



# HP Z220 Workstation Architecture

## Introduction

The HP Z220 CMT and SFF Workstations are the follow-on generation to the HP Z210 workstations and introduce new functionalities and technologies to the entry workstation class. They feature the Intel® Xeon processor E3-1200 v2 family and next gen Intel Core™ processors, based on the new Intel micro-architecture code-named Ivy Bridge. A substantial increase in I/O bandwidth, performance, and energy efficiency, as well as upgraded ME8 manageability, 1600MHz memory speed and new integrated USB 3.0 features deliver improved productivity and stability. This paper will describe the architecture features of the Convertible Mini Tower (CMT) version, most of which are available on the Small Form Factor system as well.

## New Technologies

### New Intel Processor micro-architecture

The HP Z220 supports Intel's next generation processors, featuring a new micro-architecture in the 22nm process, providing greater compute and integrated graphics performance combined with low energy consumption. Both the latest Quad Core Intel® Xeon® processor E3-1200 v2 series, and the 3rd generation Intel Core processors (dual-core Intel Core™ i3 and selected Intel Core™ i5/i7 processors) are supported. The Intel® C216 PCH (platform controller hub) chipset complements the HP Z220's core architecture.

### New technologies supported with those processors on HP Z220:

- **RDRAND Instruction**  
This is one of the new Intel security and cryptography technologies. It comprises a software visible random number generation mechanism, supported by a high quality entropy source that is made available to programmers through the new RDRAND instruction.
- **Supervisor Mode Execution Protection (SMEP)**  
This new mechanism blocks malicious software attacks from user mode code when the system is running in the highest privilege level. It participates in protecting the system from virus attacks and potentially harmful code.
- **Power Aware Interrupt Routing (PAIR)**  
PAIR is an enhanced interrupt management scheme that routes interrupts to threads or cores based on their sleep states. For improved energy savings, a new interrupt will be routed to the active cores without waking the deep idle cores. For improved performance, new interrupts will preferably be routed to the idle cores without interrupting the already heavily loaded cores.

### PCI-Express Gen3

The HP Z220 now supports Gen3 PCI-Express speed on the processor's x16 lanes. PCIe Gen3's most notable improvement is a higher 8Gb/s bit rate which, combined with a new encoding scheme, effectively doubles the bus throughput over PCIe Gen2's 5Gb/s bit rate. PCI Gen3 Graphics cards are the primary devices that will take advantage of the increased bandwidth, as and when they become available.

### 1600MHz DDR3 ECC/nECC DIMM

The HP Z220 supports both DDR3 ECC and non-ECC unbuffered DIMMs, up to 1600MHz speed. 2 channels with 2 DIMMs per channel are supported. Memory will operate at the speed of the slowest rated installed processor or DIMM. The higher memory speed, compared to HP Z210's 1333MHz speed, provides greater memory performance.

HP recommends Windows.

## iAMT 8.0 manageability technology featuring vPro Technology on Intel® Xeon and Intel Core i5/i7 processors

- Intel AMT 8.0  
Enhancements to Remote KVM  
Generational hardening of firmware adding additional defenses to platform security
- Intel Identity Protection Technology  
Growth of one-time password ecosystem for large & small business applications
- Processor-based Security  
New protection from malware & better crypto with SMEP and PP-DRNG

## Intel® HD Graphics P4000

The new integrated Intel® HD Graphics P4000 graphics engine provides professional entry graphics performance. Available on Intel® Xeon® processor E3-12x5v2 models, it comes certified for selected popular workstation applications. The graphics core integrated in P4000 Intel Xeon processors have 16 Execution Units and offers higher performance with 22nm process technology, compared to the previous generation P3000, which has 12 Execution Units. It supports Microsoft\* DirectX\*11.0 and OpenGL\* 3.3, and expanded media acceleration features like full hardware decode and encode acceleration as well as advanced video processing features.

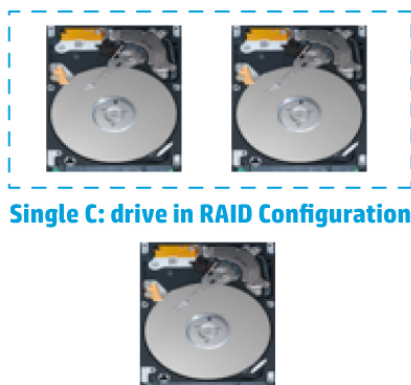
## Integrated USB 3.0

2 front and 2 rear integrated USB 3.0 ports are available on HP Z220 CMT, while the HP Z220 SFF sports 4 rear USB 3.0 ports. Integrated USB 3.0 provides cost-effective support for greater I/O bandwidth for new, faster peripherals and external storage devices, and a 10 times higher bit rate over USB 2.0. More information on the USB 3.0 Technology and Performance measurements can be found in the “Additional Resources” section below.

## Intel SRT

Intel Smart Response Technology (SRT) is a cost effective disk caching option that enables faster boot and application responsiveness.<sup>1</sup> A cost-effective 24GB SATA solid-state drive (SSD) functions as cache for a conventional, larger capacity magnetic hard disk drive, or RAIDed volumes of HDDs. It is available for Windows 7 32/64 bit only. For an expanded overview of SRT’s technology, benefits and installation, please refer to the “Additional Resources” section below.

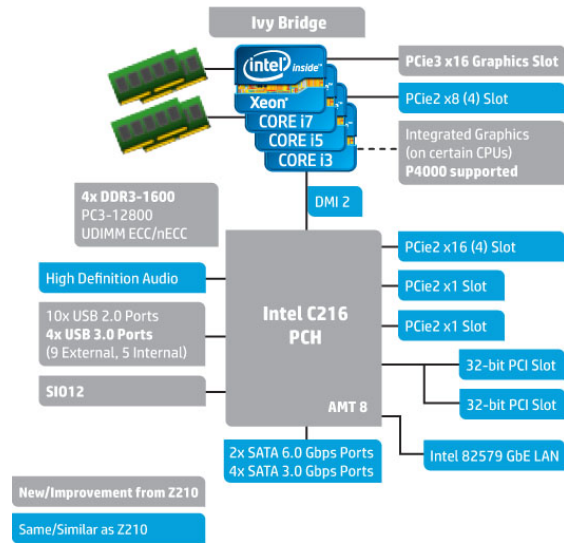
- Intel® Smart Response Technology (intelligent caching)
- SSD like performance + best \$/GB



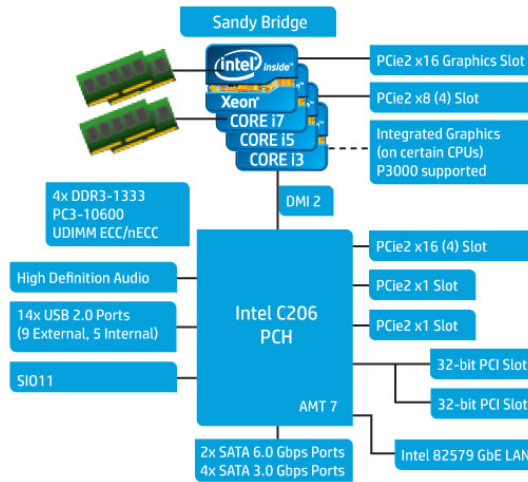
- RAID 0 and 1 support - fault tolerance and performance for HDDs
- End user performance upgrade with SSD without reinstalling OS
- Uses existing “off the shelf” components and mature interface (SATA)

## HP Z220 vs HP Z210 Block Diagram

HP Z220 CMT Block Diagram



HP Z210 CMT Block Diagram



	HP Z220 CMT	HP Z210 CMT
<b>Operating System</b>	Windows 7 Professional 64-bit and other editions available	Windows 7 Professional 64-bit and other editions available
<b>Processors</b>	Intel® Xeon E3-1200v2 and 3 <sup>rd</sup> generation Core i7/i5/i3 Processors	Intel Xeon E3-1200 and 2 <sup>nd</sup> generation Core i7/i5/i3 Processors
<b>Memory</b>	1600 MHz DDR3 ECC & nECC Un-buffered DIMM	1333MHz DDR3 ECC & nECC Un-buffered DIMM
	Up to 32GB in total, 2 channels with 2 DIMMs per channel	
<b>Integrated Graphics</b>	Intel® HD Graphics P4000 Intel® HD Graphics 4000 Intel® HD Graphics 2500 Intel® HD Graphics 2000	Intel® HD Graphics P3000 Intel® HD Graphics 2000
<b>PCIe</b>	1x PCIe Gen3 x16(x16) 1x PCIe Gen2 x16 (x4) 1x PCIe Gen2 x8 (x4) 2x PCIe Gen2 x1	1x PCIe Gen2 x16 (x16) 1x PCIe Gen2 x16 (x4) 1x PCIe Gen2 x8 (x4) 2x PCIe Gen2 x1
<b>USB 3.0</b>	4 integrated USB 3.0 ports (2 front, 2 rear)	No integrated USB 3.0 ports, optional card only
<b>Manageability</b>	Intel ME8/AMT8, Intel vPro*	Intel ME7/AMT7, Intel vPro*

\*if supported by the selected processor

## Workstation advantages over HP Desktop PCs

### Higher CPU Performance

The workstation Quad Core Intel® Xeon® processor E3-1200 v2 series includes models up to a 3.7GHz base frequency, when the 3rd generation Intel Core™ i7 processors for desktop PC reach only up to 3.4GHz. The Intel Xeon E3 processors also offer many processors with Hyper Threading and larger 8MB cache compared to their Intel Core i5 counterparts.

Quad-Core	Xeon E3-12X0v2 ECC	Xeon E3-12X5v2 ECC	Desktop client non-ECC
Higher base frequencies	<b>Intel® Xeon® E3-1290v2<sup>^</sup></b> 3.70GHz/4.1T/HT/8MB/87W/GTO/vPro		NOTE: only commercial desktop (Intel vPro™ capable) Core-i5/i7 SKUs are shown
8-Way HT Processing (Xeon E3/Core i7)	<b>Intel® Xeon® E3-1280v2</b> 3.60GHz/4.0T/HT/8MB/65W/GTO/vPro	Intel Xeon E3-1275v2 <b>X</b> 3.50GHz/3.90T/HT/8MB/77W/GTO/vPro	<b>Intel® Core™ i7-3770</b> 3.40GHz/3.90T/HT/8MB/77W/GT2 <sup>#</sup> /vPro
PCIe Gen3, CPU Turbo, more cache, Intel vPro	<b>Intel® Xeon® E3-1270v2</b> 3.50GHz/3.90T/HT/8MB/63W/GTO/vPro	<b>Intel Xeon E3-1245v2</b> 3.40GHz/3.80T/HT/8MB/77W/67Z/vPro	
	<b>Intel® Xeon® E3-1240v2</b> 3.40GHz/3.80T/HT/8MB/63W/GTO/vPro	<b>Intel Xeon E3-1225v2</b> 3.20GHz/3.60T/HT/8MB/77W/67Z/vPro	<b>Intel® Core™ i5-3570</b> 3.40GHz/3.80T/6MB/77W/GT1/vPro
	<b>Intel® Xeon® E3-1230v2</b> 3.30GHz/3.70T/HT/8MB/63W/GTO/vPro		<b>Intel® Core™ i5-3470</b> 3.20GHz/3.60T/6MB/77W/GT1/vPro
	<b>Intel® Xeon® E3-1220v2</b> <b>X</b> 3.10GHz/3.50T/8MB/69W/GTO/vPro		

Dual-Core	Core i3	Pentium	Decoder
Ivy Bridge processor/ i-gfx, 4-way HT Processing, 1600MHz memory	<b>Intel Core i3-3240</b> 3.4GHz/3MB/55W/GT1		<b>Orange Highlight</b> Xeon Differentiator vs Core
S/Bridge processor/ i-gfx, No HT, 1066MHz memory	<b>Intel Core i3-3220</b> 3.30GHz/3MB/55W/GT1		<b>Grayed out SKU</b> X Not offered on HP Z220
	<b>Intel Core i3-2120 (S/Bridge)</b> 3.30GHz/3MB/65W/GT1#	<b>Intel Pentium G8xx (S/Bridge)</b> <b>X</b>	<b>Processor Code:</b> 3.50GHz/3.90T/HT/8MB/69W/GTO/vPro Base freq/Max 1Core, Turbo freq/Hyper Threading/Cache/TDP/Int Graphics/vPro
		<b>Pentium G640 (S/Bridge)</b> 2.80GHz/3MB/65W/GT1#	<b>Integrated Graphics Code:</b>
			<b>GT0</b> No integrated Graphics
			<b>GT1</b> Intel HD Graphics 2500 (except GT1#)
			<b>GT2 (Core i7-3770)</b> Intel HD Graphics 4000
			<b>GT2 (Xeon E3-12x5v2)</b> Intel HD Graphics P4000

#: GT1: Intel HD Graphics 2000 on Core i3-2120 and Intel HD Graphics on Pentium G640  
 ^ E3 - 1290v2 only supported on Z220 CMT

### ECC

Error Correcting Code (ECC) memory is supported on workstation Intel Xeon and Intel Core i3 SKUs, thereby improving data integrity. If ECC memory is used in conjunction with a non-ECC processor sku, ECC protection is not available and the DIMMs will appear to the system as Non-ECC memory. Desktop PCs do not typically support ECC, even when using processor skus such as Intel Core i3 which do support ECC on workstations.

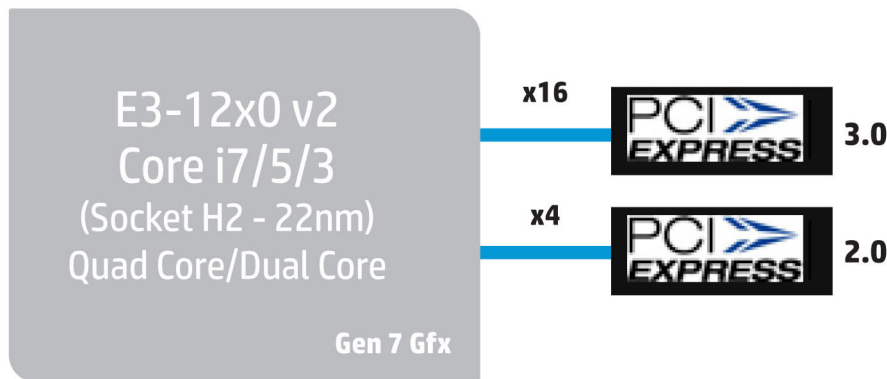
HP recommends Windows.

## Intel® HD Graphics P4000

The Intel® HD Graphics P4000 supported on Intel® Xeon® processor E3-12x5 SKUs uses a specific driver optimized for Workstation graphics workloads. In contrast, the Intel® HD Graphics 4000 on Core i7 uses a non-Workstation driver. This results into a 3D performance on P4000 that is, on average, around 10% higher than on 4000, depending on the benchmark or the application. Additional information is provided in the HP Z220 Graphics white paper.

## PCI-Express expandability and performance

On the HP Z220 CMT Workstation, thanks to the use of the C216 Workstation chipset and an optimized implementation, all the Intel Xeon or Intel Core processors provide an additional x4 PCIe Gen2 slot. Being closer to the processor and memory, lower latencies and less bandwidth sharing with other devices are experienced, compared to the slots behind the chipset. This can result into higher performance in dual-graphics card configurations, or for high-speed I/O cards. No additional x4 PCIe lanes from the processor is supported on desktop PCs. The only x4 PCIe slot available is provided by the chipset and the I/O bandwidth to and from the processor is shared with all the other chipset devices like LAN, USB 3.0, SATA, etc.



## 400W Power Supply

The higher capacity power supply on HP Z220 CMT workstation supports higher-end 3D graphic cards with an additional power dongle, thereby providing greater expandability and higher performance options. The 400W power supply also enables the support of the 87W Xeon workstation sku that boasts the highest 3.7GHz base frequency and performance available. Business desktops typically have smaller power supplies and do not cater to high end 3D graphics cards.

### Additional Resources

[hp.com/go/whitepapers](http://hp.com/go/whitepapers), includes white papers on **USB 3.0 technology** and an **SRT overview**

[hp.com/support/Z220SFF\\_manuals](http://hp.com/support/Z220SFF_manuals)

[hp.com/support/Z220CMT\\_manuals](http://hp.com/support/Z220CMT_manuals)

1 Requires an 2nd gen Intel® Core™ processor, enabled chipset, Intel Rapid Storage technology software, and a properly configured hybrid drive (HDD + small SSD). Intel Smart Response Technology is sold as an optional feature and is only available on HP's 2012 Workstations, HP EliteBooks and HP Ultradepending on system configuration, your results may vary.

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