Wintune 95 - Memory

The Memory analyzer tests the performance of the CPU's internal cache, the level-2 RAM cache (if any), and main RAM.

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 topic using the >> and << buttons above, or select a specific item from the list below.

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Why isn't all my RAM showing up?

Wintune obtains the Installed RAM number from Windows. Sometimes, however, the BIOS or a 16-bit driver will claim memory before Windows does its count. See the FAQ item <u>Why is Windows RAM less than Installed RAM?</u>for more details on this situation.

Another possibility is that the system BIOS is not recognizing all the memory, or has a setting that conflicts with the way that Windows requires memory to be configured. For example, some BIOS have an option called "Memory Hole at 16MB". If this option is enabled (that is, the size of the hole is not zero), Windows will not count any memory above 16MB.

Why is Windows RAM less than Installed RAM?

The BIOS and older 16-bit drivers both get the opportunity to claim some system RAM before Windows initializes itself. Many system BIOS versions offer an option called *ROM shadowing* that will copy the contents of the system and video BIOS ROM areas to RAM. On DOS and Windows 3.1, this often would improve performance because ROM is generally slower to access than RAM. However, Windows 95 and Windows NT rarely access the ROM. It is better to turn off shadowing (using your system's CMOS setup program) so that the memory can be used by Windows. This is especially true when the system has 8MB or less RAM.

Windows 95 does not require a CONFIG.SYS or AUTOEXEC.BAT file, but supports the two files so that you can load 16-bit drivers for devices not supported by native 32-bit drivers. The memory claimed by these drivers is not usable by Windows 95 for any other purpose. Sometimes, older third-party setup programs will try to increase BUFFERS settings in CONFIG.SYS, or install Share, SmartDrive or other software in AUTOEXEC.BAT. CORELCDX is another common RAM-eater. These programs are not required and will waste memory. To get this memory back, remove the drivers from your configuration files.

Why do I have so little Free RAM?

"Windows is using all my memory!" This is a common complaint from new users of Windows 95 on a system with less than 16MB of RAM. However, it's not always bad to have very little memory free. If Windows didn't use it, who would? Why have half of your RAM free, not doing anything?

Windows actively works to keep memory usefully occupied, especially on a system that's tight on RAM. It tries to keep a balance between program code, program data, and disk cache. For example, if you load many programs and switch between them frequently, it may trim the disk cache so that it has room for all the program code and data in RAM. If you then start searching through the disk for a file, it may increase the disk cache and swap out a program you aren't currently using.

In short, it is completely normal to have very little Free RAM. It means that Windows is making the most of the RAM you have.

Why are some Pentiums slower than a 486 in the RAM Write test?

I don't know for sure, but here's what I think is happening. Many Pentium system boards use a write-back secondary (L2) RAM cache. If the CPU writes to a location already in L2 cache, the system board can perform this write very quickly and write the results back to RAM later. However, if the location isn't in cache¾as is the case for Wintune's RAM Write test¾the system incurs a penalty higher than if it had just written the data directly to main memory. The system designer is betting that the already-cached case happens much more frequently than the not-cached case so that average performance will be higher.

The other possibility is that the Pentiums actually have a higher number of wait states on memory than the 486 systems do.   To be able to analyze this situation completely, you would need to know more about the differences between the slow and fast Pentiums: wait states, EDO RAM, RAM cache sizes, etc.

Installed RAM

The total amount of RAM installed in the system.

See also:

> Windows RAM
>
> FAQ: Why isn't all my RAM showing up?
>
> FAQ: Why is Windows RAM less than Installed RAM?

Windows RAM

Windows typically will use all the RAM installed in the system, but the BIOS and some 16-bit drivers can use memory that reduces the amount available to Windows.   See the FAQ items for more help.

See also:

Installed RAM

FAQ: Why isn't all my RAM showing up?

FAQ: Why is Windows RAM less than Installed RAM?

Free RAM

This is the amount of memory that Windows does not currently have allocated to any specific purpose. Windows tries to keep a small amount of RAM free so that it can quickly respond to new requests for memory. However, it also tries to keep the disk cache large, which reduces the amount of free RAM.

See also:

Memory used

FAQ: Why isn't all my RAM showing up?

FAQ: Why do I have so little Free RAM?

Memory used

The "Memory used" percentage is measured a bit different than Free RAM in that it doesn't count information that could be easily discarded such as already-written disk cache buffers. If this measure is at or near 100 percent, then the system is finding it necessary to swap important (active) data to the swap file. Adding more RAM would improve performance in these situations.

See also:

>> Free RAM

>> FAQ: Why isn't all my RAM showing up?

>> FAQ: Why do I have so little Free RAM?

Total page file

Windows uses the page file, also known as the swap file, to provide virtual memory. If all the programs and data currently running do not fit into available RAM, Windows swaps some of them to the page file. Since the hard disk is much slower than RAM, performance suffers when Windows needs to use the page file. This is another reason why installing more RAM can increase performance.

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RAM Read avg

Wintune's RAM Read test is useful in determining the size and effectiveness of RAM caches. On a 486 or Pentium system, you should see a sharp decrease in RAM speed after the 8KB block size. This is because the internal (level 1) data cache on a 486 or Pentium is 8KB. (Note: some Intel 486/100 chips have a 16KB cache.) If you have an external (level 2) cache you should also see a large difference between performance at the 32KB and 2048KB block levels.

On systems with less than 8MB of RAM, Wintune does not test the 2048KB block size because sufficient RAM is unavailable. If the test were attempted without sufficient RAM, Windows would swap heavily and the resulting performance would approximate the uncached disk speed.

To obtain the RAM Read score, Wintune averages the results for all of the RAM read tests. If the 2048KB block size was not tested, the average is calculated as if it were zero.

See also:

RAM Write avg

RAM Copy avg

RAM Write avg

The RAM Write test provides a good indication of the efficiency and speed of main memory. If your RAM has a high number of wait states, the RAM Write result will be low. You can compare your RAM results to those of similar systems in the database to see if you may have a problem with slow RAM.

If you do find that your results are low, you should check your BIOS settings to see if your wait state settings are correct.

On systems with less than 8MB of RAM, Wintune does not test the 2048KB block size because sufficient RAM is often not available. If the test were attempted without sufficient RAM, Windows would swap heavily and the resulting performance would approximate the uncached disk speed.

To obtain the RAM Write score, Wintune averages the results for all of the RAM write tests. If the 2048KB block size was not tested, the average is calculated as if it were zero.

See also:

RAM Read avg

RAM Copy avg

FAQ: Why are some Pentiums slower than a 486 in the RAM Write test?

RAM Copy avg

Both applications and Windows itself frequently copy blocks of data from place to place in memory. This test measures the performance of in-memory copy operations using the C compiler's *memcpy( )* function. For a given block size, the copy test moves twice as much data as the read or write tests, since it must first read the data from one buffer and then write it to another buffer.

Typically, the RAM Copy performance will be about equal to the RAM Write performance at the 4KB block size. This is because the write to external RAM is the limiting performance factor in the operation; the read comes essentially for free because it is in the internal CPU cache. At larger block sizes, though, the copy operation will also have to read from RAM (rather than internal cache) which will reduce performance.

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See also:

RAM Read avg

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Page file driver

The page file, or swap file, is located on the hard disk. If you have multiple hard disks, you may get better performance by moving the page file to the fastest disk available on your system. The uncached speed result from Wintune's disk test can be used to determine which is the fastest disk.

Windows will generally use a 32-bit page file driver unless it does not support the disk controller hardware or the disk itself is formatted with incompatible software.

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 MEM101: Install More RAM

When Microsoft first started its publicity for Windows 95, an oft-stated goal was to have Windows 95 run the same as Windows 3.1 does with 4MB of RAM. This is one area where Microsoft succeeded. Windows 3.1 is very slow with 4MB of RAM, and so is Windows 95. To be fair, Windows Magazine tests show that Windows 95 usually runs applications a bit better on a 4MB system, but it's still very slow.

With 8MB of RAM, Windows 95 becomes much less swap-happy and provides decent performance. Moving up to 10, 12 or 16MB can improve performance even more. On a system of any kind with 4MB of RAM, an upgrade to 8MB of RAM is invariably the most cost-effective purchase you can make to increase Windows performance.

Tip MEM102: Use 32-bit page file driver

If the page (swap) file is on a disk that is using a 16-bit disk driver, performance will suffer. This is especially true on systems with 8MB or less RAM, where swapping occurs frequently.

Tip MEM103: Change "Typical Role" to Mobile

On a system with less than 8MB of RAM, Microsoft recommends that you set the 'Typical role of this system' to Mobile. This reduces operating system buffers to conserve memory. To change this setting, run the System icon from Control Panel and click the Performance tab. Click the File System button, and set the Typical Role to "Mobile or Docking".

Tip MEM104: Reduce CD-ROM cache size

Although a large CD-ROM cache can sometimes improve performance, it may actually harm performance on systems that have 8MB or less RAM. The exact impact on performance depends on the kind of CD-ROM accesses and the speed of the system and CD-ROM drive. You may want to experiment with a smaller CD-ROM cache size to see if it improves overall performance without significantly slowing CD-ROM accesses.

Tip MEM105: Increase DOS (low 640KB) memory

This system has very little free DOS memory. Although Windows 95 does a pretty good job of managing memory, it still depends on having at least a small amount of memory available below the 640KB address line.   (Since DOS was restricted to the addresses below 640KB, this is often called "DOS memory".) If no DOS memory is available, Windows 95 may be unable to run more applications.

The solution to this problem in Windows 95 is the same as the solution under Windows 3.x.   Use MemMaker or a third-party memory manager to load any necessary DOS device drivers or TSR programs into high memory. However, since Windows 95 provides 32-bit support for most devices, you should first check to see whether you need these programs at all. If you put a REM in front of the lines in CONFIG.SYS and AUTOEXEC.BAT it will prevent these device drivers from loading. If all of your devices and programs still run fine then it's likely that you don't need the line at all.

Tip MEM106: Check RAM write wait states

Wintune's RAM Write test gave a result that is particularly low for this class of system. It is possible that the system has either very slow memory or excessive wait states set for RAM. Check your BIOS setup and ensure that the memory speed settings, if any, are appropriate for your memory.

Tip MEM107: Check RAM read wait states

Wintune's RAM Read test gave a result that is particularly low for this class of system. It is possible that the system has either very slow memory or excessive wait states set for RAM. Check your BIOS setup and ensure that the memory speed settings, if any, are appropriate for your memory.

Tip MEM108: Create a fixed-size page file

(This tip is not currently generated by Wintune.) Some users with 8MB or less RAM have reported improved performance when the page file is set to a fixed size, but we have not been able to verify these reports through our own testing. You may want to experiment with setting a fixed page file size to see if it reduces paging. Select the System icon from Control Panel and select the Performance tab. Click the Virtual Memory button. In the manual settings section select the drive letter that you want to use for the page file, and set the minimum and maximum size to the same value, about 2.5 times your installed RAM.

Tip MEM109: Move page file to faster disk

There are at least two disk drives¾or two partitions of the same disk drive¾available on this system. The drive that currently has your page (swap) file is significantly slower than another drive on the system. You may be able to obtain much faster performance by moving the page file to the faster drive.

One common situation where this occurs is with compressed drives. Windows 95 introduced the ability to place the page file on a DriveSpace volume. This eliminates the need to set aside space on the host drive for a page file, but it also reduces the speed of paging operations.

If you can spare the disk space on the faster drive (or host drive in the case of DriveSpace), you can direct Windows 95 to create the page file on that drive. Select the System icon from Control Panel and select the Performance tab. Click the Virtual Memory button. In the manual settings section select the drive letter that you want to use for the page file.

Tip MEM110: Move page file to roomier disk

The disk that currently holds the page file is very low on disk space. However, you have at least one other disk volume that has more space. You may want to consider moving the page file to the drive with more free space.

If you can spare the disk space on the faster drive (or host drive in the case of DriveSpace), you can direct Windows 95 to create the page file on that drive. Select the System icon from Control Panel and select the Performance tab. Click the Virtual Memory button. In the manual settings section select the drive letter that you want to use for the page file.

Tip MEM111: Check system resources

Windows 95 greatly increased the amount of system resources available to programs. It is highly unusual to have less than 50% of system resources available, but it appears to be the case with this system. This is due either to many programs being active or some kind of system error. You may want to exiting all other programs and running Wintune again.

Tip MEM112: Check CPU cache settings

Disabling CPU cache is almost always an inadvertent error caused by an incorrect BIOS setting. If your internal CPU cache is turned off, there should be a setting in the BIOS to turn it on. In your BIOS setup program, check for a setting labeled something like "Internal Cache", "L1 Cache", or "CPU Cache" and make sure it is enabled.

It is also possible that some hardware design defect is causing the CPU to turn off its internal cache. Some older Packard Bell 486 systems (with Phoenix BIOS 1.01) have this problem, which requires a BIOS upgrade to fix. Some older Gateway 2000 systems (again, with Phoenix BIOS 1.01) have a similar problem where memory accesses are very slow unless the external cache is upgraded to 128KB.