

WORKSTATION NEWS

Understanding your desktop technology



Subscribe



Brought to you in part by:







HP Smart Buys

HP Z210 CMT
Workstation
Special deals starting at \$640.



Screen image courtesy of Autodesk

HP Z400 Workstation Special deals starting at \$924.



Screen image courtesy of Autodesk

Specifying Your Inventor Workstation

Put your money in the right places for optimal performance.

By Robert Green, Cadalyst Contributing Expert



Do you use Autodesk® Inventor® to create your 3D mechanical models? If not, does your company plan a move to Inventor soon? If you already use Inventor, how do you extend your design environment to take advantage of the advanced functionalities that Inventor facilitates such as stress and thermal analysis, advanced visualization, design simulation. What about adding third-party solutions for applications such as plastic

mold designs or more advanced stress/thermal calculations. Pondering these types of applications forces CAD users to think about how their computing environment will have to change to achieve maximum Inventor performance.

Besides the obvious software and training issues that Inventor use raises, you also must deal with hardware issues such as:

- What operating system should I use?
- How many processor core(s) do I need?
- How much memory do I need?
- What type of graphics processor do I need?
- What configuration guidelines do I use to get the best performance for the money?

These questions are tough to answer because different companies use Inventor so differently. In this issue of Workstation Innovation News, I'll endeavor to give you the information you'll need to plan a hardware environment for your Inventor-based mechanical design future.

HP Z600 Workstation Special deals starting at \$1,729.



Screen image courtesy of Cannon Design

HP Z800 Workstation Special deals starting at \$1,813.



Screen image courtesy of Autodesk

NEW! HP EliteBook 8460w Mobile Workstations Special deals starting at \$1,299.



HP ePrint & Share

Contact HP

Get the latest news about HP along with a host of resources for online technical help and support.



Inventor running on dual screens on HP's Z400. (Screen image courtesy of Autodesk.)

Autodesk's Inventor Specifications

Want to know what kind of hardware is required for Inventor? Start with what Autodesk recommends:

Minimum System Recommendations for Inventor A trip to the <u>Autodesk web site</u> reveals the detailed minimum and performance configuration recommendations for Inventor tools.

A close perusal of these minimum requirements for Inventor show that almost any desktop or laptop machine running Windows XP 32-bit operating systems purchased in the last three years meets the criteria. Given my workplace experience with these types of machines, attempting to run Inventor with these minimum requirements may work in a training room environment but won't work well for production.

64-Bit Performance System Recommendations from Autodesk Microsoft Windows 7 64-bit, Windows Vista 64-bit (SP2) or Windows XP

Professional x64 Edition (SP2)⁴

8 GB RAM (or more)

Workstation class graphics card

AMD64 or Intel® 64 processor 1,3

8 GB RAM or more

CAD workstation-class graphics card

Microsoft .Net Framework 4.0

CAD workstation-class graphics card

1,280 x 1,024 true-color monitor

CAD workstation-class graphics card

Microsoft Internet Explorer 7.x (or later)

Microsoft Mouse-compliant pointing device

Download or installation from DVD

Internet connectivity for license registration

Although these specifications certainly are more aggressive, newer workstations with more modern, Intel Xeon 5500 series^{1,3} processors offer dual sockets that support multiple quad-core¹ processors and much more memory for Inventor users who take on more aggressive projects.

Specifying Inventor Workstations

To get guidance on how to best configure and purchase a workstation for Inventor, I asked HP Technical Consultant Frank Deming about his experiences with a variety of

More from HP

HP Certification
Has your workstation been
tested and certified?

<u>HP Workstations.tv</u> <u>Check out HP on YouTube!</u>

HP Autodesk Microsite

HP Performance Advisor

<u>HP Remote Graphics</u> <u>Software</u>

HP Total Care

Download the HP & Autodesk Productivity White Paper and The HP & Autodesk Brochure

Workstation Finder Tool

From our Sponsors

ROCK-SOLID INNOVATION



Inventor clients running HP Z Workstations with Intel processors. Our conversation covered a lot of ground and proved to be very educational in understanding the inner workings of today's workstations for Inventor (or other high-end 3D CAD systems).

HP System Recommendations for Inventor

Priority One: Cores. Equip your system with as many as cores as your application needs with the highest speed you can afford.

Priority Two: Graphics. Use an Autodesk-certified graphics accelerator that

fits your rendering and output needs.

Priority Three: Memory. Fill all slots with as much dual-rank (2-, 4-, or 8-GB)

memory (use the same type in all slots) as you can afford.

Priority Four: Disk. Use 7,200-rpm SATA format disks unless large-volume rendering or detailed analysis is required.

Operating system. You must use a 64-bit operating system to deliver maximum memory performance.

<u>To learn more about HP system recommendations, consult its workstation finder tool.</u>

Robert Green (RG): How important are the workstation's various subsystems, such as processors, graphics, memory, and disk, in helping Inventor to perform optimally?

Frank Deming (FD): Inventor is fairly complicated app to size. Given the varied features of the two 2012 editions, Inventor and Inventor Professional, what should be emphasized is different. Additional considerations for the user are the Autodesk Suites offerings and the analysis programs that are commonly used. Suites containing Inventor allow users to work within Autodesk Digital Prototype workflow. These other products have their hardware requirements that could exceed those of standalone

"We've found the order of importance of the HP Z Workstation subsystems seems to be CPU first, the graphics card second, memory third, followed by disks."

- Frank Deming

Inventor. The additional applications with suites are Showcase, AutoCAD Mechanical, and 3D Studio Max Design among others. A basic theme with all these is that you should first consider CPU and graphics.

System Memory (RAM)

RG: Given the primary importance of memory with respect to performance, how much memory does Inventor really need?

FD: For just basic Inventor, 4 to 6 GB should be enough unless very large models with numerous assemblies are involved. If you use Inventor Professional, then you should consider additional memory. Inventor Professional has additional analysis capabilities that let you run additional background tasks while interactively working on the model. Additional memory is required in this instance to enable both the analysis plug-ins and Inventor's other functionalities to both stay in memory — 8 GB to 12 GB is standard in this situation. I suggest that Inventor users examine how much memory Inventor consumed previously and use this to estimate how large their needs will be during the lifetime of the workstation. Understanding your history is key to understanding your future requirements. Don't fall into the trap of having too little memory and trying to work towards your fullest capacity.

RG: Given that various processors have different memory architectures, what's the best way to allocate memory for dual-channel (number of memory slots divisible by two) and three-channel (number of memory slots divisible by three) architectures? ⁵

FD: For HP Z Workstations with two-channel architectures, HP Z210 Convertible

Minitower Workstation (Z210 CMT) and HP Z210 Small Form Factor Workstation (Z210 SFF), simply fill all available channels with dual-rank (2-, 4-, or 8 GB) rather than single-rank (1 GB) memory modules. For three-channel architectures, HP Z400 Workstation, Z600 Workstation, and Z800 Workstation, you should still fill all available memory channels with dual-rank memory but make sure that all channels are balanced by using the same size memory in all channels. To push memory even higher, you can use quad-rank (16 GB) modules, but the speed of the memory will be somewhat slower due to lower frequency ratings.⁵

RG: So it seems like a good rule of thumb is to fill all channels with the same type of memory as opposed to mixing types or leaving some channels empty, right?

FD: Correct.



Inventor running on HP's Z210 CMT. (Screen image courtesy of Autodesk.)

CPU Parameters

RG: So what about the central processing unit (CPU) cores on HP Z Workstations? What is the optimal number of cores to use?

FD: This is very application-, and sometimes usage-, specific. For AutoCAD-based products, you could say a two-core CPU such as the Intel Core i5 in our Z210 Workstation is optimal; however, for other CAD applications such as Inventor or if any significant amount of time is spent rendering designs, then four or more cores and the Intel Xeon is a must. Another consideration is throughput of a system and not just performance. If you run multiple tasks, one actively in the foreground and some analysis running in the background, four to eight cores (or more) can be a recommendation. 1,2,3

Running multiple tasks is a common scenario for power users of Inventor Professional and Autodesk's new Product Design Suite. Both of these editions let users utilize the significant computer resources of multiple cores. This lets them have many active tasks working at once to give them the quick, accurate results they need in today's demanding manufacturing/design environment. Some Inventor users also run Autodesk Simulation (formerly Algor), Moldflow, and the recently available Blue Ridge Numerics CFD package. All of these applications take good advantage of multiple cores, up to the 12 cores, 24 cores with Intel Hyper-threading, available on the HP Z600 and Z800 workstations. Many cores are king for Inventor power users.

RG: I usually tell my clients to buy the number of cores they need, with the fastest processing rate they can afford, and then put as much memory in as

"Buy the number of cores you need — with the fastest

practical — my logic being that you can always upgrade memory later but not the processors. Is that sound advice?

processing rate you can afford
— and then put in as much
memory as is practical."

FD: It is.

Operating System and Graphics Issues

Autodesk's 4 GB memory and 1,280 true-color graphics requirements for Inventor are met easily by even three-year old laptop machines with embedded graphics running 32-bit Windows operating systems. With so much more graphics resolution and memory available using 64-bit operating systems and modern graphics processing unit (GPU)-based video/rendering cards, I wanted to ask Frank about these issues.

RG: With all these cores and memory, we have to run 64-bit operating systems given the 4 GB maximum memory for 32-bit operating systems. I'm seeing a lot of Windows 7 64-bit⁴ in the field in the past year — is there a certain level of memory where Windows 7 64-bit starts to run CAD better?

FD: Innately, no. However, related to throughput, the answer is yes. If you run multiple applications, let's say several Autodesk apps, Outlook, and a browser, then enough RAM to allow the majority of each app to reside in memory can make a big difference in the user experience.

As an example of a poor experience, I recently ran several browsers, multiple Microsoft applications, and one Autodesk application on a 4 GB equipped 64-bit Windows 7⁴ laptop. Total run-time memory requirements of all the apps were typically just more than 6 GB, so switching between any of the applications was a tedious experience. In this case, I was overextending the capabilities of the laptop, but that's how I need to work, so I'll be giving myself an upgrade this summer.

I do want to stress that modern web sites, as well as CAD, are RAM hungry and getting worse. All that graphical richness comes at a cost, both for CPUs and particularly memory.

Autodesk Recommended Graphics Cards For recommended graphics hardware and frequently asked questions (FAQ) documents, visit the <u>Autodesk Certified Hardware Services & Support page</u>.

RG: Speaking of graphics, what is the memory impact of the GPUs in the high-end graphics cards available today?

FD: Typically there is no impact on system memory with a 64-bit operating system. However, 32-bit Windows (XP, Vista⁴, and 7⁴) systems do lose working RAM to the graphics card. The graphics card adds additional size to the system's memory-mapped I/O (MMIO) region, contributing to the 2GB user space cap, unless the /3GB and /USERVA switches are applied. This is one of the main reasons to move to a 64-bit OS — the user gets a much fuller use of the RAM in a system.

RG: The HP Z210 Workstation uses Intel's embedded graphics to save the cost of an add-on GPU based graphics card. How does this affect machine performance?

FD: Intel's embedded graphics solutions, which are actually on the CPU, do use system RAM instead of having dedicated video memory. The embedded graphics processor's RAM use is user selectable, to a degree, but always takes RAM away from core processing tasks. Access to graphics data in system memory is slower than access between a graphics card's GPU and the DDR5 memory available in today's professional cards.

Disk Systems

Finally, I wanted to get Frank's opinion about how various disk systems could assist Inventor's performance. I specifically wanted to see if multidisk systems using RAID or solid state disks (SSDs) were worth their additional expense.

RG: What are the performance differences for single- and multiple-disk configurations and controller technologies such as $RAID^6$ as opposed to the standard SATA drives in most HP Z Workstations?

FD: RAID 0 is useful for data-intensive applications such as large data-set mechanical finite-element analysis (FEA) applications. RAID can be particularly helpful with some of the Autodesk Media and Entertainment products that perform video and film editing because three or more RAID 0 disks can be used.

RG: So, it sounds like most normal Inventor users can stay with conventional SATA disks unless they're doing energy analysis or substantial rendering or animation tasks and put their money in faster cores with more memory?

FD: Correct.

RG: What about SSD technology?

FD: There are definitely indications of good boot-time performance with SSD, but boot-up is an infrequent action for most desktop users. Users of analysis tools from Autodesk, Simulation, Moldflow, or Blue Ridge Numerics CFD can see a remarkable speedup in some functionalities. One module of Moldflow speed up by 6 times with a current generation Intel SSD over the use a standard HDD.

Wrapping Up

I hope this detailed discussion of how to configure your workstations for optimal Inventor performance will help you better plan your hardware budget. Simply knowing how to prioritize cores, memory, graphics systems, and disk systems can go a long way toward getting the greatest amount of Inventor performance for every HP Z Workstation dollar you spend. I hope you found our discussion as interesting as I did.

Authors note: I'd like to personally thank Frank Deming from HP for taking the time to share his configuration expertise.

About the Author

Robert Green

Robert provides CAD implementation, consulting, and programming services for a variety of companies throughout the United States and Canada. He holds a degree in mechanical engineering from the Georgia Institute of Technology and is the author of *Expert CAD Management: The Complete Guide*. Reach him via his web site at www.cad-manager.com.

DISCLAIMERS

- (1) Multicore technologies are designed to improve performance of multithreaded software products and hardware-aware multitasking operating systems and may require appropriate operating system software for full benefits. Not all customers or software applications will necessarily benefit from use of these technologies.
- (2) Intel's numbering is not a measurement of higher performance.
- (3) 64-bit computing on Intel architecture requires a computer system with a processor, chipset, BIOS, operating system, device drivers, and applications enabled for Intel 64 architecture. Processors will not operate (including 32-bit operation) without an Intel 64 architecture-enabled BIOS. Performance will vary depending on your hardware and software configurations. See www.intel.com/info/em64t for more information.
- (4) Windows 7 systems may require upgraded and/or separately purchased hardware and/or a DVD drive to install the Windows 7 software and take full advantage of Windows 7 functionality. See www.microsoft.com/windows/windows-7 for details. Certain Windows Vista product features require advanced or additional hardware. See www.microsoft.com/windowsvista/getready/hardwarereqs.mspx and

www.microsoft.com/windowsvista/getready/capable.mspx for details. Windows Vista Upgrade Advisor can help you determine which features of Windows Vista will run on your computer. To download the tool, visit www.windowsvista.com/upgradeadvisor.

- (5) Each processor supports as many as two channels (HP Z200/HP Z200 SFF) or three channels (HP Z400/HP Z600/HP Z800) of DDR3 memory. To realize full performance, at least 1 DIMM must be inserted into each channel. To get full 6-channel support, two processors must be installed.
- (6) SATA hardware RAID is not supported on Linux systems. The Linux kernel, with built-in software RAID, provides excellent functionality and performance. It is a good alternative to hardware-based RAID. Please visit http://h20000.www2.hp.com/bc/docs/support/SupportManual/c00060684/c00060684.pdf for RAID capabilities with Linux. HP Z210SFF does not support RAID 10 Because of drive-bay limitation.

Intel, Pentium, Core, and Xeon are trademarks of Intel Corporation in the U.S. and other countries. Microsoft, Windows, and Vista are U.S. registered trademarks of Microsoft Corporation. Autodesk and Inventor are registered trademarks of Autodesk, Inc., in the USA and other countries. AMD and Athlon are trademarks of Advanced Micro Devices, Inc.

© Copyright 2011 Hewlett-Packard Development Company, L.P. The information contained herein is subject to change without notice.

Reproduction in whole or in part is prohibited without written permission.

You are currently subscribed to %%list.name%% as %%emailaddr%%. Please do not reply to this message. If you wish to leave this mailing list, simply <u>Unsubscribe</u> Cadalyst is a division of Longitude Media LLC, P.O. Box 832, Dover, MA 02030.

© 2011 Longitude Media Group, Inc. All Rights Reserved. Refer to our <u>Privacy Policy</u>. Send us your feedback: <u>customerservice@longitudemedia.com</u>