- 1. 3. 1. Hardware -

Adding, configuring, and removing hardware devices

Since its introduction in Windows 95, Plug and Play technology has evolved tremendously.

Early incarnations of this technology were notoriously unreliable, leading some users to dismiss the feature as “plug and pray.”

As this now-mature technology enters its third decade, however, hardware and software standards have converged to make most device configuration tasks completely automatic.

Any computer that was certified as compatible with Windows 7 or later supports the Plug and Play device standard, which handles virtually all the work of configuring computer hardware and attached devices.

A Plug and Play device identifies itself to Windows by using unique identifiers in a well-organized hierarchy, listing its required resources (including drivers), and allowing software to configure it.

Plug and Play devices can interact with the operating system, with both sides of the conversation responding to device notification and power management events.

A Plug and Play driver can load automatically when Windows detects that a device has been plugged in, and it can suspend its operations when the system sleeps and resume without issue when the system wakes.

Installing a new Plug and Play device

When you install a Plug and Play device for the first time, Windows reads the Plug and Play identification tag in the hardware’s BIOS or firmware.

It then compares that ID tag with a master list of corresponding tags drawn from all the Setup Information files in the %SystemRoot%\Inf folder.

If it finds a signed driver with a matching tag, it installs that driver package and makes other necessary system modifications with no intervention required from you.

If everything goes as expected, the only subtle indication you might see is a progress dialog box (typically minimized) that displays a green bar over its taskbar icon and then vanishes when its work is complete.

Any user can plug in a new device and begin using it if a driver for that device is included with Windows 10 or is available via Windows Update.

Installing a new driver that is downloaded from a third-party site and is digitally signed by a third party rather than by Microsoft requires an administrator's credentials.

If Windows detects a Plug and Play device (after you've plugged it into a USB port, for instance) but cannot locate a digitally signed driver that matches the device, it doesn't provide any warning notification.

Instead, a stub for the device is installed as it awaits the arrival of a proper driver.

These partially installed devices appear in Device Manager, under the Other Devices heading, with a yellow exclamation point over the device name, as in the next image:

When Windows Update can't find a signed driver (and, thankfully, those occasions are becoming rarer as the Windows ecosystem matures), you need to manually install a device driver.

The built-in Windows drivers are perfectly adequate for many device classes.

Some devices, especially complex ones like scanners and all-in-one printers, might require utility software and additional drivers to enable the full range of features for that device.

How device drivers and hardware work together

Before Windows can work with any piece of hardware, it requires a compatible, properly configured device driver.

Drivers are compact control programs that hook directly into Windows and handle the essential tasks of communicating your instructions to a hardware device and then relaying data back to you.

After you set up a hardware device, its driver loads automatically and runs as part of the operating system, without requiring any further intervention on your part.

Many individual technologies used in Windows 10 devices use minidriver models, where the device driver is made up of two parts.

Typically, Microsoft writes a general class driver that handles tasks that are common to devices in that category.

The device manufacturer can then write device-specific code to enable custom features.

Windows 10, even more than its recent predecessors, includes a surprisingly comprehensive library of class drivers that allow most devices to function properly without requiring any additional software.

There are class drivers for pieces of hardware that are, these days, typically integrated into a larger system: audio devices, network adapters, webcams, and display adapters, for example.

Windows 10 also includes drivers for external add-ons (wired and wireless) including printers, monitors, keyboards, scanners, mice and other pointing devices, smartphones, and removable storage devices.

You can add new drivers to the driver store in a variety of ways, including the following:

- Windows Update offers drivers when it detects that you're running a device that's compatible with that driver but is currently using an older version. You can also search for the most recent driver via Windows Update when installing a new device.
- A Windows quality or feature update can refresh the driver store with new and updated drivers.
- As an administrator, you can add signed third-party drivers to the driver store by running an installer program.

Any driver that has been added to the store is considered to be trusted and can be installed without prompts or administrator credentials.

All drivers, new or updated, that are downloaded from the Windows Update service are certified to be fully compatible with Windows 10 and are digitally signed by Microsoft.

A Windows hardware driver package must include a Setup Information file (with the extension .inf).

This is a text file that contains detailed information about the device to be installed, including the names of its driver files, the locations where they are to be installed, any required registry settings, and version information.

All devices with drivers in the DriverStore folder include Setup Information files in the %SystemRoot%\Inf folder.

Although the Setup Information file is a crucial part of the driver installation process, you don't work with it directly.

Instead, this file supplies instructions that the operating system uses during Plug and Play detection, when you use a setup program to install a device or when you manually install a driver update.

When Windows completes the installation of a driver package, it performs all the tasks specified by the Setup Information file and copies the driver files themselves to %SystemRoot%\System32\Drivers.

Getting useful information from Device Manager

The more you know about individual hardware devices and their associated driver versions, the more likely you are to make short work of troubleshooting problems or configuring advanced features for a device.

In every case, your starting point is Device Manager, a graphical utility that provides detailed information about all installed hardware, along with controls you can use to conFigure devices, assign resources, and set advanced options."

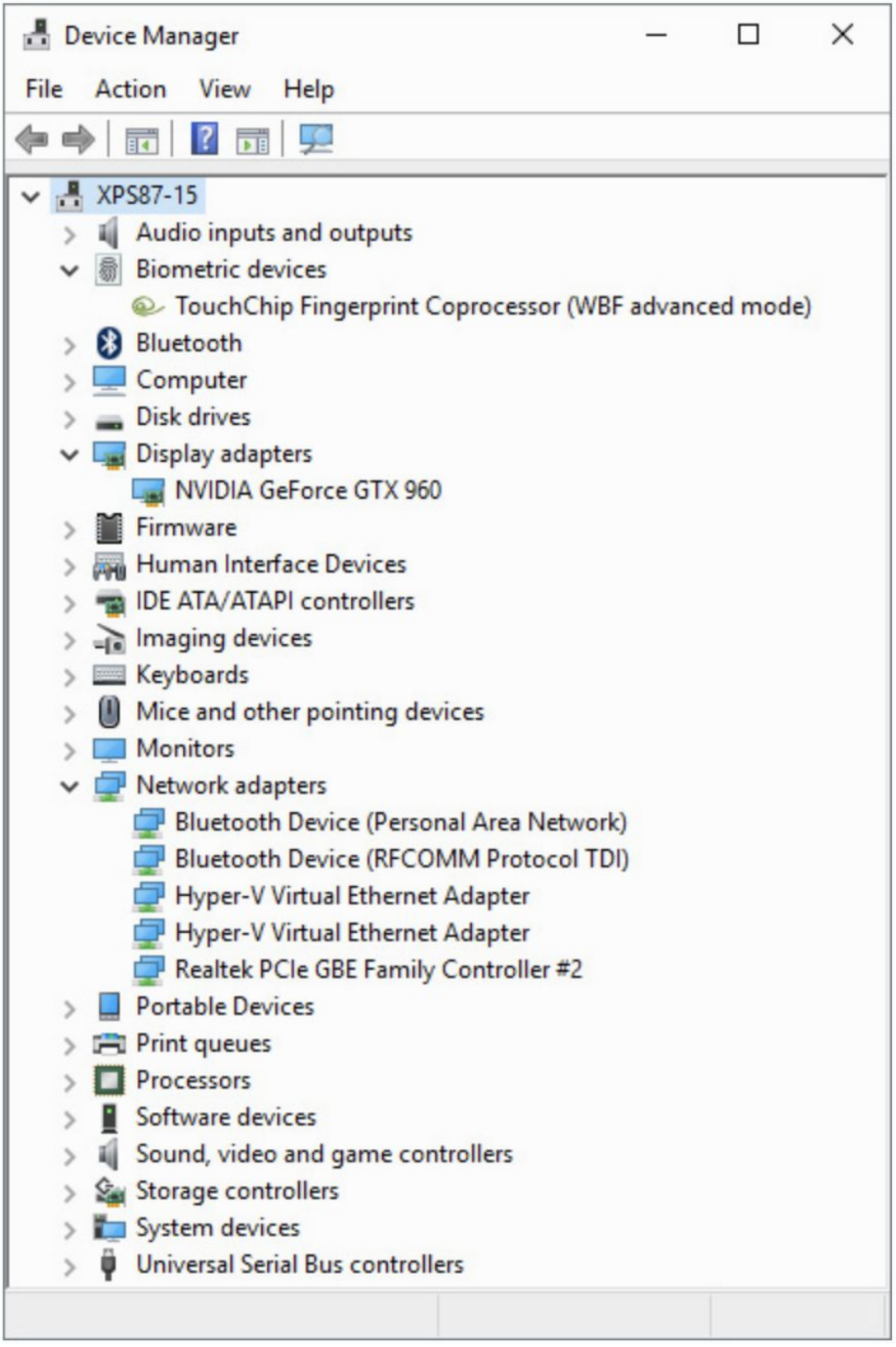
The easiest way to open Device Manager (Devmgmt.msc) is to right-click the Start button (or press Windows key+X) and then click the Device Manager shortcut on the Quick Link menu.

Alternatively, type device in the search box and then click the Device Manager entry from the top of the results list.

Device Manager is also available as a snap-in under the System Tools heading in the fully stocked Computer Management console.

As the next picture shows, Device Manager is organized as a hierarchical list that inventories every piece of hardware within or connected to your computer.

The default view shows devices by type.

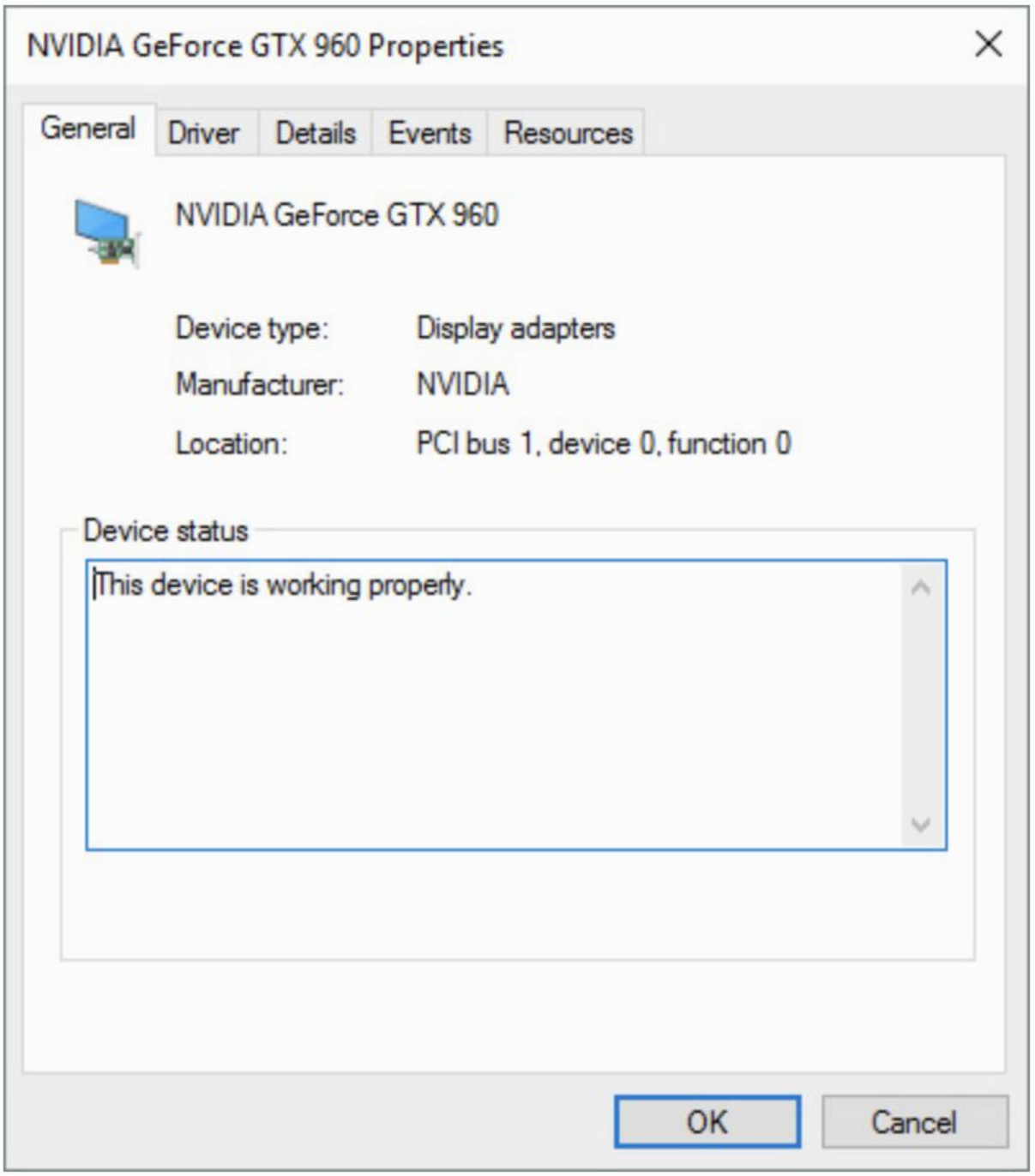


To view information about a specific device, double-click its entry in Device Manager's list of installed devices.

Each device has its own multitabbed properties dialog box.

Most hardware devices include a selection of tabs, including General and Driver.

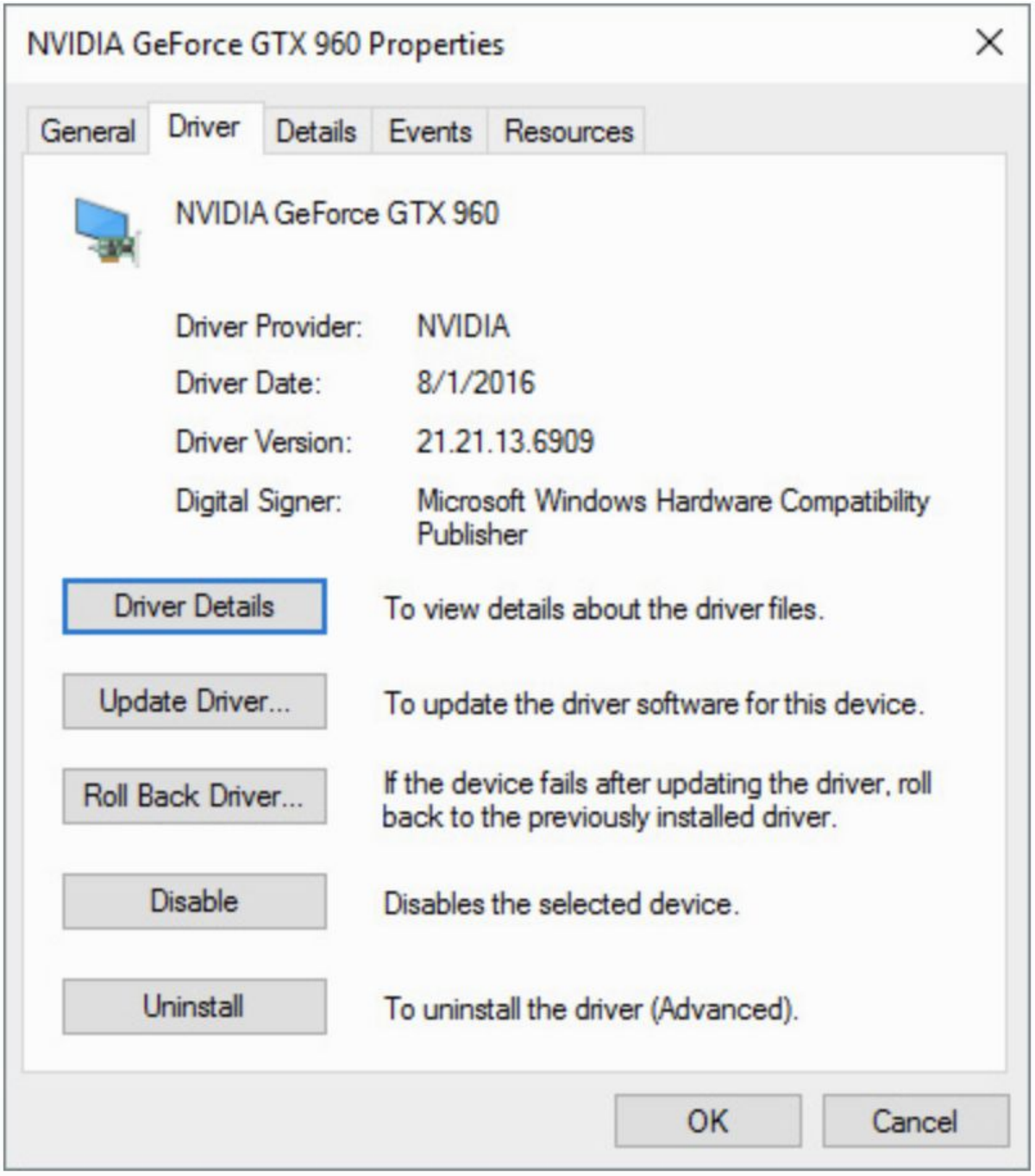
The General tab lists basic facts about the device, including the device name and type, the name of its manufacturer, and its current status, as in the example in the next figure:



The Driver tab, shown in the next image, lists version information about the currently installed driver for the selected device.

Although the information shown here is sparse, it covers the essentials.

You can tell at a glance who supplied the driver, and you can see who digitally signed it; you can also determine the date and version number of the driver, which is important when considering whether you should download and install an available update.



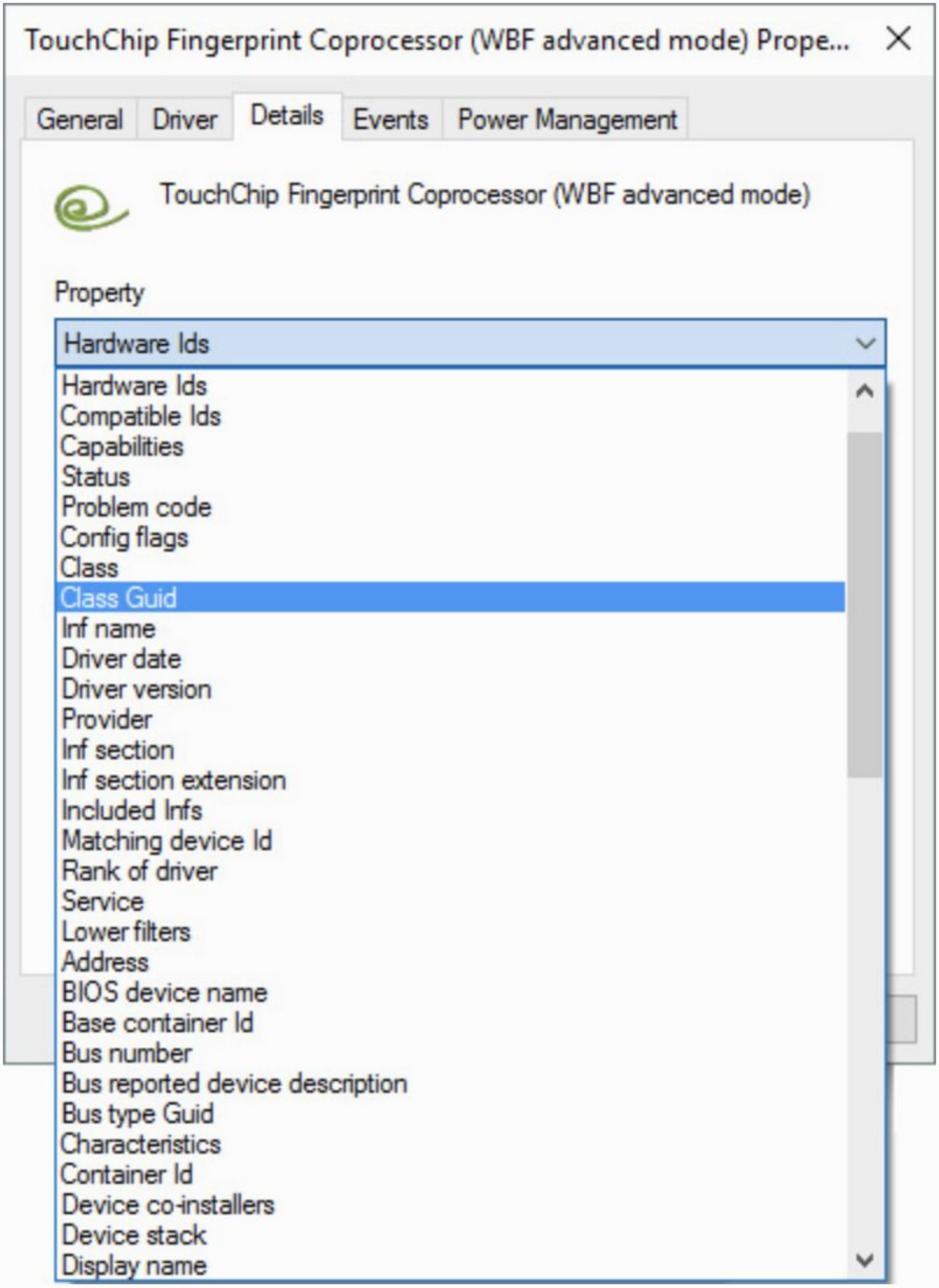
Clicking the Driver Details button on the Driver tab leads to another dialog box that lists the names and locations of all files associated with that device and its drivers.

Selecting any file name from this list displays details for that file in the lower portion of the dialog box.

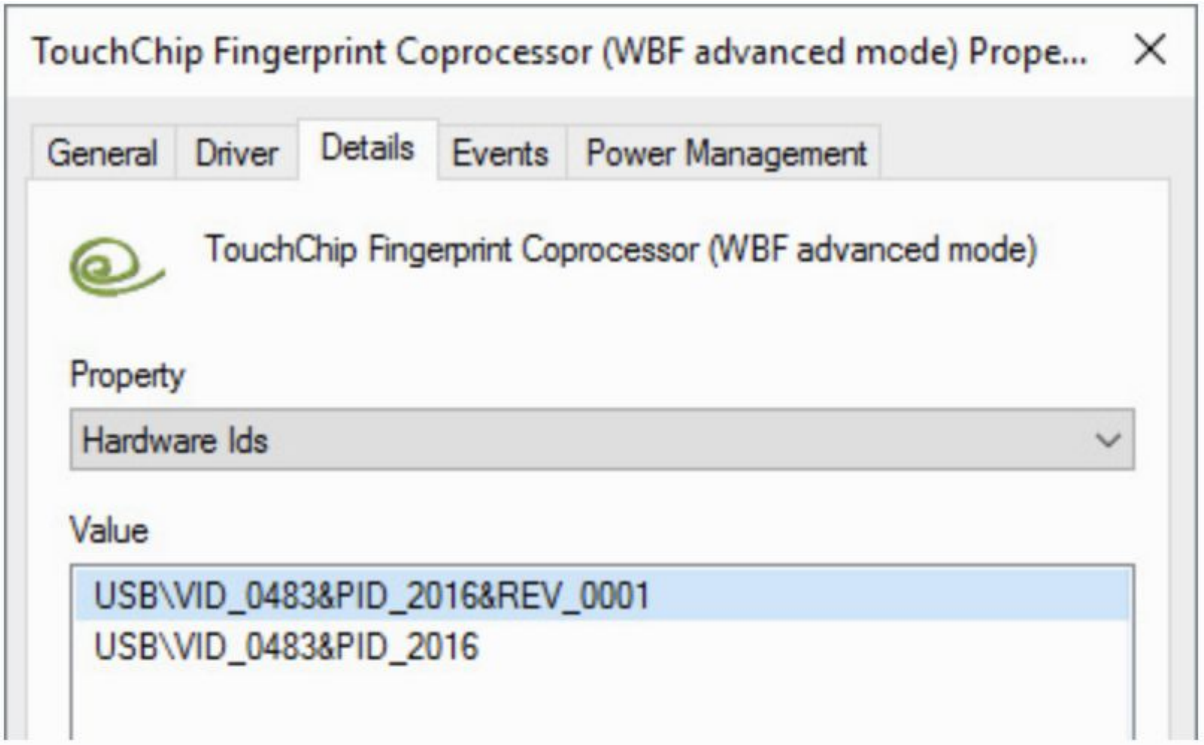
Click the Details tab for a potentially overwhelming amount of additional information, arranged in a dialog box in which you can see one property and its associated value at a time.

You can see the full list of properties by clicking the arrow to the right of the current entry in the Property box.

The next figure shows the typically dense result:

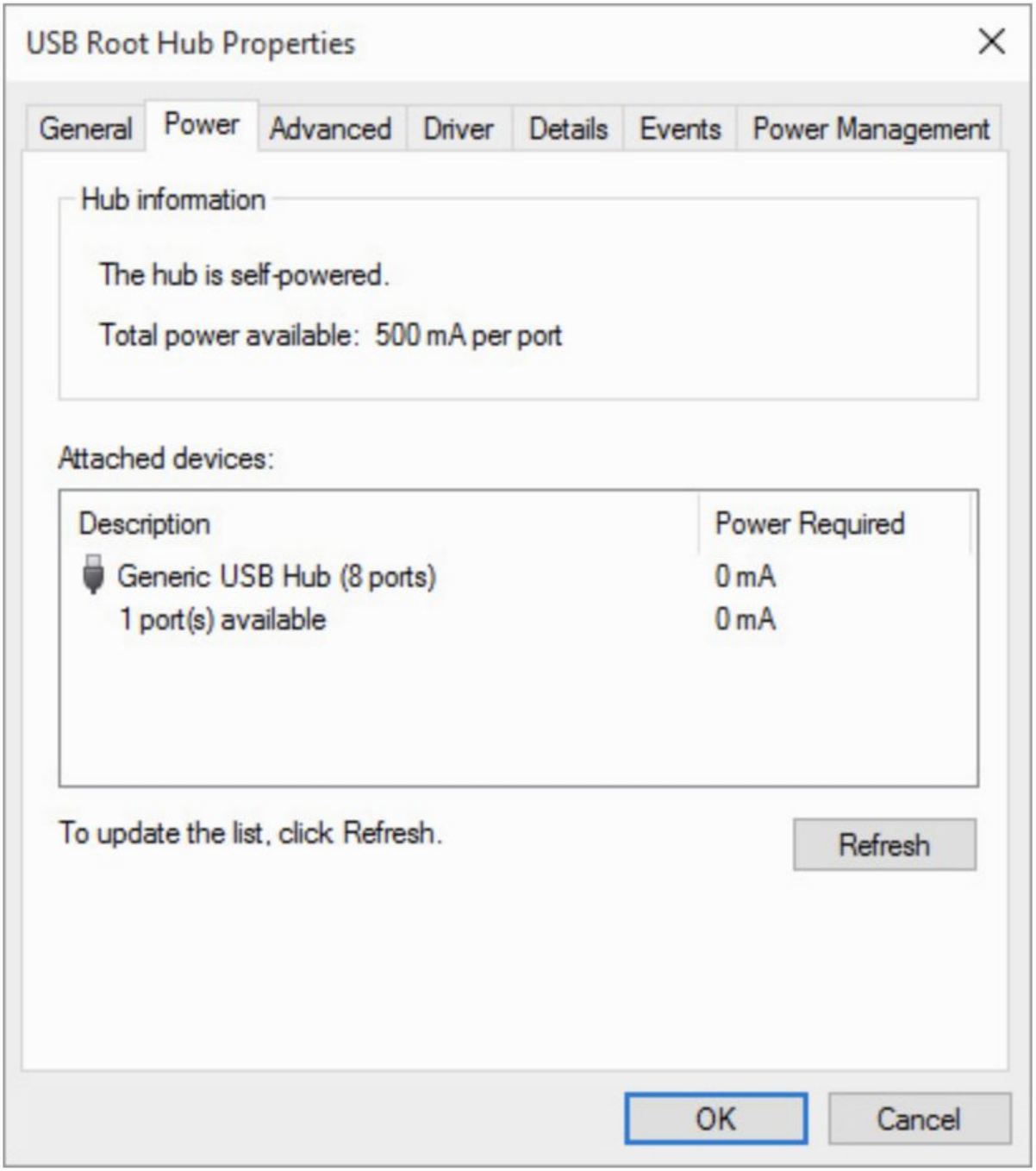


Choosing a property tucks the list away and displays the value associated with that property, as in the example shown here, which lists the Plug and Play IDs associated with the selected device:



In addition to this basic information, the properties dialog box for a given device can include any number of custom tabs.

The USB hub built into the motherboard of the PC shown in the next picture, for example, adds a custom tab (Power) that you can use to view how much power is available for devices connected to ports on a particular USB hub:



By design, the information displayed in Device Manager is dynamic.

When you add, remove, or reconfigure a device, the information stored here changes as well.

Enabling and disabling devices

Any device listed in Device Manager can be disabled temporarily.

You might choose this option if you're certain you won't need an installed device under normal conditions but you want to keep it available just in case.

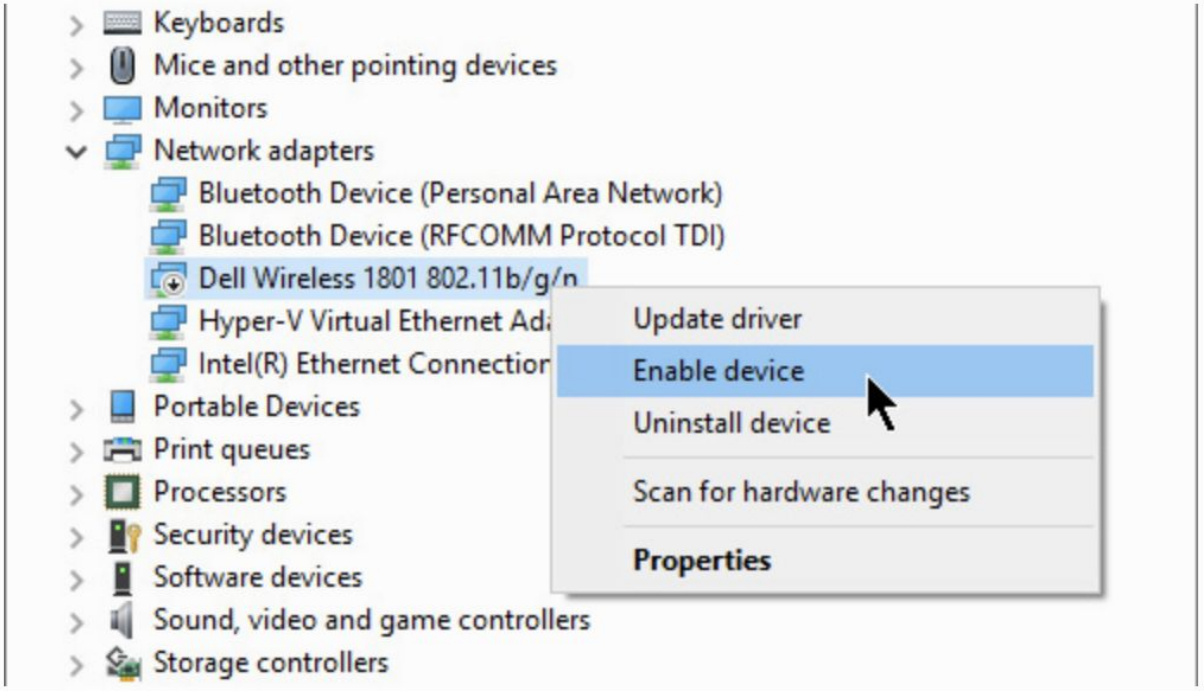
On a desktop PC with a permanent wired Ethernet connection, for example, you can keep a Wi-Fi adapter installed but disabled.

That configuration gives you the option to enable the device and use the wireless adapter to connect to a mobile hotspot when the wired network goes out of service.

Right-click any active entry in Device Manager to see a shortcut menu with a Disable command.

To identify any device that's currently disabled, look for the black, downward-pointing arrow over its icon in Device Manager, as shown here.

To turn a disabled device back on, right-click its entry in Device Manager and then click Enable Device.



Updating and uninstalling drivers

If you're having a hardware problem that you suspect is caused by a device driver, your first stop should be Device Manager.

Open the properties dialog box for the device, and use the following buttons on the Driver tab to perform maintenance tasks:

- Update Driver. This choice opens the Update Driver Software dialog box.
- Roll Back Driver. This option uninstalls the most recently updated driver and rolls back your system configuration to the previously installed driver. This

option is available from Safe Mode if you need to remove a driver that's causing blue-screen (Stop) errors. Unlike System Restore, this option affects only the selected device. If you have never updated the selected driver, this option is unavailable.

- Uninstall. This button completely removes driver files and registry settings for the selected device and, if you select the appropriate option, completely removes the associated driver files as well. Use this capability to remove a driver that you suspect was incorrectly installed and then reinstall the original driver or install an updated driver.

Microsoft uses the Windows Update mechanism to deliver drivers for many devices.

Using this feature, you can plug in a new device with relative confidence it will work without extra effort on your part.

You also can use it to automatically receive updated drivers, which typically fix reliability, stability, and compatibility problems.

Updating a device driver manually

Microsoft and third-party device manufacturers frequently issue upgrades to device drivers.

In some cases, the updates enable new features; in other cases, the newer version swats a bug that might or might not affect you.

New Microsoft-signed drivers are often (but not always) delivered through Windows Update.

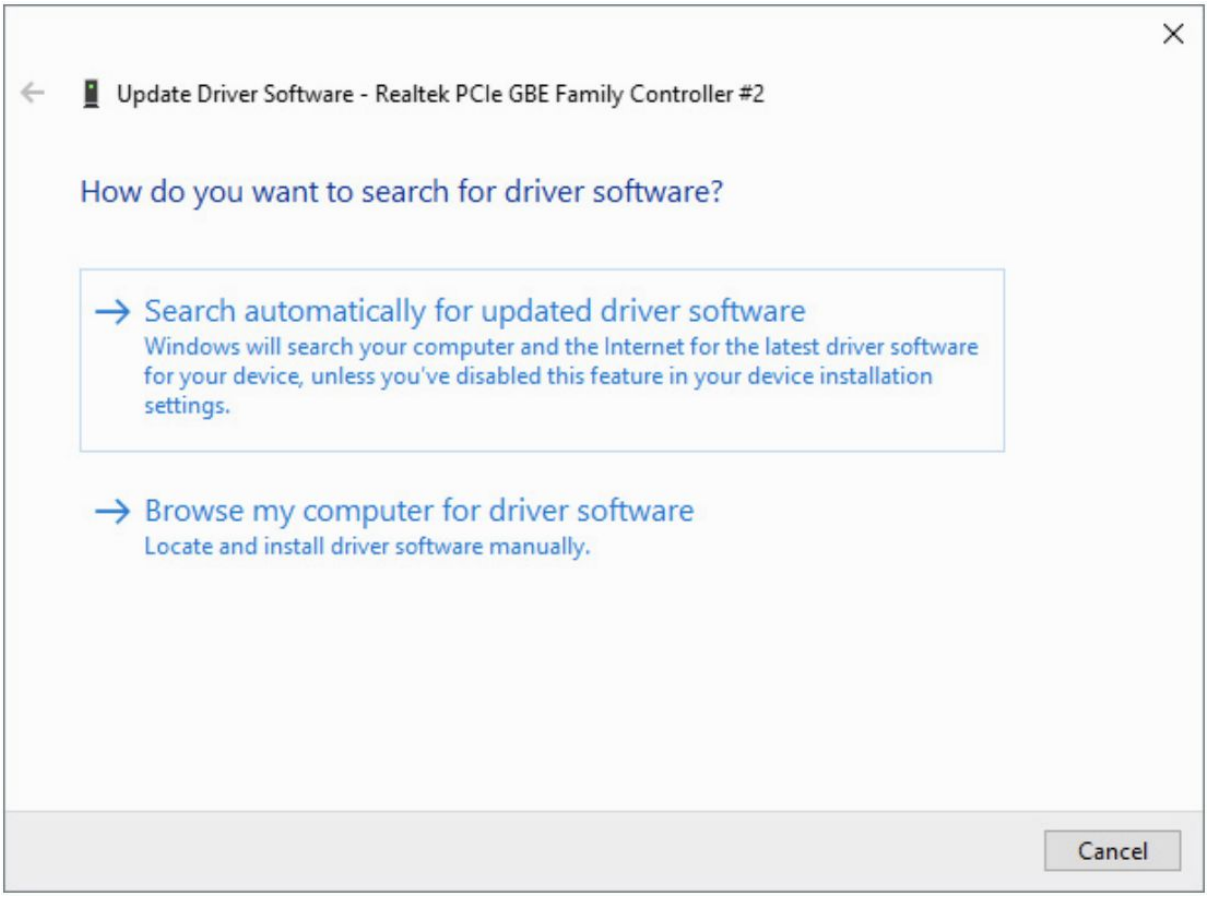
Other drivers are available only by downloading them from the device manufacturer's website.

Kernel-mode drivers must still be digitally signed before they can be installed.

If the new driver includes a setup program, run it first so that the proper files are copied to your system.

Then start the update process from Device Manager by selecting the entry for the device you want to upgrade and clicking the Update Driver button on the toolbar or the Update Driver option on the right-click shortcut menu.

That action opens the dialog box shown in the next picture:



Click "Search Automatically For Updated Driver Software" if you want to look in local removable media and check Windows Update.

Click "Browse My Computer For Driver Software" if you want to enter the location of a downloaded driver package or choose from a list of available drivers in the driver store folder.

Clicking the latter option opens a dialog box like the one shown in the next picture, with two options for manually selecting a driver:

If you've downloaded the driver files to a known location or copied them to removable storage, click Browse to select that location, and then click Next to continue.

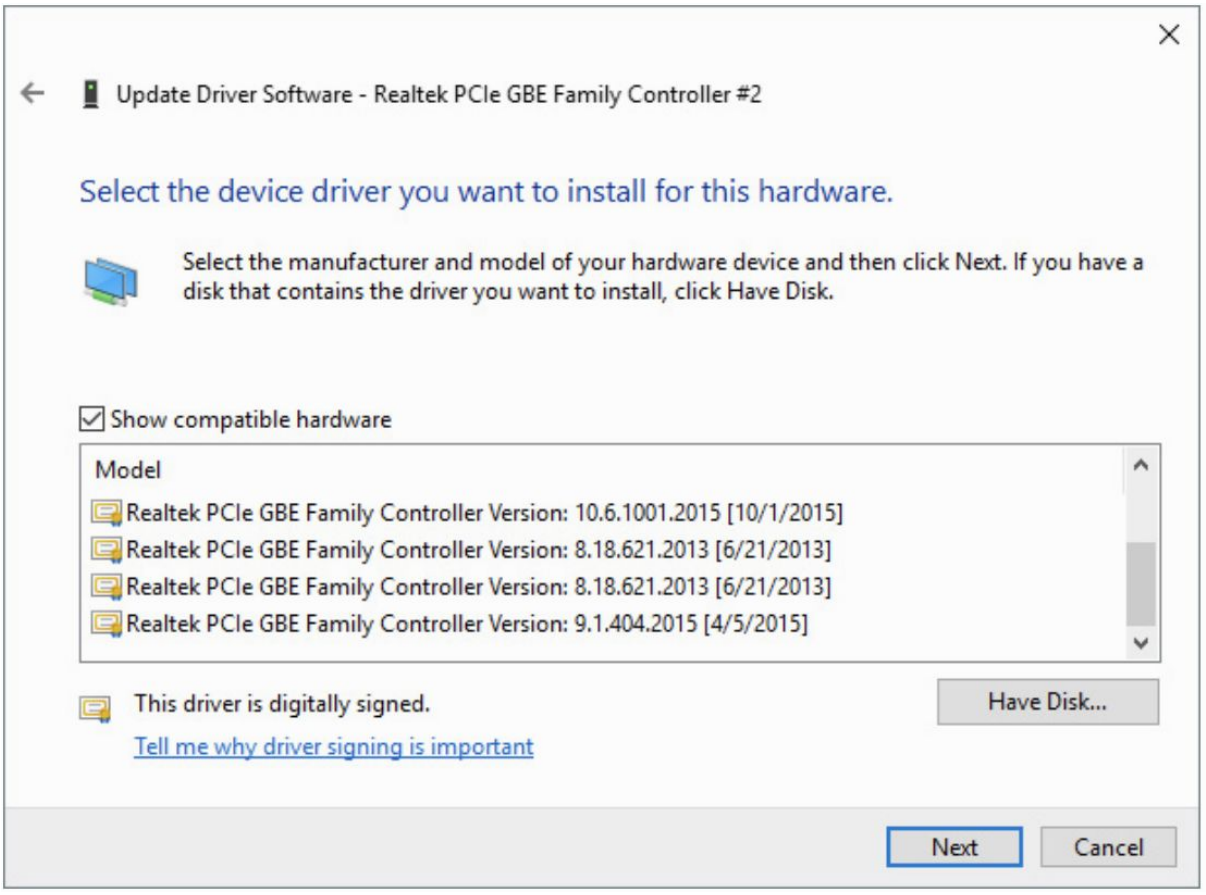
With the Include Subfolders option selected, as it is by default, the driver update software will do a thorough search of the specified location, looking for a Setup Information file for the selected device; if it finds a match, it installs the specified driver software automatically.

Use the second option, "Let Me Pick From A List Of Device Drivers On My Computer", if you know that the driver software you need is already in the local driver store.

In general, choosing this option presents a single driver for you to choose.

In some cases, as in the example in the following figure, you can see previous versions of a driver, with the option to replace a new driver with an older one for troubleshooting purposes.

If you need to install an alternative driver version that isn't listed, clear the "Show Compatible Hardware" check box and then choose a driver from an expanded list of all matching devices in the device category:



Rolling back to a previous driver version

Unfortunately, updated drivers can sometimes cause new problems that are worse than the woes they were intended to fix.

This is especially true if you're experimenting with prerelease versions of new drivers.

If your troubleshooting leads you to suspect that a newly installed driver is the cause of recent crashes or system instability, consider removing that driver and rolling your system configuration back to the previously installed driver.

To do this, open Device Manager and double-click the entry for the device you want to roll back.

Then go to the Driver tab and click Roll Back Driver.

The procedure that follows is straightforward and self-explanatory.

Uninstalling a driver

There are at least three circumstances under which you might want to completely remove a device driver from your system:

- You're no longer using the device, and you want to prevent the previously installed drivers from loading or using any resources.
- You've determined that the drivers available for the device are not stable enough to use on your system.
- The currently installed driver is not working correctly, and you want to reinstall it from scratch.

Removing and reinstalling the driver for a Plug and Play device requires a little extra effort.

Because these drivers are loaded and unloaded dynamically, you can remove the driver only if the device in question is plugged in.

Use the Uninstall button to remove the driver before unplugging the device.

To reinstall the device driver without unplugging the device, open Device Manager and choose Action, Scan For Hardware Changes.

To remove a driver permanently, open Device Manager, right-click the entry for the device in question, and click Uninstall.

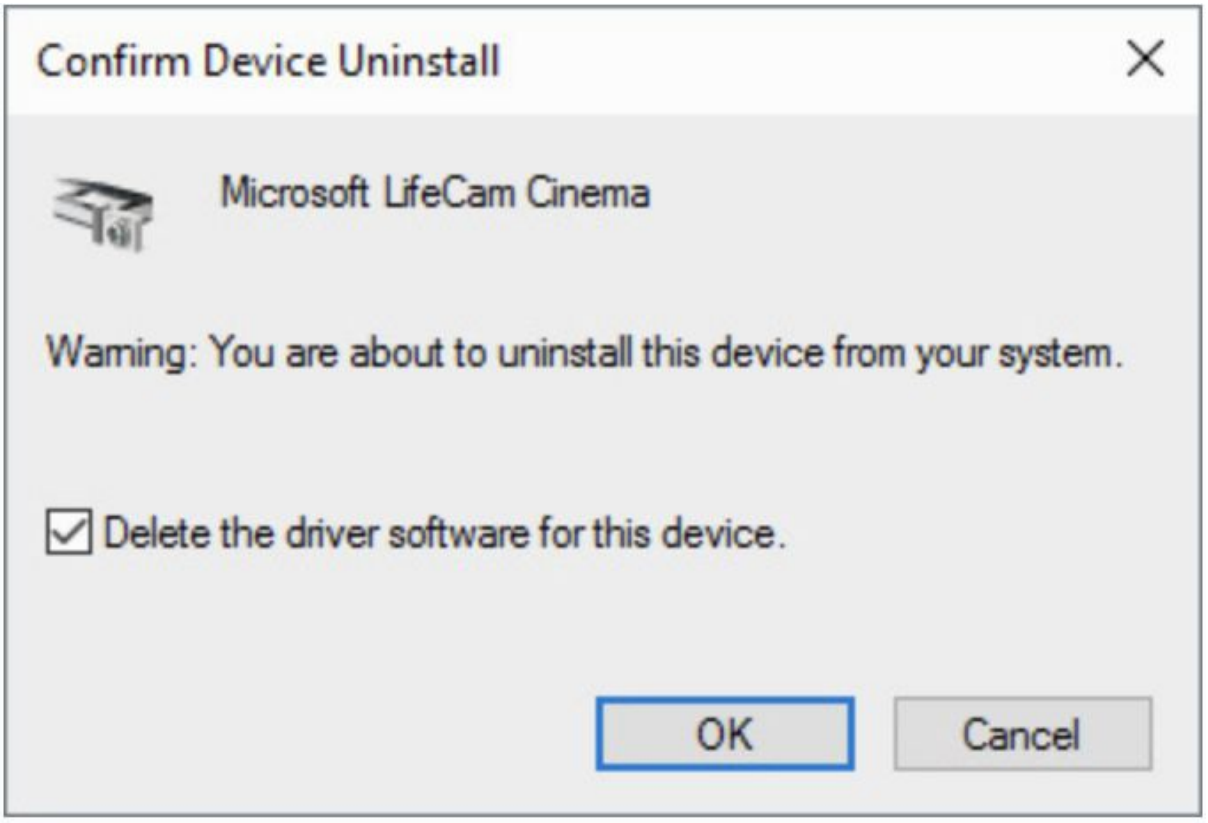
If the entry for the device in question is already open, click the Driver tab and click Uninstall.

Click OK when prompted to confirm that you want to remove the driver, and Windows removes the files and registry settings completely.

You can now unplug the device.

If you installed the driver files from a downloaded file, the Confirm Device Uninstall dialog box includes a check box (shown in the next image) you can select to remove the files from the driver store as well.

This prevents a troublesome driver from being inadvertently reinstalled when you reinsert the device or restart the computer:



Note that you can't delete driver software that's included with Windows 10.

If the troublesome device driver was delivered through Windows Update, removing it is only a temporary fix.

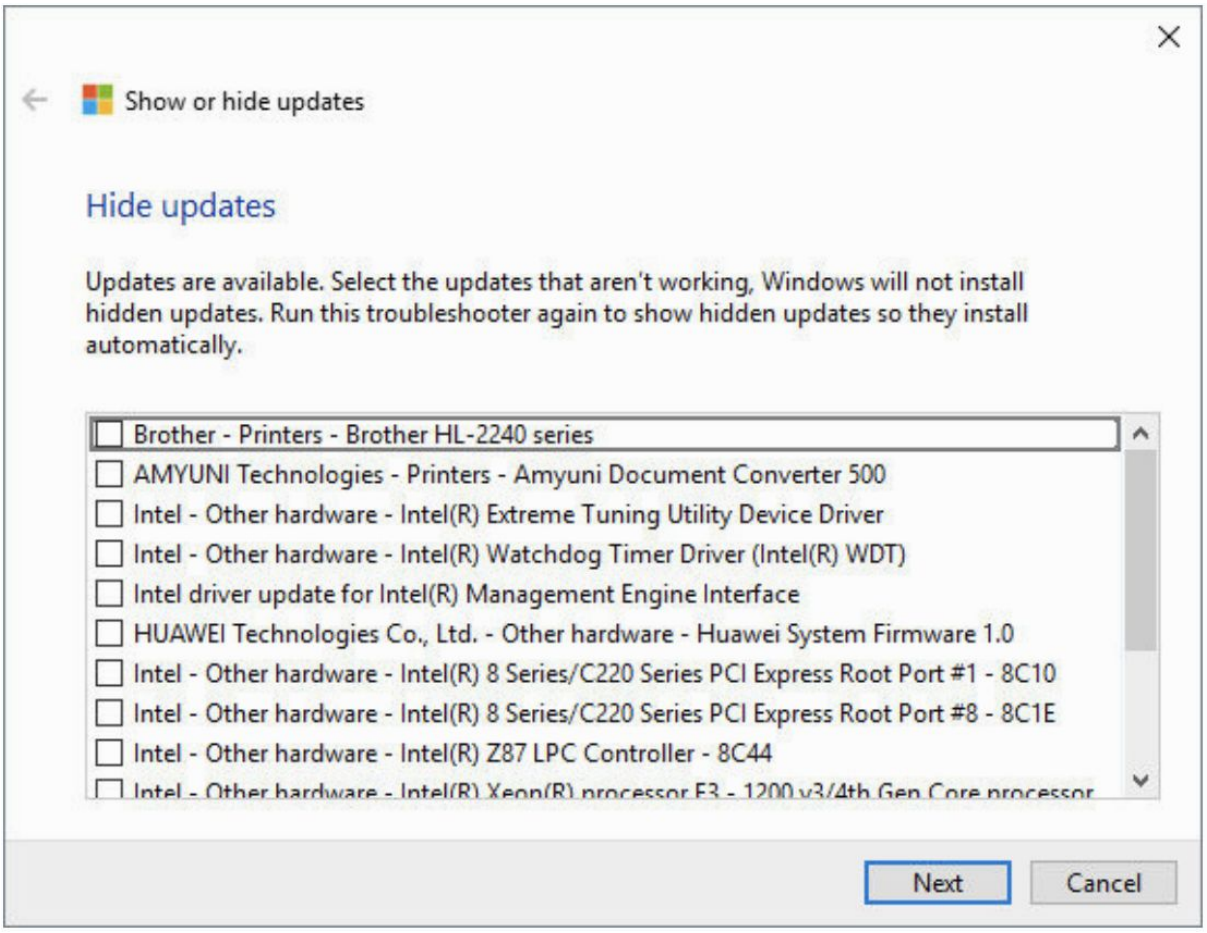
The next time Windows checks for new updates, it will download and install that same driver, unless you take steps to exclude that driver.

To do that, use the troubleshooting package Microsoft created expressly for this problem.

You can download it from https://bit.ly/wushowhide .

After downloading the package, run it and follow the prompts, choosing the Hide Updates option.

After checking for available updates, the troubleshooter displays a list of driver updates that apply to the current system, as shown next:



Select the check box to the left of the unwanted driver, and finish the wizard.

If you find that a later update has resolved the problem, rerun the troubleshooter and choose the Show Updates option to make the driver available again via Windows Update.

Printers and print queues

To install a modern printer that plugs into a USB port on the PC where you plan to use it, just connect the device.

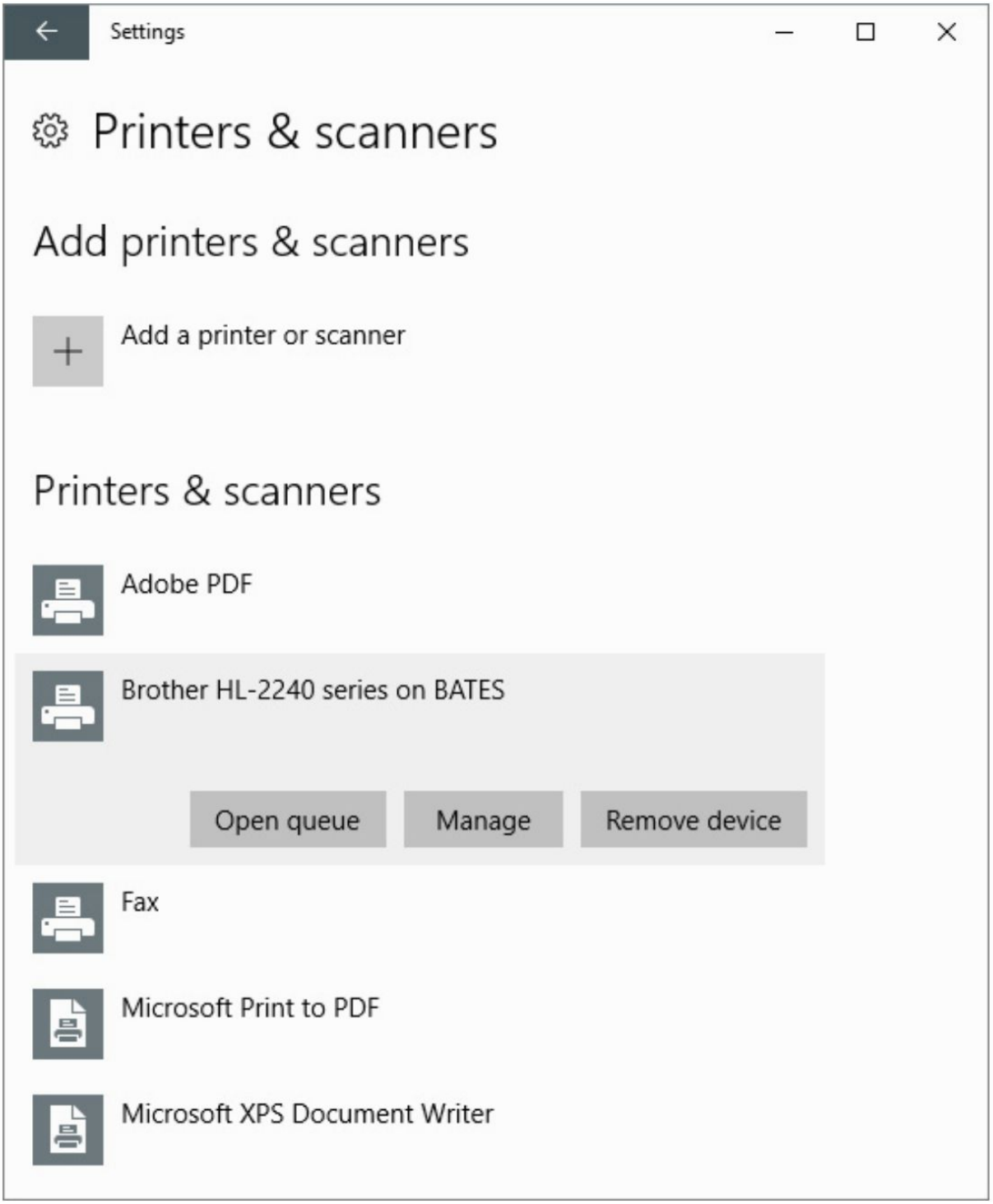
Plug and Play does the rest of the work.

Wireless printers that connect over Wi-Fi or by using Bluetooth also support Plug and Play.

Follow the manufacturer's instructions to complete the wireless connection.

To configure a printer or work with documents in a print queue, go to Settings > Devices > Printers & Scanners.

Click any installed printer to show buttons like those visible in the next image:



The Open Queue button, naturally, takes you to a list of pages waiting to print.

Click Manage to see options that include the familiar printer-queue dialog box as well as links to printer settings and the extremely useful Print A Test Page command.

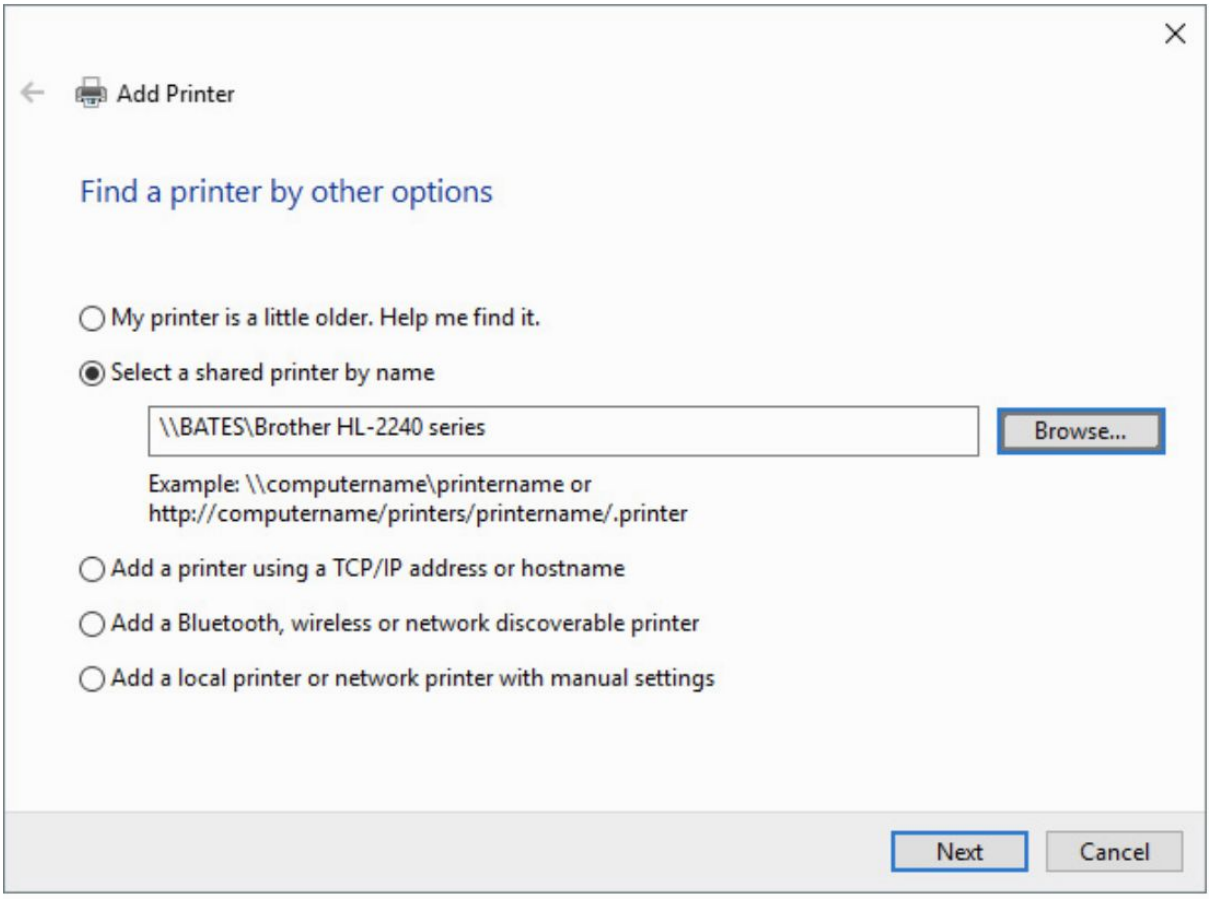
Click Manage > Printer Properties to see status information and other configuration options.

Printers aren't exactly like snowflakes, but there are far too many variations in hardware and software design for us to offer more than the most general advice: get to know your printer by inspecting these settings, and don't be afraid to read the manual.

To make a wireless or networked printer available locally, go to Settings > Devices > Printers & Scanners and click Add A Printer Or Scanner.

If the planets are properly aligned, the autodiscovery software might locate your printer and walk you through setting it up.

If you're not so lucky, click The Printer I Want Isn't Listed to open the manual options shown in the next figure:



Among the "other options" available on this page in the Add Printer Wizard, you can connect to a network printer using its Universal Naming Convention (UNC) name.

The device shown in the previous image, for example, is connected to a printer on a server named Bates, making its UNC address \\BATES\Brother HL-2240 Series.

You can also use an IP address for a device that has a permanently assigned address, and you can enlist the help of a wizard to connect a wireless or Bluetooth printer.

Often the easiest way to determine the TCP/IP address or host name for a printer is to use the printer's control panel to print a configuration page, which usually includes this information.

One of the simplest ways to connect to a shared network printer doesn't involve any wizards at all.

Just use File Explorer to browse to the network computer, where you should see an entry for any shared printer available to you.

Double-click that icon to begin the process of connecting to that printer.

Because Windows requires a local copy of the network printer's driver, you'll need an administrator's credentials.

If you can't find a driver that's specifically designed for your printer, you might be able to get away with using another driver.

Check the hardware documentation to find out whether the printer emulates a more popular model, such as a Hewlett-Packard LaserJet.

If so, choose that printer driver, and then print some test documents after completing setup.

You might lose access to some advanced features available with your model of printer, but this strategy should allow you to perform basic printing tasks.

Configuring displays

On a desktop or portable PC with a single screen (and, in the case of a desktop, the proper cable), you shouldn't need to do anything to configure your display.

All modern display adapters deliver up-to-date drivers via Windows Update, and the display is capable of configuring itself as soon as it's connected.

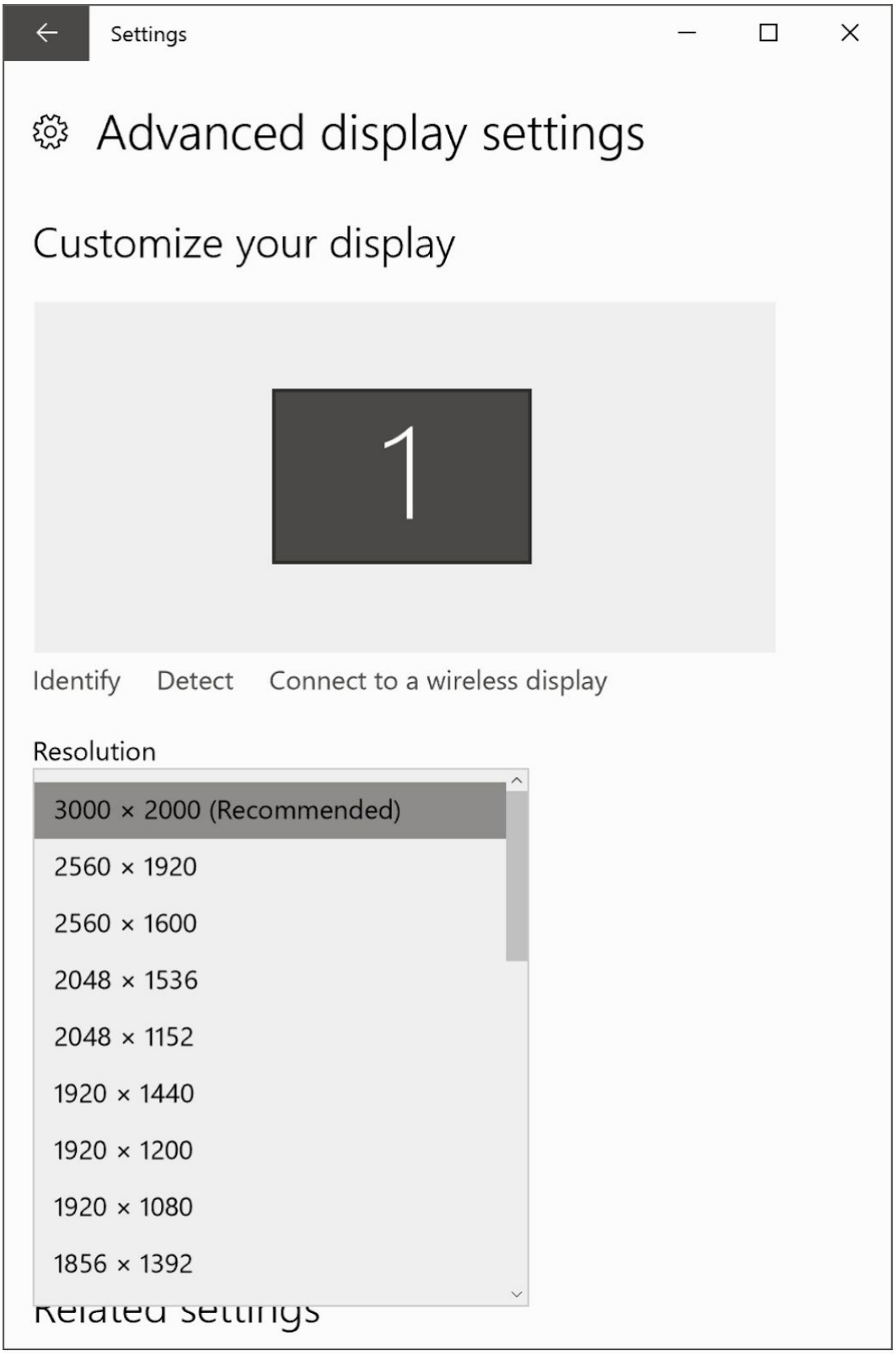
So when do you need to pay attention to these settings?

One scenario involves so-called high-DPI displays, which are typically found today on high-end portable PCs.

You can make display changes by going to Settings > System > Display.

Here are the three display settings you need to pay attention to:

- Resolution. Every display has a native resolution, one where the number of physical pixels matches the number of pixels Windows wants to show. Configuring the display at a non-native resolution generally results in a subpar viewing experience, often with a blurry, stretched display. That's probably why you have to take an extra step and go to the Advanced Display Settings page to see and change resolution. The next image shows a Surface Book running at its native resolution of 3000 by 2000 pixels, as indicated by the word "(Recommended)" in the label, with its full list of other supported resolutions open below it.

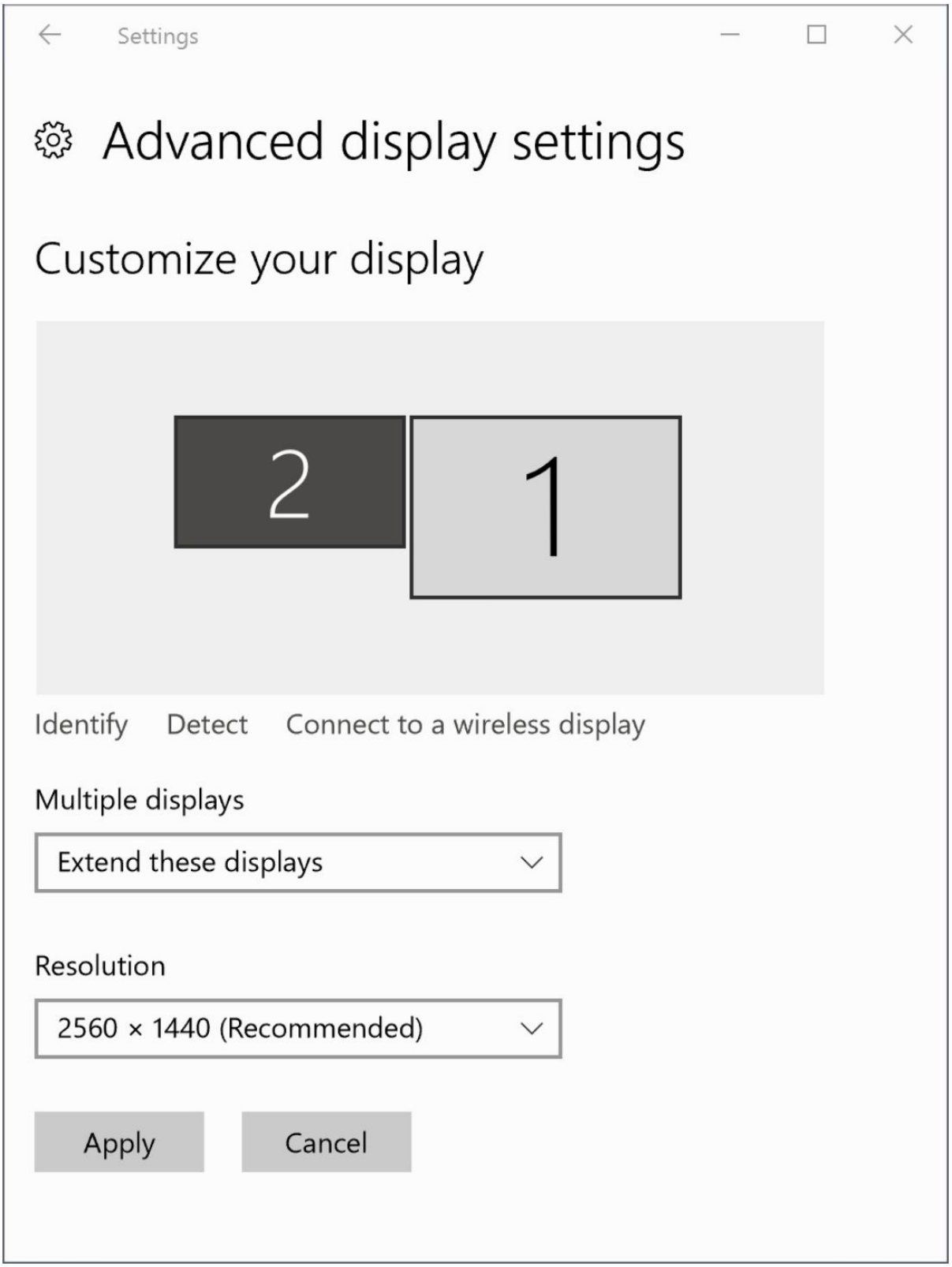


Why would you choose a non-native resolution?

One common scenario is projecting to a large display—in a conference room, for example, or to a Miracast adapter connected to the HDMI input on a TV.

If you choose the option to duplicate displays on both monitors, you need to set the resolution to match what your audience is seeing, even if it looks squashed on your built-in display.

- Scaling. On high-resolution monitors, you can increase the apparent size of apps and text. Here, too, Windows recommends a scaling factor based on the size of the display and the resolution. You might choose a larger or smaller scaling factor for your own personal comfort. On a system with a single display, you can adjust the scaling by using a slider below the thumbnail of the current monitor on the Display page in Settings.
- Multiple displays. When you attach a second (or third or fourth) display to Windows 10, the Display page in Settings changes. Thumbnails in the preview pane (which you can see in the following image) show each display at its relative size (in terms of resolution), and you can drag the displays to either side of one another (or even stack one on top of the other). You can also adjust the alignment of the two displays to match their actual physical alignment, with the goal of having your mouse pointer move naturally between displays without a jarring shift when crossing the bezels.



Setting up Bluetooth devices

Bluetooth is one of those rare standards that passes the “it just works” test consistently.

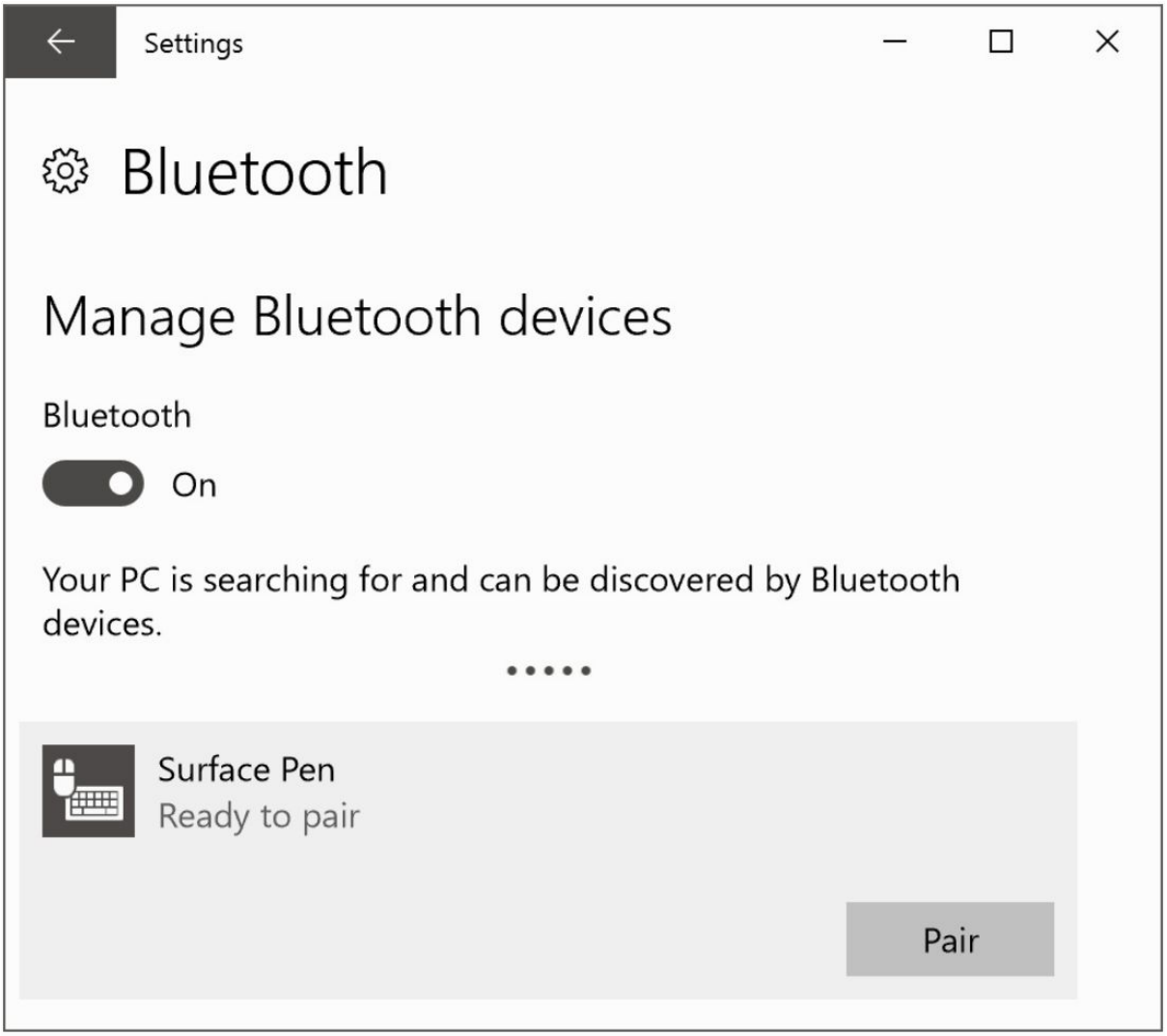
These days, virtually every portable device supports Bluetooth for wirelessly connecting headsets and pairing fitness devices.

Many desktop PCs include Bluetooth support as well, for connecting keyboards and mice.

Before you can use one Bluetooth device with another, you have to pair it, a process that generally involves making the external device discoverable, switching to the Bluetooth tab in Settings > Devices, and then following some instructions.

The next picture shows a Surface pen, made discoverable by holding down a special button combination for several seconds.

Tapping Pair completes the connection and makes the device usable with Windows 10, running in this example on a Surface Book.



Bluetooth connections represent a security risk—a low one, to be sure, but a risk nonetheless.

That's why pairing a keyboard, for example, requires that you enter a code from the PC's screen.

Without that precaution, an attacker might be able to connect a wireless keyboard to your computer and then use it to steal data or run unauthorized and potentially dangerous software.

The Bluetooth Settings page contains an on-off switch for the Bluetooth adapter.

On mobile PCs, this is a power-saving feature.

On a desktop PC, be careful before disabling Bluetooth, because doing so could render your wireless keyboard and mouse—and thus the entire PC—unusable.

The only cure in that case is to plug in a wired keyboard or mouse and turn the setting back on.

Managing USB devices

Universal serial bus, more commonly known as USB, is one of the oldest and most reliable Plug and Play standards in the world.

Through the years, the USB standard has progressed from version 1.1 to 2.0 to 3.1, with the latest jump making a monumental difference in the speed of data transfer between USB-connected devices.

The new USB 3.1 standard is probably the greatest evolution of all, offering the ability to power full-size laptops, transfer data at blistering speeds, and even drive high-resolution displays.

In an unfortunate bit of timing that has inspired some confusion, a new USB Type-C connector arrived at the same time as USB 3.1 began to appear in high-end computing machinery.

USB Type-C connectors typically support USB 3.1 and can connect to older USB devices using adapters.

However, because the USB Type-C specification mandates support only for the older, slower USB 2.0 standard, you have no guarantee of USB 3.1 compatibility.

Alternate modes for USB Type-C support adapters for DisplayPort, Thunderbolt, and Mobile High-Definition Link (MHL) connections.

The USB Type-C connector is reversible (no more flipping the USB plug three times until you find the right orientation).

These new connectors are compatible with older USB devices, but only with an adapter.

All USB devices are Plug and Play compatible.

Knowing the types of connectors and the highest standard supported on your device can help ensure that you avoid compatibility hassles and carry the right cables.

Speakers, microphones, and headsets

Windows 10 supports a broad array of high-quality audio outputs, capable of delivering multichannel surround sound to sophisticated home theater setups or just driving the tiny speakers on a laptop.

As with other hardware subsystems, most of this capability is built into the Windows core drivers and doesn't require custom drivers from hardware manufacturers.

A few useful built-in capabilities are buried deep in the configuration dialog boxes of the Windows 10 audio subsystem.

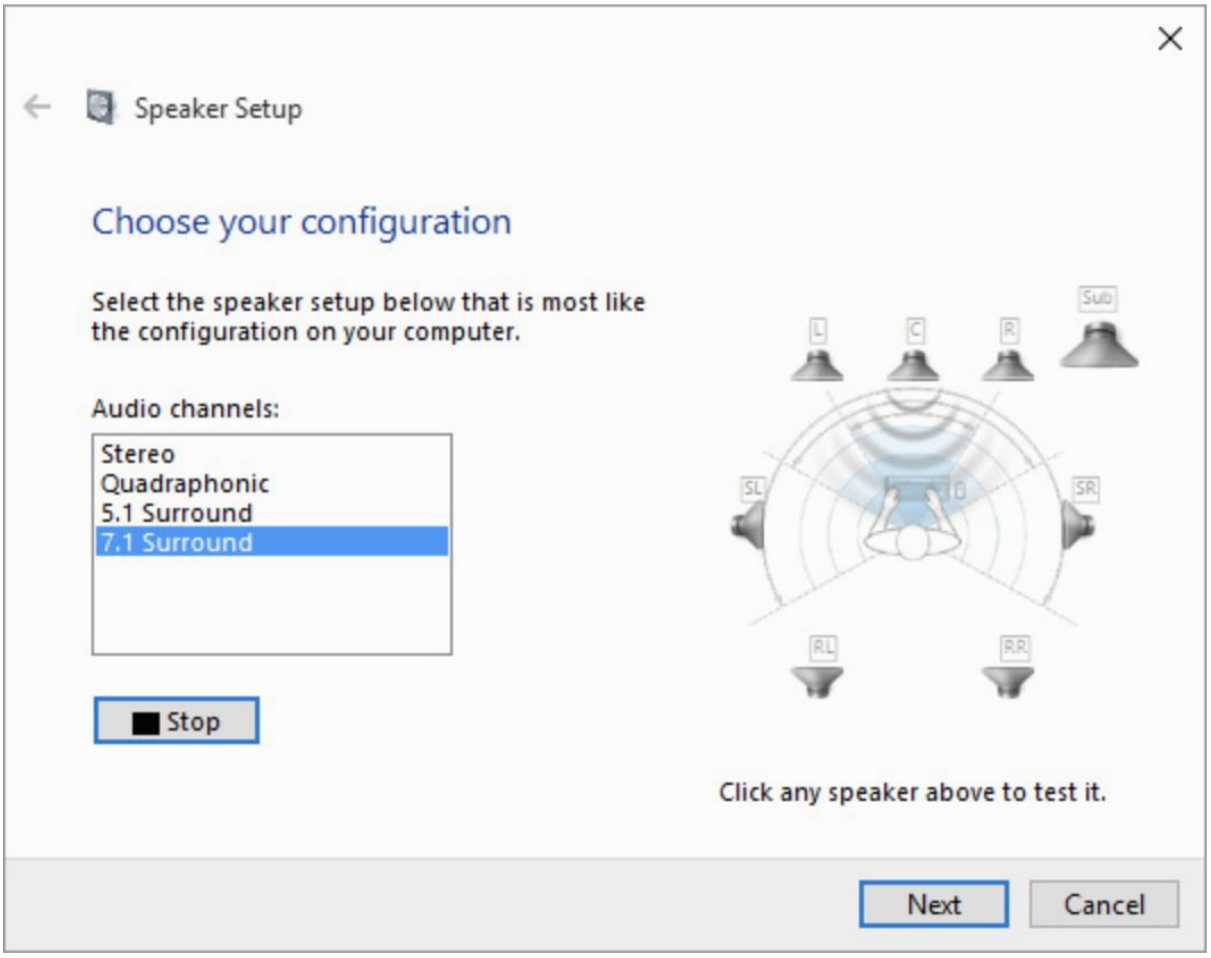
The first allows you to test your surround-sound (or stereo) audio configuration to confirm that every speaker is working properly.

Enter audio in the search box in Settings, and open the Playback tab of the Sound dialog box.

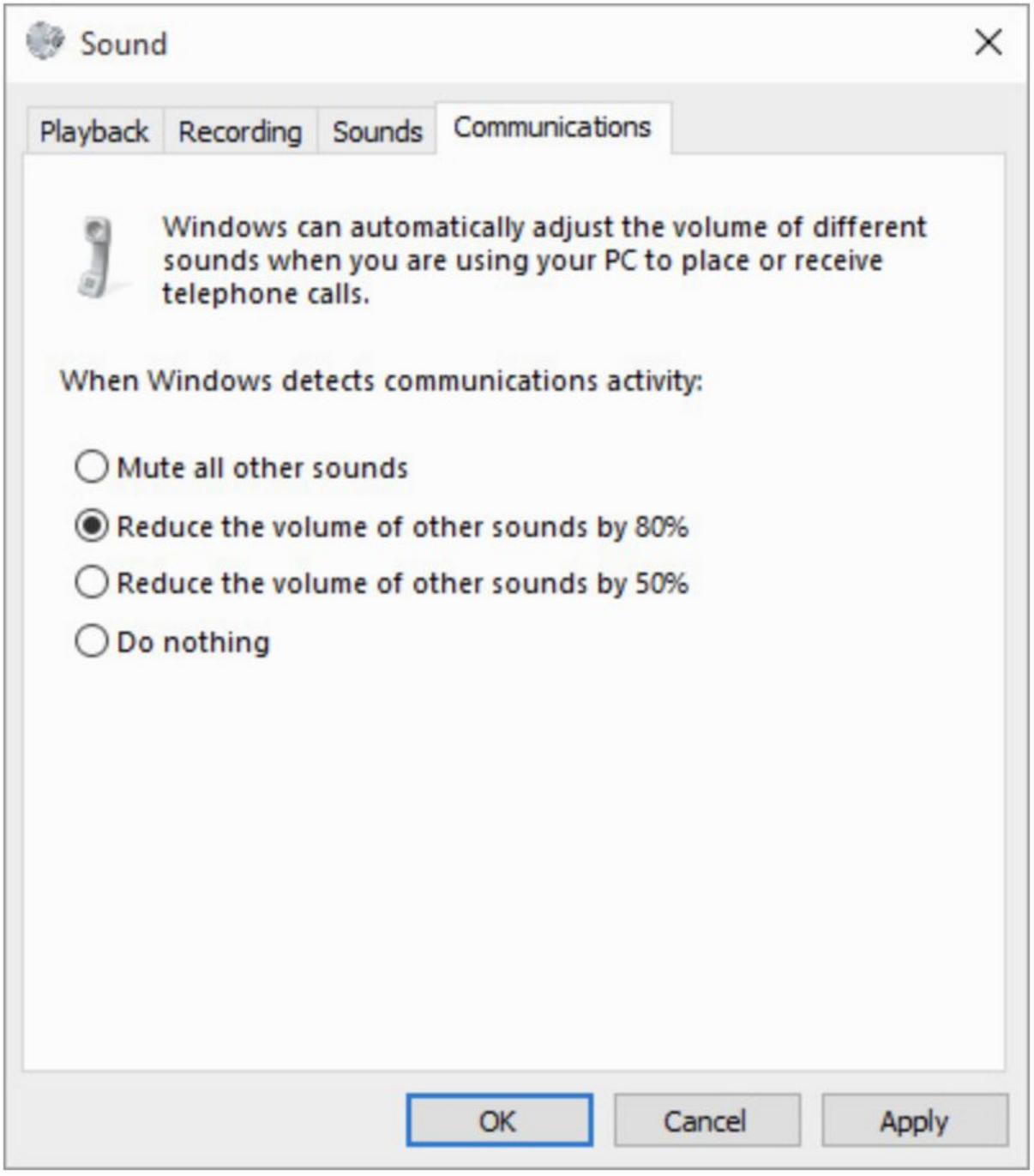
Choose the default playback device (marked with a green check mark) and then click Configure to open the test app.

Pick your speaker layout and then click Test to cycle through all the speakers, with a visual display showing which one should be playing.

To end the test, click Stop, as shown in the next figure:



Windows 10 also allows you to designate a playback device, typically a headset, for use as the default communications device, as shown in the following picture:



After making that designation, you can change playback behavior so that other sounds automatically reduce their volume when your communication device is in use and the sound of, say, loud music would interfere with your communication.

- Exercises - 1. 3. System maintenance and troubleshooting -

You are going to create a new Google Document inside the "1. Windows Client" folder of your Google Drive, named:

"1. 3. System maintenance and troubleshooting - Apellidos, Nombre"

being "Apellidos, Nombre" your Last Name and Name.

Share this Google Document with the teacher (jorge@iesdoctorbalmis.com) with "Edit" permissions.

Inside this Google Document you are going to answer to the exercises of the following sub-units:

- 1. 3. 1. Hardware
- 1. 3. 2. Managing disks and drives
- 1. 3. 3. System maintenance and performance
- 1. 3. 4. Backup, restore, and recovery
- 1. 3. 5. Troubleshooting

- Exercises - 1. 3. 1. Hardware -

Open the following Google Document that you have just created:

"1. 3. System maintenance and troubleshooting - Apellidos, Nombre"

being "Apellidos, Nombre" your Last Name and Name.

Inside this Google Document you are going to copy and answer all the "Exercises" of this sub-unit:

1. Go to Settings -> Devices -> Connected devices -> Device Manager. Check if you have items with drivers problems on the “Other devices” section.
2. Go to your Device Manager, open the “Display adapters” section, and check the properties of your graphics adapter.
3. Go to your Device Manager, open the “Network adapters” section, and check the properties of your network adapter.
4. From the Device Manager, disable and enable your network adapter.

5. From the Device Manager, try to update the driver software of your graphics adapter.
6. Go to your Device Manager, open the “DVD/CD-ROM drives” section, check the properties of your CD-ROM, go to the “Driver” tab and check the “Roll Back Driver” button (do NOT roll back the driver).
7. Go to your Device Manager, open the “DVD/CD-ROM drives” section, check the properties of your CD-ROM, go to the “Driver” tab and check the “Uninstall” button (do NOT uninstall the driver).
8. Go to Settings -> Devices -> Printers & scanners -> Microsoft Print to PDF. Check the Open queue. Click on “Print a test page” and save it as a PDF: later, open that PDF file. Click on “Manage” and check: “Printer properties” and “Printer preferences”.
9. Go to Settings -> System -> Display -> Advanced display settings. Change the resolution of your display and see the effects of the changes. Leave your original resolution.
10. Go to the Windows Search Box and open “Manage audio devices”. Select “Speakers” (or “Headphones”) and click on the “Playback” tab. Click on the “Configure” button, and play the “Test” button.