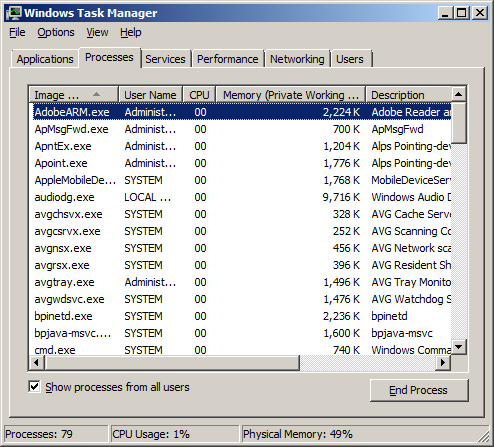
**System Performance**

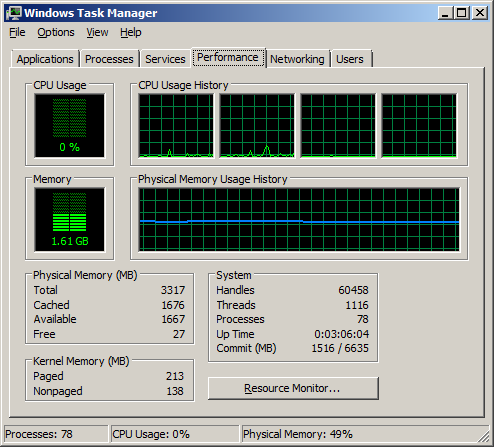
**Task Manager**

Windows Task Manager is a tool which helps you monitor essential hardware resources, including your central processing unit (CPU), memory, and network adapter. You can quickly spot programs that are using excessive amounts of system resources and just as quickly determine whether a sudden slowdown is caused by too little memory. Sometimes the reason a system turns sluggish is because too many programs or services are running in the background.

**You can open the Windows Task Manager at any time by pressing Ctrl+Alt+Delete. Then click Start Task Manager. (Can type taskmgr at Run dialog, or press Ctrl+Shift+Esc).**



The Windows Task Manager is a multi-tabbed dialog box. The Applications, Processes, Services and Performance tabs are visible on all Windows 7 systems. The Networking tab is visible only if the computer is configured with a network adapter, and the Users tab is shown only if Fast User Switching is enabled. A status bar at the bottom of the window, visible on all tabs, displays the number of processes that are currently running, the percentage of your CPU’s processing capacity that’s currently in use, and some information about your system’s current memory usage. Each entry on the Processes tab of Windows Task Manager provides useful details about memory and CPU usage for that process.



The Performance tab gives you a big-picture view of CPU and memory usage. It provides four graphs and some tabular data. The CPU Usage and Memory Usage graphs display the percentage of your CPU’s processing capacity and the amount of physical memory capacity that your system is currently using as of the most recent update of Windows Task Manager. The CPU Usage History and Physical Memory Usage History graphs show the same performance measures over time.

How much history the two history graphs record depends on Windows Task Manager’s current update speed and the width of its window. Each vertical gridline in these graphs represents six update intervals. If you widen the window, you see more history. **By default, Windows Task Manager updates its data once every two seconds.** To increase the frequency to twice per second, in Task Manager, click View, choose Update Speed, and then change the frequency from Normal to High. To reduce the update frequency to once every four seconds, choose the Low setting from the Update Speed menu. If you want to study the graph of the most recent history, you can stop all updates by clicking View and choosing Update Speed, Paused.

On the vertical axis, all four graphs are scaled from 0 to 100 percent. Increasing the height of the window expands the axis without changing its end points, making the graphs easier to read.

The percentage of physical memory being used is listed at the bottom of the Task Manager window.

**Monitoring Memory Usage**

The most common reason a Windows system slows down is that you’ve filled every bit of physical memory. When this happens, Windows begins a process called ***paging***—that is, moving blocks of program code and data files (each block is called a *page*) out of memory and onto disk. A modest amount of paging is perfectly normal, but excessive paging can take a terrible toll on overall system performance. This type of performance problem is especially noticeable when trying to switch between several memory-intensive programs on a computer that doesn’t have enough RAM to keep up. The result is nearly nonstop “thrashing” as the disk tries in vain to shuffle data to and from the much faster memory chips.

For a quick snapshot of current memory usage, open Windows Task Manager and examine the Performance tab. The statistic at the far right, **Commit (MB)**, lists two numbers, presented as a fraction. The first number (the numerator) represents your current *total commit charge*—the total amount of physical and virtual memory in use by all running processes. (*Virtual memory* is memory backed by your page file.) The second number (the denominator) represents your total available memory, physical and virtual. By itself, this number will only tell you whether you’re about to completely run out of memory—in other words, when commit charge is nearly equal to available memory.

**Decoding Task Manager Performance Data**

**Physical Memory (MB)**

**Total** Total amount of physical RAM installed in the computer, measured in megabytes.

**Cached** Cached refers to the amount of physical memory used recently for system resources. Windows will try to use as much physical RAM as possible for this function, but will release RAM from the file system cache when needed for programs and operating system functions.

**Available** The amount of memory that's immediately available for use by processes, drivers, or the operating system

**Free** Free is the amount of memory that is currently unused or doesn't contain useful information

**Kernel Memory (MB)**

**Paged** The total amount of virtual memory used by by the core part of Windows, called the kernel.

**Nonpaged** The total amount of physical memory used by the kernel.

**System**

**Processes** Total number of processes (programs, subsystems, and services) running for all users of the local computer. (This number is also displayed in the lower left corner of the Task Manager window.)

**Uptime** Time since system startup.

**Commit (MB)** Total/Limit

**Total** Total amount of physical and virtual memory currently in use by the operating system and all programs. Commit charge increases as you open additional programs and data files and should decrease when you close programs and files.

**Limit** Total amount of physical and virtual memory on your computer. To raise this limit, add more RAM or increase the size of the page file, or both.

**Note:**

If your system starts to slow down and you suspect that memory is the issue, a quick scan of the Performance tab can provide important clues. If Total Commit is higher than Total Physical Memory, for instance, Windows must swap pages between fast RAM chips and the much slower virtual memory in the page file, causing the system to slow down.

On the other hand, if the Total Commit is a lot less than Total Physical Memory, the excess RAM will not go to waste. Windows will devote a large portion of it to caching previously loaded programs and data files. You will be able to see this in the Cached value in Physical Memory. The result is a tremendous boost in apparent speed in everyday use. Each time you start a program or load a file, Windows first checks to see whether that file is already stored in the cache; if the file is there, it loads in a fraction of the time it would take to access the file from the hard disk. An operation that might take eight to ten seconds when running from the hard disk can complete in two to three seconds if the necessary files are already in the cache.

**Preventing Low Memory Problems**

When your computer doesn't have enough memory for all of the actions it's trying to perform, Windows and your programs can stop working. To help prevent information loss, Windows will notify you when your computer is low on memory. You can also learn to recognize the signs of low memory and take steps to prevent the problem.

## What are the signs of low memory?

Signs of low memory include poor performance, low-memory or out-of-memory notifications, and display problems. For example, if you try to open a menu in a program when your computer is low on memory, the program might respond slowly or appear to stop responding. If the menu appears, it might not respond when you try to click an item or it might not display all items. If you click a menu item, the menu might also disappear and leave a blank area on the screen instead of displaying the contents of the document or file you're working in.

## Why do low memory problems occur?

Your computer has two types of memory, random access memory (RAM) and virtual memory. All programs use RAM, but when there isn't enough RAM for the program you're trying to run, Windows temporarily moves information that would normally be stored in RAM to a file on your hard disk called a paging file. The amount of information temporarily stored in a paging file is also referred to as virtual memory. Using virtual memory—in other words, moving information to and from the paging file—frees up enough RAM for programs to run correctly.

Low memory problems occur when your computer runs out of RAM and becomes low on virtual memory. This can happen when you run more programs than the RAM installed on the computer is designed to support. Low memory problems can also occur when a program doesn't free up memory that it no longer needs. This problem is called memory overuse or a **memory leak**.

## How to prevent low memory problems

**Running fewer programs at one time** can help prevent low memory problems and information loss. It's a good idea to observe which programs show signs of low memory conditions and try not to run them at the same time.

However, it’s not always convenient or practical to run a limited number of programs. Signs of low memory can indicate that the computer needs more RAM to support the programs you use. Here are the recommended ways to solve or prevent low memory problems:

* **Increase the paging file (virtual memory) size**

Windows automatically attempts to increase the paging file size the first time your computer becomes low on memory, but you can also manually increase it up to a maximum size that is determined by the amount of RAM installed. Although increasing the paging file size can help prevent low memory problems, it **can also make your programs run more slowly**. Because your computer reads information from RAM much faster than from a hard disk (where the paging file is), making too much virtual memory available to programs will slow them down.

* **Install more RAM**

If you see signs of low memory, or if Windows warns you about a low memory problem, check the information that came with your computer or contact the computer manufacturer to determine which type of RAM is compatible with your computer, and then install more RAM. To install RAM, check the information provided by the manufacturer.

* **Determine if a program overuses memory**

If the computer becomes low on memory whenever you run certain programs, one or more of those programs might have a memory leak. To stop a memory leak, you need to close the program. To repair a memory leak, you need to check for updates for the program or contact the publisher of the software.

To determine which program is using the most memory, follow these steps:

* 1. Open Task Manager by right-clicking the taskbar, and then clicking Start Task Manager.
  2. Click the Processes tab.
  3. To sort programs by memory usage, click Memory (Private Working Set).

You can also check for program errors and troubleshooting information using Event Viewer.

* 1. Open Event Viewer by clicking the Start button Picture of the Start button, clicking Control Panel, clicking System and Security, clicking Administrative Tools, and then double-clicking Event Viewer.‌ Administrator permission required If you're prompted for an administrator password or confirmation, type the password or provide confirmation.
  2. In the left pane, click Applications and Services Logs to view error events. To see a description of the problem, double-click the event. To see if troubleshooting information is available, look for a link to online Help.

**The Processes Tab**

To view memory use for individual processes on your computer, click the Processes tab. The Memory (Private Working Set) column is selected by default. Private working set is a subset of **Working Set**, a technical term that describes how much memory is being used by each process. **Private Working Set** specifically describes the amount of memory a process is using that can't be shared by other processes.

The CPU column shows the percentage of CPU used by the process.

To do:

Run Task Manager

**Exercise 1**

List the applications (if any) that are running

Internet Explorer, Powerpoint, Word, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Note: these are all started by you. The Applications tab does not list any system processes or hidden processes or services.

From the Processes tab, specify

The process using the maximum amount of memory \_SavService.exe\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

From the Performance tab, specify

The number of processes \_\_\_77\_\_\_\_\_

The total amount of physical and virtual memory currently in use by the operating system and all programs.\_\_\_\_1796\_\_\_\_\_\_\_\_\_\_

Total amount of physical and virtual memory available on the computer\_\_\_\_\_16gb\_\_\_\_\_\_\_

Total physical memory i.e. RAM\_\_\_\_\_\_8061\_\_\_\_\_\_\_

The available RAM\_\_\_\_\_3980\_\_\_\_\_\_\_\_\_\_

Amount of RAM used for System Cache \_\_\_\_1916\_\_\_\_\_\_\_\_

For the kernel: (i.e. operating system)

Paged memory \_\_\_\_474\_

Nonpagedmemory**\_\_\_52\_\_\_\_**

What is ratio of Total commit charge to Total Physical Memory?

From the Processes tab:

Check the Show processes from all users if it is not already checked.

Specify any System process \_\_\_\_\_\_\_cmd.exe\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Specify any Local Service \_\_\_\_\_\_\_\_SavService.exe\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Specify any Network Service \_\_\_\_\_\_svchost.exe\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Note: the System Idle Process is not a process, more a counter which is displayed in Task Manager used for measuring how much idle time the CPU is having at any particular time.

How much CPU time is used by System Idle Process? \_\_\_\_\_\_\_\_99\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Exercise 2**

Start two separate instances of the **notepad** application. (Start, Type notepad.exe just above the start button in the text box that has “Search all programs and files”, then hit return OR click the ‘New Task’ button on the applications tab and type in Notepad.exe). Confirm that the Task Manager Applications tab shows both applications running.

Right click on one instance of Notepad in the Applications tab. Choose Go To Process

What is the corresponding process ? \_\_Notepad.exe\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the total amount of physical and virtual memory now in use by the operating system and all programs? \_\_2482\_\_\_\_\_\_\_\_\_\_\_\_

Verify that it is larger than the value above, before Notepad was run.

In the Applications tab select one of the notepad applications and then click the ‘Switch to’ button. Describe what happens.

The second one minimizes

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Then click the ‘End Task’ button and describe what happens.

\_Notepad closes.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Finally start an instance of **WordPad** using the ‘New Task’ button. Type in WordPad.exe

Verify that all applications appear in Applications tab.

**Exercise 3**

Select the Processes tab. Identify the process that is using most of the CPU time.

System Idle Process

**Exercise 4**

Create a simple java (or basic program) with an infinite loop that repeatedly performs some simple math calculation.

while (true)

simple calculation

Run this program.

**Note: java.exe is the process that is running while your java program is executing.**

What is the percentage of CPU time your program is using. Explain the result.

30% The cpu usage is clocking from 29% to 30% because of the infinite loop.

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You can see the CPU time used by the operating system. To do this select the menu item View, then Show Kernel Times to add an additional kernel related red line to the graph.

How much CPU time is used by the operating system while your java program is running. \_\_25%\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Now add code to do output inside your loop e.g. System.out.println(“Hello World”)

How much CPU time is now used by the operating system while your java program is running. Explain your answer. \_1 second, the print is outside the loop!! \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Run the program with the infinite loop 4 times. i.e. open your IDE 4 times and create and run the same program.

What is the percentage of CPU time is now being used by your processes. Explain the result. \_\_95-100% 4 processes are sharing 4 different cores

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Run it another time so that now your infinite loop is running 5 times. What is the percentage of CPU time is now being used by your processes. Explain the result.

\_Constant 99 to 100% extra infinite loop is causing stress in the cpu resulting in the computer to freeze \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Exercise 5**: Run the infinite loop program. When the program is running, assign it to one processor, say CPU 0. To do this, right click on the java.exe process in Processes tab, and choose Set Affinity.. Select CPU 0 only.

What is the percentage of CPU time the java.exe process is using? Explain the result.

100% It’s taking up the entire CPU usage because the program is an infinite loop. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Run the infinite loop program another time and again assign the process to CPU 0 only.

What is the percentage of CPU time the two java processes are using? Explain the result.

\_\_100% There is no change

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**Exercise 6:**

Create a simple java (or basic program) that requests the user to input some value. Use JOptionpane.showInputDialog, or similar, to ask for input in Java.

Run this program. Let it wait for input. Check the Processes tab of the Task Manager and identify the process and write down the percentage of CPU time it is using. Explain the result.

28% When you run the java program (using JOptionPane.showInputDialog) the CPU clock hikes up to 28%, but it immediately drops down to 0% slowly.

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**Exercise 7:**

Select the Performance Tab. Select the menu item View, Show Kernel Times’ to add an additional kernel related red line to the graph. Run Notepad again. Put TaskManager window over Notepad window. Click and hold the left mouse button over the Notepad window title. Move the window rapidly over around the screen and watch the CPU usage graph change. Explain what is happening. Look at what is happening in Processes tab in CPU column also.

The red line (kernel time) goes up.

**Exercise 8:**

Specify for the kernel: (i.e. operating system**)**

Paged memory\_534\_\_\_\_

Nonpaged memory **\_\_\_61\_\_\_\_**

Start 5 instances of **Wordpad** and describe. Now specify kernel level memory.

Paged \_534\_\_\_\_

Nonpaged **\_\_\_61\_\_\_\_**

Explain what has happened. \_\_Didn’t change anything\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Exercise 9**

**Looking at System process, Local Services and Network Service.**

As well as user processes, there are Local Services, Network Services and System processes running.

In the Processes tab, you can add extra columns by choosing View menu option, then Select Columns.. and check any column you want to add. Add the Description column.

Find the following information in the Processes tab:

**System processes**

Name of any system process \_\_System Idle Process\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Description of this process \_\_Percentage of time the processor is idle\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Local Service**

Name of Local Service \_\_\_svchost.exe\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Description of service \_\_\_Host process for Windows services\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Network Service**

Name of Local Service \_\_\_WmiPrvSE.exe\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Description (summary) of service \_\_WMI Provider Host\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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