Windows User Benchmarks Contents

The index lists help topics available for the Windows User Benchmarks. Use the scroll bar to see entries not currently visible in the Help window.

For further information on using help, press F1 or choose Using Help from the Help menu.

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![W] Commands

To get help for the menu commands below, choose the appropriate menu title.

For further information on using help, press F1 or choose Using Help from the Help menu.

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Basic Skills

The Basic Skills list gives you information about the basics of the Windows User Benchmarks. Use the scroll bar to see more items if necessary.

For further information on using help, press F1 or choose How to Use Help from the Help menu.

Running the Benchmarks
> Running the Benchmarks
> Running Individual Tests

General
> Printing the Display
> Using the Clipboard
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Advanced Techniques

The Advanced Techniques list gives you information about advanced topics. Use the scroll bar to see more items if necessary.

For further information on using help, press F1 or choose How to Use Help from the Help menu.

Obtaining Accurate Results
Analysing the Results
Comparing Tests

Glossary

The Glossary topic gives you definitions of commonly used terms.

For further information on using help, press F1 or choose How to Use Help from the Help menu.

Benchmark
Bitmap
Cache
CIX
Colour Depth
CPU
Disk Fragmentation
Expanded Memory
Extended Memory
IDE
Landmark
Metafile
MIPS
Rebooting
Reference System
SCSI
Shell
Status bar
Tool bar
Wait States
WIN87EM.DLL

File Menu Commands

Use the scroll bar to see more commands.

New
Clears any previous benchmark results.

New will zero the results of any previous tests, ready for you to perform a new set of benchmarks. The New command will also turn off the benchmark display's 'monitor'.

Related Topics
Running the Benchmarks

Open
Opens a previously saved set of benchmark results.

Open will load in a previously saved .MRK file and display the overall results. You can then print them out, copy them to the clipboard, or compare them with another set using the Compare command.

Related Topics
Comparing Tests
Printing the Display
Using the Clipboard

Save
Saves a copy of the current test results.

If the current file is 'Untitled' then you will be prompted with a dialog box to specify the file name. You can only save the tests once a complete run has been performed.

Related Topics
Comparing Tests

Save As
Saves a copy of the current file under a specified name.

If the file already exists then you will be prompted to say if you wish to overwrite the older copy.

Related Topics
Comparing Tests

Print
Prints the current display.

The current display is printed, although any icons on the display will not appear.

Print Setup

Sets up a printer.

Displays the standard Windows printer setup dialog box. You can use this dialog box to change your active printer or modify its settings.

Exit
Exits the Windows User Benchmarks.

Edit Menu Commands

Copy

Copies the display to the clipboard in text, <u>bitmap</u> and <u>metafile</u> formats. You can then paste the results in any of these formats into another application.

Related Topics
<u>Using the Clipboard</u>

Machine Name

Allows you to enter a name for your machine. This will appear on result printouts and on the comparison graph.

Related Topics
<u>Comparing Tests</u>

Test Menu Commands

Use the scroll bar to see more commands.

Processor
Tests the processor speed. The maths co-processor (or a Windows-based emulation of it) is also tested.

Memory
Tests the speed of memory allocations within Windows.

Graphics
Tests the speed of graphics operations. Only a few operations are tested; these are the most significant ones for the majority of common Windows applications.

Disk
Tests the speed of the hard disk. If you have more than one hard disk, then the Benchmarks use whichever disk is used by Windows for creating temporary files.

Windows
Tests the speed of Windows in a variety of operations, including DOS session speed. If you are running in Standard Mode, then the windowed DOS tests are replaced by full screen DOS session tests.

Related Topics
Running Individual Tests

Everything
Performs the complete suite of benchmark tests.

Related Topics
Running the Windows User Benchmarks

Three Test Average
Runs the complete suite of benchmark tests three times and displays an average result. Use this setting, with input disabled, to obtain the most accurate results.

Obtaining Accurate Results

Disable Input
Disables keyboard and mouse input during testing to make the results more accurate.

Related Topics
Obtaining Accurate results

System Menu Commands

Use the scroll bar to see more commands.

System Information
Displays a dialog box giving detailed system information, divided into DOS/hardware and Windows-specific sections.

Related Topics
Viewing System Information

CONFIG.SYS
Edits your CONFIG.SYS file using Notepad. Reboot your system to make the changes take effect.

AUTOEXEC.BAT
Edits your AUTOEXEC.BAT file using Notepad. Reboot your system to make the changes take effect.

WIN.INI
Edits your WIN.INI file using Notepad. Restart Windows to make the changes take effect.

SYSTEM.INI
Edits your SYSTEM.INI file using Notepad. Restart Windows to make the changes take effect.

Restart Windows
Restarts Windows to make any changes to WIN.INI and/or SYSTEM.INI take effect.

Reboot System
Reboots your machine to make any changes to AUTOEXEC.BAT and/or CONFIG.SYS files take effect.

Help Menu Commands

Use the scroll bar to see more commands.

Contents
Shows the Contents page of this Help system.

Search for Help On
Displays the keyword search dialog of the Help system.

Analyse Results
Analyses the benchmark results.

The Analyse command displays a dialog listing the results of the benchmark analysis.
Double click on a title in the list to display the required information.

Related Topics
Analysing the Results
Obtaining Accurate Results

How to Use Help
Displays the help for the Help system.

About Benchmarks
Displays the copyright and version information.

🟢 **Running the Benchmarks**

The best way of running the Windows User <u>benchmarks</u> is to click on the 'GO' button at the left hand end of the <u>tool bar</u>, or by selecting 'Everything' from the Test menu. This will start a series of system tests, displaying the results after approximately two to three minutes depending upon the speed of the PC.

The tests are designed to check the performance of all parts of your system, from your <u>CPU</u> right through to the graphics controller and hard disk. Don't worry if your monitor makes a clicking sound during the DOS session tests - this is normal for some multisync monitors as they switch modes.

As the tests progress, the icons at the bottom of the screen give the individual results for each of the five components of each test. The grey <u>status bar</u> at the bottom of the screen shows the progress of each test in percentage terms.

The results are given in the form of a comparative bar chart which compares your machine with four <u>reference systems</u> ranging from low-powered machines to high-powered workstations. Most machines will fall somewhere in between.

The red bar shows your machine, and the blue bars show the reference systems. The individual components are displayed along the bottom of the screen.

Once all the results have been calculated you can use the <u>Analyse Results</u> button or menu item to give you more details of your system's relative speed, as well as any bottlenecks which may be occurring.

Unless the Disable Hardware option is checked, the tests can be interrupted at any time by pressing the Esc key. However, disabling hardware input gives much more accurate results.

Individual results
You can also run the individual benchmark components one at a time by using the five buttons in the tool bar or by choosing the component items from the Test menu. After running individual tests a bar chart will be displayed, comparing your system's performance on the test with four reference systems. However, the Analyse Results option is only available if the most recent test completed was the overall test or if you open a previously saved .MRK file.

See also:
<u>Running Individual Tests</u>
<u>Obtaining Accurate Results</u>
<u>Comparing Tests</u>
<u>Printing the Display</u>
<u>Using the Clipboard</u>

Running Individual Tests

The individual tests can be run using the buttons on the <u>tool bar</u> or by selecting individual test items from the Test menu. Once completed, the results are displayed in a bar chart together with four <u>reference systems</u>.

The tests are discussed below in their five categories. Whilst every care has been taken to ensure that the results are generally reproducible to within ±3%, results cannot be guaranteed to be exactly the same during each test session because of the constantly changing nature of the Windows system. It is advisable to take the average value over three or four testing periods, particularly when running the Windows User Benchmarks on machines with low memory,

Processor
The processor tests check the speeds of general CPU operations:

- Memory moves
- Register processing
- Near and far jumps
- Integer calculations
- Floating point calculations

The tests are weighted in favour of simple memory and register operations and integer arithmetic. The floating point calculations do not have a huge bearing on the overall figure, since most Windows software does not require or use a maths co-processor explicitly. Where a co-processor (or 486DX) is not installed, the calculations are carried out using the <u>WIN87EM.DLL</u> library. Calculations involving the use of this library may be up to an order of magnitude slower than they would be with a hardware co-processor installed. Floating point calculations tests are carried out using both double and IEEE 80-bit representations, to cater for the needs of a broad range of applications such as spreadsheets, CAD packages and science and engineering software.

Memory
Memory speed is no longer a major issue in PC design, as most modern processor chips have a <u>cache</u> for enabling near-zero wait state access. However, under Windows the amount of memory and its fragmentation will affect performance greatly.

The test checks:

- Local memory
- Global memory (32K to 128K)
- Global memory (256K to 512K)
- Memory copy
- Memory set

Both local and global memory is tested, although the weighting system places more importance on the global memory results since local memory is usually not used for anything other than temporary storage.

Graphics

The graphics display is the biggest single factor in the perceived speed of a Windows system, and may well make the difference between a computer with a fast CPU seeming sluggish or quick.

The test checks the following:

- Bitmap drawing (2, 4, 8 and 24-bit BitBlt functions)
- Bitmap stretching (2, 4, 8 and 24-bit StretchBlt functions)
- Vector graphics drawing (lines, curves and complex filled regions)
- Filled rectangle drawing
- Scrolling
- Text output (in a variety of faces, sizes and styles)

The graphics tests are designed to test the most frequently called graphics routines. For example, the Arc/Ellipse routines are rarely called by Windows applications and are thus given comparatively little weighting in these tests, but the FillRect function is widely used. The graphics test results are highly dependent on the type of graphics system present, the chipset in use and the display driver, although the speed of the CPU and bus will have a bearing.

Hard disk

The hard disk is one of the most crucial elements in a Windows system, since Windows relies on reloading code segments from disk as memory is discarded. In enhanced mode, the efficiency of a swap file set up to allow virtual memory usage also depends upon the hard disk speed.

The following are tested:

- Small size file read/writes (20 bytes to 5K)
- Medium size file read/writes (10K to 256K)
- Large size file read/writes (512K to 2Mb)
- Temporary file creation/deletion
- General disk operations

The disk tests automatically use the fastest hard disk available. SmartDrive (or any other disk cache) is enabled for the duration of the tests, but the write cache buffer (if any) is flushed, giving a truer reflection of hard disk speed. The tests are weighted towards medium size files, since the smaller and larger sizes are atypical of most Windows applications. General disk operation tests include creation and deletion of files and random read/writes.

Windows

The final test checks general Windows specifics which are not covered in the previous tests. To a large extent this involves checking internal functions as well as the speed of DOS box operations.

The tests include:

- Dialog box creation
- Window management
- Windowed DOS session (full screen for 286's in standard mode)
- Full screen DOS session
- General Windows functions from the GDI, USER and KERNEL libraries

The use of the DOS session leads to a slight inconsistency in the results between 286 and 386/486 machines, since machines operating in standard mode cannot open windowed DOS sessions. This is not a problem, as long as it is realised that measuring standard mode operation against enhanced mode operation is not a valid comparison.

Do not be alarmed if the monitor clicks loudly during the full screen DOS test. Multisync monitors which use separate relays to switch in the different scanning frequencies may exhibit this phenomenon.

Printing the Display

The results display can be printed by selecting the Print option from the File menu or by clicking on the print button in the <u>tool bar</u>. Printing is disabled if there are no results displayed. Icons at the bottom of the display are not printed.

You can configure your printer by using the Print Setup dialog box to change printer, paper size and orientation and paper source.

Using the Clipboard

The clipboard can be used to paste the displayed results graph into another application. The following formats are available:

- ANSI text
- Windows bitmap
- Windows metafile
- OEM text

The metafile does not contain any bitmaps, but is scalable and will print at the full resolution of any output device. The resolution of printed bitmaps is restricted to the resolution of your display.

Viewing System Information

The Windows User Benchmarks can provide a wealth of information about your hardware and system software. The System Information dialog allows you to select information on two topics:

- **DOS**
  The processor type, presence of co-processor, memory and hardware configuration are listed. The <u>extended memory</u> value is the total extended memory in addition to the base 1Mbyte of conventional memory.

  The DOS version is listed, together with the name of the network driver which is currently being used.

- **Windows**
  Version and configuration information for your Window setup is displayed, including screen resolution and number of colours, swap file information and resources. The system resources value displayed in Program Manager's About box is in fact the lower of the GDI and USER values which are displayed by the benchmarks.

![icon] Obtaining Accurate Results

Whilst every effort is made by the benchmark program to obtain accurate results, successive tests may give slightly different results. This can be due to many factors, including software and/or hardware disk <u>cacheing</u> and memory fragmentation. We recommend that the tests are carried out more than once and an average value taken for greatest accuracy. In order to facilitate this process, the Three Test Average command on the Test menu can be used. This will run through the complete suite of tests three time and display an average over all three tests.

You can also make your results more accurate by running with only your <u>shell</u> program loaded (Program Manager, for example) and by using the Disable Input option to turn off the mouse and keyboard hardware during the tests. If input is disabled, you will not be able to cancel the tests by using the Esc key.

Analysing the Results

Once all the tests have been completed, the Analyse option on the Help menu (and the Analyse button on the <u>tool bar</u>) will become available. Choosing Analyse displays a dialog with a list of options. In addition to a general results analysis and help in optimising the performance of your system, the Benchmarks may also highlight any bottlenecks. These are components which are markedly slower than the rest of your system.

Sometimes these bottlenecks can be cleared easily. For example, your system might exhibit a poor display speed which can be improved by switching to a lower resolution or colour depth. Similarly, hard disk performance may be improved by enabling SmartDrive or configuring a hard   disk cacheing controller correctly. Often, however, hardware replacement is the only solution.

Comparing Tests

After a complete set of tests has been run you can save the results with a representative name for your machine (entered using the Machine Name... option on the Edit menu). The date the tests are carried out is also saved.

You may also compare the current set of results with a previously saved set. Both machine names and test dates are displayed alongside a comparative bar graph. Using file comparison in this way can help you fine tune your system and gauge the benefits of any hardware changes or software optimisation.

![W] About Windows User

Windows User, from Reed Business Publishing, was the first newsstand magazine devoted solely to all things Windows. Each month, Windows User analyses all the news from the world of Windows, reviews major new hardware and software products and provides a wealth of background information for Windows users everywhere.

Windows User is well known for the quality of its in-depth reviews and for its coverage of Windows hardware. A thriving question-and-answer section and the innovative Points and Clicks pages serve to make Windows computing easy and fun for all our readers.

Windows User also runs a conference on the CIX on-line service - at the prompt type **join windows_user**. This is an open conference where readers and the Windows User team can discuss issues arising from the magazine, swap ideas and explore some of the cultural issues surrounding Windows. In addition we try to deal with readers' technical problems, and shareware programs, macros and hints and tips are regularly uploaded to the file area.

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![W] About the Reference System

As with all benchmarking systems, a <u>reference system</u> is required to provide a baseline for the results. The old-fashioned concept of IBM PC = 1.0 obviously doesn't apply to machines running Windows, so instead a "standard" Windows system was chosen and assigned an overall index of 10.0. The reference system is a 486-based PC and has the following configuration:

- 33MHz i486 processor with 64K secondary processor <u>cache</u>
- 8 Mbyte 70 ns RAM
- 211 Mbyte hard disk, 15ms access time
- 1 Mbyte cacheing <u>IDE</u> controller
- SuperVGA graphics running at 640 x 480 x 16 colours
- MS-DOS version 5.0
- Windows version 3.1

This machine represents a fast Windows setup suitable for high powered applications, although the low screen resolution would preclude its use in professional desktop publishing and CAD applications or programming environments such as Visual Basic. The five Windows User benchmark components each have an index of 10.0 on the reference machine, giving an overall benchmark of the same figure.

About Inova

Inova is a software design, documentation and marketing consultancy located in Highgate, North London. Inova offers a range of services including technical writing, bespoke software, marketing consultancy, literature design and printing.

Inova consultants have a wide variety of experience, including commercial Windows programming, print buying, project management and business consultancy.

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![W] What do the Numbers Mean?

The numbers are based around a reference system consisiting of a 486/33 PC with SuperVGA graphics and a cacheing hard disk controller. The system is given a benchmark of 10.0, with faster machines having larger numbers and slower machines having smaller numbers.

The subjective speed of your Windows setup depends not only on your machine hardware (and how well it has been optimised) but also on the software which you use. A drawing package will be fast on a machine with an accelerated video card, but the improved display speed may not be so apparent with a spreadsheet or word processor.

The numbers themselves are only representative of speed. They have no relation with any physical parameters, unlike the MIPS and Landmark tests. However, due to their broad nature they give a good indication of the real-world performance of Windows and its applications on your PC.

See also
Optimising Enhanced Mode
Optimising Standard Mode

General Results

Your system runs like a 286.

Despite what many people say, it is quite possible to run Windows on a reasonably fast 286 machine. Ideally you should have a fast hard disk and 4Mb RAM, although a single application should be able to squeeze into 2Mb RAM.

286 machines can only run in standard mode, and so cannot multitask DOS programs nor use part of the hard disk as virtual memory. However, standard mode has some advantages over 386 enhanced mode operation - notably speed - so many people prefer to run standard mode even on 386 and 486 machines.

If you find that your 286 is too slow for Windows, even with 4Mb RAM, then it may be possible to upgrade its motherboard - a 25MHz 386SX would be a good choice. Whether or not this is feasible will depend upon the characteristics of the original system, and whether or not you can reuse expansion cards such as the hard disk controller. With most clones there should be few problems, but look out for memory compatibility and the presence of disk and video controllers which are integrated with the motherboard.

![icon] General Results

Your system runs like a slow 386.

Machines in this bracket include 16 and 20MHz 386 SX's and DX's. The machine's lack of speed may well be caused by <u>wait states</u> being required due to the processor having no <u>cache</u>. Unfortunately most motherboard designs do not allow a cache to be retro-fitted, so you will require a new motherboard for any great improvement.

It is usually possible to increase the speed slightly by adding more memory up to about 8Mbyte. If you have a comparatively slow hard disk but 8Mbyte RAM, then dedicating 1Mbyte to SmartDrive and 1Mbyte to a RAM disk for temporary files should prove to be a good combination.

A graphics card with an accelerator chip should also help to speed things up, relieving the CPU from the onerous task of moving large amounts of data to the display. S3-based cards in particular are now as cheap as fast VGA cards, and should give a large improvement in subjective speed.

General Results

Your system runs like a medium speed 386.

Medium speed 386's include cached 20 and 25MHz SX and DX's. You may also find that a 33MHz 386 gives this result due to video or hard disk bottlenecks. If this is the case you should consult the optimisation section of the Benchmarks help system in order to address these problems.

A medium speed 386 is generally suitable for running all but the most complex of Windows software. The actual size of any processor cache present (usually 64K or 256K) has a slight bearing on overall speed, although the difference between cached and uncached CPUs is much larger. 386 PCs will benefit from a matched video card like those based on the Tseng ET4000 chip set, and a fast hard disk. If you are upgrading, then look for disks with an access time of less than 19ms.

![icon] General Results

Your system runs like a fast 386.

Machines in this group include 33 and 40MHz Intel and AMD 386's. You may also find that slow (20MHz) 486SX's give this result due to video and hard disk bottlenecks.

The 33MHz and 40Mz 386's from Intel and AMD represent the limit of 386 technology. You can increase your overall CPU index by adding a maths co-processor, but there is little else you can do to improve the speed of the heart of your machine without replacing the CPU.

Some recent systems make this easy, with the CPU and cache components being located on a separate module which can be replaced easily. However, many systems will require that you replace the motherboard in its entirety.

Fast 386's are suitable for all CPU tasks, although you may find that a maths co-processor is a necessity for statistical, numerical software or CAD packages.

⬛ General Results

Your system runs like a medium speed 486.

Such systems include 25MHz and 33MHz 486SX and 486DX-based machines. This category may also cover 50MHz 486s whose processor speed is not matched by equally powerful graphics and disk hardware.

The medium speed 486 is the current mainstay of personal computing - many manufacturers are now turning to the 486 as their entry level machine. The Intel 486 CPU has an on-board <u>cache</u> of 8K, although it will benefit from an external cache of 64 or 256K of fast static RAM.

The 486SX procvessor is identical to the DX chip, except that the built-in maths co-processor is disabled. In order to upgrade the 486SX you can add a 487SX chip, a standard 486DX with an additional pin which will disable the existing486SX.

Many new 486 computers can also be upgraded by using the Intel OverDrive upgrade processor, the DX2. This is a standard 486 chip which works internally at twice the speed of your current system board, so a 25MHz board could use a 50MHz 'clock doubler' and a 33MHz board could take the 66MHz DX2. While an OverDrive processor will not double performance, as the memory and peripherals will still be addressed at the original speed, it will generally improve the overall speed of your system, particularly for computationally intensive tasks.

![icon] General Results

Your system runs like a fast 486.

Fast 486s range from 33MHz systems with fast hard disks and graphics cards to 66MHz DX2s. These cover the current top end of the PC market and are generally supplied with fast (<15ms access) hard disks, possibly with hardware cacheing, and accelerated graphics cards.

If your system does not have these extra peripherals, then it may be worth thinking about them as an upgrade. A graphics accelerator card, for example, will give a marked improvement in Windows performance in many cases, especially if you choose one based on the TI34020 co-processor. In general you should match the hardware upgrade to your purpose, so if you only use a database at low resolution a hard disk upgrade might be more worthwhile.

General Results

Your system runs like a very fast 486.

Currently the fastest 486s are those based on the Intel 486DX2 running at 66MHz. However, clock doubling to 100MHz is also possible, so we may see the appropriate DX2 chip released soon.

If your system obtains this result then it probably has a fast graphics co-processor, perhaps based around the TI34020 chip set running at a low resolution or <u>colour depth</u>, and a fast cacheing hard disk controller.

Memory Bottleneck

Your system has a memory bottleneck. This means that under Windows your memory cannot keep up with your CPU. This problem may be due to one of two reasons: either you have too little memory installed in your machine (or not enough is allocated to Windows), or your memory is addressed too slowly.

Too little memory for Windows
Windows requires at least 4Mbyte to work well on a system. Although 2Mbyte operation is possible it is not recommended. Windows will also work much better on a 5-8Mbyte system than one with 4Mbyte RAM.

If you use an expanded memory manager such as EMM386.EXE to provide LIM EMS expanded memory, then this will reduce the amount available to Windows. RAM disks and disk caches will also reduce the amount of available extended memory which Windows can use for programs and data. If you need expanded memory outside of Windows, then it may be worthwhile investing in a third party expanded memory manager which can provide both expanded and extended memory to applications on a need basis. If you use a disk cache or RAM disk, then use the following guidelines:

System RAM	Disk Cache	RAM Disk
2 Mbyte	0 Mbyte	0 Mbyte
4 Mbyte	512 Kb	0 Mbyte
6 Mbyte	1 Mbyte	512 Kb
8 Mbyte	1 Mbyte	1 Mbyte
16 Mbyte	1 Mbyte	2 Mbyte

If you use a RAM disk, then set your TEMP variable to point to it. You may find that you require a larger RAM disk than the sizes shown if you regularly print large bitmaps which may overflow the available space.

There is little, if anything, to be gained from increasing the size of your hard disk cache beyond 1Mbyte.

Memory too slow
Your system's memory may be too slow for one of two reasons: either the physical speed of the memory may not be fast enough, due to slow chips or the lack of a static RAM cache, or else your cache may be improperly configured.

There is little you can do if your system does not have a cache and cannot be fitted with one, but if you do have a hardware cache then you should make sure it is properly configured and that it caches the whole of the address space.

Disk Bottleneck

Your system has a hard disk bottleneck. This means that the access time and/or transfer rate of your hard disk is not fast enough to keep up with the rest of your system.

Hard disk speed is measured by a number of components, the chief amongst them being the average access speed (the time it takes for the read/write head to move to a particular point on the disk surface) and the rate at which data is transferred between the hard disk and the CPU.

A large number of factors affect hard disk performance: hard disk type, presence of a hardware or software cache, and the fragmentation level. Each of these factors is discussed below.

Hard disk type
The hard disk type determines its capacity, physical access times and data transfer rates. In fact, the type of interface between the hard disk and the CPU is also a factor in transfer rates. Most modern hard disks use the IDE standard, also known as AT-Bus. This puts most of the interface electronics on the drive itself, requiring just a cheap expansion card to make the connection to the CPU. IDE drives generally have a fast data transfer rate of up to 1Mbyte/second and beyond.

The main competitor to the IDE standard is SCSI. This interface is mainly used for larger drives, although you may find it used with smaller capacity drives on some machines, notably Compaq. SCSI comes in two flavours - SCSI-1 and SCSI-2, with SCSI-2 offering much faster data transfer rates.

Disk cache
The presence of a cache will affect the data transfer rates and the hard disk access times. A hardware cache is likely to improve performance more than a software cache, although you may need to use both if the transfer rate between the hardware cache and the CPU is a limiting factor. In order to be effective, hardware caches should have at least 1Mbyte of RAM on board.

If you don't have a hardware cache then you should use a software cache for optimum performance. Although SmartDrive is supplied with Windows, there are a number of alternatives which give better performance such as PC-Super Kwik and Fast!. Although cache size is important, it is unlikely that you will perceive any great benefit in increasing the size of the software cache beyond 1Mbyte. A final point: software caches work much faster if they are given extended, rather than expanded memory.

System RAM	Disk Cache	RAM Disk
2 Mbyte	0 Mbyte	0 Mbyte
4 Mbyte	512 Kb	0 Mbyte
6 Mbyte	1 Mbyte	512 Kb
8 Mbyte	1 Mbyte	1 Mbyte
16 Mbyte	1 Mbyte	2 Mbyte

Fragmentation level
The level of disk fragmentation will affect both data access and the overall speed of Windows. If a single data or program file is distributed widely across a hard disk, then the

disk will spend much of its time moving the read/write heads around reading the dispersed data, leading to decreased performance as a result.

As a general rule, defragment your hard disk at least once a month using a product like PC Tools' Compress or Norton's SpeedDisk. It is also worth defragmenting before you install any big new applications.

Video Bottleneck

Your system has a video bottleneck. This means that your graphics adapter cannot keep up with the rest of your system. The problem may be due to running your display at a high resolution or with a large number of colours. The higher the resolution and number of colours, the more data a display card must move about and the slower the system becomes as a result. You may be able to improve your performance by moving to a lower resolution (800x 600 instead of 1,024 x 768, for example) or by using 16 colours instead of 256.

If you need the high resolution and <u>colour depth</u>, perhaps for desktop publishing or computer aided design, then you should consider upgrading your PC with a graphics accelerator. These cards remove many of the more onerous video tasks from the main CPU, and can increase raw video speed by as much as 200%. There are three main types available, each based on a different technology.

S3 cards are currently the cheapest, and offer high performance. However, the 8514/A standard might be a better bet if you run other software apart from Windows, since the S3 standard has not yet attracted the necessary drivers for other applications. The third type, the TIGA standard, is mainly used in the DTP and CAD fields and offers potentially the highest speed, resolution and colour depth, although it is the most expensive.

Benchmark

A system of routines to test the speed and performance of a computer. The Windows User Benchmarks are the only tests currently available which test the speed of all the system components while running under Windows.

Bitmap

A bitmap is an image made up of individual pixels. The Windows Paintbrush program can be used to create, edit, and view bitmaps.

Cache

A cache is often used to improve the performance of a CPU or a hard disk. Caches work by saving the most recently accessed information in fast RAM, so that if this data is required again it can be taken directly from fast memory rather than the hard disk or the slow system RAM.

CIX

The Compulink Information Exchange. CIX is an electronic conferencing system which has a huge number of conferences, including many Windows-related ones.   CIX can be joined on-line on 081-390 1244. Voice contact is available on 081-390 8446.

Colour Depth

Colour depth refers to the number of colours displayed on your screen. An 8-bit colour depth gives 256 separate colours, whereas a 24-bit colour depth gives over 16 million shades.

CPU

Central Processing Unit. The chip at the heart of the computer, responsible for moving data, making calculations and controlling peripherals.

Disk Fragmentation

Disk fragmentation occurs when DOS cannot store data in a single contiguous space on your hard disk. Instead it distributes the file, using space as and where it finds it. This means that a full hard disk can become very fragmented when reading and writing lots of files. Fragmentation slows down the overall speed of your PC, but a commercial disk defragmenter can be used to reorder the files so that all occupy contiguous space and are thus much faster to access.

Expanded Memory

Expanded memory (EMS) dates from before pre-Windows days and allows applications to store data in banks of 64K. Originally expanded memory was only available in the form of special expansion boards, although now all 386 and 486s (and some 286s) can convert extended memory into expanded. The standard for expanded memory was devised by Lotus, Intel and Microsoft (LIM).

Extended Memory

Extended memory is memory above the 1Mbyte line on 286, 386 and 486 machines. Windows uses all available extended memory to run programs and store data.

IDE

Integrated Drive Electronics. The IDE interface is the means by which most hard disks transfer data to the CPU. The IDE standard puts most of the interface electronics on the drive, with only a simple expansion card required.

Landmark

The Landmark test (from Landmark Software) measures raw processor speed in MHz. The tests make allowances for wait states, so cached systems give an unrealistically high reading (55MHz for a cached 33MHz system) and the test is now little used.

Metafile

A metafile is a collection of instructions used to draw a vector graphic. Since the components of the graphic are stored mathematically as coordinates, a metafile can be scaled so that it loses no resolution at larger sizes. Metafiles will therefore print at the full resolution of your printer, whether it is a 9-pin dot matrix or a 600dpi laser.

MIPS

Millions of Instructions Per Second. The MIPS test benchmarks integer, register and memory operations carried out by the CPU. Workstation vendors (and some PC manufacturers) used to quote the MIPS performance of their machines, but the MIPS benchmarks are little used for testing machines today since overall performance of a system depends upon much more than raw processor speed.

Rebooting

Restarting your machine so that changes to the initialisation files (CONFIG.SYS and AUTOEXEC.BAT) take effect. You can reboot your machine by hitting Ctrl-Alt-Delete. You should not reboot your machine while running a program unless all else fails, since the use of a disk cache may cause loss of data. Windows 3.1 will warn you against rebooting your machine while it or any applications are running.

Reference System

The computer hardware against which the test results are measured. The Windows User Benchmarks are based on a 33MHz 486 machine.

SCSI

Small Computer System Interface. SCSI is a technique for "daisy-chaining" peripherals together. Often these are large hard disks, but SCSI is also used to connect tape drives, CD-ROMs and scanners.

Shell

The shell is the Windows application which loads first when you start Windows and which provides access to the system as a whole. Most often this is Program Manager, although replacement shells like Norton Desktop, BackMenu and Power Launcher are also popular. You can change your shell by editing the shell= line in your SYSTEM.INI file.

Status bar

Windows User

The status bar at the bottom of the Benchmarks window shows the progress of each benchmark test as it progresses. It also gives extra help on menu items when you use the menu bar.

Tool bar

The tool bar contains a selection of shortcut buttons which can be used as a quick alternative to selecting items from the menu bar.

Wait States

The CPU will insert wait states (processor cycles) if the machine's memory is too slow for data to be transferred in a single clock cycle. The use of a fast static RAM cache can reduce the number of wait states required.

WIN87EM.DLL

A code library supplied with Windows which emulates a hardware-based floating point co-processor.