SPRINGBOARD SERIES

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Windows

Overview Series: Windows Vista® Performance and Tuning

Improve Performance Quickly and Easily

The Windows Vista® operating system and the recent Service Pack 1 (SP1) provide major advancements in usability, reliability, connectivity, and security. These improvements are helping businesses and consumers become more productive than ever.

While performance is often thought of simply in terms of speed, it is better to think of performance as a combination of speed and responsiveness. For example, one approach to optimizing performance when copying large numbers of files would be to copy those files as fast as physically possible. Unfortunately, this approach would leave the system unresponsive during the operation.

Windows Vista and SP1 focus on delivering greater performance and overall system responsiveness. By striking a balance between speed and responsiveness, Windows Vista and SP1 deliver a level of performance that has the greatest positive impact on the system's usability.

Improving the performance of a computer follows the principle of diminishing returns. There are a few actions you can take with any computer that should improve performance dramatically. Additional actions provide smaller performance improvements.

This guide looks at the following areas of performance improvement:

- Making configuration changes that help a computer feel more responsive when you use it.
- Using hardware to boost the actual physical speed of a computer.
- Making configuration changes that help a computer to start faster.
- Making the computer more reliable may help increase performance.
- Monitoring performance occasionally so that you can stop problems before they get too big.

While the bulk of this guide focuses on performance improvements on a single computer, this guide also takes a look at some of the tools used in enterprise environments to help make performance tuning manageable on a much larger scale.

Optimizing Hardware Specifications to Your Organizational Needs

Although the minimum requirements for the Windows Vista operating system are highlighted in the Windows Vista TechCenter, you should validate hardware performance with your intended applications and user expectations before determining your organization's standard hardware specifications.

For example, when deploying Windows Vista many organizations have found that the following configuration yields good results, especially for higher knowledge worker scenarios:

- At least 2 GB of RAM.
- At least a 2 GHz processor.
- A compatible graphics adapter that provides improved performance.

If you are deploying Windows Vista with the Windows® Basic theme settings, you can reduce these recommendations considerably. Customize the hardware specifications and operating system configurations based on the user roles and operational needs in your organization.

For more information about customizing the hardware specifications and operating system configuration, see:

- Windows Vista Enterprise Hardware Planning Guidance http://technet.microsoft.com/en-us/windowsvista/aa905075.aspx

Make Your Computer Feel More Responsive

Another way to improve perceived performance on a

computer is to make it feel faster. Or more accurately, you can remove things that make the computer feel slower. You do this by making sure that various configuration settings are optimized.

Check Power Settings on Mobile Computers

When a computer is operating on a battery, you must strike a balance between battery life and performance. Better performance almost always drains battery life more quickly.

Windows Vista provides three built-in power plans, as shown in Table 1. You can modify the settings for the three built-in plans to suit your needs, or even create your own power plans. You can change a built-in plan's settings or create your own plan by using the Power Options settings in Control Panel.

Power Plan	Description
Balanced	Balances energy consumption and performance by adapting the computer's resources to a specific activity. By balancing the power used, when more power is needed, more becomes available; when less is needed, less is available.
Power Saver	Saves power by reducing system performance. The primary objective of this plan is to maximize battery life.
High Performance	Offers the highest performance possible by maximizing available resources for best performance. There will be a trade off for the high performance with battery life.

Table 1. You can choose from three power plan options

To choose a preferred plan:

1. Click **Start**, and then click **Control Panel**.
2. In the Control Panel window, click **System and Maintenance**, and then click **Power Options**.
3. Select the desired power plan, as shown in Figure 1. Note that depending on the manufacturer of the computer, you may see additional power-management options.

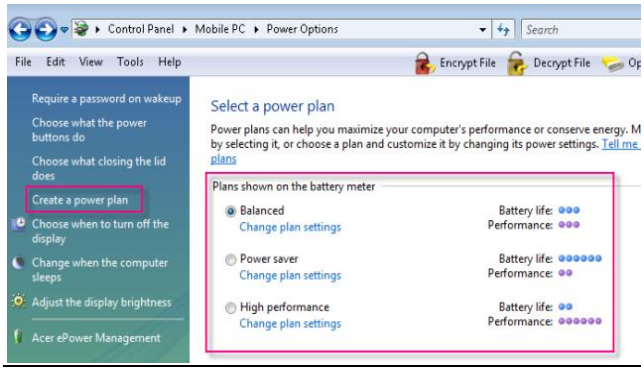


Figure 1. Select the most appropriate plan

To create a power plan:

1. If you want to create your own power plan, with the Power Options window open, click **Create a Power Plan** (refer to Figure 1).
2. Select the built-in power plan that most closely matches what you want to create.
3. Type a name for the plan, and then click **Next**, as shown in Figure 2.

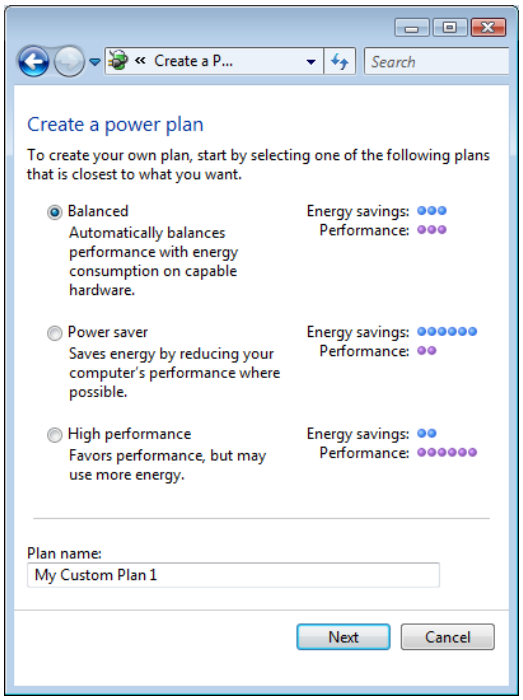


Figure 2. Create your new power plan

4. Configure custom settings for your plan, including when to turn off the display, when to put the computer to sleep, and display brightness depending

on whether the mobile computer is plugged in or running on battery power (Figure 3).

5. Click Create.

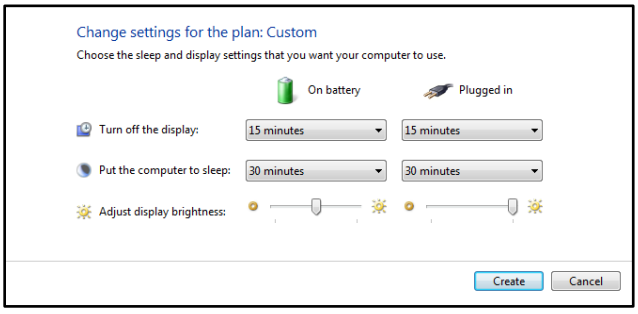


Figure 3. Create your own power plan

Click the Battery Meter icon in the notification area to open the menu shown in Figure 4, which lets you change to a different power plan and also offers more visual cues about battery life. For example, when the battery life reaches 25 percent, a yellow triangle with an exclamation point appears over the battery icon. When the charge reaches critically low battery levels, a red circle with a white X appears.

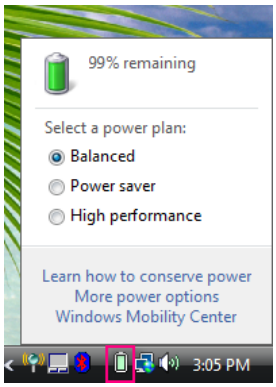


Figure 4. Use the Battery Meter to change power plans quickly

Disable Visual Effects

Many of the visual effects in Windows Vista, such as the Aero® desktop experience, are beautiful and are designed to enhance user productivity. They add not only a certain flair to the computing experience but also subtle visual clues about what's happening in Windows, which may help user productivity.

That said, these visual effects can slow down the perceived performance of a computer, by making windows, dialog boxes, and menus take just a bit longer to open and work with—particularly on slower computers. By default, Windows Vista enables visual features based on the capabilities of the computer, but you can enable or disable specific visual effects to help strike a balance between performance and appearance.

Windows Vista provides quick access for enabling and disabling these effects.

To disable visual effects

1. Click **Start**, and then click **Control Panel**.
2. In the Control Panel window, click **System and Maintenance**.
3. Click **System**.
4. In the **Tasks** pane, click **Advanced System Settings**.
5. Enter your administrator credentials and click **Continue** if you are prompted by User Account Control.
6. On the Advanced tab, click **Settings** in the **Performance** section.
7. Use the Performance Options dialog box to enable or disable visual effects, as shown in Figure 5.

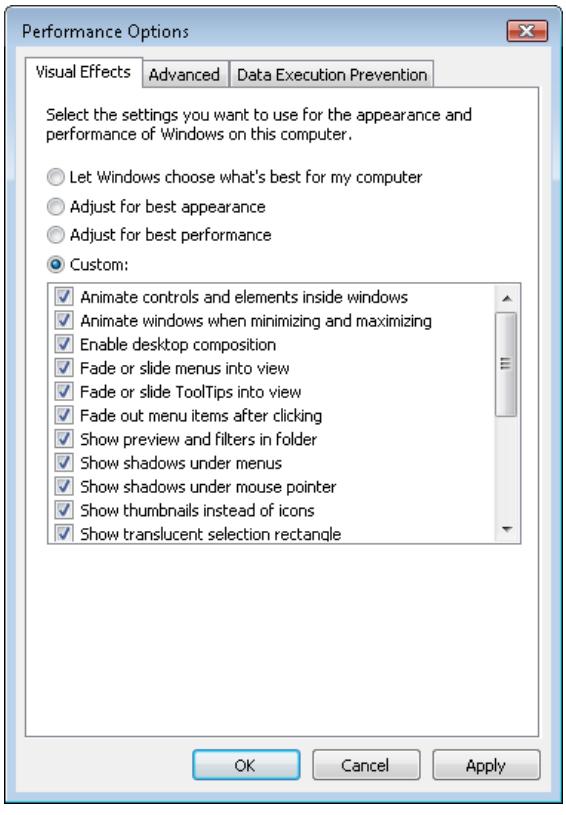


Figure 5. Disable visual effects to enhance performance slightly

In order to disable Aero effects, you can right click your desktop and click Personalize. In the Personalize appearance and sounds window, click Windows Color and Appearance and chose a theme. Make sure the Enable transparency box is not checked to disable Aero.

Adjust Search Settings

For users who run Windows Vista SP1, installation of Windows Search 4.0 offers the most efficient and comprehensive way of improving performance of search and reducing the impact of indexing on the system. Both search queries and data indexing are faster with Windows Search 4.0, and indexing process is better at releasing system resources when they are required by the user or other processes on the PC.

Another method for optimization of search functionality, also available to users without Windows Search 4.0 installed, is to adjust indexing settings. The index in Windows Vista stores information about the files on a system, including but not limited to the file name, date modified, and author, as well as information allowing fast searches over textual content of the indexed files for many supported file formats. Instead of looking through the entire hard disk for a file, Windows scans the index for the information first.

To access the indexing options

1. Click **Start**, and then click **Control Panel**.
2. In the Control Panel window, click **System and Maintenance**.
3. Click **Indexing Options**.

Modifying options in the following ways can help improve a computer's performance:

- Add or remove folders by clicking **Modify** (Figure 6). By default, personal folders (e.g., My Music, My Documents, My Pictures) are indexed.
- Rebuild a corrupt index or change the location of the index by clicking **Advanced**.
- Remove rarely searched folders or shared folders from the index, and do not include unused folders. (Windows Search 4.0 automatically adds all shared folders to the list of indexed locations, to enable efficient remote searches on them. If you don't expect files on the share to be searched over, you can disable indexing on it.).

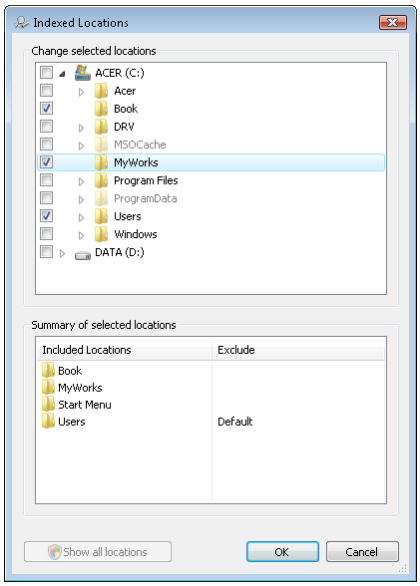


Figure 6. Add or deleted indexed folders

Please note that searching over locations not included in the index is significantly slower than searching over indexed locations.

Use Hardware to Boost Performance

The most effective way to increase the performance of a computer is by improving the hardware in the computer.

The three main hardware issues governing performance are CPU, hard disk speed, and memory capacity. This guide looks at less invasive ways to boost performance through hardware.

Speed up Your Computer with Windows ReadyBoost™

While adding more memory to a computer is a great way to boost performance, it isn't always easy to do. To install memory, you must be willing (or allowed) to open the computer case or pay someone else to do it. Sometimes, it can be difficult to tell what type of memory you need to install or how much you can install. And depending on the type of computer you have, even getting to the memory slots can be tricky.

Windows Vista includes a feature named Windows

ReadyBoost (shown in Figure 7). ReadyBoost technology uses non-volatile flash memory, such as that found on a USB Drive or Secure Digital (SD) card, and a memory management technology called Windows SuperFetch™ to provide a cache for the memory paging file stored on the computer's hard disk. Since accessing flash memory is much faster than accessing a hard drive, using Windows ReadyBoost can significantly increase performance.

Figure 7. ReadyBoost is simple to use

And since the swap file itself is still stored on hard disk (only a cache for that file is stored on the USB drive), no data can be lost if you remove the ReadyBoost drive from the computer.

Using ReadyBoost is simple. Just plug a ReadyBoost compliant USB 2.0 drive into the computer. To determine if a USB 2.0 is ReadyBoost compliant, right click the USB drive in Computer and choose Properties. When you go into the Properties dialog box, ReadyBoost will perform a performance test to see if the device is fast enough. A drive should support 2.5MB/s for 4KB random reads and 1.75MB/s for 1MB random writes.

Windows Vista determines whether the drive is fast enough or has enough space to use as a ReadyBoost drive. If the drive is fast enough, Windows displays the Speed up my system option in the AutoPlay window.

After selecting the Speed up my system option, Windows Vista displays the ReadyBoost tab of the disk's Properties dialog box, as shown in Figure 8. You can turn ReadyBoost off for the drive or if left on, designate how much space to use for speeding up the system.

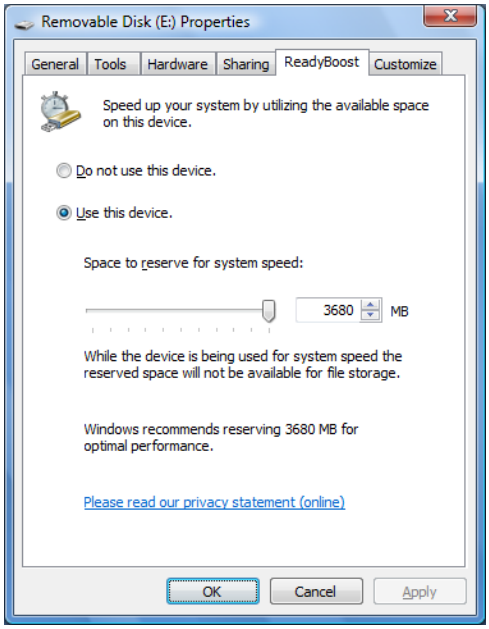


Figure 8. You configure how much space to allocate to Windows ReadyBoost

Of course, there are some limitations to ReadyBoost. Generally speaking, the lower the physical memory of the computer, the bigger the existing disk cache that can be offloaded to the ReadyBoost drive, and the greater the gain in performance. As a computer gains more physical memory, the performance boost is less significant.

Consider Windows ReadyDrive™

Windows ReadyDrive technology is another feature introduced in Windows Vista that works in tandem with two new types of disk drives:

- Hybrid hard disk drives, which are traditional hard drives with an integrated cache of non-volatile flash memory.
- Intel TurboMemory drives, where the non-volatile flash memory is actually detached from the drive.

ReadyDrive technology provides three benefits:

- Performance-critical data is loaded into flash memory so that it is accessed faster than if it were stored on traditional hard disk.
- Startup files are loaded into flash memory, which translates to shorter startup times for Windows Vista.
- Since the traditional hard disk needs to be accessed

less often, it can spin down for longer periods, boosting the battery life of mobile computers.

- In Windows Vista Service Pack 1, ReadyDrive improves startup speed by 27-55% compared to Windows Vista RTM (Source: Internal Microsoft Testing).

Note: You can purchase products that are supported by ReadyDrive from the Windows Marketplace, as well as select retail locations.

Make Your Computer Start Faster

One of the most frustrating times for a user can be waiting for a computer to start. You wait for the computer to boot up, wait for Windows to load, log in, and then finish waiting for all the background programs and services to load. It is not usually hard to trim the startup time for a computer and doing so almost always makes for a more pleasant computing experience. Removing unwanted background programs and services also may have the side benefit of helping to make a more secure, reliable system.

Put Your Computer to Sleep

Sleep is a feature in Windows Vista, supplanting the Standby feature of previous Windows OS versions. In the past, Standby didn't always work well and computers were slow to come out of standby. In contrast, Sleep in Windows Vista is reliable, fast, and useful. In fact, in Windows Vista, Sleep should be considered the new default "Off" state.

If you don't already use the Sleep function in Windows Vista, you will find that you can start up a computer much faster by not shutting it down completely in the first place.

Putting a computer to sleep is easy. You can choose Sleep from the Start menu (shown in Figure 9), press the power button on your computer (in Power Settings the power button must be configured to Sleep), press the Sleep button offered on many keyboards, or just close the cover of a laptop computer.

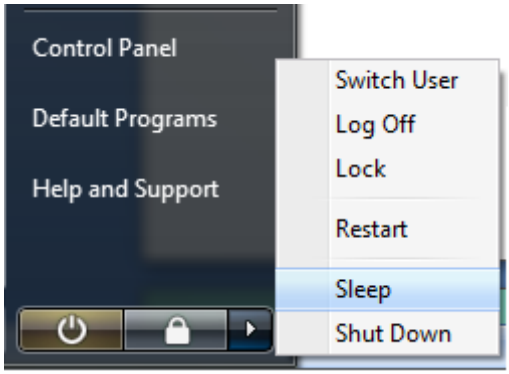


Figure 9. Sleep is the new Off state

When a computer enters Sleep state, Windows Vista saves the current session to memory and enters a low power state where only memory is powered.

In Sleep state, the computer uses very little power—extending battery life for mobile computers and conserving energy even for desktop computers while ensuring that the computer is still ready for action quickly. In fact, on a modern laptop computer, power consumption in sleep state is typically less than one watt.

Windows Vista also includes a new Hybrid Sleep function. Hybrid Sleep will function as a failsafe in case of power loss by saving the session to memory normally, but also writing it all to the hard drive (similarly to how hibernate works). This ensures that even when power is lost, data remains intact.

When you want to resume working, just press the power button, tap a key on the keyboard, or, on laptop computers, open the cover. Windows Vista takes only a few seconds to resume from sleep, though it can take a little longer to resume from Hybrid Sleep after you restore a power source to the computer.

Note: The success of using Sleep on any computer is reliant on having good drivers for hardware peripherals. The best results will come from a computer designed for Windows Vista.

Disable Unwanted Startup Programs

Many programs have components that start when Windows starts and run in the background. While some of these programs are necessary (such as antispyware programs), you will find that others may not be necessary.

Some of these programs may have been preinstalled with a new computer and some may have been installed by the user. It will be up to you as the IT Pro and the user to determine what programs are unused.

Each program that runs in the background consumes system resources, so removing unused programs not only may help the computer start faster, but may also improve overall performance.

Some programs that run in the background are represented by icons in the notification area, shown in Figure 10.

Figure 10. Each icon represents at least one running process and sometimes many more

There are two approaches you can take to prevent a program from starting with Windows Vista unnecessarily:

- If it is a program you don't need at all, then you can uninstall the program using Add/Remove Programs in Control Panel
- If it is a program you want to keep on your computer, but you don't need the program running in the background, you need to prevent the program from starting automatically with Windows.

Remove Unused Programs

If you do not need a program at all, you can simply uninstall the program. Removing unused programs prevents those programs from running in the background and frees up disk space on the computer.

To remove a program:

1. Click **Start**, and then click **Control Panel**.
2. In the Control Panel window under Programs, click **Uninstall A Program**.
3. Click the program you want to uninstall and then click **Uninstall/Change**.
4. If you are prompted by User Account Control, enter your administrator credentials and then click **Continue**.
5. Follow the directions provided by the uninstall program.

Disable Background Programs or Services

If you don't want to uninstall a program or service completely, you can prevent the program or service from starting with Windows.

Many programs offer an easy way to prevent this behavior. You should try the following:

- Click or right-click the program icon in the notification area. Look for an Options, Preferences or Properties command. Sometimes, the program offers an option for having the program start with Windows.
- Start the program and look through the program menus for a similar option.
- Check the Startup folder on the Start menu. Often, programs place shortcuts there to load components at startup.

If a program does not offer a friendly way to prevent it from running with Windows, you can move on to the more powerful System Configuration utility (often called MSCONFIG, after the name of its executable file).

To use System Configuration:

1. Click **Start**. In the **Start Search** window, type **msconfig**. (You can also press WINKEY+R to open the Run dialog and then type msconfig.exe)
2. Under the search results, click **msconfig.exe**.
3. Enter your administrator credentials and click **Continue** if you are prompted by User Account Control.
4. In the System Configuration window, the **Startup** tab shows all the programs that are scheduled to start with Windows, as shown in Figure 11. Resize the columns so that you have a good view of the name and manufacturer.
5. Go through each item, clearing the check box for programs you don't want to start with Windows.
6. Click **OK**, and then restart the computer.

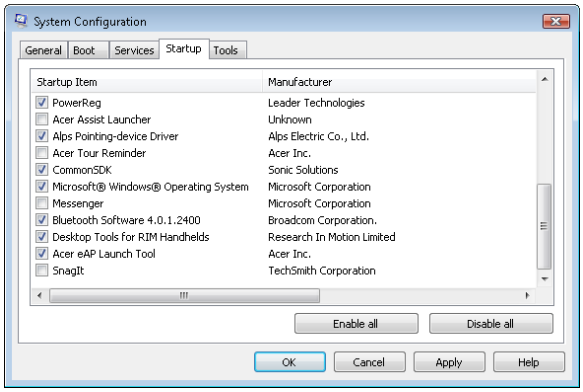


Figure 11. The Startup tab shows programs scheduled to start with Windows

Note: If you are not sure what a program is, research the program before disabling it. Also, while it takes longer, you might want to disable programs one at a time, restarting Windows to ensure that everything is running smoothly before disabling the next item.

You can also use Windows Defender to disable startup programs (Figure 12). The interface is more polished and includes information about the programs, but works much the same as the System Configuration tool. Note that if you have another anti-spyware program installed, Windows Defender likely will be unavailable.

To use Windows Defender to disable startup programs

1. Click **Start** and then type **Windows Defender** in the Search box.
2. When the Windows Defender dialog box appears, click **Tools**.
3. Under Tools, click **Software Explorer** and disable the programs you don't want to startup.

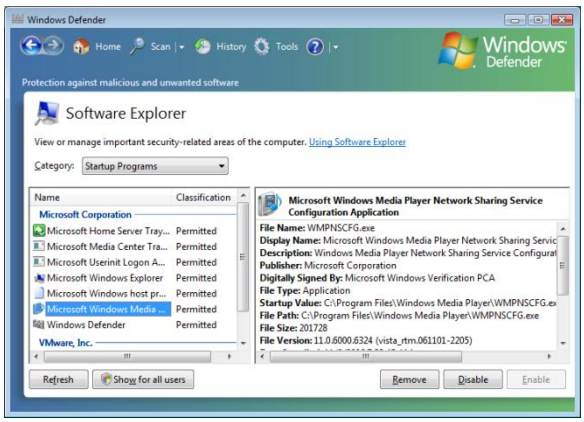


Figure 12. Windows Defender provides useful information about startup programs

Disable Unwanted Services

A service is a program designed to run in the background and provide particular services to the programs on a computer. While this sounds a lot like a regular program that runs in the background, there are a couple of important differences:

- Services can log onto the computer with specific credentials. This means that a service can run even if a user does not log on.
- Services may have dependencies. Services can be set so that other services must load first in order for a service to start.

These distinctions are important to understand when you set off to locate and disable unused services. Before you turn a service on or off, you must understand what that service does and whether other services depend on it to load.

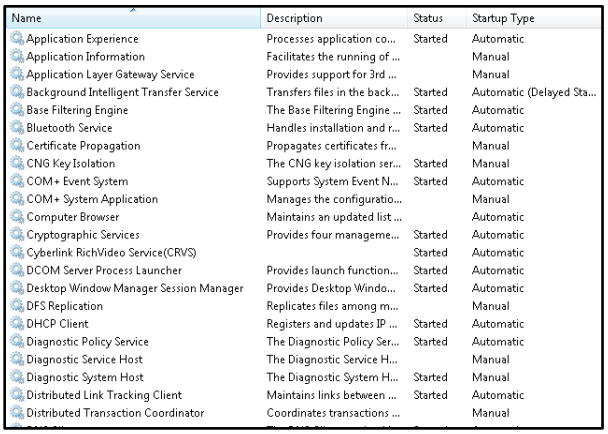
It is not a purpose of this guide to detail every service available on a computer running Windows Vista. However, it can give you some tips for determining if a service is a good candidate to disable and show you how to disable a service.

Warning: If you are ever unsure of what a service does, do not disable or stop it.

To view all services available on a computer:

1. Log onto the computer with an administrator account.
2. Click **Start** and then type **Services** in the Search box.
3. Under Programs, click **Services**.
   Enter your administrator credentials and click

Continue if you are prompted by User Account Control. The Services window is shown in Figure 13.



Name	Description	Status	Startup Type
Application Experience	Processes application co...	Started	Automatic
Application Information	Facilitates the running of ...		Manual
Application Layer Gateway Service	Provides support for 3rd ...		Manual
Background Intelligent Transfer Service	Transfers files in the back...	Started	Automatic (Delayed Sta...
Base Filtering Engine	The Base Filtering Engine ...	Started	Automatic
Bluetooth Service	Handles installation and r...	Started	Automatic
Certificate Propagation	Propagates certificates fr...		Manual
CNG Key Isolation	The CNG key isolation ser...	Started	Manual
COM+ Event System	Supports System Event N...	Started	Automatic
COM+ System Application	Manages the configuratio...		Manual
Computer Browser	Maintains an updated list ...		Automatic
Cryptographic Services	Provides four manageme...	Started	Automatic
Cyberlink RichVideo Service(CRVS)		Started	Automatic
DCOM Server Process Launcher	Provides launch function...	Started	Automatic
Desktop Window Manager Session Manager	Provides Desktop Windo...	Started	Automatic
DFS Replication	Replicates files among m...		Manual
DHCP Client	Registers and updates IP ...	Started	Automatic
Diagnostic Policy Service	The Diagnostic Policy Ser...	Started	Automatic
Diagnostic Service Host	The Diagnostic Service H...		Manual
Diagnostic System Host	The Diagnostic System H...	Started	Manual
Distributed Link Tracking Client	Maintains links between ...	Started	Automatic
Distributed Transaction Coordinator	Coordinates transactions ...		Manual

Figure 13. Adjust the columns so you can see the service name, description, status, and startup type

4. Click any service to see a basic description of that service.

   If you find the service description inadequate, try searching Microsoft TechNet using the service name as a key word. You can often find good information about what a service does.

5. Double-click a service to open its Properties dialog box (shown in Figure 14).
6. Use the Dependencies tab to make sure that other services are not dependent on the service you are examining.
7. To stop the service, click **Stop**.

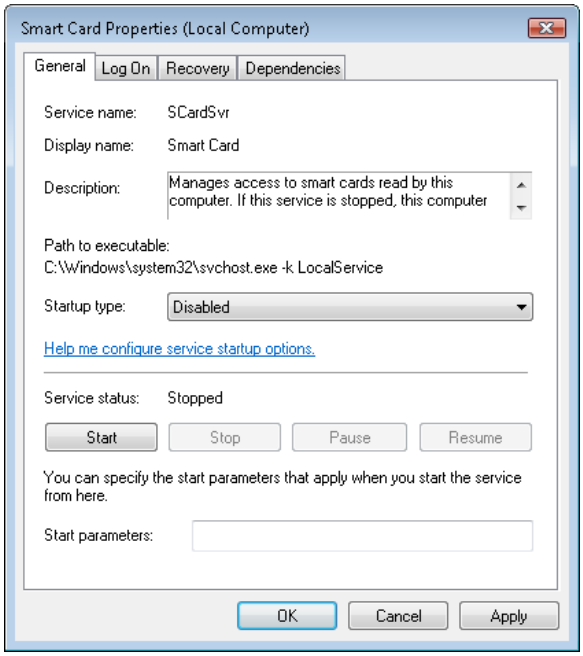


Figure 14. Disable a service if you are sure the computer does not need it.

8. To prevent the service from starting with Windows, from the Startup Type drop-down list, click **Manual**. This ensures that the service is still available, but you must start it manually if you need it. You can also choose **Disable** to make a service unavailable.
9. To prevent the service from starting during the normal startup period, but have it still run later, from the Startup Type drop-down list, click **Automatic (Delayed Start)**.
10. Click **OK**.
11. If you are asked to, restart the computer.

Improving Performance on User Account Control

While we recommend that the majority of your users run with standard user (non-administrator) privileges, there are times when it is necessary to deploy a subset of users with administrative privileges. In such circumstances, the User Account Control (UAC) Consent Prompt can slow access to administrative operations and has led some organizations to look at turning UAC off entirely.

A better alternative is to change the behavior of the elevation prompt for administrators to elevate without the prompting. This option, which can be set via Group Policy, allows the administrator to perform an operation that requires elevation without consent but still provides the

other benefits afforded by UAC, such as Internet Explorer Protected Mode.

For more information read "Understanding and Configuring User Account Control in Windows Vista" at the Windows Vista TechCenter.

Make Your Computer More Reliable

There are several steps you can take to help make a computer more reliable, and reliability can translate into better performance. Keeping your computer running reliably involves keeping your disk clean of unwanted files and keeping your disk defragmented.

Clean Things up with Disk Cleanup

Disk Cleanup examines a computer's drive to determine what files can be deleted.

Disk Cleanup can find and delete the following types of files:

- Downloaded program files
- Temporary Internet files
- Offline Web pages
- Recycle Bin contents
- Setup log files
- Temporary files
- Thumbnails
- Archived Windows Error Reporting

To run Disk Cleanup:

1. Click **Start**, point to **All Programs**, point to **Accessories**, point to **System Tools**, and then click **Disk Cleanup**. You can also type **Disk Cleanup** in the Search box on the Start menu.
2. Choose whether to clean up only the current user's files or files from all users on the computer.
3. Select the drive you want to clean up and then click **OK**.
4. After scanning the disk, Disk Cleanup presents the types of files that it found and shows how much disk space deleting those files will free up, as shown in Figure 15. Select the checkboxes of the file types you want to delete and then click OK.

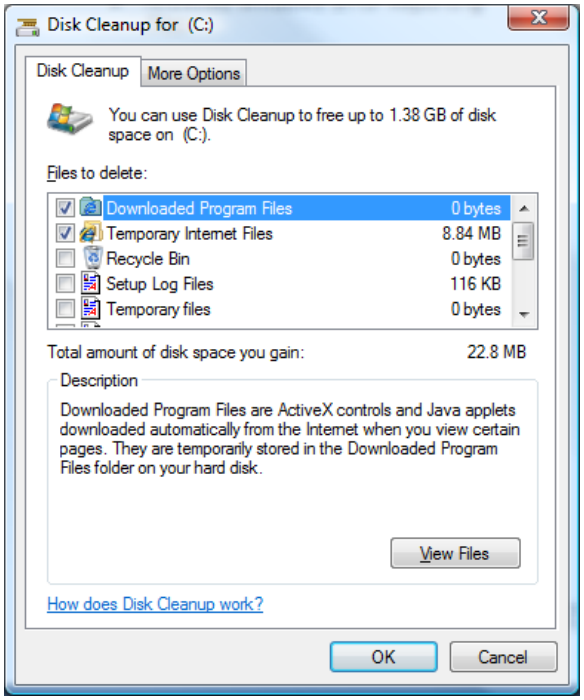


Figure 15. Use Disk Cleanup to delete unused files

Disk Cleanup becomes even more effective if you schedule it to happen automatically.

To schedule Disk Cleanup to run automatically:

1. Click **Start**. In the Search box, type **Task Scheduler**.
2. Click **Task Scheduler**.
3. In the **Actions** pane, select **Create Basic Task**.
4. Type a name for the task, and then click **Next**.
5. Select how often the task should run. For Disk Cleanup, **Weekly** is a good choice. Click **Next**.
6. Set the time and day the task should run, and then click **Next**.
7. Select **Start A Program** in the **Action** list. Click **Next**.
8. Click **Browse**, navigate to the **System32** folder (the default), and then select cleanmgr. Click **Open**.
9. Click **Next**, and then click **Finish**.

You should see your new task in the Task Scheduler window, as Figure 16 shows.

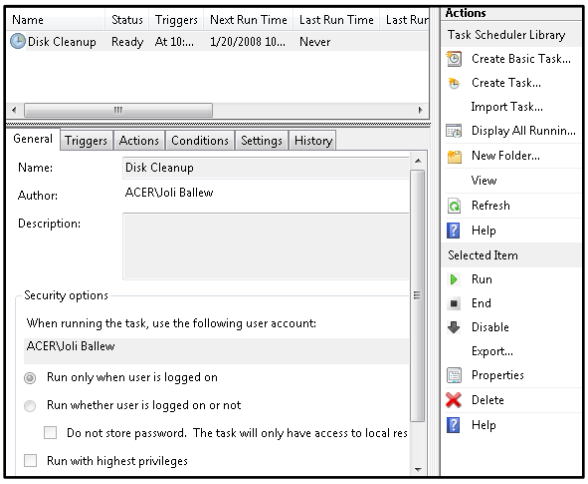


Figure 16. Create a task to run automatically to help improve performance

Defragment Your Disk

Disk fragmentation happens naturally as a computer is used. When a file here or there is deleted, Windows marks that space as available for new files to be written there.

When a new file is written, it may be bigger than those empty spaces. Part of the file may be written in one available space and part in another.

As time goes on, fragmentation becomes worse and can eventually slow the performance of the disk drive.

Windows Vista provides Disk Defragmenter, a tool that defragments a hard drive. By default, Windows Vista automatically defragments your hard drive once per week. But on occasion, you may want to run a manual defragmentation.

To run Disk Defragmenter:

1. Click **Start**, point to **All Programs**, point to **Accessories**, point to **System Tools**, and then click **Disk Defragmenter**. You can also type Disk Defragmenter in the Search box on the Start menu.
2. Enter your administrator credentials and click **Continue** if you are prompted by User Account Control.
3. Disk Defragmenter allows you to set up a schedule for defragmenting the disk automatically or to defragment the disk now, as shown in Figure 17.

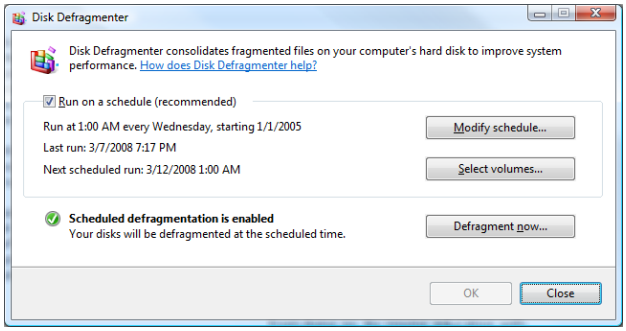


Figure 17. Defragment a disk regularly to keep it running smoothly

Defragmenting a disk can take a fair bit of time. If you are setting up a schedule, make sure you set it up to happen when the computer won't be used for a couple of hours.

Monitor Performance

In addition to configuring Windows Vista for optimum performance, you can also use built-in tools to monitor performance.

Check the Windows Vista Experience Index

The Windows Experience Index is a feature built into Windows Vista that shows how well Windows Vista and other software will perform on a computer.

A computer running Windows Vista is assigned a rating number called a base score that is a simplified measurement of a computer's hardware configuration.

The scale of the Windows Experience Index ranges from 1.0 to 5.9. A higher base score generally means that the computer will perform better and faster than a computer with a lower base score

The base score of your computer is determined by reviewing performance scores assigned to hardware components in the computer, as shown in Figure 18. These components include:

- RAM random access memory
- CPU central processing unit
- Hard disk
- General graphics performance on the desktop
- 3D graphics capability

A computer's base score is determined by the lowest

component score. For example, if the lowest score of any component is 3.3, then the base score will be 3.3.

A score of 3 is considered average and adequate for performing most tasks. A score of 4 or 5 is considered adequate for performing advanced functions.

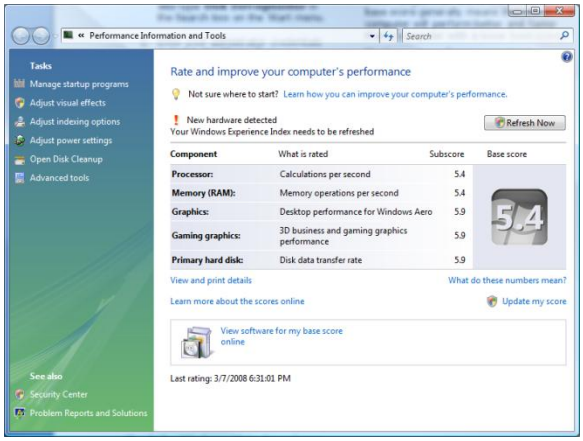


Figure 18. The Windows Experience Index gives a rough approximation of a computer's performance

Check Performance with Task Manager

Task Manager provides information about applications and processes that are currently running on a computer, and also provides real-time performance information about the processor, memory, and network usage.

You can start Task Manager in the following ways:

- Right-click any open space on the Windows taskbar and click Task Manager.
- Press CTRL+ALT+DELETE and select Start Task Manager.
- Press CTRL+SHIFT+ESCAPE.

The main tab in the Task Manager window that measures performance is the Performance tab, shown in Figure 19.

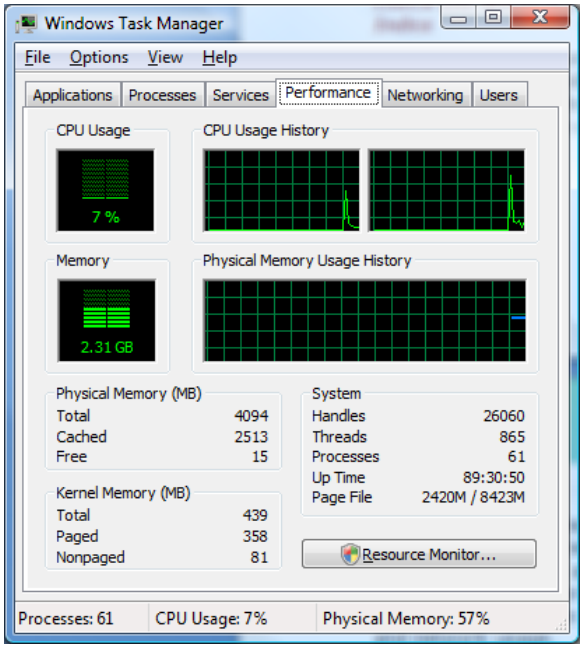


Figure 19. Use Task Manager to provide a real-time look at performance

The Performance tab is divided into the following sections:

- **CPU Usage** indicates the percentage of processor cycles that are not idle at the moment. If this graph displays a high percentage continuously (and not when there is an obvious reason, like such as a big application), your processor may be overloaded. If your computer has two processors, two graphs are shown.
- **CPU Usage History** indicates how busy the processor has been recently, although the graph only shows values since Task Manager was opened.
- **Memory** indicates the percentage of the physical memory that is currently being used.
- **Physical Memory Usage History** indicates how full the physical memory has been over time, although it also only shows values since Task Manager was opened.
- **Physical Memory (MB)** indicates the total and available physical memory, as well as the amount of memory in the system cache.
- **Kernel Memory (MB)** indicates the memory used by the operating system. Paged kernel memory is available only to system processes. Non-paged kernel memory can be used by applications when necessary.
- **System** provides totals for the number of handles, threads, and processes currently running. A process is

a single executable program. A thread is an object within a process that runs program instructions. A handle represents a specific input/output (I/O) instance. A process may have multiple threads, each of which in turn may have multiple handles.

Using Resource Monitor

On the Performance tab of Task Manager, you will also notice a button named Resource Monitor (refer to Figure 19). Click this button (and enter your credentials when prompted by UAC) to open Resource Monitor, shown in Figure 20.

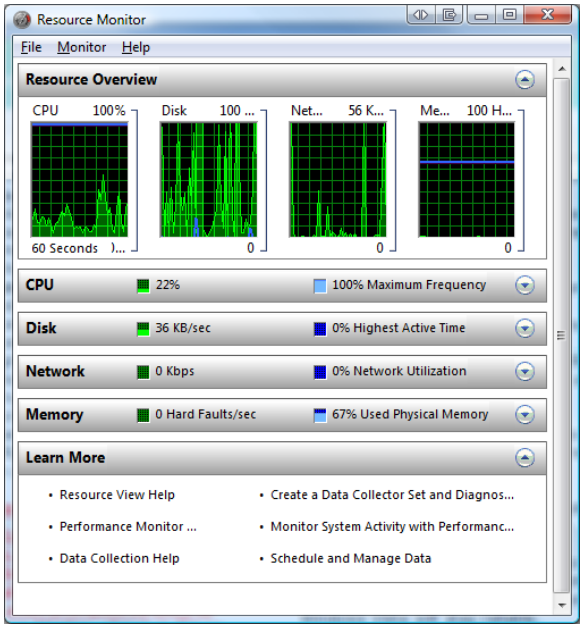


Figure 20. Monitor resource use in real time

The Resource Monitor window is divided into several sections:

- **Resource Overview**. This section shows graphs that are identical to those shown in the Task Manager Performance tab.
- **CPU**. This section lists processes that are consuming CPU cycles, much like the Processes tab in Task Manager.
- **Disk**. This section shows in real time what processes are reading and writing to disk.
- **Network**. This section shows in real time what processes are sending and receiving on the network.
- **Memory**. This section shows in real time what processes are committed to memory.
- **Learn More**. This section features links to various information in Windows Help about monitoring resources.

Apply Improvements Across the Organization with Group Policy

In an organization with an In an organization with an Active Directory® Directory Service domain, Group Policy allows you to efficiently enforce security and configuration settings for groups of computers and users by distributing the settings automatically throughout a site, domain, or organizational unit.

You can use Group Policy to control the following types of settings:

- The programs available to a computer or user (including the ability to deliver customized installations of programs).
- The programs that appear on a user's desktop.
- Options for how the Start menu appears.
- Security options like password requirements and Guest account status.
- Whether the user can add new hardware devices or install new programs.
- Disk Quota limits.
- Whether the user can change system settings.
- Many settings found in various Control Panel applications.
- Additional registry-based settings for Windows components or other applications.

Being able to control the applications that are installed on users' computers greatly reduces the impact of background programs, improperly configured programs, and malware on a computer's performance.

Being able to control users' ability to change system settings also helps ensure that a properly-performed installation of Windows Vista will stay reliable.

Note: For a deeper look at Group Policy, visit http://www.microsoft.com/grouppolicy.

Teach Your Users Well

Beyond traditional performance improvements, such as physically improving a computer or optimizing system

settings, you can also improve the performance of your organization as a whole by making sure that users are well-trained.

For example, you can make sure that users understand that installing third-party software or downloading and installing software from the Internet can cause computer or network-wide problems. You can also block users from being able to do this in many situations.

By mixing education with management techniques, you can keep your enterprise computers from being compromised by your own employees and help users work more safely and efficiently at the same time. You can also teach users how to improve their productivity by using the tools included with Windows Vista.

Summary

There are multiple ways to improve a computer's performance. You can use hardware to boost the actual performance of a computer. New technologies in Windows Vista such as ReadyBoost and ReadyDrive can help speed up a system with relatively little effort.

Making a computer start faster can also improve the perceived performance of the computer, as well as its reliability and security. Start by disabling unused programs and services scheduled to start with Windows.

There are also numerous configuration changes you can make that help a computer feel faster when you use it. These include optimizing power settings and indexing options, as well as disabling unused visual effects.

And when you have learned how to optimize the performance of a single computer, you can then learn ways to apply those optimizations to multiple computers across a network. Features of Windows, such as Group Policy, make it easy to apply configuration changes to entire groups of computers and users.
