

Installing/Updating/Downgrading/Uninstalling Drivers

Device drivers are configured or reconfigured during three different actions:

- **Install** (a hardware device is added to the computer and a software driver is configured by Microsoft® Windows® so that the device can be used)
- **Update** (a different software driver for the hardware device is configured by Windows; the new software driver is newer than the previously-configured driver)
- **Downgrade** (a different software driver for the hardware device is configured by Windows; the new software driver is older than the previously-configured driver)

Issues related to driver choice can arise during any of these actions and are often related to whether drivers are signed or unsigned. The following scenarios are discussed, with specific examples related to e-gate™ USB Smart Card drivers:

Action	Signed	Unsigned
Install	“Installing Signed Drivers” on page 4	“Installing Unsigned Drivers” on page 5
Update (see Table 2, “Update Scenarios,”)	“Updating Signed Drivers” on page 6	“Updating Unsigned Drivers” on page 10
Downgrade (see Table 3, “Downgrade Scenarios,”)	“Downgrading Drivers” on page 12	

Table 1: Install/Update/Downgrade Scenarios

Because update is at the root of many driver issues, the update discussion is further broken down like this:

Action	... to signed drivers	... to unsigned drivers
Update from signed drivers ...	“Update from older signed driver to newer signed driver” on page 6	“Update from signed driver to unsigned driver” on page 6
Update from unsigned drivers ...	“Update from unsigned driver to signed driver” on page 10	“Update from older unsigned driver to newer unsigned driver” on page 10

Table 2: Update Scenarios

Downgrade scenarios mirror update scenarios, but because Windows XP provides a convenient tool to downgrade drivers, the scenarios are presented somewhat differently:

Action	... to signed drivers	... to unsigned drivers
Downgrade drivers on Windows XP	“Windows XP: Downgrade drivers” on page 12	
Downgrade on Windows 2000 from signed drivers ...	“Windows 2000: Downgrade from signed driver to unsigned driver; from newer signed driver to older signed driver ...” on page 13	
Downgrade on Windows 2000 from unsigned drivers ...	“Windows 2000: Downgrade from unsigned driver to signed driver” on page 13	“Windows 2000: Downgrade ... from newer unsigned driver to older unsigned driver” on page 13

Table 3: Downgrade Scenarios

Uninstalling Drivers is described in “Uninstalling e-gate USB Smart Card Drivers” on page 16.

In addition, the following supporting information is provided in this document:

- “Device Drivers Overview” on page 3
- “Recovering from Inconsistent Driver State” on page 14
- “Driver Version Identification” on page 15
- “Installing e-gate USB Smart Card Drivers” on page 15
- “Updating e-gate USB Smart Card Drivers” on page 16
- “Windows Update and e-gate USB Smart Card Drivers” on page 17
- “Appendix A: How Windows Selects Drivers” on page 18
- “Appendix B: Driver Files” on page 20

NOTE *All instructions are specific to performing driver-related tasks on the Microsoft Windows 2000 and Windows XP operating systems. Unless otherwise noted, all references to “the operating system” and to “Windows” refer to Microsoft Windows 2000 and Windows XP.*

Device Drivers Overview

The e-gate USB Smart Card driver suite uses standard guidelines and techniques recommended by the Microsoft Windows DDK for “third-party” device installation. A “driver package” supplies the necessary device support components, which fall into three categories:

- Device driver (*.sys*) files provide the I/O interface for the e-gate USB Smart Card and smart card reader.
- Installation files include device setup information (*.inf*) files and catalog (*.cat*) files containing driver digital signatures.
- A co-installer, referenced by the device setup information (*.inf*) files, contains additional logic to coordinate installation of the interdependent e-gate drivers.

Additional detail about driver files installed in Windows is provided in “Appendix B: Driver Files” on page 20.

Windows device drivers become a trusted and privileged extension of the operating system kernel. It is vital that only validated code is installed in the operating system. To address this security issue, Microsoft issues digital signatures for compliant driver packages through the WHQL qualification program.

Starting with Windows 2000, both initial driver installation and driver updating encourage the use of and check for digital signatures. Depending on driver signing options established by local system security policy, driver installation may either silently allow, display a warning message, or block the installation of drivers without corresponding signatures (“unsigned drivers”).

It is our goal to provide up-to-date, signed e-gate USB Smart Card drivers. Since the WHQL qualification process can be long in duration, we frequently supply partners with beta unsigned drivers for compatibility testing with their applications. Unfortunately, mixing and matching signed and unsigned driver packages can cause complications because the rules of ranking and selecting drivers vary from operating system to operating system, and situation to situation.

Additional detail about driver ranking and selection is provided in “Appendix A: How Windows Selects Drivers” on page 18.

Installing Signed Drivers

General Discussion

Signed drivers are preferred over all other drivers by Windows when a new device is installed on a computer.

If Windows finds a signed driver, installation is completely automatic: Windows detects the new device, finds the installed driver whose hardware ID matches the device's hardware ID, and configures the device to use the driver. If more than one signed driver is found, the selection criteria (see "Driver Selection Criteria by Operating System" on page 19) dictate that the newest signed driver for the device will be chosen.

If Windows does not find a driver, the Found New Hardware wizard prompts the user to identify the location of the driver file.

e-gate USB Smart Card Drivers

If a signed driver for e-gate USB Smart Card is found by Windows, installation is automatic. After the e-gate USB Smart Card is attached to the computer, messages confirm that Windows has found the device, found the installed driver whose hardware ID matches the e-gate USB Smart Card's hardware ID, and configured the device to use the driver. Because e-gate USB Smart Cards also use additional interdependent drivers, those drivers are also installed and configured. If more than one signed driver package is found, the newest signed driver package is selected.

If Windows does not find a driver, the Found New Hardware wizard prompts the user to identify the location of the driver file. See "Installing e-gate USB Smart Card Drivers" on page 15 for instructions.

Installing Unsigned Drivers

General Discussion

When a new device is added to a computer, Windows strongly prefers to configure the device to use a signed driver. If no signed driver is found, Windows uses other criteria (see “Driver Selection Criteria by Operating System” on page 19) to determine the best driver choice for the device. The date is never considered as a selection criterion for an unsigned driver.

Depending on driver signing options established by local system security policy (Control Panel > System Properties > Hardware > Driver Signing...), driver installation might either silently allow, display a warning message, or block the installation of drivers without corresponding signatures (“unsigned drivers”).

If driver signing options allow unsigned drivers and Windows finds an unsigned driver, Windows either automatically installs the driver, or it opens the Found New Hardware wizard and prompt the user to confirm that the unsigned driver it has found should be installed.

If Windows does not find a driver, the Found New Hardware wizard prompts the user to identify the location of the driver file.

e-gate USB Smart Card Drivers

When a new e-gate USB Smart Card is attached to the computer, messages confirm that the system has found the new hardware and is searching for a driver. If driver signing options allow unsigned drivers and Windows finds an unsigned e-gate USB Smart Card driver, on Windows 2000, the operating system finds and installs the driver automatically. On Windows XP, the operating system launches the Found New Hardware wizard and prompts the user to confirm that the unsigned driver it found should be installed. The user should select the option to let Windows search for a suitable driver (which installs the unsigned driver already found).

If Windows does not find a driver, the Found New Hardware wizard prompts the user to identify the location of the driver file. See “Installing e-gate USB Smart Card Drivers” on page 15 for instructions.

Updating Signed Drivers

General Discussion

Update from older signed driver to newer signed driver

The criteria for driver selection (see “Driver Selection Criteria by Operating System” on page 19) favor a newer signed driver over an older signed driver. When a signed driver for a device is updated, a newer signed driver is automatically selected over an older signed driver.

Update from signed driver to unsigned driver

The criteria for driver selection also favor any signed driver over any unsigned driver. If a user wants to replace an older signed driver with a newer unsigned driver, Windows’ preference must be overridden.

In addition, depending on driver signing options established by local system security policy (Control Panel > System Properties > Hardware > Driver Signing...), driver installation might either silently allow, display a warning message, or block the installation of drivers without corresponding signatures (“unsigned drivers”).

If driver signing options allow unsigned drivers, one way to override Windows’ preference is to remove from the computer the *.inf* and *.pnf* files associated with the previously-installed driver. If Windows does not find these files during update, it is not aware that signed drivers were previously installed, and so its disinclination to install unsigned drivers over signed drivers is not challenged. See “Remove appropriate *.inf* and *.pnf* files” on page 7 for an example of how to use this mechanism.

If driver signing options allow unsigned drivers, another way to override Windows’ preference for signed drivers is to manually update a device’s driver or drivers, using the Update Wizard to point to the correct driver, even if that driver is unsigned. See “Manually update drivers” on page 8 for a specific example of how to use this mechanism.

e-gate USB Smart Card Drivers

Update from signed driver to unsigned driver

The examples presented here illustrate “forcing” Windows to accept configuration of an e-gate USB Smart Card to use a newer unsigned driver instead of an older signed driver, if driver signing options allow unsigned drivers. Two solutions are presented:

- “Remove appropriate .inf and .pnf files”
- “Manually update drivers”

Remove appropriate .inf and .pnf files

If driver signing options allow unsigned drivers, here is the specific procedure to overcome Windows’ reluctance to install unsigned drivers over installed signed drivers by removing the .inf and .pnf files associated with signed e-gate USB Smart Card drivers (note that this procedure is adapted for other devices by searching the .inf files until the relevant device is identified):

- 1 In the \$WINDOWS\Inf directory¹, find the *oem*.inf* files (for example, *oem1.inf*). These are information setup files for all devices installed on the computer after system setup.
- 2 You need to identify all *oem*.inf* files that correspond to e-gate USB devices. Open each *oem*.inf* file in the \$WINDOWS\Inf¹ directory (open the file in a text editor); the e-gate USB device *oem*.inf* files include one of the following references at the top of the file: *egate.inf*, *egatebus.inf*, *egaterdr.inf*, or *egateraw.inf*.
- 3 Remove each *oem*.inf* file (for example, *oem1.inf*) that contains an e-gate reference listed in the previous step.
- 4 Remove the corresponding .pnf file for each .inf file you identified (for example, *oem1.pnf*). Note that while the .inf files are readable using a text editor, .pnf files are not readable; you must select the .pnf file to remove based on the file name.

After the files have been removed, run Update Driver for the e-gate USB Smart Card device and point to the location of the drivers you want to install. See “Updating e-gate USB Smart Card Drivers” on page 16 for instructions.

NOTE *Do not remove any .inf and .pnf files that do not contain e-gate references.*

1. \$WINDOWS is the root Windows directory on the system; on a Windows 2000 system, the default root Windows directory is C:\WINNT, so the .inf and .pnf files are located in the C:\WINNT\Inf directory.

Manually update drivers

If driver signing options allow unsigned drivers, you can also override Windows' preference to use a signed driver if you manually update the drivers on the system.

These are the steps to manually update the e-gate drivers. (Note that in the case of e-gate USB Smart Card, this procedure is complicated by the fact that e-gate USB Smart Card uses an interdependent system of drivers; most devices have only one driver to update.)

You will perform steps 1-4 for *each* e-gate driver on the system. DO NOT reboot until ALL drivers have been updated.

Drivers must be updated in the following order:

- a e-gate USB Smart card readers. These devices are listed under the Smart card readers device type. Update *each* e-gate USB Smart card reader device.**
- b e-gate Virtual Reader Enumerator. There is always exactly one of this device, listed under the e-gate Virtual Reader Enumerators device type. Update the single Virtual Reader Enumerator.**
- c e-gate USB Smart Card. When you are ready to update the e-gate USB Smart Card devices, ensure that an e-gate USB smart card is inserted into each configured e-gate USB connector if you are using a desktop connector, or that all e-gate tokens are inserted into USB slots. A corresponding number of e-gate USB Smart Card devices are listed under the e-gate USB Smart Cards device type. Update *each* e-gate USB Smart Card device.**

You have the option to update the e-gate USB Smart Card devices by connecting or inserting *one* e-gate USB Smart Card and updating its driver, and then connecting or inserting the next e-gate USB Smart Card and updating its driver, etc. Although it is possible to step through the update this way, we recommend that you connect or attach *all* e-gate USB Smart Cards before you update the e-gate USB drivers.

- 1** In the Device Manager, expand the device type (e.g., Smart card readers), and then double-click one of the devices listed (e.g., e-gate USB Smart card reader) to open its Properties. In the device's Properties, click the **Driver** tab, and then click the **Update Driver...** button.
 - 2** The Update Device Manager (on a Windows 2000 system) or Hardware Update wizard (on a Windows XP system) is launched and guides you through the process of locating the new drivers:
 - a** On Windows 2000, in the Update Device Driver wizard, select "Display a list of the known drivers for this device so that I can choose a specific driver."
 - b** On Windows XP, in the Hardware Update wizard, select "Install from list or specific location (Advanced)," click **Next**, and then click "Don't search. I will choose the driver to install."
 - 3** In the Select a device driver screen, click **Have Disk ...**, and then navigate to the directory into which you extracted the downloaded driver files.
 - 4** At the conclusion of the update, you will be prompted to reboot the computer. **DO NOT** reboot until **ALL** drivers have been updated.
- Repeat steps 1-4 for *each* e-gate driver on the system.**
- 5** After *all* drivers have been updated, reboot the computer.

Manually updating drivers is the most likely scenario to result in drivers on the system being left in an inconsistent state, which requires a specific recovery procedure. See "Recovering from Inconsistent Driver State" on page 14.

Updating Unsigned Drivers

General Discussion

Update from unsigned driver to signed driver

The criteria for driver selection (see “Driver Selection Criteria by Operating System” on page 19) favor any signed driver over any unsigned driver. Use the standard Update Driver feature in the Device Manager to update the drivers.

Update from older unsigned driver to newer unsigned driver

The criteria for driver selection on Windows 2000 and Windows XP pre-SP1 ignore both the date and the driver version when drivers are unsigned. This can cause unanticipated results when older unsigned drivers are updated to newer unsigned drivers. A sequence to work around this situation is presented in “Windows 2000 and XP (pre-SP1) unsigned drivers to unsigned drivers update” on page 10.

On Windows XP SP1, the date is ignored when drivers are unsigned, but the driver version number is used as a selection criterion, so update from older unsigned drivers to newer unsigned drivers is successful. Use the standard Update Driver feature in the Device Manager to update the drivers.

Depending on driver signing options established by local system security policy (Control Panel > System Properties > Hardware > Driver Signing...), driver installation might either silently allow, display a warning message, or block the installation of drivers without corresponding signatures (“unsigned drivers”).

e-gate USB Smart Card Drivers

Update of unsigned e-gate USB Smart Card drivers works as described in the General Discussion section. See “Updating e-gate USB Smart Card Drivers” on page 16 for instructions.

Windows 2000 and XP (pre-SP1) unsigned drivers to unsigned drivers update

On Windows 2000 and Windows XP pre-SP1 (but not on Windows XP SP1) systems, Windows sometimes selects older unsigned drivers over newer unsigned drivers. This happens because on these platforms, the date and the driver version number associated with unsigned drivers are ignored during the ranking process (see “Driver Selection Criteria by Operating System” on page 19 for details).

To avoid this situation, before updating unsigned drivers with newer unsigned drivers, remove the *.inf* and *.pnf* files for the older drivers before you begin the update. Instructions about identifying and removing the appropriate *.inf* and *.pnf* files are in “Remove appropriate .inf and .pnf files” on page 7.

If you attempt to update without first removing the *.inf* and *.pnf* files for the older drivers, the remedy is to update *each* e-gate driver manually. Instructions about manually updating the e-gate drivers are in “Manually update drivers” on page 8.

This scenario can result in different driver versions for the interdependent e-gate USB Smart Card drivers on the system, which requires specific recovery procedures. See “Recovering from Inconsistent Driver State” on page 14.

Downgrading Drivers

In effect, downgrade is a variation of update in which the “older to newer” paradigm is reversed.

Windows XP: Downgrade drivers

Windows XP offers a feature to roll back to the previous driver version. This feature configures the device to use the previous driver version (n-1); if rollback is then invoked a second time, the device is reconfigured to use the pre-rollback version of the drivers again (n).

These are the steps to roll back the e-gate drivers.

You will roll back *each* e-gate driver on the system. DO NOT reboot until ALL drivers have been rolled back.

Drivers must be rolled back in the following order:

- a e-gate USB Smart card readers. These devices are listed under the Smart card readers device type. Roll back *each* e-gate USB Smart card reader device.**
- b e-gate Virtual Reader Enumerator. There is always exactly one of this device, listed under the e-gate Virtual Reader Enumerators device type. Roll back the single Virtual Reader Enumerator.**
- c e-gate USB Smart Cards. When you are ready to roll back the e-gate USB Smart Card devices, ensure that an e-gate USB smart card is inserted into each configured e-gate USB connector if you are using a desktop connector, or that all e-gate tokens are inserted into USB slots. A corresponding number of e-gate USB Smart Card devices are listed under the e-gate USB Smart Cards device type. Roll back *each* e-gate USB Smart Card device.**

You have the option to roll back the e-gate USB Smart Card devices by connecting or inserting *one* e-gate USB Smart Card and rolling back its driver, and then connecting or inserting the next e-gate USB Smart Card and rolling back its driver, etc. Although it is possible to step through the roll back this way, we recommend that you connect or attach *all* e-gate USB Smart Cards before you roll back the e-gate USB drivers.

- 1 In the Device Manager, expand the device type (e.g., Smart card readers), and then double-click one of the devices listed (e.g., e-gate USB Smart card reader) to open its Properties. In the device's Properties, click the **Driver** tab, and then click the **Roll Back Driver** button.
- 2 You might be prompted to reboot the computer after rolling back the driver. **DO NOT** reboot until **ALL** drivers have been rolled back.

Repeat for *each* e-gate driver on the system.

- 3 After *all* drivers have been rolled back, reboot the computer.

**Windows 2000:
Downgrade from
unsigned driver to
signed driver**

The criteria for driver selection favor any signed driver over any unsigned driver. Use the standard Update Driver feature in the Device Manager to update the driver. See "Updating e-gate USB Smart Card Drivers" on page 16 for instructions.

**Windows 2000:
Downgrade from
signed to unsigned;
from newer signed
to older signed; from
newer unsigned to
older unsigned**

The criteria for driver selection favor any signed driver over any unsigned driver; a newer signed driver over an older signed driver; and a newer unsigned driver over an older unsigned driver (except on Windows 2000 and XP pre-SP1, which ignores the date for unsigned drivers). If a user wants to use a driver that does not conform to those criteria, Windows' preference must be overridden.

Follow the instructions in "Remove appropriate .inf and .pnf files" on page 7 to remove the files that identify the driver you want to replace, and then use the standard Update Driver feature in the Device Manager to update the drivers. See "Updating e-gate USB Smart Card Drivers" on page 16 for details.

Recovering from Inconsistent Driver State

If at any time the e-gate drivers do not “match” (that is, different driver versions are configured for the interdependent e-gate drivers), system failure might result, and you might not be able to restart the computer.

These are the steps to recover from this situation:

- 1 Detach all e-gate USB Smart Cards, and restart the computer.
- 2 In the Device Manager, expand the Smart card readers device type, right-click the first e-gate USB Smart card reader device, and select **Uninstall** from the context-sensitive menu. Repeat for each e-gate USB Smart card reader device.
- 3 In the Device Manager, expand the e-gate Virtual Reader Enumerators device type, right-click the e-gate Virtual Reader Enumerator device, and select **Uninstall** from the context-sensitive menu.

NOTE *Because all e-gate USB Smart Cards have been detached from the computer, there are no e-gate USB Smart Card devices to uninstall.*

- 4 Remove the appropriate *.inf* and *.pnf* files, as described in “Remove appropriate *.inf* and *.pnf* files” on page 7.
- 5 Reattach the e-gate USB Smart Cards. Windows will find the new devices and guide you through the process of locating the new drivers.
 - a On Windows 2000, in the Update Device Driver wizard, select “Display a list of the known drivers for this device so that I can choose a specific driver.”
 - b On Windows XP, in the Hardware Update wizard, select “Install from list or specific location (Advanced),” click **Next**, and then click “Don't search. I will choose the driver to install.”
- 6 In the Select a device driver screen, click **Have Disk ...**, and then navigate to the directory into which you extracted the downloaded driver files.

The e-gate USB Smart Card is ready to use without rebooting the system.

Driver Version Identification

Follow these steps to reliably identify driver version numbers:

- 1 In the Device Manager, expand the device type that includes the device whose driver version number you want to check, and then double-click the name of the device to open its Properties. For example, to check the version number of the e-gate USB Smart card reader driver, expand the Smart card readers device type, and then double-click **e-gate USB Smart card reader**.
- 2 In the device's Properties, click the **Driver** tab, and then click the **Driver Details...** button.
- 3 The File version number displayed in the Driver File Details dialog correctly describes the current driver.

NOTE *The Driver Version information displayed in the Driver tab is not reliable.*

Installing e-gate USB Smart Card Drivers

- 1 Download and extract the driver package in any available space on the computer (for example, in a \downloads directory).
- 2 Plug in an e-gate USB Smart Card connector, and attach an e-gate USB Smart Card.
- 3 The Found New Hardware wizard launches as soon as you attach the e-gate USB Smart Card. The wizard guides you through the process of locating the e-gate USB Smart Card drivers:
 - a On Windows 2000, select "Display a list of the known drivers for this device so that I can choose a specific driver." On Windows XP, select "Don't search. I will choose the driver to install."
 - b In the Select a device driver screen, click **Have Disk ...**, and then navigate to the directory into which you extracted the downloaded driver files. The wizard uses information contained in the *egate.inf* file to install all the e-gate driver files.

The e-gate USB Smart Card is ready to use without rebooting the system.

Updating e-gate USB Smart Card Drivers

- 1 Ensure that an e-gate USB smart card is inserted into each configured e-gate USB connector if you are using a desktop connector, or that all e-gate tokens are inserted into USB slots.
- 2 In the Device Manager, expand the e-gate USB Smart Cards device type, and then double-click the e-gate USB Smart Card device listed to open its Properties. (If more than one device is listed, double-click any one of the e-gate USB Smart Card devices.) In the device's Properties, click the **Driver** tab, and then click the **Update Driver...** button.
- 3 The Upgrade Device Manager (on a Windows 2000 system) or Hardware Update wizard (on a Windows XP system) is launched and guides you through the process of locating the new e-gate USB Smart Card drivers:
 - a On Windows 2000, in the Upgrade Device Driver wizard, select "Display a list of the known drivers for this device so that I can choose a specific driver." On Windows XP, in the Hardware Update wizard, select "Install from list or specific location (Advanced)," click **Next**, and then click "Don't search. I will choose the driver to install."
 - b In the Select a device driver screen, click **Have Disk ...**, and then navigate to the directory into which you extracted the downloaded driver files. The wizard uses information contained in the *egate.inf* file to update the e-gate driver files.

At the conclusion of the upgrade, you will be prompted to reboot the system.

Uninstalling e-gate USB Smart Card Drivers

- 1 Detach all e-gate USB Smart Cards, and restart the computer.
- 2 In the Device Manager, expand the Smart card readers device type, right-click the first e-gate USB Smart card reader device, and select **Uninstall** from the context-sensitive menu. Repeat for each e-gate USB Smart card reader device.
- 3 In the Device Manager, expand the e-gate Virtual Reader Enumerators device type, right-click the e-gate Virtual Reader Enumerator device, and select **Uninstall** from the context-sensitive menu.

NOTE *Because all e-gate USB Smart Cards have been detached from the computer, there are no e-gate USB Smart Card devices to uninstall.*

- 4 At this point, the drivers have been removed from the computer. If you will be installing new unsigned e-gate USB Smart Card drivers, we recommend that you also remove the appropriate *.inf* and *.pnf* files, as described in “Remove appropriate *.inf* and *.pnf* files” on page 7.

The uninstall steps remove all knowledge of the devices from the plug-and-play system; however, they do not return the computer to the same state as before the install.

Windows Update and e-gate USB Smart Card Drivers

A Windows Update can include signed device drivers, as well as general operating system updates, fixes, and enhancements.

If you already have e-gate USB Smart Card drivers installed, but want to update to signed drivers contained in a Windows Update, *before beginning the update*, ensure that an e-gate USB smart card is inserted into each configured e-gate USB connector if you are using a desktop connector, or that all e-gate tokens are inserted into USB slots. Only connected devices will be updated during Windows Update.

If Windows Update installs new e-gate USB smart card driver files, and some or all e-gate USB Smart Cards (or tokens) were not attached to the computer when the Windows Update occurred, you must initiate an update in order for these e-gate USB devices to use the new drivers:

- 1 After the new drivers are installed on the computer, attach an e-gate USB Smart Card, and start a manual update. In the Device Manager, expand the e-gate USB Smart Cards device type, and then double-click the e-gate USB Smart Card device listed to open its Properties. (If more than one device is listed, double-click any one of the e-gate USB Smart Card devices.)
- 2 In the device's Properties, click the **Driver** tab, and then click the **Update Driver...** button.
- 3 The operating system will search for and find the new, signed driver added during Windows Update, and installation will be automatic.

Appendix A: How Windows Selects Drivers

These events trigger the Windows 2000 and Windows XP operating systems to choose the “best” available driver for a device:

- A new device is installed on the computer.
- A user begins the standard procedure to update a device driver.
- Operating system updates are installed, making new drivers available on the computer.

To identify the best driver, Windows compares the device’s hardware IDs and compatible IDs (as reported by the device’s parent bus driver) to the hardware IDs and compatible IDs listed in the *.inf* files associated with available drivers on the system.

Windows assigns a rank indicating its degree of confidence in the match to each driver identified as potentially usable. The lower the rank, the stronger Windows’ confidence that the driver is the best match for the device. Trusted (signed) driver packages are assigned lower rank numbers than untrusted (unsigned) packages, and an exact match between a device’s hardware ID and the hardware ID in the *.inf* file for a signed driver (a “hardware ID match”) is identified as the best match of all.

If Windows tries to find a driver for a device added to the system and it cannot detect *any* potential matches (neither the hardware IDs nor the compatible IDs for the device match those in the available *.inf* files), the Found New Hardware wizard is launched, and the wizard prompts the user to identify a driver for the device.

If the user initiates a driver search (e.g., using the Device Manager’s Driver Update feature), Windows starts the wizard if it cannot identify a driver that is a very strong match (i.e., a signed driver with matching hardware IDs), giving the user the opportunity to identify a driver for the device.

In addition to comparing rank numbers for different potential drivers, the operating system considers other specific factors in selecting the best driver. These are the specific criteria that specific versions of the operating systems use to select a driver for a device:

Operating System	Criteria
Windows 2000 Windows XP (pre-SP1)	Selects the driver with the lowest rank number. If drivers have the same rank number and the driver package is signed, selects the driver with the most recent date. If the driver package is unsigned, driver selection is undefined; the operating system sets the date to 00/00/0000, which means that the date is ignored as a criterion for selection. Version number is not considered as a criterion.
Windows XP SP1	Selects the driver with the lowest rank number. If drivers have the same rank number and the driver package is signed, selects the driver with the most recent date. If the driver package is unsigned, sets the date to 00/00/0000, which means that the date of unsigned driver packages is ignored as a criterion for selection. If drivers have the same rank number and date (including 00/00/0000), selects the driver with the highest version number.

Table 4: Driver Selection Criteria by Operating System

Appendix B: Driver Files

After a driver for a device has been selected (either by Windows' evaluation and selection process, or by the user's Found New Hardware wizard selection), Windows driver package files are copied to locations on the system defined in the *.inf* file in the driver package:

- **.sys* files are copied to the \$WINDOWS\System32\Drivers directory¹
- **.dll* files are copied to the \$WINDOWS\System32 directory¹.
- **.inf* files are copied to the \$WINDOWS\Inf directory¹ and renamed to *oem*.inf*. A corresponding *oem*.pnf* is also created. Here are details about these *.inf* and *.pnf* files.

File	Description
<i>oem*.inf</i>	Copy of each <i>.inf</i> file in the device driver package (e.g., <i>egate.inf</i>), named as described below; contains setup information for the device, including the location of the driver files, in readable format.
<i>oem*.pnf</i>	Contains additional setup information for the device in a pre-compiled, non-readable format.

Table 5: Driver Node *.inf* and *.pnf* Files

The \$WINDOWS\Inf directory¹ contains an *.inf* and *.pnf* file for each device installed on the computer after system setup. The *.inf* and *.pnf* filenames are sequentially numbered; for example, the files for the first installed device are named *oem0.inf* and *oem0.pnf*. Existing *.inf* and *.pnf* files are never removed by the system, even if a device is uninstalled, but they can be manually removed by a user. If existing *.inf* and *.pnf* files are manually removed, the sequence numbers are re-used by the next device installed. This ensures that the file names are unique, but the number contained in the file names does not necessarily reflect the order in which devices were installed.

1. \$WINDOWS is the root Windows directory on the system; on a Windows 2000 system, the default root Windows directory is C:\WINNT, so the *.sys* files are copied to the C:\WINNT\System32\Drivers directory; the *.dll* files are copied to the C:\WINNT\System32 directory, and the *.inf* files and copied to the C:\WINNT\Inf directory.

Files copied to the \$WINDOWS\System32\Drivers, \$WINDOWS\System32, and \$WINDOWS\Inf directories¹ are never removed by the system, even when a device is uninstalled.

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1. \$WINDOWS is the root Windows directory on the system; on a Windows 2000 system, the default root Windows directory is C:\WINNT, so the *.sys* files are copied to the C:\WINNT\System32\Drivers directory; the *.dll* files are copied to the C:\WINNT\System32 directory, and the *.inf* files are copied to the C:\WINNT\Inf directory.