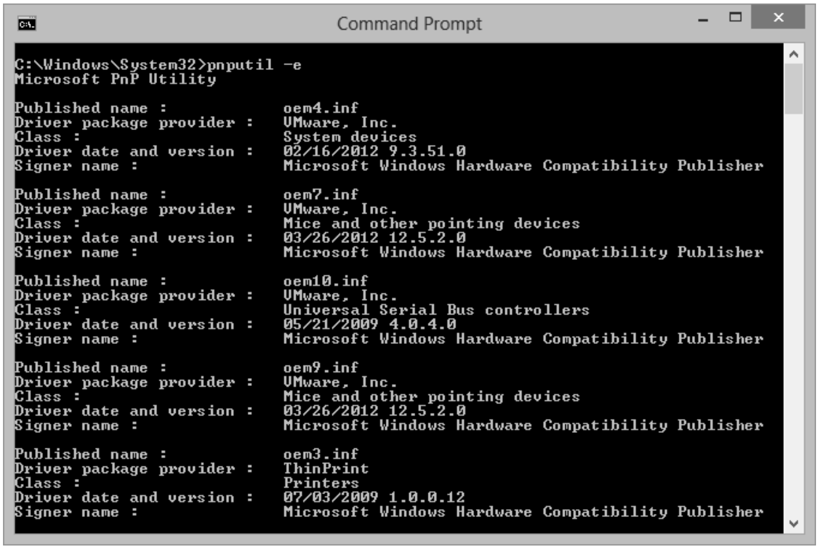
Windows includes a command-line tool called Pnputil.exe which you use to manage the driver store with a number of parameters, listed in Table 3-3.

TABLE 3-3 Pnputil.exe parameters

Parameter	Description
pnputil -a	Adds a driver package to the driver store.
pnputil -i	(Used with -a) If the driver matches any existing hardware devices on the system, the driver software will be installed.
pnputil -e	Shows you a list of third-party drivers currently loaded in the driver store.
pnputil -d	Deletes a package from the driver store.
pnputil -f	(Used with -d) Forces the deletion of a package from the driver store. The parameter is required when a driver you want to delete is associated with a device that is still connected to the system.

Sample commands:

- **pnputil -a c:\NewDriver.inf** Loads the NewDriver.inf driver located in C drive into the driver store.
- **pnputil -d oem3.inf** On the sample system used for this chapter, removes the driver associated with the VMware ThinPrint service.
- **pnputil -e** Shows you a list of the third-party drivers currently loaded on the system (Figure 3-23).



```
C:\Windows\System32>pnputil -e
Microsoft PnP Utility

Published name :            oem4.inf
Driver package provider :   VMware, Inc.
Class :                     System devices
Driver date and version :   02/16/2012 9.3.51.0
Signer name :               Microsoft Windows Hardware Compatibility Publisher

Published name :            oem7.inf
Driver package provider :   VMware, Inc.
Class :                     Mice and other pointing devices
Driver date and version :   03/26/2012 12.5.2.0
Signer name :               Microsoft Windows Hardware Compatibility Publisher

Published name :            oem10.inf
Driver package provider :   VMware, Inc.
Class :                     Universal Serial Bus controllers
Driver date and version :   05/21/2009 4.0.4.0
Signer name :               Microsoft Windows Hardware Compatibility Publisher

Published name :            oem9.inf
Driver package provider :   VMware, Inc.
Class :                     Mice and other pointing devices
Driver date and version :   03/26/2012 12.5.2.0
Signer name :               Microsoft Windows Hardware Compatibility Publisher

Published name :            oem3.inf
Driver package provider :   ThinPrint
Class :                     Printers
Driver date and version :   07/03/2009 1.0.0.12
Signer name :               Microsoft Windows Hardware Compatibility Publisher
```

FIGURE 3-23 A list of the third-party drivers loaded on the system

Lesson summary

- Drivers are the software glue that connects the operating system to the hardware devices.
- The Device Manager tool is used to manage all aspects of driver software in Windows 8.
- The Driver Verifier utility helps pinpoint potential driver issues that could be causing system instability.
- By adding drivers to the Driver Store, you can help employees more easily add new devices to their computers.
- You might have to roll back a driver to a previous version if a newer driver is unstable.

Lesson review

Answer the following questions to test your knowledge of the information in this lesson. You can find the answers to these questions and explanations of why each answer choice is correct or incorrect in the "Answers" section at the end of this chapter.

1. Which tool provides you with read-only access to a variety of system information elements?

   A. Device Manager

   B. Driver Verifier

    C. System Information
    D. Computer Management
2. How do you enable the viewing of hidden devices?
    A. In View, choose Hidden Devices in Driver Verifier.
    B. Open Device Manager, choose View, and then select Show Hidden Devices.
    C. Right-click a device category and choose Show Hidden Devices.
    D. Open System Information and navigate to the Hidden Devices node.
3. Which of these methods does not update drivers?
    A. Driver Verifier
    B. Windows Update
    C. Driver pre-staging
    D. Internet download

Lesson 2: Managing hardware devices

Drivers are the software that binds the operating system to the hardware connected to the system. Drivers bring you to the focus of this chapter, which is the hardware.

After this lesson, you will be able to:

- Enable and disable hardware devices by using Device Manager.
- Monitor the amount of power USB devices use.

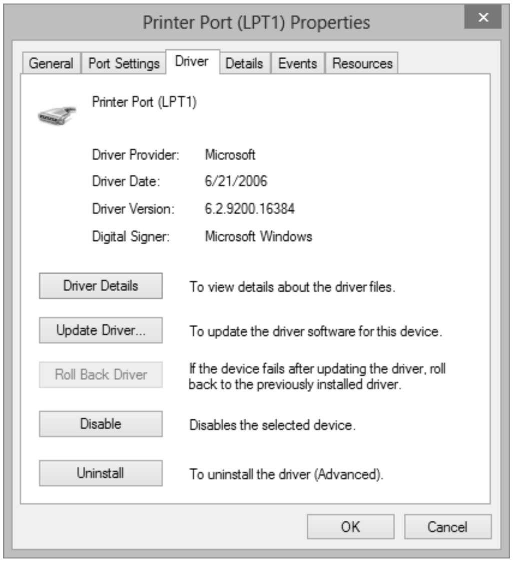
Estimated lesson time: 20 minutes

Enabling and disabling hardware devices

Not all hardware has to be enabled all the time. In fact, as you work on troubleshooting hardware in your organization, you might find it necessary to disable a device if it is causing problems. Then, after you correct a problem, you must bring the device back into operation.

To disable and enable devices, open the Device Manager by using one of the methods discussed previously in this chapter. Open the Properties page for the device you want to enable or disable and navigate to the Driver tab. From there, click either the Disable button (if the device is presently enabled) or the Enable button (if the device is presently disabled).

In Figure 3-24, note that the Disable button is currently available.



Printer Port (LPT1)

Driver Provider: Microsoft
Driver Date: 6/21/2006
Driver Version: 6.2.9200.16384
Digital Signer: Microsoft Windows

Driver Details: To view details about the driver files.
Update Driver...: To update the driver software for this device.
Roll Back Driver: If the device fails after updating the driver, roll back to the previously installed driver.
Disable: Disables the selected device.
Uninstall: To uninstall the driver (Advanced).

FIGURE 3-24 Disabling devices that are causing problems

Monitoring USB devices

Most devices that employees in your organization attach to their computers are USB-based. Such devices include keyboards, mice, cameras, and thumb drives. USB is so popular because it’s so easy to use. In many cases, all you have to do is plug in the device, and it just works. This is for two reasons. First, many common devices already have generic drivers loaded in Windows. When the device is plugged in, Windows already knows how to handle the hardware. Second, USB ports, in addition to enabling communication between the device and the computer, also provide power to the connected device. That’s why you don’t need to plug a thumb drive into a power source when you connect it to the computer.

Although some of the devices you use are connected directly to USB ports in the computer, others might be connected through a USB hub. There are two varieties of USB hubs:

- **Self-powered** A self-powered USB hub has a power supply that connects to an electrical outlet. These kinds of USB hubs provide their own power to connected devices.
- **Bus-powered** A bus-powered USB hub gets its power from the system’s USB connectors and passes along that power to connected devices. The amount of available power in this scenario is more limited than it is with self-powered hubs.

USB devices can operate at multiple speeds, and each speed is based on a different USB standard. Different devices conform to different standards. Modern computers often include USB ports that operate at multiple speeds. For example, a single computer might include ports that operate at both USB 2.0 and USB 3.0 speeds. Here's a look at the different standards and the speeds at which each operates:

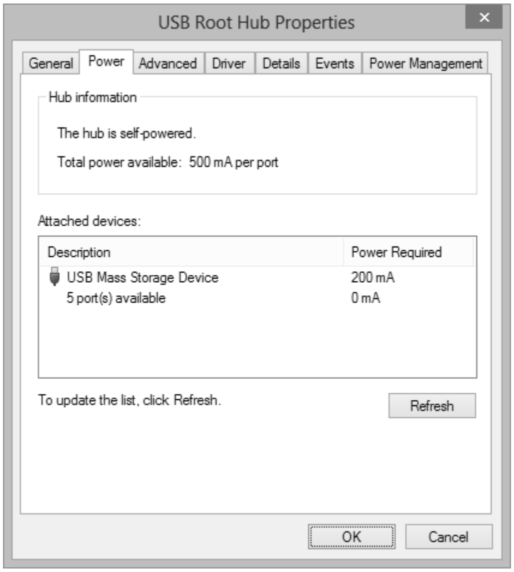
- **USB 1.0/USB 1.1** Operates at a maximum speed of 12 megabits per second (Mbps)
- **USB 2.0** Operates at a maximum speed of 480 Mbps
- **USB 3.0** Operates at a maximum speed of 5 gigabits per second (Gbps)

Bandwidth is an important factor in USB troubleshooting, particularly when you're dealing with older USB 1.0 or USB 1.1 systems. If there isn't sufficient bandwidth to support the devices on a particular USB port, users can receive error messages such as "USB controller bandwidth exceeded." When this happens, devices might not operate correctly.

Many devices will report to Windows the amount of bandwidth they use on the Advanced tab of the device's Properties page in Device Manager. However, this is not true for all devices. This makes troubleshooting bandwidth issues a best-effort task rather than a scientific one. Fortunately, with the rise of USB 3.0 and a maximum bandwidth of 5 GHz, bandwidth issues are not as serious as they once were.

As mentioned previously, USB devices consume power from the USB bus. Therefore, it's important to watch the USB port's power budget to ensure that connected devices don't surpass the power limit on the port. When you use a bus-powered USB hub to connect many devices, the possibility of exceeding this limit becomes more likely.

To view the current power usage on a USB hub—even an internal one that just manages a computer's physical USB ports—open the Device Manager Properties page for a USB hub. On that page, select the Power tab to see a list of the devices connected to the hub and the power required to operate each device (Figure 3-25).



The hub is self-powered.

Total power available: 500 mA per port

Description	Power Required
USB Mass Storage Device	200 mA
5 port(s) available	0 mA

To update the list, click Refresh.

FIGURE 3-25 Hub showing a device consuming 200 mA of power

Lesson summary

- There are several versions of USB, each with its own speed limit.
- Device Manager is used to enable and disable devices.
- There are two kinds of USB hubs: bus-powered and self-powered.

Lesson review

Answer the following questions to test your knowledge of the information in this lesson. You can find the answers to these questions and explanations of why each answer choice is correct or incorrect in the “Answers” section at the end of this chapter.

1. How fast is USB 2.0?

   A. 400 Mbps

   B. 480 Mbps

   C. 12 Mbps

   D. 5 Gbps

2. Which is more important: bandwidth or power usage on USB?

   A. Bandwidth.

   B. Power.

   C. They are equally important.

   D. Neither is important.

Lesson 3: Managing enterprise hardware policies

Enterprises have stricter requirements with regard to hardware than do home computers. In the enterprise, the ramifications are far greater if information is stolen or if malware infects the organization.

After this lesson, you will be able to:

- Understand how you can prevent the installation of all removable devices.
- Describe which policies allow or prevent device installation on a granular basis.
- Describe the difference between device ID strings and device classes.
- Identify the ID string and class for a hardware device.

Estimated lesson time: 40 minutes

Managing enterprise hardware installation policies

Administrators can create organizational policies that define how devices are managed by using Group Policy. You can disable the installation of removable devices completely, or you can take a more surgical approach by allowing or preventing the installation of removable devices.

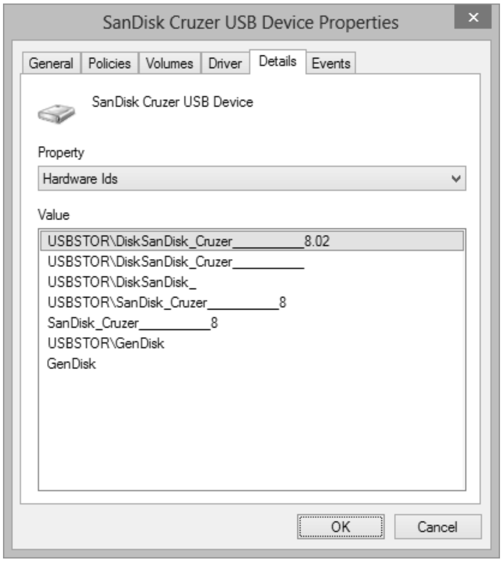
Before undertaking this effort, make sure you understand the two ways by which you can choose devices to allow or prevent such installations:

- **Device identification strings** This is the most granular way to allow or prevent the installation of hardware devices. By using this method, you can identify specific devices to include in the policy.
- **Device setup classes** By using device setup classes, you take a group-based approach to allow or prevent hardware devices from being installed. For example, you could prevent the installation of any device that's a scanner.

Identifying hardware strings and classes

To identify the hardware string and class for a hardware device:

1. Plug the device into a Windows-based computer.
2. Open Device Manager.
3. Open the Properties page for the newly installed device.
4. Navigate to the device's Details page.
    - Select the Hardware Ids property to view all the hardware IDs associated with the device (Figure 3-26).
    - Select the Compatible Ids property to view the device class for the new device (Figure 3-27).



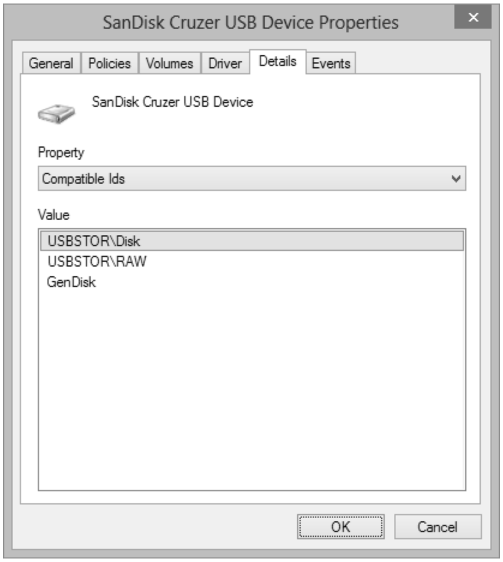
SanDisk Cruzer USB Device

Property: Hardware Ids

Value:

```
USBSTOR\DiskSanDisk_Cruzer__________8.02
USBSTOR\DiskSanDisk_Cruzer__________
USBSTOR\DiskSanDisk_
USBSTOR\SanDisk_Cruzer__________8
SanDisk_Cruzer__________8
USBSTOR\GenDisk
GenDisk
```

FIGURE 3-26 Hardware IDs for a USB thumb drive



SanDisk Cruzer USB Device

Property: Compatible Ids

Value:

```
USBSTOR\Disk
USBSTOR\RAW
GenDisk
```

FIGURE 3-27 Compatible IDs for a USB thumb drive

Note that there are multiple options for both hardware ID and class ID. For the hardware ID, the options give you a way to be somewhat granular in how you handle devices. For example, you could choose to prevent or allow just SanDisk devices or prevent or allow just the specific device model.

REAL WORLD **COPY AND PASTE THE HARDWARE ID**

To save a lot of trouble, copy and paste the hardware IDs rather than trying to type them and match the number of underscore characters. You will minimize errors this way.

Disabling installation of removable devices

High-security organizations do not generally allow the use of any removable devices on a system. To do so would enable an insider to just connect a USB thumb drive and steal corporate assets or other secrets. By using Group Policy, it's possible to disable the installation of removable devices completely. The Group Policy described in the following list will, when set, enable you to disable the installation of removable devices on as many computers in your organization as you like:

- **Policy name** Prevent Installation Of Removable Devices.
- **Policy path** Windows Settings, Administrative Templates, System, Device Installation, Device Installation Restrictions.
- **Policy description** This policy setting enables you to prevent Windows from installing removable devices. A device is considered removable when its driver indicates that the device is removable. For example, a USB device is reported to be removable by the drivers for the USB hub to which the device is connected. This policy setting takes precedence over any other policy setting that allows Windows to install a device.
- **Enabled** If you enable this policy setting, it prevents Windows from installing removable devices, and the drivers for existing removable devices cannot be updated. If you enable this policy setting on a remote desktop server, the policy setting affects redirection of removable devices from a remote desktop client to the remote desktop server.
- **Disabled or not configured** If you disable or do not configure this policy setting, Windows can install and update device drivers for removable devices as allowed or prevented by other policy settings.

Managing installation of specific devices based on device ID or group

The ability to prevent the installation of removable devices is nice, but it is a heavy-handed approach to the problem. Other policies are available by which you can be a bit more granular in how you handle allowed and disallowed devices.

For these policies, you need to know the class of the device.

RESTRICTING DEVICE INSTALLATION BASED ON CLASS

The following Group Policy enables you to specify device classes that are not allowed to be installed in the organization:

- **Policy name** Prevent installation of devices using drivers that match these devices' setup classes.

- **Policy path** Windows Settings, Administrative Templates, System, Device Installation, Device Installation Restrictions.
- **Policy description** This policy setting enables you to specify a list of device setup class globally unique identifiers (GUIDs) for device drivers that Windows is prevented from installing. This policy setting takes precedence over any other policy setting that allows Windows to install a device.
- **Enabled** If you enable this policy setting, Windows is prevented from installing or updating device drivers whose device setup class GUIDs appear in the list you create. If you enable this policy setting on a remote desktop server, the policy setting affects redirection of the specified devices from a remote desktop client to the remote desktop server.
- **Disabled or not configured** If you disable or do not configure this policy setting, Windows can install and update devices as allowed or prevented by other policy settings.

ALLOWING DEVICE INSTALLATION BASED ON CLASS

The following Group Policy enables you to specify device classes that are allowed to be installed in the organization. Use this policy only when you also configure the Prevent Installation Of Devices Not Described By Other Policy Settings policy setting. This policy overrides the hardware installation restrictions for any device classes you list.

- **Policy name** Prevent installation of devices using drivers that match these devices' setup classes.
- **Policy path** Windows Settings, Administrative Templates, System, Device Installation, Device Installation Restrictions.
- **Policy description** This policy setting enables you to specify a list of device setup class GUIDs for device drivers that Windows is allowed to install. Use this policy setting only when the Prevent Installation Of Devices Not Described By Other Policy Settings policy setting is enabled. Other policy settings that prevent device installation take precedence over this one.
- **Enabled** If you enable this policy setting, Windows is allowed to install or update device drivers whose device setup class GUIDs appear in the list you create unless another policy setting specifically prevents installation. (Examples are the Prevent Installation Of Devices That Match These Device IDs policy setting, the Prevent Installation Of Devices For These Device Classes policy setting, and the Prevent Installation Of Removable Devices policy setting). If you enable this policy setting on a remote desktop server, the policy setting affects redirection of the specified devices from a remote desktop client to the remote desktop server.
- **Disabled or not configured** If you disable or do not configure this policy setting, and no other policy setting describes the device, the Prevent Installation Of Devices Not Described By Other Policy Settings policy setting determines whether the device can be installed.

RESTRICTING DEVICE INSTALLATION BASED ON HARDWARE ID

The following Group Policy enables you to specify device IDs that are not allowed to be installed in the organization. You need to specify hardware IDs when enabling this policy.

- **Policy name** Prevent installation of devices that use any of these device IDs.
- **Policy path** Windows Settings, Administrative Templates, System, Device Installation, Device Installation Restrictions.
- **Policy description** This policy setting enables you to specify a list of plug-and-play hardware IDs and compatible IDs for devices that Windows is prevented from installing. This policy setting takes precedence over any other policy setting that allows Windows to install a device.
- **Enabled** If you enable this policy setting, Windows is prevented from installing a device whose hardware ID or compatible ID appears in the list you create. If you enable this policy setting on a remote desktop server, the policy setting affects redirection of the specified devices from a remote desktop client to the remote desktop server.
- **Disabled or not configured** If you disable or do not configure this policy setting, devices can be installed and updated as allowed or prevented by other policy settings.

ALLOWING DEVICE INSTALLATION BASED ON HARDWARE ID

The following Group Policy enables you to specify device IDs that are allowed to be installed in the organization. You need to specify hardware IDs when enabling this policy.

- **Policy name** Allow installation of devices that use any of these device IDs.
- **Policy path** Windows Settings, Administrative Templates, System, Device Installation, Device Installation Restrictions.
- **Policy description** This policy setting enables you to specify a list of plug-and-play hardware IDs and compatible IDs for devices that Windows is allowed to install. Use this policy setting only when the Prevent Installation Of Devices Not Described By Other Policy Settings policy setting is enabled. Other policy settings that prevent device installation take precedence over this one.
- **Enabled** If you enable this policy setting, Windows is allowed to install or update any device whose plug-and-play hardware ID or compatible ID appears in the list you create unless another policy setting specifically prevents that installation. (Examples are the Prevent Installation Of Devices That Match Any Of These Device IDs policy setting, the Prevent Installation Of Devices For These Device Classes policy setting, and the Prevent Installation Of Removable Devices policy setting). If you enable this policy setting on a remote desktop server, the policy setting affects redirection of the specified devices from a remote desktop client to the remote desktop server.
- **Disabled or not configured** If you disable or do not configure this policy setting, and no other policy setting describes the device, the Prevent Installation Of Devices Not Described By Other Policy Settings policy setting determines whether the device can be installed.

Creating an administrative override for device installation

As an administrator, it might be necessary to install a device that is generally restricted in the organization. To accomplish this goal, use the following policy settings:

- **Policy name** Allow administrators to override Device Installation Restriction policies.
- **Policy path** Windows Settings, Administrative Templates, System, Device Installation, Device Installation Restrictions.
- **Policy description** This policy setting enables you to determine whether members of the Administrators group can install and update the drivers for any device regardless of other policy settings.
- **Enabled** If you enable this policy setting, members of the Administrators group can use the Add Hardware Wizard or the Update Driver Wizard to install and update the drivers for any device. If you enable this policy setting on a remote desktop server, the policy setting affects redirection of the specified devices from a remote desktop client to the remote desktop server.
- **Disabled or not configured** If you disable or do not configure this policy setting, members of the Administrators group are subject to all policy settings that restrict device installation.

MORE INFO **CONTROLLING DEVICE INSTALLATION BY USING GROUP POLICY**

Microsoft has created a resource entitled *Step-By-Step Guide to Controlling Device Installation Using Group Policy*, which provides in-depth information about how to use the various Group Policy objects to control hardware installation in an organization better. It's an invaluable resource for any administrator who wants to implement granular controls over hardware devices; find it at *http://msdn.microsoft.com/en-us/library/bb530324.aspx*.

Lesson summary

- Hardware strings enable you to be as inclusive or as granular as you like when you must allow or prevent the installation of hardware devices.
- By using the Allow Administrators To Override Device Installation Restriction Policies policy, you can implement restrictive policies in the organization but still leave room for special cases.
- Device setup classes are used to take a device group–based approach to hardware management.
- When you enable the Prevent Installation Of Devices Not Described By Other Policy Settings policy, you should create policies that enable specific devices to override the restriction policies.
- Group Policy provides you with an easy way to create hardware installation policies across the organization.

Lesson review

Answer the following questions to test your knowledge of the information in this lesson. You can find the answers to these questions and explanations of why each answer choice is correct or incorrect in the "Answers" section at the end of this chapter.

1. Which hardware strings could be used to restrict the installation of a hardware device with ID USBSTOR\DiskSanDisk_Cruzer__________8.02? (Choose all that apply.)

   A. USBSTOR\DiskSanDisk_Cruzer__________8.02

   B. USBSTOR\DiskSanDisk_Cruzer__________

   C. USBSTOR\DiskSanDisk_

   D. USBSTOR\SanDisk_Cruzer__________8

2. Which method will encompass and restrict the greatest number of devices?

   A. Hardware ID

   B. Class ID

   C. Device Name

   D. Device SID

3. How do you allow an administrator to install hardware even when Group Policy forbids it?

   A. Enable the Allow Administrators To Override Device Installation Restriction Group Policy.

   B. Add the Administrators group to the No Hardware Restrictions group.

   C. Add users to the local Administrators group on their PCs.

   D. Enable Admin Mode in Device Manager.

Practice exercises

In these practice exercises, you navigate from the Windows 8 Start screen to find hardware IDs and create Group Policy to allow or prevent the installation of devices.

Exercise 1: Locate hardware ID for a USB thumb drive

In this exercise, you identify the specific hardware ID for a USB thumb drive. You probably have one of these devices lying around somewhere.

1. Open Device Manager.
2. Find your device.
3. Using the device properties, find the hardware ID.

Exercise 2: Create Group Policy to prevent the installation of hardware devices

In this exercise, you create Group Policy that prevents the installation of removable devices. To complete this exercise, your Windows 8 system must be joined to a Microsoft Windows Server domain.

1. Use the Group Policy Editor on the computer running Windows Server.
2. Configure the appropriate Group Policy and test it.

Suggested practice exercises

The following additional practices are designed to give you more opportunities to practice what you've learned and to help you successfully master the lessons presented in this chapter.

- **Exercise 1** Practice configuring and applying Group Policy to see how each policy works.
- **Exercise 2** Use Driver Verifier and learn to interpret its output.
- **Exercise 3** Add drivers to the Driver Store.

Answers

This section contains the answers to the lesson review questions in this chapter.

Lesson 1

1. **Correct answer: C**
    - **A. Incorrect:** Device Manager is a read/write tool used to manage devices and drivers.
    - **B. Incorrect:** Driver Verifier locates deep-rooted driver issues.
    - **C. Correct:** System Info displays general information about hardware and software configured on a computer. Information displayed is read-only.
    - **D. Incorrect:** Computer Management is a general-purpose tool used to manage the system.
2. **Correct answer: B**
    - **A. Incorrect:** Driver Verifier checks the installation of device drivers; it does not display hidden devices.
    - **B. Correct:** The Device Manager View menu can show or hide hidden devices.
    - **C. Incorrect:** Selecting a device category will expand and collapse devices within that category, but doing so does not change the hidden status of a device.
    - **D. Incorrect:** There is no Hidden Devices node in System Info.
3. **Correct answer: A**
    - **A. Correct:** Driver Verifier locates driver issues.
    - **B. Incorrect:** Drivers can be installed by using this method.
    - **C. Incorrect:** Drivers can be installed by using this method.
    - **D. Incorrect:** Drivers can be installed by using this method.

Lesson 2

1. **Correct answer: B**
    - **A. Incorrect:** FireWire runs at 400 Mbps, which is slower than USB 2.0.
    - **B. Correct:** USB 2.0 has bandwidth typically around 480 Mbps.
    - **C. Incorrect:** USB 1.1 maintained speeds of around 12 Mbps.
    - **D. Incorrect:** USB 3.0 is rated at around 5 Gbps.

2. **Correct answer: C**
   - **A.** **Incorrect:** Bandwidth issues can cause problems ensuring that a USB device has enough power to function correctly.
   - **B.** **Incorrect:** Improperly powered USB devices can affect bandwidth and performance of the device.
   - **C.** **Correct** Power and bandwidth are equally important in determining USB device performance because underpowered devices will suffer bandwidth performance issues.
   - **D.** **Incorrect:** USB has two components that are typically watched, bandwidth and power, and both are equally important in determining device performance.

Lesson 3

1. **Correct answers: A, B, C, and D**
   - **A.** **Correct:** Installation of the specific device with version 8.02 will be prevented.
   - **B.** **Correct:** No DiskSanDisk_Cruzer device can be installed, which includes the device in question.
   - **C.** **Correct:** No SanDisk-based device can be installed.
   - **D.** **Correct:** No DiskSanDisk_Cruzer version 8 device can be installed, which includes the device in question.
2. **Correct answer: B**
   - **A.** **Incorrect:** The device ID would include only this specific device.
   - **B.** **Correct**: The class ID for a set of devices would include any devices of the same class.
   - **C.** **Incorrect:** The device name would include only devices with the same name, much like device ID covers only a specific device.
   - **D.** **Incorrect:** Hardware devices are not assigned a SID; these are reserved for logical objects such as user accounts or computer accounts.
3. **Correct answer: A**
   - **A.** **Correct:** Enable the Group Policy options to allow an override.
   - **B.** **Incorrect:** There is no group called No Hardware Restrictions for use with this feature.
   - **C.** **Incorrect:** Adding accounts to the local Administrators group will not specifically allow this action; Group Policy options must be configured so that domain administrators can override settings.
   - **D.** **Incorrect:** The Device Manager snap-in does not have an admin mode specific to computer hardware; the MMC console has an author mode, but that is used to manage the console.

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