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HP's Z820, Z620, and Z420 Workstations

Newly upgraded Z Series offers even more power and CAD capabilities.

By Robert Green, *Cadalyst* Contributing Expert



Lots of cores, plenty of RAM, full-size towers, plenty of expandability, and killer graphics deployed in IT-friendly, tool-free cases. This was the story line in 2009 when HP's Z Series Workstations were first brought to market. This year, HP updates this series and delivers more of everything at better prices.

For CAD users who perform 3D modeling, analysis, and rendering on large projects where workstation speed, power, and graphics capabilities are a necessity, these new HP Z Workstations bring the power. There's simply no confusing these workstations with a consumer PC.

The Updated HP Z Family

The HP Z Workstation family has grown to include everything from the all-in-one Z1 (see [April's newsletter](#) for more information on the Z1), to the entry-level Z210 and Z210 SFF machines to the new Z420, Z620, and Z820 machines on which we'll focus in this edition.

In the new family lineup, the HP Z420 represents the high-performance entry point to the Z Series, while the HP Z620 occupies the mid-range, and the HP Z820 is the no compromise, high-end machine to cover extreme processing needs. All the Z Workstations come in a clean, tool-free tower chassis¹ with plenty of front and rear panel peripheral connection options and robust power supplies to support the large RAM, disk (both magnetic and solid state), and graphics systems power users demand.

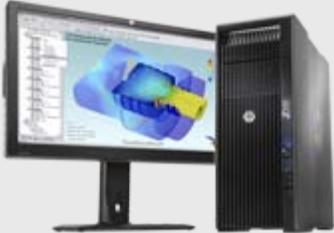
The new Z Workstations boast some new technology: in-disk controllers via the SATA III 6 GB per second drive controllers, solid state disk (SSD) options, support for more and faster RAM and enhanced graphics, all of which assist in high-end CAD processing tasks. To really get a feel for what you can do with the new Z Workstations, you have to break out the spec sheets and see the vast amount of configuration flexibility these machines offer.

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From the compact Z210 SFF (on the far left) to the uncompromising Z820 (second from right) the Z family covers everything from basic CAD needs to high end analysis and simulation tasks.

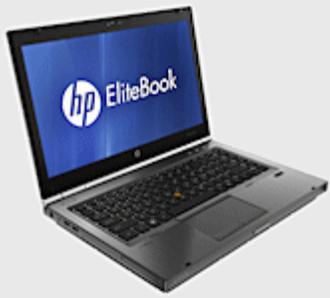
Under the Hood

Of course the biggest variables that control workstation performance is the chipset architecture that determines the number of cores, cache, speed, and memory supported. In these areas, the new Z Workstations offer a lot of power:

The HP Z420 Workstation is powered by a single Intel® Xeon® processor E5-1600 product family and Intel® C602 chipset. The HP Z420 supports processor options that range from a 2.8GHz with a 10MB L3 cache processor up to 3.2Ghz processor with a 20MB L3 cache. Each processor supports Intel® Turbo Boost Technology, Intel® vPro Technology and memory configurations up to 64GB with speed up 1600Mhz.

The HP Z620 Workstation offers the broadest range of solutions based on the Intel® Xeon® processor E5-1600/2600 product family^{2,3,4,7} This workstation is dual-processor-capable (meaning up to 16 cores may be installed) and is based on the Intel® C602 chipset. It offers tremendous latitude in processor and memory selection that range from a 2.8 GHz, 4 core, 10 MB cache model with support up to 64 GB of 1,066 MHz memory or you can select up to two 2.9 GHz, 8 cores each with support for a 20 MB L3 cache and memory support up to 96 GB of 1,600 MHz memory. Each processor supports Intel® Turbo Boost Technology, Intel® vPro Technology and offers a wide variety of memory configurations ranging from 8GB to 96GB⁶.





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Like the Z620 shown here, all the Z Workstations have a clean, vertically piped front panel with front and rear expansion ports.

The HP Z820 Workstation offers users access to most capability and capacity to meet end user needs. Based on the Intel® Xeon® processor E5-2600 product family, the HP Z820 with the Intel C602 chipset supports up to 16 cores and 512 GB of 1,600 MHz memory in 16 dimm slots. It offers an array of processor selections that range from an entry level 2.8 GHz, 4 core processor with a 10 MB cache, up to two 3.1 GHz, 8 core with 20 MB cache processor. All processors support Intel® Turbo Boost technology and Intel® vPro Technology.

Performance note: With either eight or twelve memory channels available for RAM, the new Z Workstations can be far more efficient at moving data than their three or four channel ancestors. When it comes to performance, the greater the number of memory channels, the faster the data gets to the cores and the faster your work gets done.

Processor Features

Built into the Intel® Xeon® processors that power the HP Z Workstations are a selection of performance enhancing technologies including vPro Technology (on all processors) and Intel® Turbo Boost Technology with hyper-threading on all but the 1,066 MHz memory architecture processors⁵. While vPro addresses security and manageability issues such as remote power on via networks, Intel® Turbo Boost with hyper-threading support monitors the processors core temperatures and speeds the cores up to achieve greater performance consistent with thermal limits. In CAD applications where hyper-threading isn't supported, Intel® Turbo Boost can increase the performance of the core running your CAD application even when the other cores aren't in use.

I like to think of these features as squeezing every last bit of performance from the processor, so you get the best processing value possible for the money you spend. Not a very technical description, but an accurate one.

Fast Drives

Next to processing and RAM, fast disk devices are of extreme importance as processors can only crunch data as fast as the disks can deliver it. With fast SATA III controllers, instead of the previous generation SATA II, a variety of high RPM mechanical drives, and SSDs, the disk systems in the new Z Workstations offer maximum performance with a wide variety of storage configurations^{8,9}.

The HP Z420 Workstation offers an integrated 3 or 6 GB per second SATA or SATA III controller (depending on model) and an optional 6 GB per second SAS controller driving up to four 3.5" 7,200 rpm disks or 15,000 rpm SAS drives and up to four 2.5" 10,000 rpm or SSDs^{8,9}. The 3.5" drives are installed in three internal or three external drive bays.

The HP Z620 Workstation offers an integrated 6 GB per second SATA III controller and an optional 6 GB per second



Intel solid state drives (SSDs) are an option on all Z Workstations^{8,9}. Comprised entirely of memory

SAS controller driving up to four 3.5" 7,200 rpm disks or 15,000 rpm SAS drives and up to four 2.5" 10,000 rpm or SSDs^{8,9}. The 3.5" drives are installed in three internal or two external drive bays.

and having no moving parts, SSDs provide fast storage and retrieval for large volumes of data common in high-end CAD applications.

The HP Z820 Workstation offers an integrated 2 channel 6 GB per second SATA III controller along with an integrated 8 channel 6 GB per second SAS controller driving up to five 3.5" 7,200 rpm disks or 15,000 rpm SAS drives and up to six 2.5" 10,000 rpm or SSDs^{8,9}. The 3.5" drives are installed in four internal or three external drive bays.

With SATA III controllers moving data from your disks at twice the rate of the SATA II controllers in the prior generation of Z Workstations, you can see big increases in speed particularly when using SSDs for very large models that would otherwise saturate the disk controller. After all, the cores and RAM in the world won't do much good if your disk systems can't deliver data to them, right?

Graphics

For rendering, analysis, and animation tasks, graphics processing units (GPUs) are crucial for fast performance. All the new Z Workstations offer greatly expanded graphical power by offering the following controller selections:

- Professional 2D: NVIDIA NVS 300, NVIDIA NVS 310*, AMD FirePro™ 2270, NVIDIA Quadro NVS 450
- Entry 3D: NVIDIA Quadro 410*, NVIDIA Quadro 600, AMD FirePro™ V3900, AMD FirePro™ V4900
- Mid-range 3D: NVIDIA Quadro 2000, AMD FirePro™ V5900
- High-end 3D: NVIDIA Quadro 4000, AMD FirePro™ V7900, NVIDIA Quadro 5000, NVIDIA Tesla C2075¹⁰

** Note that NVIDIA NVS 310 and NVIDIA Quadro 410 expected to ship June/July 2012*

Specific GPUs may require larger power supplies depending on the Z Workstation you select and the optional equipment. Depending on the workstation model and number of GPU's installed, Z Workstations can drive up to eight displays for truly customized workstation software environments.

Quieter, Cheaper, and Easier to Maintain

Although the raw speed, memory capacity, and graphics capabilities of the new HP Z Workstations are what most grabs our attention, a number of other design innovations are worth noting.

Energy consumption. All power supplies in the HP Z Workstations are either 88% or 90% efficient with the Z420 at 600W, followed by the Z620 at 800W and the Z820 Workstation at 1125W. These power supplies ensure you can load the machines up with drives, RAM, and graphics without generating a lot of waste heat that degrades workstation components.

With efficient power supplies and intelligent processor management enabling super low power consumption in standby mode, you'll not only have a cooler workstation that lasts longer but you'll pay less to power it and less to cool your office environment.

Lower noise. The cases for the new Z Series Workstations continue the tradition of moving air efficiently, thus reducing fan speeds and providing quieter cooling. If your Z620 or Z820 Workstation is fully loaded with components, you can choose the optional liquid processor cooling to almost entirely eliminate fan noise. These options all make the Z's quiet enough to put on top of your desk instead of under it.

Tool-free chassis. The new Z Workstations continue the tradition with tool-free, snap-fit, chassis design that makes maintenance easy for IT personnel to service¹.



With tool-free serviceability, the interior of the HP Z620 is remarkably clear of all but the essential component cabling and has optimized air-flow management to allow lower speed and quieter fans.

HP Performance Advisor. All Z Workstations ship with HP's Performance Advisor software. This software helps you analyze and custom configure the cores, memory, and prioritization of your software tools so your workstation puts its resources where you want them. HP Performance Advisor also helps track drivers and updates from your CAD applications to keep your workstation optimally configured.



Performance Advisor's Memory Graph functionality helps you analyze and record memory use of specific applications, allowing you to better understand RAM and tuning requirements.

Of course no one buys a workstation solely on its serviceability, power consumption, or quiet operation but taken together these factors add up to a machine that is cheaper to work on, well configured, and less expensive to power while contributing cool quiet operation to your employees office environments. I can confidently report I've never heard anyone complain about an easy to maintain, quiet, reliable machine that saves money on power.

Justifying the Cost

Obviously, big performance costs and HP Z Workstations loaded with 16 cores, tons of RAM, and SSDs don't come cheap. It is therefore important to ask how much time you can save your high-end users by giving them a workstation that can power through the toughest CAD modeling and analysis tasks.

Here's a very simple example of how to look at the cost savings justification¹¹ for an HP Workstation (in these calculations I assume 48 work weeks per year and a three-year workstation service life). *These numbers should be used as a reference only and you should check with your management team to obtain numbers relevant for your office.*

1 hour per week over three years saves this much, where RATE is measured in \$/hour:
Rate x 1 x 48 x 3 = Savings over 3 years

We can see that:

- For a \$75/hour rendering specialist the number would be \$10,800
- For a \$100/hour structural analyst the number would be \$14,400

By now you can see that even a small weekly time saving can really add up. If you could save these employees 1 hour per day, the numbers would go up five-fold! If you saved 30 minutes per day, the numbers would go up by a factor of 2.5.

So, how much are you really saving by having a \$100/hour structural analyst wait for hours and hours to get a computational result from an old computer when they could save hours with a new workstation? I'll let you be the judge by running your own numbers. I think you'll find that a faster workstation can actually pay for itself via labor savings.

Wrapping Up

With the new series of Z Workstations, HP has provided us with the capability of cramming more cores, more RAM, faster magnetic and super fast solid state disks, and more graphical firepower than I would have thought possible three years ago. For those CAD analysts, 3D specialists, renderers, animators, and scientists who need the power, the HP Z Workstations provide a no compromise platform to deliver that power.

And for the IT and accounting managers who have to make purchasing decisions, the savings HP Z Workstations provide make them an excellent way to lower workstation ownership and labor costs.

About the Author

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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.

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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 <http://www.microsoft.com/windows/windows-7/> for details.

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1. The Power Supply, Graphics Card, Hard Drives, Optical Drive, System Cooling Blower and

- Memory can all be accessed, and removed without tools. Tools may be required for all other components.
2. Dual-, quad-, six-, and eight-core 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.
 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 <http://www.intel.com/info/em64t> for more information.
 4. Intel's numbering is not a measurement of higher performance.
 5. Intel® Turbo Boost stepping occurs in 100MHz increments. Processors that do not have turbo functionality are denoted as N/A. Intel® Turbo Boost Technology requires a PC with a processor with Intel® Turbo Boost capability. Intel® Turbo Boost performance varies depending on hardware, software, and overall system configuration. Please visit <http://www.intel.com/technology/turboboost> for more information.
 6. Each processor supports up to 4 channels of DDR3 memory. To realize full performance at least 1 DIMM must be inserted into each channel.
 7. Z620 systems configured with E5-1600 series processors may not add a 2nd processor. To support two processors, E5-2600 series processor must be chosen.
 8. 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.
 9. For hard drives, 1 GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 8 GB of hard drive (or system disk) is reserved for the system recovery software for Windows® XP and XP Pro, up to 12 GB for Windows® Vista®, and up to 20 GB for Windows® 7.
 10. NVIDIA Tesla C2075 requires the 1125W power supply.
 11. Note that these are the author's estimates for the purpose of example, and not intended to be accurate in individual situations, as users' experiences will vary depending on their circumstances and implementation.

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