Wintune 95 - Disk

The Disk analyzer determines the types and sizes of the locally-connected disk drives, and tests each hard disk for cached and uncached performance. It does not automatically test floppy disks or other removable devices such as Bernoulli, Syquest, or Zip drives. You can test any drive individually by right-clicking on the drive in Wintune's Details tab and selecting "Run Test Now".

For questions on a particular item reported by this analyzer, click on the item in Wintune's Details tab and press F1, or right-click on the item and select "Tell Me More". You can also browse the help topics using the >> and << buttons above, or select a specific item from the list below.

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Why does the cached speed vary between tests?

Windows (95 and NT) has a dynamically-sized disk cache. Depending on the demands for memory by applications, the operating system itself, and disk operations, the size of the disk cache will grow and shrink as applications run. Although this is generally a good way to make effective use of memory, it can be inconvenient for a benchmark like Wintune that wants to test cached performance. In systems with 16MB or more RAM, the cached speed is usually the same within 5 percent from run to run, which is very consistent.

Systems with 8MB or less RAM, however, often cannot effectively cache even the small file that Wintune uses for its cached disk test. Repeated runs of the disk test do not give consistent results. Adding more RAM will provide the system with enough memory to maintain at least a small cache in all cases, and produce repeatable tests. Lacking that option, you should just be aware that the disk caches cannot operate effectively on low-memory systems.

Why does the uncached speed vary between tests?

On most systems, the uncached disk performance should vary by less than 10 percent between runs. Two big reasons for variation are due to the differences in where the file is placed on the disk, and whether the file can be created in contiguous space or is fragmented into multiple locations. If the uncached disk test is giving erratic results you may be able to get more consistent results by defragmenting the disk.

Another possible reason for erratic uncached results is that you are using a disk controller that has cache RAM on the controller. These controllers appear to Windows as standard disk controllers, so there is no way for Wintune (or any application) to ensure that data is really being written to the disk. Microsoft specifically recommends against using a hardware caching disk controller with Windows NT for this reason, because it doesn't allow the operating system to ensure the consistency of the hard disk.

Why is cached speed slower than uncached speed?

This is an open issue. It is known to occur with disks that are using 16-bit compatibility mode drivers. It also happens with some models of Promise disk controllers. It appears that some drivers do not honor the NO_BUFFERING flag and instead perform cached disk I/O in some cases.

How can disk free space be more than total space?

Oh, if it were only true. Unfortunately, it seems to be a bug with early versions of Norton Protected Recycle Bin in the Norton Utilities for Windows 95. If you empty their recycle bin, it returns you to harsh disk space reality.

Why is the disk so slow?

The big question is "Compared to what?" If you notice a significant slowdown from the disk performance you got under Windows 3.1, the first thing to check is whether you are using compatibility-mode drivers. Go to Control Panel/System and click the Performance tab. Windows will list any severe performance problems there, or if everything seems OK it will say "Your system is configured for optimal performance".

Under Windows 95, systems with less than about 10MB of RAM may seem busier than with Windows 3.1 because the disk is constantly churning as it swaps programs in and out of memory.

If you are comparing Wintune's result to other disk benchmarks such as Coretest, or comparing the result to theoretical numbers such as EIDE Mode 4 transfer speed of 16MB/s, then you will be disappointed. Wintune's uncached disk speed is usually the best performance that can be expected of the disk, but is representative of what an application can do under Windows.

For a double-check of real performance, you can perform this simple test: Find or create a large file on your disk, something between 5 and 10 megabytes. Then time how long it takes to copy that file to a new file name on the same disk. The disk throughput from this test can be calculated as:

    2 * (file size in megabytes) / (time to copy)

and is expressed in megabytes per second. For example, if you copied an 8 megabyte file and it took 6 seconds, the result would be 2 * 8 / 6 = 2.66 megabytes per second.

Cache min,now,max

Both Windows 95 and Windows NT change their disk cache dynamically to accommodate the demands on RAM and disk I/O in the best possible way. Windows 95 provides registry entries that tell the minimum, maximum, and current size of the disk cache. A single disk cache is used for the data from removable drives, floppy disks, hard disks, and remote network drives. The CD-ROM gets its own separately-sized cache.

The minimum and maximum size of the cache are determined when Windows 95 boots, and are set to very aggressive values that let the cache shrink to almost nothing or grow to fill nearly all RAM. You can change the limits by editing the SYSTEM.INI file (thought that file was dead, did you?) and putting the following entries in the [vcache] section:

MinFileCache= *size in KB*

MaxFileCache= *size in KB*

For example, on a 32MB system, you might want to make sure that the cache didn't grow beyond 8MB by putting in the line MaxFileCache=8192. This would keep Windows from growing the cache by swapping programs out of memory, but still provide adequate cache memory.

The "cache now" value is very fleeting, it is simply the value of the cache at the point just before disk testing was begun. It is likely that the disk activity caused by the testing will change the cache size if its not at its limit.

Typical Role

The Windows 95 file system sets the size of its buffers and caches based upon a registry entry called "Typical Role". Although the names of the roles are "Network Server", "Desktop Computer", and "Mobile or Docking System" those are more like general guidelines than hard and fast rules. For example, Microsoft recommends that any system with less than 8MB of RAM be configured as a "Mobile" role because that profile uses less memory. Similarly, you may want to configure a system with 24MB or more RAM as a "Network Server" to increase the number of buffers since you can afford to use the RAM.

Troubleshooting

Windows 95 provides troubleshooting options that let you control the behavior of certain file system functions. In general you should leave these alone because they reduce either the performance or reliability of the system, or both. To examine Troubleshooting options, select the System icon from Control Panel and click on the Performance tab. Click the File System button and then the Troubleshooting tab.

Troubleshooting settings are detailed in the Microsoft Windows 95 Resource Kit. It is available on the standard Windows 95 CD as a help file, or you can purchase the printed book. The topic to search for is "Using File-System Troubleshooting Options". (In the book it's in Chapter 17.) The short 4-letter acronyms are Wintune's shorthand, you should look for the topics using the long names:

DNFS Disable New File Sharing
DLNP Disable Long Name Preservation
DPDI Disable Protected-Mode Hard Disk Interrupts
D32D Disable 32-bit Disk Drivers
DWBC Disable Write-Behind Caching.

There is one setting that is not described in the Resource Kit:

DSBC Disable Synchronous Buffer Commits

In the strictest terms, this last setting isn't really a troubleshooting option. A few disk-intensive programs run faster on Windows 3.1 and Windows for Workgroups 3.11 due to the liberal write-behind caching of those two environments. Windows 95 also provides write-behind caching, but it is more conservative and thus less likely to lose data. Since speed sells, Microsoft provides the DSBC setting to let you loosen the disk cache to the standards of the older Windows. Our own tests show that it doesn't make more than a 5 or 10 percent difference for most work, but some database users have reported performance gains of 20 to 30 percent. The downside is reduced security of the disk data.

Drive type

The most common type of drive tested by Wintune is the hard disk. However, you can manually test removable drives like the Iomega Zip drive or a Syquest drive by right-clicking on their drive icon in the Details window and selecting Run Tests Now. Floppy drives will only run the cached test, because the uncached test is too large to fit on a floppy. (You don't really want to test a floppy, trust me on that.)

Cached speed

The overall performance in cached disk I/O is calculated by adding the times taken for each of the cached tests, then dividing by the total number of bytes read and written during the tests. The file size for the cached disk test is generally small enough to fit into the disk cache in Windows, except on systems with very little RAM.

Cached disk performance is not as dependent on the disk speed as it is on the speed of the CPU and memory. Very little actual disk I/O is done during the cached test, so typical cached disk results are much faster than a hard disk could deliver. To get an idea of the performance of the hard disk, you should examine the uncached speed.

See also:

- FAQ: Why is cached speed slower than uncached speed?
- FAQ: Why does the cached speed vary between tests?
- FAQ: Why is the disk so slow?

Uncached speed

The overall performance in uncached disk I/O is calculated by adding the times taken for each of the uncached tests, then dividing by the total number of bytes read and written during the tests. To ensure that the file is written directly to disk, the file is opened with the NO_BUFFERING flag so that Windows will bypass its own software disk cache.

The NO_BUFFERING flag is new in the 32-bit Windows interfacethat is, it wasnt available in Windows 3.xand it gives the fastest direct access to the disk that you can get under Windows. Low-level benchmarks such as the DOS-based Coretest report higher disk throughput numbers, but they are not representative of Windows performance. Similarly, disk controller interfaces often can transfer 10MB/s or more, but today's hard disks cannot deliver the data that quickly. In other words, just because you have an EIDE Mode 4 disk and controller does not mean you will be able to read or write data at a sustained 16MB/s.

See also:

FAQ: Why is cached speed slower than uncached speed?
FAQ: Why does the uncached speed vary between tests?
FAQ: Why is the disk so slow?

Total space

This is the total number of megabytes on the disk. In the Explorer and most file utilities the files on your hard disk are listed in KB and MB where KB=1,024 bytes and MB=1,024*1,024=1,048,576 bytes. However, hard disk vendors call their megabytes 1,000,000 bytes, which means their disks are about 5 percent larger with no extra labor involved. After you take out space for the overhead such as the partition table and the file allocation table it's not unusual to have 10% less space than the size on the outside of the disk box.

See also

Free space
FAQ: How can disk free space be more than total space?

Free space

Free space on your disk may disappear more quickly than you expect because disk space is allocated in units of clusters. Even a one-byte file takes a whole cluster, so on a disk with a 8KB cluster size you're wasting 8191 bytes on that one file!

See also:

Cluster size
FAQ: How can disk free space be more than total space?

Cluster size

As typical hard disks have grown from around 200MB to over 1GB in the past few years, it hasn't been well publicized that the only way to make that space available under the DOS-style (FAT) file system was to increase the cluster size. All files on a disk are allocated in multiples of the cluster size. If the cluster size is 16KB, then even a one-byte file takes 16,384 bytes and thereby wastes 16383 bytes that can't be used by another file. Since on average a file will have its last cluster half-filled, the amount of space wasted this way on your disk will be the number of files on the disk times one-half the cluster size.

One way to circumvent this problem is to use disk compression software such as the DoubleSpace software that comes with Windows 95. In addition to compressing the data, DoubleSpace uses a 512-byte cluster size which reduces the waste of disk space. Another way is to partition a large hard disk into multiple smaller disk partitions that have smaller cluster sizes. However, this often leads to having a shortage of disk space in one partition or another.

Recycle Bin max

The Recycle Bin stores files that you delete from a folder view or the Explorer. The advantage is that if you accidentally delete a file you can retrieve it. The disadvantage is that the file you thought you had deleted is still using space on your hard disk. The maximum size of the Recycle Bin can be set on a disk-by-disk basis, or you can use one setting for all disks. To change it, right-click on the Recycle Bin and select Properties.

Recycle Bin now

This is the total size of the files that are currently in the Recycle Bin. Because the number of files in the Recycle Bin may be large and it may take some time to tally them, Wintune waits until it performs its tests before determining the size of the Recycle Bin. You can clean out the Recycle Bin and permanently delete all its files by right-clicking the trash can and selecting Empty Recycle Bin. If you want to permanently delete a file from a folder or Explorer view and not send it to the Recycle Bin, hold down the Shift key and press Delete.

Last scan

This is the last date that you scanned the drive for errors. Wintune knows about the ScanDisk program in Windows 95 and the Norton Disk Doctor program in Norton Utilities for Windows 95. Both of these programs place information in the registry to indicate the last date that they scanned the drive. You should check your drive for errors at least monthly, and preferably every week.

Last optimize

This is the last date that you scanned the drive for errors. Wintune knows about the Defrag program in Windows 95 and the Norton Speed Disk program in Norton Utilities for Windows 95. Both of these programs place information in the registry to indicate the last date that they defragged the drive. You should defrag your drive at least monthly, and preferably every week. This will help to ensure that existing files can be accessed at maximum speed, and that new files are created contiguously on the disk.

Create file cached

Time required to create the file used for the cached file test.

Seq write cached

Time required to sequentially write the file used in the cached write test. The number in parenthesis is the total size of the file that was written.

Seq read cached

Time required to sequentially read the file used in the cached write test. The file is read multiple times, and the number in parenthesis is the total number of bytes read.

Rnd write cached

Time required to write random blocks of data in the cached file test.

Rnd read cached

Time required to read random blocks of data in the cached file test.

Delete file cached

Time required to close and delete the cached file.

Create file uncached

Time required to create the file used for the uncached file test.

Seq write uncached

Time required to sequentially write the file used in the uncached write test. The number in parenthesis is the total size of the file that was written.

Seq read uncached

Time required to sequentially read the file used in the uncached write test.

Rnd write uncached

Time required to write random blocks of data in the uncached file test.

Rnd read uncached

Time required to read random blocks of data in the uncached file test.

Delete file uncached

Time required to close and delete the uncached file.

Tested on

Once the analyzer has completed all its tests, it sets this entry to the current date and time. If this entry shows as "Not tested" then testing has not been performed, or testing was started but stopped by the user or an error condition before it could complete.

Tip DSK101: Use a 32-bit Disk Driver

If the disk is using a 16-bit disk driver, performance will suffer. Windows 95 will fall back to 16-bit drivers only in a handful of situations.

***Hardware problems**:* If the disk controller was not recognized by Windows 95 during setup, or there was a conflict between the disk controller and some other piece of hardware, Windows 95 will use 16-bit drivers. Go to Control Panel and click the System icon, then select Device Manager. See if there are any problems listed for your disk controller.

***Software problems**:* If you have incompatible software that is controlling your disk, they may cause 16-bit drivers to load. Some computer viruses may also prevent 32-bit drivers from loading. . Go to Control Panel and click the System icon, then select the Performance tab. If you are using 16-bit compatibility mode, Windows 95 will usually list the device that is causing the problem.

If the device listed is MBRINT13.SYS, the disk either has a boot-sector virus or an incompatible version of software such as Disk Manager or EZ-Drive. Otherwise you may be able to eliminate compatibility mode by removing the listed driver from your CONFIG.SYS or AUTOEXEC.BAT file if it is loaded there.

Tip DSK102: Turn off Troubleshooting Options

Most of the disk troubleshooting options should only be used for tracking down crashes or compatibility problems. See the Troubleshooting item for more information about what the options mean. To change the Troubleshooting options, select the System icon from Control Panel and click on the Performance tab. Click the File System button and then the Troubleshooting tab.

See also:

Troubleshooting

Tip DSK103: Increase Disk Free Space

There is very little free space on this disk. If you try to save a file to this disk and there isn't enough space, the file may become corrupted.

Tip DSK104: Reduce Recycle Bin Size

The maximum Recycle Bin size is large compared to the free space available on the drive. You may want to reduce the maximum size of the Recycle Bin to ensure that deleted (recycled) files do not cause an out-of-disk condition. To change the Recycle Bin size, right click on the Recycle Bin icon on the desktop and select Properties. You can set all drives on the system to be the same size, or configure each drive individually based on its size and available space.

Tip DSK105: Scan for Errors Monthly

Using ScanDisk or a third-party disk scanning utility can prevent data loss or disk crashes from undetected disk errors. You can run ScanDisk by clicking Start/Run and typing in "Scandisk".

Tip DSK106: Optimize Disk Monthly

Optimizing (defragmenting) your disk can improve the performance of your hard disk. Windows 95 includes a defragmenter. You can run it by clicking Start/Run and typing "Defrag".

Tip DSK107: Increase Max Disk Cache Size

The maximum cache size for this disk is very small relative to the total RAM in the system. A good rule of thumb is that the cache size should be about one-quarter of the total RAM in the system. You should consider increasing the size, or let Windows 95 manage the cache size automatically. See Cache min,now,max for instructions on how this is done.

See also:

Cache min,now,max

Tip DSK108: Decrease Min Disk Cache Size

The minimum cache size for this disk is very large relative to the total RAM in the system. A good rule of thumb is that the cache size should be about one-quarter of the total RAM in the system. You should consider reducing the size, or let Windows 95 manage the cache size automatically. See Cache min,now,max for instructions on how this is done.

See also:

Cache min,now,max

Tip DSK109: Change Typical Role to Server

The Windows 95 file system sets the size of its buffers and caches based upon a registry entry called "Typical Role". Although the names of the roles are "Network Server", "Desktop Computer", and "Mobile or Docking System" those are more like general guidelines than hard and fast rules. You may want to configure a system with 24MB or more RAM as a "Network Server" to increase the number of buffers since you can afford to use the RAM.

To change the Typical Role, run the System icon from Control Panel and select the Performance tab. Click the File System button. The Typical Role is under the Hard Disk tab.

See also:

Typical Role