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A GUIDE TO IMPROVING YOUR WORKSTATION EXPERIENCE

12 FREE STEPS



ILLUSTRATION: @ROBBIDULPH

Produced by
DEVELOP3D
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OPTIMI

Tune your workstation for free

Just like a kettle, workstations get furred up over time. Regular maintenance can help them perform to their true potential. Here are twelve simple steps you can take to improve performance for free.
Here's the disclaimer — proceed with caution and, before you start, make sure all of your data is backed up and that you have a system repair disk!

1 UNINSTALL UNNECESSARY APPLICATIONS

The simplest, most effective way to improve performance is to uninstall unnecessary applications as these take up memory and clog up startup sequences. Make sure you do this in the correct way, through Start > Settings > Control Panel > Add/Remove Programs.

2 TURN OFF UNWANTED STARTUP APPS

Some applications can't be uninstalled in the traditional way. To overcome this, click Start > Run and type MSCONFIG. Click the STARTUP tab and you will see all the processes that run at startup before the OS is ready to be used. Here's the WARNING! Be very careful what you turn off. For example, if you take out ATI.dll, on restart your screen will not display! Search the web for details of each process.

3 DELETE UNNECESSARY FILES

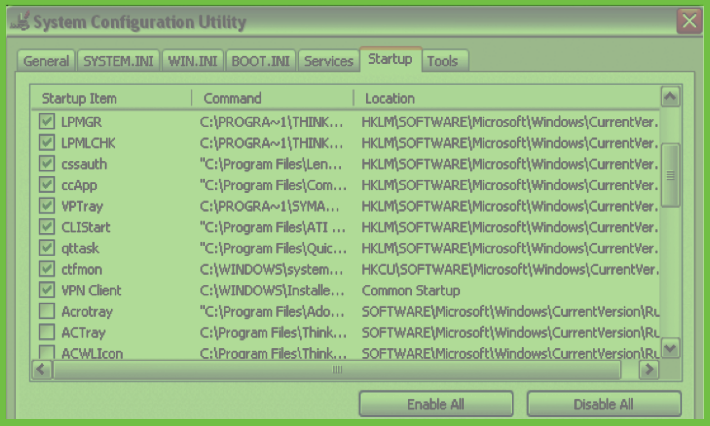
Hard drives soon fill up, which can slow down performance. Capacity can be a particular challenge with Solid State Drives (SSDs) as price per GB is high so drives tend to be smaller.

To start, delete any installation files you have downloaded. CAD software and service packs can soon add up to tens of GBs. Many installers also store temp files in the root of the C drive. Once the application is installed it won't need them. Delete these files, but before emptying the recycle bin run the application to check it works OK. If it does, it's safe to permanently delete.

To get rid of other unwanted files, including temporary Internet files, use the built in Windows tool. Right click on your drive, select properties and disk Clean-up.

Third party tools can also help. Try Auslogics' Duplicate File Finder or for a deeper clean of your drive Piriform's CCleaner.

Fig.1 AUTOMATIC PROGRAM UPDATES, SUCH AS ADOBE'S PDF UPDATE UTILITY, CAN BE REMOVED FROM STARTUP



4 REBOOT REGULARLY

When applications and datasets load they take up valuable memory. Over time this memory can become full, as resources are not always freed up when things are closed. This can slow down your workstation, as new applications will then push some data to a swap file on the hard drive, which is a lot slower. Restarting your workstation periodically can clear up these minor memory leaks, helping ensure you have all of your memory available.

5 DEFRAG YOUR HARD DRIVE

Defragmentation can be a great way to increase the performance of a mechanical SATA hard disk drive (HDD). (N.B. do not do this with a Solid State Drive (SSD) as it there is no benefit and it can actually reduce the life-span of the drive).

HDDs are spinning platters with heads that read/write data. The disks spin at a constant rate so the outside edge read/writes more data per revolution than the inside. This difference can be as much as 20%.

As you add and delete data, files can get spread over the disk with one part in the middle and one part at the end. This decreases performance because the head needs to physically move from one part of the disc to another and over a period of time your system can start to feel slower.

Defragmenting your HDD on a regular basis can help with this as it moves all the files back together.

6 INSTALL THE LATEST DRIVERS

Hardware drivers are important. Windows comes with a base set of drivers but you can still benefit from ones that are more up to date. For 3D apps, graphics drivers, then chipset drivers are the most important.

For graphics, first visit your CAD application's certification page e.g. Siemens NX (tinyurl.com/NX-graphics). These are updated periodically but graphics card vendors might have a more recent one. e.g. AMD FirePro (tinyurl.com/cert-firepro).

Over the life of a pro graphics card, updating to the latest drivers can improve performance dramatically so be sure to check back regularly.

There are utilities that can do this for you. The Dell Precision Optimizer (tinyurl.com/Dell-DPO), which comes free with Dell Precision workstations, will help you keep on top of all driver, firmware and BIOS updates.

7 TURN OFF ENCRYPTION AND COMPRESSION

On NTFS disks save space and increase security by compressing and encrypting files. However, for maximum performance always turn these off.

8 SET TO MAXIMUM PERFORMANCE

By default, the power profile in Windows is set to 'balanced', giving a combination of performance and reduced energy consumption. To set these to maximum performance click Start > Settings > Control Panel > Power Options. Then click 'show

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additional plans' and set to 'high performance'.

9 DISABLE INTEL SPEED STEP AND C-STATE

Intel Speed Step cuts the processor speed if it thinks the system is idle or running a lightweight application. However, sometimes the GPU might be doing the work and Speed Step might not realise. It can be turned off in the workstation's BIOS. You can also turn off Intel C-State, which adds additional "wait states" if the CPU thinks nothing is happening.

Disabling both will make the CPU run at full speed all of the time but will likely use more electricity.

10 SET CPU AFFINITY

Hardcore compute operations like rendering can hog CPU resources, making it almost impossible to work on other tasks. However, by setting specific processes to run on specific cores you will be able to manage your CPU resources and multi-task much more efficiently.

Start Task Manager (CTRL, ALT, DEL), select the processes tab, right-click on the process you want to change and 'set affinity'. You will then be able to select which processors (cores) are used for that particular process.

Note that this change is only temporary. Once you close an application, the affinity settings will return to default.

PRACTICAL TIP For an 8 core CPU try assigning 6 cores to a rendering app.

11 ENABLE / DISABLE HYPER-THREADING

Intel Hyper-Threading technology creates two virtual cores out of each physical CPU core with a view to increasing performance when possible. It can be enabled or disabled in the BIOS.

Enabling it can boost performance in multi-threaded applications (e.g. ray trace rendering) but for single threaded applications (e.g. CAD) it is usually best to disable it as it can slow things down.

If you are unsure, check with your software supplier or use a utility like the Dell Precision Optimizer (tinyurl.com/Dell-DPO), to automatically adjusts settings for each app.



12 SPRING CLEAN YOUR MACHINE

Over time, a build up of dust can clog up fans, which are used to cool CPUs and GPUs. This makes them less effective, and in some cases causes processors to slow down to stop them overheating.

Cleaning inside the machine can help this, but be very careful. Workstations are delicate and sensitive to static so this should be done by hand using an anti-static cloth or compressed air, not with a vacuum cleaner or cleaning products!

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UPGRAD

Invest in new components

Your workstation can be improved further by upgrading key components. As machines get older, compatible components come down in price, and there are some great second hand bargains, so upgrading can be a very cost effective way of getting a lot out of a small budget.

1 PROFESSIONAL GRAPHICS (GPU)

Upgrading to a new graphics card can help improve 3D performance when models increase in size and complexity or when using advanced real time rendering effects.

For example, the AMD FirePro W5100 and W7100 GPUs feature AMD Graphics Core Next (GCN) architecture which is designed to make optimal use of GPU resources for maximum performance. This is particularly important when using features that improve image quality such as Full Scene Anti Aliasing (FSAA), and True Shading mode in Siemens NX.

A new graphics card can also help maintain full support with new software. Older graphics cards can become out of date if they don't support the latest APIs, such as OpenGL 4.4 and DirectX 12, which are used by modern 3D applications.

Those that currently use a gaming card, such as AMD Radeon, may be missing out on features that are only supported on professional graphics cards, such as AMD FirePro. In addition, gaming cards do not benefit from the rigorous testing process that AMD FirePro cards undergo when drivers are optimised for performance, quality and stability in a variety of 3D CAD applications.

The amount of Graphics Processing Unit (GPU) memory is also an important factor when considering an upgrade. 512MB or 1GB is common in some older generation cards, but modern 3D applications, particularly those that have implemented Vertex Buffer Objects (VBOs), such as Siemens NX, need more to run to their full potential.

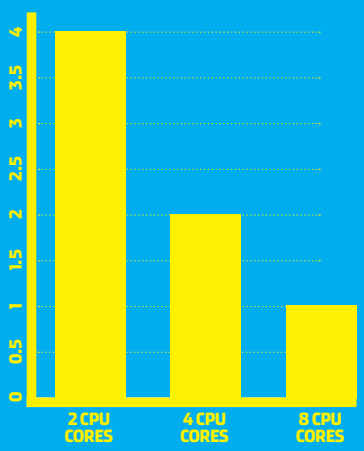
VBOs allow 3D geometry to be directly stored and modified in the graphics card's dedicated memory, rather than in system memory. This reduces latencies by essentially shortening the data path to the GPU. It can also reduce CPU cycles allowing the workstation to stay more responsive.

To find out how much memory your graphics card uses AMD offers a free memory viewer tool. Simply load up your key applications and datasets, then run the utility. (tinyurl.com/AMD-memory).

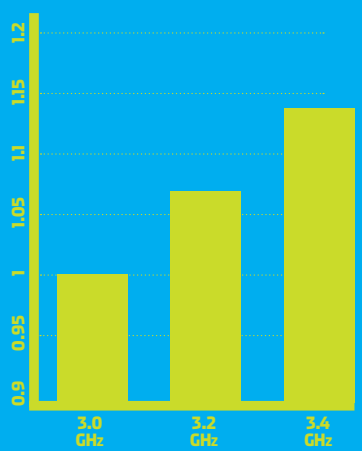
PRACTICAL TIP #1 Make sure your new graphics card is fully compatible with your workstation. PCIe 3.0 cards will not work to their true potential in PCIe 1.0 workstations.

PRACTICAL TIP #2 Make sure you have sufficient power (watts) and the appropriate AUX power connector (if required). Some PSUs simply don't output enough power for high-end graphics cards.

RENDERING TIME IN RELATION TO CPU CORES (SMALLER IS BETTER)



CAD SOFTWARE PERFORMANCE IN RELATION TO CPU SPEED (BIGGER IS BETTER)

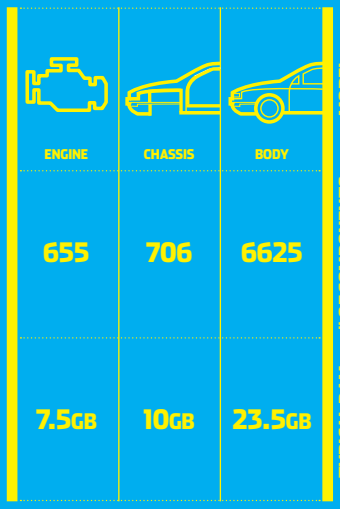


2 CPU (CENTRAL PROCESSING UNIT)

Those considering an upgrade to a new CPU should concentrate on two main areas – GHz and CPU cores.

All applications will benefit from a CPU with a higher GHz so this is a good way to boost general performance. Increasing the amount of CPU cores will have a major benefit for multi-threaded processes such as rendering and simulation, but will also boost performance for certain CAD tasks and increase potential for multi-tasking. Four CPU cores is a good amount for mainstream CAD.

MEMORY (RAM) REQUIREMENTS FOR TYPICAL CAD MODELS



Investing in a faster CPU can also benefit 3D graphics. Increasing the GHz of the CPU will almost always improve 3D performance.

PRACTICAL TIP #1 Make sure the CPU is compatible with the socket on the motherboard.

PRACTICAL TIP #2 Make sure you have the correct heat sink and use a good quality thermal paste to 'bond' the CPU to the motherboard.

3 MEMORY (RAM)

Multi-application workflows and highly complex datasets mean workstations need more RAM than ever before. When a workstation runs out of memory, the system can slow down completely due to hard drive caching. Here, adding more memory can be a very cost effective way of improving performance, but make sure you have a 64-bit operating system.

DELL

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PRACTICAL TIP #1 To check how much memory you are using press CTRL, ALT, DEL and click the performance tab. Memory usage in Dell Precision workstations can be tracked and analysed over time using the Dell Precision Optimizer (tinyurl.com/Dell-DPO).

PRACTICAL TIP #2 To get the best performance, make sure new RAM is matched to existing RAM and added in pairs or quads (depending on the CPU architecture).

4 DISPLAYS

A new display can give many benefits. In general, IPS panels are best for 3D CAD, featuring more vivid colours and wider viewing angles than TN panels.

Resolutions are greater. FHD (1,920 x 1,080) is now standard while new 4K (3,840 x 2,160) and 5K (5,120 x 2,880) displays deliver incredible detail, which is great for visualising complex designs without having to zoom in.

Modern graphics cards can support multiple displays, which can either be used for individual applications or positioned side by side for an extended desktop.

PRACTICAL TIP #1 Don't throw out your current display. Use it for a complementary process, such as email or document management.

PRACTICAL TIP #2 Don't stop at two. AMD Eyefinity technology can support three or more displays.

PRACTICAL TIP #3 4K and 5K displays have significantly more pixels than FHD, which places more load on the GPU. You may need a more powerful GPU to maintain the same levels of 3D performance.



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5 STORAGE

There are two main reasons to upgrade storage. 1) to increase performance 2) to increase capacity.

For performance, moving to a Solid State Drive (SSD) can give your workstation a whole new lease of life. Boasting significantly faster access times than mechanical hard disk drives (HDDs), an SSD will instantly make a workstation feel more responsive. Faster read/write performance also means the operating system and applications should load quicker.

While the price of SSDs is falling, the cost per GB is still high compared to HDDs so mechanical disks remain important for data. Capacities are also significantly higher.

PRACTICAL TIP #1 Buy an SSD for operating system and applications and use your existing HDD for storing the bulk of your CAD data.

PRACTICAL TIP #2 Use a dedicated migration software tool to transfer data to your SSD quickly and effectively e.g. Paragon Drive Copy or Samsung Data Migration Software (free with Samsung SSDs).

INVEST

Buy a brand new workstation

Investing in a brand new workstation can deliver huge productivity benefits, enabling new workflows that are simply not possible with aging hardware. But where do you spend your money? We look at the key components and what they all mean.

1 GRAPHICS PROCESSING UNIT (GPU)

Professional GPUs, such as AMD FirePro, are a good choice for designers and engineers as they are tested, optimised and certified to work with all the leading CAD/CAM/CAE applications.

For CAD, an entry-level or mid-range card with 2GB or more of memory is a good choice. However, when working with exceptionally large models a more powerful card with more memory can help ensure smooth model manipulation, particularly when using advanced visualisation features.

When buying a workstation it is important to find a good balance between CPU and graphics card. A high-end graphics card will not be able to express its true performance if matched with a low GHz CPU.

Higher end graphics cards can also offer additional benefits. A single AMD FirePro W7100, for example, can span a CAD model across four 4K displays for incredibly detailed visualisation. This is made possible by AMD Eyefinity multi-display technology.

AMD Eyefinity multi-display technology is also available in other graphics cards. The AMD FirePro W5100, for example, features four discrete display outputs, while the AMD FirePro W9100 features six.

GPUs can also be used to accelerate compute intensive operations such as Finite Element Analysis (FEA), Computational Fluid Dynamics (CFD) and ray trace rendering — tasks that are traditionally carried out by CPUs.

With Siemens NX Nastran, for example, support for OpenCL means professional GPUs can be used for modal frequency response calculations to optimise designs for weight and strength characteristics, or to minimise noise or vibrations.

For ray trace rendering, the new AMD FireRender plug-in delivers interactive photorealistic rendering functionality in major software applications using AMD FirePro W-Series GPUs.

GRAPHICS PROCESSING UNIT (GPU) MEMORY REQUIREMENTS FOR TYPICAL CAD MODELS

MODEL TYPE	ENGINE	CHASSIS	BODY
# OF COMPONENTS IN ASSEMBLY	655	706	6625
TYPICAL GPU MEMORY CONSUMED	370MB	1GB	1.2GB

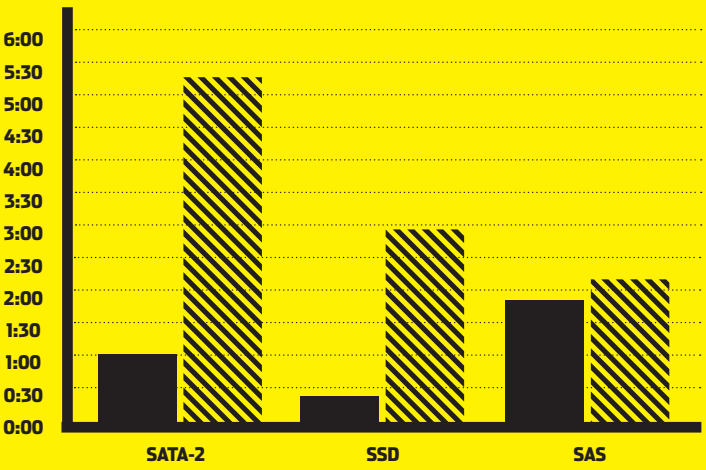
2 CENTRAL PROCESSING UNIT (CPU)

Modern CPUs comprise multiple processors (cores). When there was only one core per chip you had the choice of a single or dual processor workstation. Now things are measured in single or dual sockets and the number of cores per socket. On a single socket workstation four cores are common, but two, six, eight, even 14 core processors are also available. On a dual socket workstation the number of cores can go all the way up to 36.

In general for 3D software the speed of the CPU is more important for performance than the number of cores. This is measured in GHz. For CAD, two cores should be a minimum, as one core looks after the memory allocation while the other takes care of interface/modelling. Certain elements of CAD software, such as assembly loading and boolean operations, can also take advantage of multiple CPU cores as can drivers for graphics cards.

Today, in order to benefit from a larger number of cores, you will need to use specialist software for rendering or simulation. While ray trace rendering software works incredibly efficiently, taking full advantage of thirty-six cores, not all simulation software scales so well across multiple cores. However, multi core workstations can be put to good use when solving multiple simulations at the same time as long as disk and memory I/O can keep up.

RELATIVE PERFORMANCE OF WORKSTATION HARD DRIVES (SMALLER IS BETTER)



3 STORAGE

There are three main types of hard drives in workstations today. Hard Disk Drives (HDDs), Solid State Drives (SSDs) and Serial Attached SCSI (SAS).

SSDs are an excellent choice for workstations. Read/write speeds are superior to HDDs, which means the operating system, applications and some datasets should load faster. Most importantly, however, the workstation as a whole will feel much more responsive. This is due to SSDs having much lower latency (the time taken to respond

to a read/write request).

SSDs typically support one of two interfaces. SATA is the most common but PCIe SSDs are now becoming more widely available. PCIe SSDs offer faster transfer speeds when reading / writing large files (typically 2 to 3 times faster than SATA SSDs), but this won't necessarily benefit all workflows, including CAD, which feature smaller compressed files in a part and assembly structure.

The downside of SSDs is that the cost per GB is still high and capacities aren't a large as HDDs. As a result, a popular choice for workstations is to use an SSD for operating system, applications and current datasets and a HDD for the bulk of the data.

HDDs feature read/write heads that move across platters that typically rotate at 7,200RPM. This is why access times can be slow.

SAS drives offer excellent read/write performance. Like HDDs drives they feature read/write heads that move across rotating platters, but rotation speeds are typically from 10,000RPM to 15,000RPM. As the cost per GB is also high, a combination of SAS (for performance) and HDD (for storage) is also typical.

Disks can also be combined in multiple ways with a hardware solution called RAID. This comes in many forms, but here are two of the most popular.

RAID 0 is where you take two disks and stripe the data across both. You get better performance than a single drive and the full capacity of both drives, but if one drive fails you lose all your data.

RAID 1 is where the drives are mirrored. If one drive fails your data is backed up on the other, but you only get the capacity of one drive.



ILLUSTRATION: @ROBBIDDULPH

MEMORY Memory requirements are growing in CAD/CAM/CAE workstations and 16GB is now considered 'entry-level' with 32GB or more often needed to run multiple applications at the same time or load up complex datasets.

Additional memory is required for compute intensive operations such as simulation, rendering, and CAM.

To improve system stability Error Correcting Code (ECC) memory is often recommended and this is standard in high-end workstations. Non-ECC memory is more common in entry-level machines. In addition, Dell's patented Reliable Memory Technology (RMT) can increase reliability and reduce crashes due to memory errors.

To get the best performance it is also important to match your memory to the processor. Configure in pairs for dual channel memory architectures and in fours for quad channel memory.

When buying a new workstation it is also good practice to ensure there are spare DIMM slots reserved for future upgrades. However, don't break the bank doing this by having to buy expensive high capacity modules. The price of memory always comes down over time, so in the long run it could be more cost effective to replace the entire memory in the workstation.

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TAILOR

Match a workstation to a specific workflow

The hardware requirements for design visualisation software are very different to those for 3D CAD. Here are some guidelines to help you choose the most appropriate workstation for the software that dominates your workflow.

1

I USE SIEMENS NX FOR DESIGN. WHAT SPEC WORKSTATION IS BEST FOR ME?

e.g. Dell Precision Tower 5810
A single high GHz processor with four CPU cores • AMD FirePro W5100 or FirePro W7100 GPU • SSD for OS and apps with a HDD for data • 16GB or 32GB RAM • Windows 7 Professional 64-bit.

2

I USE SIEMENS NX RAY TRACED STUDIO. WHAT SPEC WORKSTATION IS BEST FOR ME?

e.g. Dell Precision Tower 7810
Two medium to high GHz processors each with 8 to 12 CPU cores • AMD FirePro W7100 GPU • SSD for OS and apps with a HDD for data • 32GB or 64GB RAM • Windows 7 Professional 64-bit.

3

I USE SIEMENS NX FOR SIMULATION. WHAT SPEC WORKSTATION IS BEST FOR ME?

e.g. Dell Precision Tower 7810
Two medium to high GHz processors each with 4 to 12 CPU cores • AMD FirePro W5100 GPU (W8100 or W9100 if solver supports OpenCL) • SSD (PCIe optional) and HDD • 32GB or 64GB RAM • Windows 7 Professional 64-bit.

4

I USE SIEMENS NX FOR MANUFACTURING. WHAT SPEC WORKSTATION IS BEST FOR ME?

e.g. Dell Precision Tower 5810 or 7810
One or two medium to high GHz processors each with 6 or 8 CPU cores • AMD FirePro W5100 GPU • SSD for OS and apps and HDD for data • 16GB RAM or more • Windows 7 Professional 64-bit.



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