The entry-level HP Workstations: market segments and application areas

The entry-level workstations from HP provide an excellent alternative for users that need more power, flexibility, and reliability than is available from high-end business desktop PCs.
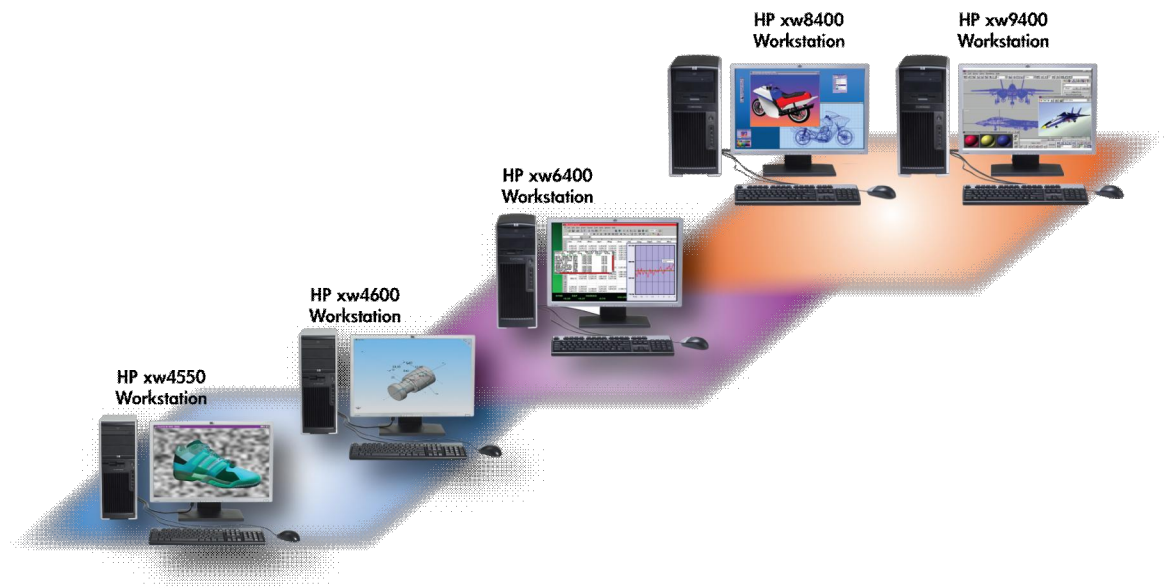
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Introduction

Engineers, designers, and power office users are constantly demanding more from their desktop systems. Increasingly sophisticated applications require more computing performance, larger memory, and a range of professional graphics—all on similar or shrinking budgets. Although ordinary business PCs can sometimes fulfill these users' needs, the demands these applications make on a desktop system often make a workstation a required solution. However, until recently, the per-unit pricing of workstations meant that organizations could only justify deployment to users with higher-end computing requirements.

With the recent introduction of two entry-level workstations, HP has made workstation power uniquely affordable to a broader range of users (Figure 1). The new products provide the benefits of personal workstations—expandability, flexibility, and performance—at a lower price point than traditional workstation products. The entry-level systems meet key needs for customers that need more capability or performance than a business desktop computer can provide, while providing the expandability and robustness features of a workstation.

Figure 1. The HP personal workstation product line.

The new HP xw4550 Workstation and HP xw4600 Workstation give users an excellent entry point into a broad line of personal workstations. The systems are well suited for applications in:

- Computer-aided design (CAD)
- Digital content creation (DCC)
- Financial services
- Software development
- Power office
- OEM

This paper will examine the architecture of the two entry-level systems (the HP xw4550 and xw4600 Workstations), and compare their respective features and benefits. These features will be used to map the advantages of each in popular workstation market segments, giving the reader an idea of which workstation should be used in different application environments.

Overview of the entry-level HP Workstation architectures

Before describing the applicability of the different architectures to different market segments, it is useful to describe the architectural features of the two entry-level workstations. Briefly, the HP xw4550 Workstation is based on the single-socket AMD Opteron™ dual-core[1] processor and related chipset, while the HP xw4600 Workstation is based on Intel® Core™ 2 Duo, Core 2 Quad, and Core 2 Extreme[2,3] processors and related chipsets. Importantly, they both execute the same instruction set (including 64-bit instructions) and are able to run the same operating systems and applications. Below we will highlight the features that distinguish the two architectures from one another.

HP xw4550 Workstation

The entry-level HP xw4550 Workstation is based on the AMD Opteron processor and its chipset, namely the AMD 690G and the AMD SB600. As shown in Figure 2, the HP xw4550 Workstation uses a dual-core AMD Opteron processor, with separate ports for memory and I/O (AMD calls this a "Direct Connect Architecture").

The AMD Direct Connect Architecture integrates a memory controller on the processor die, reducing processor-to-memory latency (which ultimately increases performance on latency-sensitive applications). The AMD Opteron processors also feature a HyperTransport connection to the chipset. HyperTransport is a low latency, point-to-point, cache coherent link that increases bandwidth between the processor/memory to I/O and display devices.

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[1] Quad-Core and Dual-Core are new technologies designed to improve performance of multithreaded software products and hardware-aware multitasking operating systems and may require appropriate operating system software for full benefits; check with software provider to determine suitability; Not all customers or software applications will necessarily benefit from use of these technologies.

[2] This workstation does not support the Intel Core 2 Extreme processor over-clocking feature.

[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.

Figure 2. AMD processor architecture and related chipsets used in the HP xw4550 Workstation.
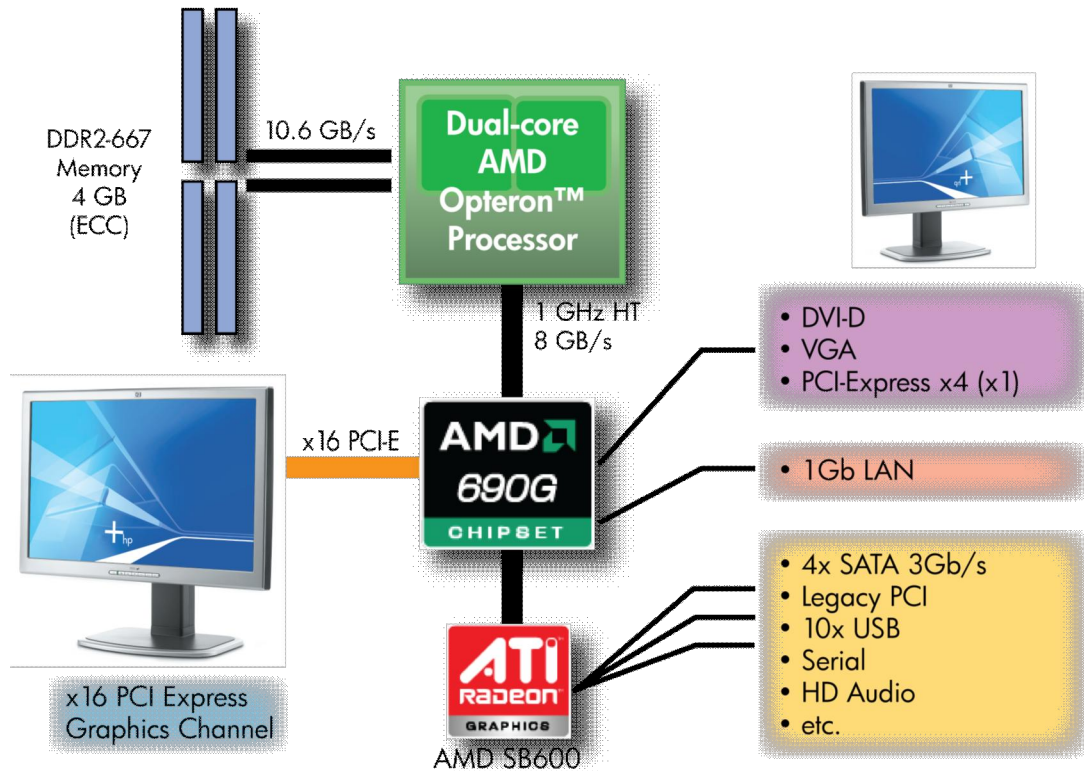
One of the important benefits of the HP xw4550 Workstation architecture is the inclusion of an ATI Radeon X1250 integrated graphics port on the AMD 690G chipset. While the performance of the integrated graphics is lower than that of other (optional) discrete professional graphics solutions supported on the HP xw4550 Workstation, it provides an ideal choice for customers who value processor performance and data integrity but don't need professional-level graphics.

The HP xw4550 Workstation supports up to 4 GB of memory, and is available in both ECC (error checking and correction) and non-ECC configurations. It also features an integrated RAID (Redundant Array of Inexpensive Disks) capability based on Serial ATA 3.0 Gb/s. RAID configurations that include RAID 0 (striping) and RAID 1 (mirroring).[4]

Finally, the HP xw4550 Workstation uses an 80 PLUS[5] efficiency 300 W power supply that is compact and quiet, yet will still power a fully configured system. Also, some configurations of the HP xw4550 Workstation are ENERGY STAR qualified[6].

HP xw4600 Workstation

The HP xw4600 Workstation is a substantial enhancement to the existing HP xw4400 Workstation, the previous entry product in the workstation product line. Using a new chipset from Intel, the system now supports a variety of processor options: the Intel® Core™ 2 Duo, Intel Core 2 Quad (offering more affordable quad-core), or Intel Core 2 Extreme running at a range of clock speeds (Figure 3).

[4] 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.
[5] See http://www.80plus.org/
[6] See http://www.energystar.gov/index.cfm?c=revisions.computer_spec

One of the key new features enabled by the chipset is PCI Express® Base 2.0[7] and the availability of two PCI Express x16 ("by 16") Gen2 slots. PCI Express Gen2 doubles the peak bandwidth of each PCI Express lane. Plus, users can take advantage of the additional x16 slot for graphics or for other I/O uses. The HP xw4600 Workstation supports a wider range of professional 2D and 3D graphics cards as compared to the HP xw4550 Workstation.

Figure 3. HP xw4600 Workstation block diagram.
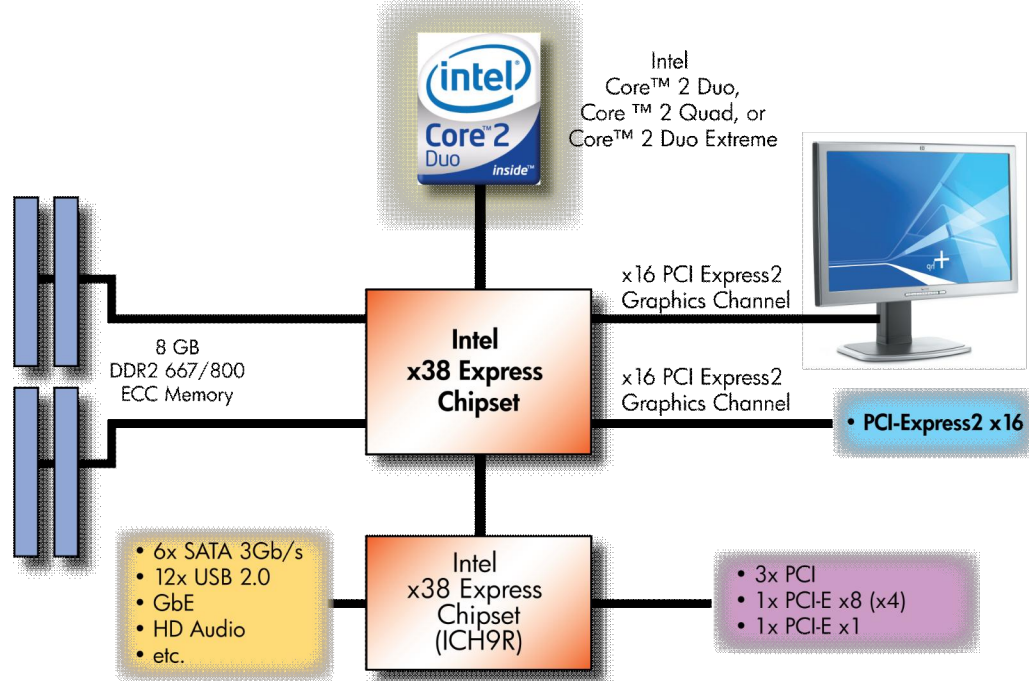
The HP xw4600 Workstation supports up to 8 GB of memory, with different bandwidth options for pricing flexibility. Customers interested in the highest performance can configure DDR2-800 ECC; customers more concerned with price can choose DDR2-667. Both memory configurations support ECC.

The HP xw4600 Workstation also features an integrated, RAID capability based on Serial ATA 3.0 Gb/s that supports multiple RAID levels, including RAID 0 (striping), RAID 1 (mirroring), RAID 5 (parity striping), and RAID 10 (parity striping + mirroring).

Finally, the new HP xw4600 Workstation uses an 80 PLUS efficiency 475 W power supply with wide-ranging voltage input capability, providing headroom for expansion and next-generation graphics. The 80% efficiency enables customers to reduce energy consumption costs without sacrificing performance. Also, many configurations of the HP xw4600 Workstation are ENERGY STAR qualified.

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[7] See http://www.pcisig.com/specifications/pciexpress/base2

Summary of features

The table below summarizes some of the relevant architectural features of the two entry-level systems.

Table 1. A comparison of HP entry-level workstation features

	HP xw4550 Workstation	HP xw4600 Workstation	Notes
CPU	AMD Opteron 1000[8] Dual Core	Intel Core 2 Duo E6000-series[9] Intel Core 2 Quad Q6000-series Intel Core 2 Extreme	Customers have a wide range of processor choices, including manufacturer, number of cores, and clock speed
Chipset	AMD 690G with ATI Radeon X1250	Intel's X38 Express chipset	Different I/O and memory connect philosophies give customers a choice
Memory architecture	4 DIMM slots Up to 4 GB DDR2-667 MHz ECC[10] Up to 2 GB DDR2-667 MHz non-ECC	4 DIMM slots Up to 8 GB DDR2-800 MHz ECC Up to 4 GB DDR2-667 ECC	ECC memory gives users data integrity required by many high-end applications
Memory and interconnect bus architecture	1 GHz AMD HyperTransport	Up to 1333 MHz FSB	Both architectures provide high processor-to-memory and I/O-to-memory bandwidth; customers can choose which they prefer
Graphics interface	Single PCI Express x16	Dual PCI Express x16 Gen2	PCI Express Gen2 doubles peak bandwidth of the PCI interface, increasing graphics performance. Dual x16 slots enable two full bandwidth graphics cards.
PCI Express graphics options	Integrated ATI Radeon X1250 NVIDIA Quadro NVS 290 (Pro 2D) NVIDIA Quadro FX 370 (Entry 3D) NVIDIA Quadro FX 570 (Entry 3D) ATI FireGL V5600 (Mid 3D) NVIDIA Quadro FX 1700	(Dual) NVIDIA Quadro NVS 290 NVIDIA Quadro NVS 440 (Dual) NVIDIA Quadro FX 370 (Dual) NVIDIA Quadro FX 570 (Dual) ATI FireGL V5600 (Dual) NVIDIA Quadro FX 1700 NVIDIA Quadro FX 3500 NVIDIA Quadro FX 4600	A wide range of professional graphics options lets users efficiently match the graphics requirements to their application.
I/O configuration	One PCI Express x1 slot (with x4 connector) Two Legacy 5V 32bit 33MHz PCI I/O Slots	One PCI Express x16 Slot (when not used for 2nd Graphics) One PCI Express x4 electrical (with x8 connector) Slot One PCI Express x1 Slot Three Legacy 5V 32bit 33MHz PCI I/O Slots	Expandability with industry-standard PCI and PCI Express I/O cards
Integrated LAN	Integrated Broadcom 5755 10/100/1000 LAN (PCIe)[11]	Integrated Broadcom 5755 10/100/1000 LAN (PCIe)	The integrated PCI Express-based LAN interface provides high network performance
Serial ATA	4 Integrated SATA 3 Gb/s Channels with NCQ RAID 0 and RAID 1 supported, with factory configurability available Q4 2007	6 Integrated SATA 3 Gb/s Channels with NCQ RAID 0, RAID 1, RAID 5, and RAID 10 supported. Factory configurability of RAID 0, 1 available at launch, RAID 5, 10 available Q4 2007	Multiple ports enable up to six total SATA devices (hard drives or optical drives) to be configured in the system. SATA 3Gb/s is the fastest SATA interface available.

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[8] AMD's numbering is not a measurement of clock speed.
[9] Intel's numbering is not a measurement of higher performance.
[10] Maximum memory capacities assume 64-bit operating systems. Microsoft® Windows® XP (32-bit) supports 4 GB (with Microsoft 32-bit, the amount of usable memory will be dependent upon your system configuration. It may be less than 4 GB); 32-bit Linux can support up to 8 GB.
[11] The term "10/100/1000" or "Gigabit" Ethernet indicates compliance with IEEE standard 802.3ab for Gigabit Ethernet, and does not connote actual operating speed of 1 Gb/sec. For high speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.

	HP xw4550 Workstation	HP xw4600 Workstation	Notes
Hard drive capacity, performance, and reliability[12]	Maximum capacity: 1 TB on 2 HDD Performance: 7200 rpm SATA drives Reliability: mainstream reliability of 7200rpm SATA	Maximum capacity: up to 4 TB on 4 HDD Performance: 10K RPM SATA and 15K RPM SAS Reliability: enterprise-class reliability of 10K and 15K drives	A range of hard drive capacities and performance levels lets customers choose the optimal price/performance for their applications.
USB ports	10 USB v2.0 ports (6 rear 2 front 2 internal)	12 USB v2.0 ports (7 rear 2 front 3 internal)	Greater USB expandability; the internal USB ports can be used for ISV software license keys
Power supply	300 W 80 PLUS	475 W 80 PLUS	Supports richer configurations and is designed with the environment in mind

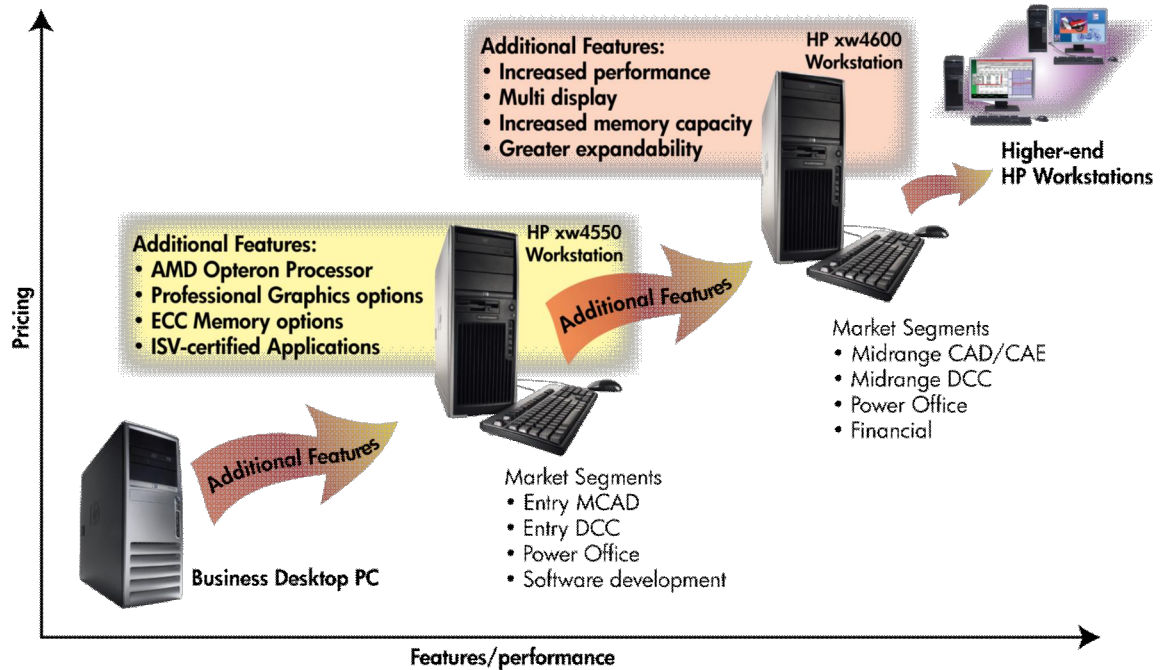# Positioning of the entry-level HP Workstations

Systems in the high-end business desktop/low-end workstation range often run enterprise-critical applications. However, due to budget pressures, acquisition price is often the number one purchasing criterion. Performance and features, although compelling to users, are sometimes overshadowed by even a small incremental price.

Workstations arguably provide that compelling set of features. As applications become a more critical component of an organization's business, and the systems themselves become more capable, workstation features become more important to an enterprise customer. Features that can generally be attributed to workstations (and perhaps not to PCs) include:

- Larger memory and disc capacity
- Certified support for the latest software applications
- Higher reliability components/packaging such as Error Checking and Correcting memory
- Optional server-class hard drives that offer higher spindle speeds and higher reliability
- Professional graphics capabilities
- Longer lifecycles
- Product stability

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[12] 1 GB = 1 billion bytes. Actual formatted capacity is less. Up to 8 GB of hard drive (or system disk) is reserved for the system recovery software (XP and XP Pro). Up to 12 GB of system disk is reserved for system recovery software. (Vista)

Figure 4. Positioning of entry-level workstations with a typical business desktop PC.

Additional Features:
- Increased performance
- Multi display
- Increased memory capacity
- Greater expandability

HP xw4600 Workstation

Higher-end HP Workstations

Additional Features:
- AMD Opteron Processor
- Professional Graphics options
- ECC Memory options
- ISV-certified Applications

HP xw4550 Workstation

Additional Features

Market Segments
- Midrange CAD/CAE
- Midrange DCC
- Power Office
- Financial

Business Desktop PC

Additional Features

Market Segments
- Entry MCAD
- Entry DCC
- Power Office
- Software development

Pricing

Features/performance

The entry-level workstations offer a workstation at a price point very similar to a high-end business PC, while offering all of the additional benefits available from a large and experienced workstation provider like HP (Figure 4).

Applicability to market segments

In the following sections, we will discuss the overall applicability of each of the HP entry-level workstations to the various market segments. As in any analysis such as this, it is an approximation, and is based on the most likely uses of the products in the indicated segments. An attempt is made to take into account the buying habits of the market segment (e.g., do they generally spare no expense, or are they very price-conscious?), the overall application characteristics (e.g., do the applications demand high-performance graphics?) and the applicability of features to the respective applications.

For each market segment, a table is presented that very generally makes a recommendation between the HP xw4550 Workstation and the xw4600 Workstation, represented by a sliding scale (far left is very much oriented toward the HP xw4550, far right is the HP xw4600).

Market segments are presented in roughly descending order of popularity for the entry-level workstations (e.g., CAD is the most popular).

Computer-aided design (CAD)

Computer-aided design (CAD) applications allow engineers to create, view, and optimize geometric models of product designs. CAD applications are found in almost every aspect of manufacturing, including automotive, heavy equipment, aerospace, tire and rubber, chemicals (processing), and discreet manufacturing.

CAD applications are almost exclusively Windows-based, with increasing interest in 64-bit computing to handle larger data sets, greater model detail and more visual realism.
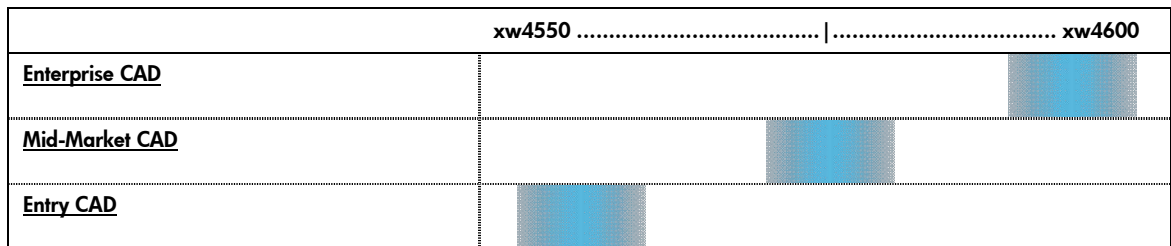
Characteristics of workstation applications in the CAD industries include:

- Processor performance is important; users typically buy as much as they can afford.
- Applications usually manipulate very large data sets, and require fast disk I/O on multiple channels.
- CAD applications use 2D and 3D graphics.
- Portions of CAD applications are usually multi-threaded, however, depending upon the application, the use of more than two cores by a single application can be limited. Some applications are the exception, such as visualization and analysis. More processor cores will increase throughput when multiple applications are run simultaneously.
- Multiple cores and processors are used to run analysis in the background while running CAD in the foreground (known as Analysis Driven Design), a typical operating environment in architectural, engineering, and construction applications.
- Customers need application testing and certification to guarantee hardware/software performance, functionality, stability and dependability.

Since CAD is a large market segment for the entry-level workstations, we will refine our analysis by breaking the market into the following sub-segments:

- Enterprise CAD: (UGS NX, Pro/ENGINEER, and CATIA). These applications often require large memory capacity, high-end and extreme 3D graphics, and elaborate RAID solutions.
- Mid-Market CAD: (UGS SolidEdge, SolidWorks, Inventor, and MicroStation). In general, the entry workstation will be a great fit for those users that require mid-market CAD solutions but are price sensitive.
- Entry CAD: (AutoCAD, AutoCAD LT, Architectural Desktop, Mechanical Desktop, Educators, Students and Others). This is a "sweet spot" for entry-level workstations in the CAD space. It combines price sensitivity with the performance needed to run 2D and 3D entry-level CAD.

Figure 5. Applicability of CAD applications on the HP xw4550 and HP xw4600 Workstations.

	xw4550 ....|................................... xw4600
Enterprise CAD	
Mid-Market CAD	
Entry CAD	

Digital content creation (DCC)

The DCC market stretches from an entry space where users are doing simple 2D image editing, web creation, and low-end video editing, to feature-film special effects creation and editing.

Characteristics of workstation applications in this industry include:

- Customers need both Linux® and Microsoft® Windows®, to support the important high-end 3D animation tools as well as proprietary in-house Linux applications.
- Large amounts of disk space.
- Multiprocessing is important for near real-time rendering.
- On the high-end, the graphics processing capabilities of the graphics devices are heavily employed for lighting and visual effects.

Since DCC is a large market segment for the entry-level workstations, we will refine our analysis by breaking the market into the following sub-segments:

- 3D Animation: (Autodesk Maya, 3ds Max, Avid SoftImage|XSI). These customers often require high-end or extreme 3D graphics cards, dual processors, and very large memory capacities, although in some cases the entry-level systems fit well.
- Digital Video/Non-linear Editing: (Adobe Premiere or Avid Media Composer or Xpress software). These applications will work well on entry workstations. In addition, mainstream real-time digital video cards such as the Matrox RT.X10 will fit with an entry workstation.
- 2D Animation/Imaging: (ToonBoom, Adobe Photoshop, Illustrator, Director, Flash, or Authorware). An entry workstation is an excellent fit for all of these applications for users that are doing advanced image manipulation and 2D animation, as the features are perfectly suited and the price is very affordable.

Figure 6. Applicability of DCC applications to the HP xw4550 and HP xw4600 Workstations.

	xw4550	.... xw4600
3D animation		▓
Digital video/non-linear editing	▓	
2D animation/imaging	▓	
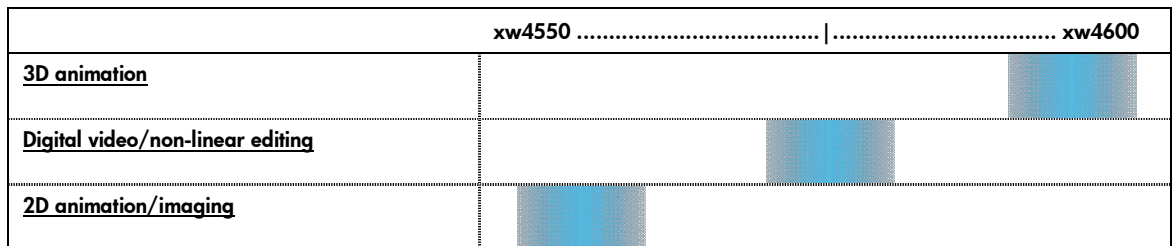
Financial services

The financial services market has two main types of workstation needs—the most predominant workstation requirement is a size-optimized multiprocessor system (i.e., the HP xw6400 Workstation). However there is also a need for a lower-cost, single-processor system. The low-cost single-socket system is typically used in front office environments where power users, bankers, and financial planners are multi-tasking many different applications. These users also tend to require multiple displays to visualize large amounts of data.

The quad core capability of the HP xw4600 Workstation gives financial customers the performance to run multiple spreadsheets and analysis tools simultaneously. Dual-display and quad-display graphics cards are an absolute requirement for the financial services market. In addition, these graphics cards need to remain stable for long periods of time because of the amount of work required for the financial institutions to re-qualify a graphics card.

Figure 7. Applicability of financial services applications to the HP xw4550 and HP xw4600 Workstations.

	xw4550	.... xw4600
Financial services		

Software development

High-end software development involves the manipulation of many files, compilation and linking of binaries, and execution and debugging of the resulting applications. Data accuracy and integrity for this type of work needs to be extremely high, and for this reason software developers need error checking and correcting (ECC) memory.

Characteristics of workstation applications in this industry include:

- Inexpensive pricing
- Large amount of disk space
- High performance and multi-core processors
- Error Checking and Correcting Memory

Figure 8. Applicability of software development environment to the HP xw4550 and HP xw4600 Workstations.

	xw4550	.... xw4600
Software development		

Power office

Power office users are those day-to-day users that perform complicated and data-intensive office functions. This includes graphics, video and web design, complex linked worksheet calculations, database storage/access, and spreadsheet manipulations (Microsoft Office suite). In addition, power office users often participate in a high degree of collaboration with engineering organizations (graphics and/or database management software).

The profile of typical user requirements in this industry include:

- Inexpensive pricing
- Large number of applications
- Demanding data processing
- Large number of (smaller) I/O operations
- Fast application startup time
- 2D multi-monitor graphics, with perhaps an occasional need for 3D graphics

Figure 9. Applicability of power office environment to the HP xw4550 and HP xw4600 Workstations.

	xw4550	.... xw4600
Power office		

OEM

The OEM market involves selling systems to a customer that adds value to the system to accommodate a specific industry or environment. The OEM customer desires the longest product life cycle, while also requiring the latest technology and lots of expandability to be competitive in their perspective vertical market. Specific OEM markets where the entry-level systems are targeted include medical imaging creation, diagnostic display, and non-linear video editing (NLE).

Because of the effort of requalification, OEMs need a product that remains unchanged over a period of 12-18 months, or the ability to have configuration change management through the product's life cycle.

OEM customers deploy both Windows- and Linux-based systems, and typically have proprietary software. While some customers are moving to Linux, there are a substantial number of customers that desire Windows-based systems.

Characteristics of workstation applications in the broader OEM market include:

- Applications are from a wide range of industries, including medical imaging, non-linear editing in DCC, and embedded controllers.
- Configurations need to remain stable over a 15-18 month period or offer a method of configuration change management for the OEM customer.
- Systems need to be highly expandable, with capability for multiple custom I/O solutions

Figure 10. Applicability of OEM applications to the HP xw4550 and HP xw4600 Workstations.

	xw4550	.... xw4600
OEM market		

Market segment summary

A summary of the applicability of each workstation to the market segments previously discussed is presented below.

Market Segment	xw4550	.... xw4600
Enterprise CAD		
Mid-Market CAD		
Entry CAD		
3D animation		
Digital Video/non-linear editing		
2D animation/imaging		
Financial services		
Software development		
Power office		
OEM		

Conclusions

The addition of the HP xw4550 Workstation to the HP line of personal workstations, and the enhancements to the HP xw4600 Workstation, give customers a choice of branded workstations that provide reliable workstation power at an affordable price. They also complement the current product line; customers are able to choose the architecture that best suits their application requirements and price point.

Both systems give customers a clear step-up path from high-end business desktops, providing them with ISV-certified applications, reliability features like ECC memory, and access to HP's renowned workstation service and support. Price-conscious CAD, DCC, software development, and business application users are encouraged to explore these new systems from HP.

For more information

For the HP sales office nearest you, please refer to your local phone directory, or call the HP regional office listed below.

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