

WHITE PAPER

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Compaq Professional Workstation Affordable Performance Line Positioning White Paper

The intent of this paper is to provide an overview of the Affordable Performance Line of Compaq Professional Workstations, a line that was introduced in June 1998. The paper compares the positioning of the Professional Workstation Affordable Performance Line to the positioning of the Professional Workstation Scalable Performance and Extreme Performance Lines. The paper also describes the distinct positioning of the Affordable Performance Line compared to Compaq high-end desktop PCs and mainstream servers. Finally, this paper should provide general criteria that help to identify which product in the Affordable Performance Line is the best choice for particular application environments.

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**Compaq Professional Workstation
Affordable Performance Line Positioning White Paper**

October 1998

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INTRODUCTION

Compaq Professional Workstations, consisting of the Affordable Performance Line, Scalable Performance Line, and Extreme Performance Line, offer customers a broad range of powerful Intel®-based and Alpha-based workstations that operate with Windows NT® or UNIX. These product lines were designed to meet the needs of workstation users who are using applications for financial trading or analysis, computer-aided design (CAD), computer-aided engineering (CAE), digital content creation (DCC), or electronic design automation (EDA).

In June 1998, Compaq introduced a new multi-line strategy for Professional Workstation products. The strategy is intended to enhance the appeal of Compaq workstations to a broad spectrum of customers.

This white paper will describe the positioning of the three new lines that make up Compaq Professional Workstation products. The paper will then focus on the Affordable Performance Line of workstations that are designed for users who are sensitive to the price:performance equation in Intel-based platforms. It will explain how the Affordable Performance Line is positioned and rationalized relative to Compaq high-end desktop PCs and Compaq mainstream server products.

Compaq will continue to design workstations for application segments. An application-oriented focus continues to be central to the design and positioning of all Compaq Professional Workstation products. Users in each of the targeted application segments have unique product requirements, dictated by the specialized nature of the complex applications they use. For example, DCC application users performing video editing, in which video scenes are added, moved or deleted with the aid of a computer, require a high degree of expandability to accommodate components, such as audio/visual drives or video capture boards. In contrast, Web site development, another DCC application, typically requires little expandability, just a fast processor and fast 2D or (perhaps) 3D graphics.

To help determine which Professional Workstation product is most appropriate for users in particular application segments, this paper will first give an overview of the Affordable Performance Line. Then, it will provide a description of each application segment and describe why a particular product is most appropriate for that segment. In some instances, multiple products may be appropriate for the same segment due to the existence of sub-segments with different needs. This paper will highlight those cases and provide some broad rules of thumb to help determine which product is most appropriate.

NEW MULTI-LINE STRATEGY FOR PROFESSIONAL WORKSTATIONS

In June 1998, Compaq unveiled a new multi-line strategy to meet the distinct needs of different classes of workstation users identified through extensive market research and customer contact.

Workstation users can generally be grouped into one of three categories:

- **Users who desire Intel-based industry standard systems, but are sensitive to price as well as performance**

A very large group of users are interested in Intel-based workstations because they have been using (or are still using) their high-end PCs to run workstation-class applications. Their applications are pushing the performance boundaries of PCs, so they are interested in upgrading to Intel-based workstations. Because of their PC origins, they believe that a key benefit of the Intel/Microsoft Windows NT-based standard is compatibility with a broad range of applications and options. They also probably have an installed base of Intel-based PCs and/or workstations running Windows NT and will want to leverage their investments in third-party software, hardware, support, and training. These users are accustomed to a very competitive marketplace, with many manufacturers offering aggressively priced products. Thus, these workstation users will be seeking a compelling price:performance story in Intel-based industry-standard products.

- **Users who desire Intel-based industry standard systems, but are extremely performance sensitive**

Research has also shown that a significant number of customers demand the fastest, most powerful workstations available, as long as they are based on the Intel standard. Some of these customers are former RISC or Alpha UNIX-based workstation users who have made the strategic architectural decision to move to Intel-based workstations running Windows NT. These users have made this move for a number of reasons, including the availability of a wide range of software applications and high-performance, third-party hardware for Intel-based machines. They also recognize that Intel-based workstations provide an excellent combination of high system performance with the benefits that industry-standard systems bring in terms of price, application, availability, and lower total cost of ownership.

- **Users who are not interested at this time to adopt the Intel-based architecture**

The third group of workstation users does not desire Intel-based systems at this point in time. This may be due to a number of reasons, including:

- Their specialized UNIX-based applications may not be available on Intel/Windows NT-based platforms
- They may be very satisfied with their installed base of Alpha UNIX or Alpha NT-based systems
- They want to leverage their investments in software, support, and training; or they want the very best application performance available -- period.

Compaq's comprehensive, multi-line strategy was formed with these three distinct user groups in mind. The new three-line approach offers users the flexibility to choose workstation platforms based on the required performance levels.

Affordable Performance

The Affordable Performance Line provides the latest workstation-class technologies for value-oriented customers. This line of Intel/Windows NT-based workstations is designed to deliver the broadest range of choices for users who need to strike a balance between performance and price. The Affordable Performance Line workstations provide *affordable performance* for users who are striving to move up the x86 performance curve. These users are interested in increasingly powerful and more full-featured Intel-based platforms. The following are examples of workstation applications these users typically operate:

- Financial trading applications that supply real-time data, such as Reuters RW32, Reuters Kobra, TIBCO Marketsheet, TIBCO TIB, MarketNet Real Time Toolkit, and NeoVision Heatmaps. Also, Risk management software such as Summit v.2.6 and NeoVision RiskMaps.
- Entry CAD or AEC applications, such as AutoCAD and Microstation, or CAD applications, such as Mechanical Desktop, SolidWorks, Pro/ENGINEER, SDRC, and EDS Unigraphics
- DCC applications for 2D or entry-3D desktop publishing, web authoring, non-linear editing, compositing, or animation, such as Photoshop, Pagemaker, Premiere, 3D StudioMAX, and Frontpage
- EDA applications for design entry and component layout, such as Cadence Concept, Mentor Graphics Board Station, Viewlogic Workview Office, VeriBest PCB, and OrCAD Express
- Applications for Software Development on Intel/Windows NT-based platforms.

The Affordable Performance Line features the latest Intel Pentium® II processors and the Intel 440BX chipset with the 100-MHz Front Side Bus. One of the ways Affordable Performance Line products achieve excellent performance at an affordable price is by providing a choice between Wide-Ultra SCSI hard drives and Ultra ATA (EIDE) hard drives. More detailed information about the Affordable Performance Line products appears later in this paper.

Scalable Performance Line

The Scalable Performance Line of products, based on the Intel Pentium II Xeon™ processor and Compaq's innovative Highly Parallel System Architecture, offer industry leading performance and features in an Intel/Windows NT-based workstation. This line is specifically designed for those users requiring uncompromising levels of *scalable performance* to run demanding applications. Examples of segment-specific applications for users fitting this profile are:

- “Power users” of CAD applications, such as Pro/ENGINEER, SDRC, and EDS Unigraphics. In contrast to Affordable Performance Line users who use similar types of CAD applications, these “power users” are typically pushing the performance boundaries of their software by working on compute-intensive problems with very large data sets.
- CAE applications, such as CATIA, NASTRAN, and Marc Analysis, which are used for design and simulation analysis.
- High-end DCC applications that perform 3D animation, rendering, or video editing, such as SoftImage|3D, Avid, Media Composer, Alias|Wavefront
- EDA applications for logic simulation, synthesis, and analysis, such as Cadence Verilog XL Turbo, Synopsys VCS, Synopsys Design Compiler, Mentor Graphics Calibre, and Viewlogic QuadXTK

- Financial analysis or risk management applications, such as Summit 2.6v, Infinity Platform, Infinity Derivatives, Infinity Risk View, C●ATALYST, CARMA, Decisioneering Crystal Ball, Analytica, Visual Numerics, NeoVision, and Numerical Algorithms.

Scalable Performance Line products will be distinguished from the Affordable Performance Line products by performance optimizing features, such as Compaq Highly Parallel System Architecture, greater memory expandability, and greater number of slots and bays.

Extreme Performance Line

The Extreme Performance Line consists of Alpha-based workstations that deliver *extreme performance* when time to solution is paramount to overall project success. The Extreme Performance Line products are designed for users requiring the highest levels of application performance. This line of products will be based on the 64-bit Alpha processor in the near term, and on both Alpha and Merced-based 64-bit processors in the future. With unprecedented levels of integer and floating point performance, coupled with an overall systems architecture tuned for speed and maximum throughput, Compaq's AlphaPowered™ Extreme Performance Line products will provide customers a choice of either the Windows NT or UNIX operating environments. The following are examples of segment-specific users and their specialized applications that may require the Extreme Performance Line's unbeatable performance:

- The most performance-sensitive "power users" with CAD or CAE applications, such as Pro/ENGINEER, Unigraphics, Matra Datavision, MSC, Ansys, and Fluent. These users are seeking the unsurpassed speed of 64-bit processing.
- The most performance-sensitive users of DCC applications performing very compute-intensive 3D rendering tasks, with applications such as SoftImage|3D and Renderman
- The most performance-sensitive EDA users with highly complex logic simulation, synthesis, or analysis tasks that would benefit from the super-fast Alpha processor, running applications such as Synopsys Design Compiler, Avant! HSPICE, and Mentor Graphics Calibre.

PROFESSIONAL WORKSTATION POSITIONING COMPARED WITH COMPAQ HIGH-END DESKTOP PCs

The Compaq Professional Workstation Affordable Performance Line and the Deskpro EP and Deskpro EN Series share several key features (see Table 3 in Appendix), such as the latest version of the Intel processor and Ultra ATA drives. Consequently, some users may be confused regarding which product is most appropriate for certain application segments.

Deskpro EP Series Positioning

The Professional Workstation Affordable Performance Line and the Deskpro EP Series have been designed with very different objectives in mind. The Deskpro EP has been developed for a broad, horizontal market that desires high performance and the flexibility to choose from a rich feature set, all at extremely competitive prices. The target customer for the high-end of the Deskpro EP Series is the technology savvy power user in the PC market. (The Deskpro EP Series also have low-end offerings that would not appeal to PC power users.) Since the Deskpro EP has been developed for the horizontal market, its goal is to be as flexible as possible in meeting the needs of a variety of users. For example, it supports a broad array of processor options and client operating systems to meet a wide range of customer needs. However, broad targeting also means the Deskpro EP has been optimized for a *horizontal* customer base, not for any particular application segment.

Deskpro EN Series Positioning

The Deskpro EN Series' primary design goals are also different from those of the Professional Workstation Affordable Performance Line. The Deskpro EN is not targeted primarily at power users. Although there are some models with features that deliver high-end PC performance, the Deskpro EN is primarily optimized to operate easily in large, networked environments, such as a large corporate enterprise. Network-based manageability, easy serviceability, and consistency of hardware components and software are the paramount requirements, rather than the latest performance enhancing features. Like the Deskpro EP, the Deskpro EN targets a broad, horizontal PC user base.

Professional Workstation Affordable Performance Line Positioning

The Compaq Professional Workstation Affordable Performance Line consists of products that are designed to deliver the broadest range of choices for workstation users who need to achieve a balance between performance and price. The Affordable Performance Line products, and all other Compaq Professional Workstations, are designed to meet the needs of an array of technical and creative users in targeted application segments, such as CAD, DCC, EDA, and finance. This strategy is in sharp contrast to the broad horizontal market approach taken by the Deskpro EP and EN Series. Optimization for specific application segments also leads to a number of key differences between Affordable Performance Line workstations and the Deskpro EP and the Deskpro EN.

Optimized to provide the advanced features that the targeted application segments demand.

- All Affordable Performance Line products feature models with the latest 3D graphics solutions that deliver new levels of price:performance for a broad range of 2D and 3D graphics applications. The 3D graphics controllers in Compaq Professional Workstations meet the specialized needs of users in the CAD and DCC segments, such as fast 24-bit color processing (up to 16.7 million colors), high resolutions, and support for OpenGL and Heidi libraries. For workstation users in the financial trading industry, multi-display support is available on all Affordable Performance Line products. Compaq has worked closely with the manufacturers of both 2D and 3D graphics controllers to test and integrate their solutions into the Professional Workstations.
- The Affordable Performance Line workstations offer scalability and expandability that many users in these vertical segments demand. For example, the AP500, the most expandable platform in the Affordable Performance Line, provides up to 6 slots (5 available) and 7 drive bays (4 available), a level of expandability not found in the Deskpro EP or EN Series. The AP400 has 6 slots (5 available) and 5 bays (2 available). Even the entry-level AP200s can provide up to 6 expansion slots (up to 3 available) and 5 bays (2 available) for future enhancements. In addition, the AP400 and AP500 offer processor and memory scalability with support for up to 2 processors and 1GB of memory.

Optimized for the stringent performance requirements of the targeted vertical application segments.

The Compaq Professional Workstation Family of products is designed with high-performance components and subsystems to ensure that overall system performance is maximized. The Affordable Performance Line, for example, consists of models with OpenGL support 3D graphics controllers, 40MB/s Wide-Ultra SCSI subsystem and fast, ECC system memory as standard features. Other features included in every Affordable Performance Line products are: 10/100 Mb/s autosensing Ethernet NIC, 32X Max CD-ROM, and Compaq PremierSound™ 16-bit audio solution.

Optimized to ensure the highest levels of performance and application compatibility when running complex applications, such as MCAD, CAE, and 3D animation.

All Compaq Professional Workstations are tested and certified to ensure the highest levels of application compatibility for users running complex applications in areas such as Mechanical CAD, 3D animation, and CAE. Compaq application engineers work closely with their counterparts at key Independent Software Vendors (ISVs) to ensure our Professional Workstation products have been integration tested and certified.

Optimized to provide seamless integration into customers' computing environments.

- In many workstation environments, UNIX and Windows NT operating systems that were once considered separate and unique entities now must coexist and interoperate with one another. Compaq has partnered with the best integration ISVs in the industry to deliver a broad range of high-performance interoperability solutions for Windows NT, UNIX, and Apple Macintosh environments. Compaq and its Interoperability Partners offer a broad range of solutions for applications access, resource access and sharing, distributed application execution, system administration, and migration tools and internetwork integration products. Compaq's Interoperability Partners test and certify Compaq workstations with their software. Alternately, Compaq tests and certifies partner software on Professional Workstations. More information about the Compaq Interoperability Program is available at:
<http://www.compaq.com/products/workstations/intsol/> .
- Compaq has preinstalled Microsoft Windows NT Workstation 4.0, Microsoft Internet Explorer 4.01, and all drivers and utilities to get users up and running quickly. A SmartStart for Workstations CD and a Windows NT 4.0 CD are included if re-installation of the operating system and device drivers is needed. The SmartStart for Workstations CD also includes additional user documentation, utility software, and applications for customer convenience.

In summary, Compaq Professional Workstations are powerful, industry-standard platforms specifically designed to be performance leaders for demanding applications. Compaq's strong partnerships with key application ISVs ensure seamless application integration and optimized solutions. Customers can deploy Professional Workstations with confidence in critical applications and projects, backed by Compaq's reliability, manageability, and seamless integration.

PROFESSIONAL WORKSTATION POSITIONING COMPARED WITH COMPAQ MAINSTREAM SERVERS

In certain instances, customers may ask about the appropriateness of deploying Compaq Professional Workstations as low-cost servers. Although there are some similarities between the feature sets and form factors of the Professional Workstation products and Compaq servers, each product class is optimized for a very different set of applications and uses. Thus Compaq workstations and Compaq servers generally do not serve as appropriate alternatives to the other.

- Servers include redundancy features to support the high availability requirements customers demand for network file and print servers. Although designed to be very reliable, Professional Workstations do not include redundancy features, such as storage fault tolerance or redundant power supplies and fans. Most workstation customers in the targeted application segments would not be willing to pay for these features, which they consider unnecessary.
- Servers are tested and optimized for the server version of network operating systems and not for client operating systems like Microsoft Windows NT Workstation.
- Only basic 2D graphic capabilities are required for servers while workstation applications typically require high-performance 2D and 3D graphics capabilities.
- Workstations are optimized and tested to run specific applications used in each target segment; whereas servers are tested with a different set of applications, such as database, internet/intranet, and file/print.

AFFORDABLE PERFORMANCE LINE PRODUCTS OVERVIEW

Three product families make up the Compaq Professional Workstation Affordable Performance Line. Table 1 compares the key features of the Compaq Professional Workstation Affordable Performance Line products.

Table 1. Key Features Comparison of Professional Workstation Affordable Performance Line Products

	Professional Workstation AP200	Professional Workstation AP400	Professional Workstation AP500
PROCESSOR	1 Pentium II 350MHz, 400MHz, 450MHz	1-2 Pentium II 350MHz, 400MHz, 450MHz	1-2 Pentium II 400MHz, 450MHz
FORM FACTOR	Convertible Minitower	Desktop	Minitower
ARCHITECTURE	PCI/ISA/AGP	PCI/ISA/AGP	PCI/ISA/AGP
MAXIMUM MEMORY	384MB	1GB	1GB
BAYS	5 (2 open)	5 (2 open)	7 (4 open)
SLOTS	6 (up to 3 open)	6 (5 open)	6 (5 open)
2D GRAPHICS		Matrox Millennium II, STB MVP-Pro 128 (multi-display, 4-port)	Matrox Millennium II
2D/3D GRAPHICS	ELSA GLoria Synergy+	ELSA GLoria Synergy+	ELSA GLoria Synergy+
3D GRAPHICS		Diamond Fire GL 4000, Compaq PowerStorm™ 300	Compaq PowerStorm 300
CD-ROM	32X Max	32X Max	32X Max

Professional Workstation AP200

- An extremely affordable entry-level, single processor system that delivers workstation features and performance at PC prices.
- Innovative, flexible convertible minitower design with Quick-Change drives allows easy conversion from a minitower to a desktop to adapt to and maximize valuable work space. The Compaq Professional Workstation AP200 is ideal for technical or creative professionals who may have been using high-end PCs or other single processor workstations, such as the Hewlett-Packard Kayak XA systems, to run entry-level CAD, EDA, DCC, or financial trading applications. For example, Mainstream CAD users, such as those running AutoCAD or Microstation, will find the AP200 extremely appealing as a powerful solution that is very affordable.

Professional Workstation AP400

- An affordable dual-processor system that effortlessly supports a broad range of workstation applications.
- The low profile desktop design easily fits into space-constrained environments, such as financial trading floors.

The Compaq Professional Workstation AP400 provides industry-leading price:performance in a space-saving desktop form factor for customers in the financial, CAD, DCC, and EDA segments.

Professional Workstation AP500

- A powerful dual-processor platform for users who must balance no-compromise workstation performance with affordable price.
- Easy-to-service minitower design saves valuable desk space and provides excellent future expandability.

The Compaq Professional Workstation AP500 delivers outstanding performance and expandability to meet the needs of users seeking an affordable, dual-processor workstation. A minitower with ample room to add specialized boards and storage devices is often a requirement among CAD and DCC users who are using 3D applications.

For more information on key features incorporated in the Compaq Professional Workstation AP200, AP400, or AP500, please see their “Specs and Options” and “Key Technologies White Papers” at <http://www.compaq.com/products/workstations/index.html>.

MATCHING PROFESSIONAL WORKSTATION AFFORDABLE PERFORMANCE LINE PRODUCTS WITH THE APPROPRIATE APPLICATION SEGMENT

Each Professional Workstation Affordable Performance Line product has been designed to meet the needs of users within specific application segments. The table below provides broad guidance in determining which product is most appropriate for a given application segment. Within a specified segment, such as CAD, a fairly broad spectrum of requirements exists across the user base. The Compaq Professional Workstation Affordable Performance Line offers customers a broad range of choices so they can select the product ideal for them. For example, in the CAD segment, the Compaq Professional Workstation AP200 provides excellent performance for entry-level applications at PC prices. The AP400 is appealing as an affordable, space-saving CAD workstation. Finally, the AP500 will be attractive to users requiring greater expandability.

Table 2. Professional Workstation Affordable Performance Line Product Fit With Segment Applications

	Financial	CAD	CAE	DCC	EDA	Other
	Trading, Financial analysis	MCAD, AEC (2D/3D design, Solids modeling, Plant design)	Part and assembly analysis, Finite Element Analysis, Thermal & vibration analysis	Graphics design, Animation, Web authoring, Video editing, Compositing, Pre-press	Design entry & editing, Layout, Place and route, Verification	Software development
AP200	Very Good	Very Good	<i>Not Targeted</i>	Very Good	Excellent	Excellent
AP400	Excellent	Excellent	<i>Not Targeted</i>	Very Good	Very Good	Good
AP500	Very Good	Excellent	Very Good	Excellent	Good	Very Good

The following is a more detailed description of each of the application segments, followed by a brief discussion of which Professional Workstation Affordable Performance Line products are most appropriate for that segment.

Finance

Compaq is targeting users in the securities trading room of the financial services market. Applications executed by these users include real-time data management, financial analysis, risk and portfolio management.

Segment Characteristics

- Strong movement to Intel/Windows NT from installed base of UNIX workstations for traders
- Large number of high-end PC users needing to move up the X86 performance curve

Product Requirements

- Exceptional price/performance
- Fast 2D graphics, support for multiple monitors and flat panel displays
- High performance, including multiprocessor support, based on industry standards
- Space saving form factor, since desk space is at a premium
- Support for UNIX to Windows NT interoperability and migration

Product Fit

- The Professional Workstation AP400 is the primary product targeted towards this segment due to the extreme space constraints that most traders endure. The AP400's efficient desktop design fits into most traders' desk areas. The low profile design also provides space on which to place most monitors. In addition, the AP400 supports up to 2 processors, a feature that is important to financial traders and analysts who want the flexibility to add processing power as their application needs change. The Professional Workstation AP400 includes models with the STB MVP Pro-128 graphics controller that enables financial customers, especially financial traders, to use multiple displays to run on a single workstation. Using this graphics controller, the Professional Workstation can support up to 4 monitors while occupying only one PCI slot, and up to eight monitors while occupying only two PCI slots.
- The AP200 is also a strong candidate for trading floors if the financial institution wants extremely competitive prices, does not require a multiprocessor system, and desires a compact minitower on the floor. The AP500 may be suitable for financial trading floors requiring dual-processor support in a minitower design.

Computer Aided Design (CAD)

CAD involves designing mechanical objects in software that displays the design in a two or three-dimensional representation. The designer sees a real-life representation of the object that can be rotated and manipulated. These applications require fast 2D or 3D graphics hardware and fast processors for improved interactivity when creating the model. Two major subsegments that exist in the CAD market are: Mechanical CAD, typically shortened to MCAD, and AEC, short for Architectural, Engineering, and Construction.

Mechanical (MCAD)

MCAD deals with designing objects from more simplistic tasks, such as computerized drafting, to more complex tasks, such as 3D solids modeling. The primary applications in this segment include AutoCAD, Microstation, Pro/ENGINEER, Unigraphics, SolidWorks, and I-DEAS.

Segment Characteristics

- Tremendous momentum towards Intel-based Windows NT systems in the low-end to mid-range sector
- All major UNIX CAD ISVs have or will port to Windows NT
- Market expansion due to adoption by small businesses

Product Requirements

- Fast 2D or 3D graphics depending on overall application requirements
- Latest processor to enhance speed of interactivity; multiprocessing support is currently not a key requirement since most applications are still single-threaded
- Expandability of slots and bays often key
- Typically prefer minitower form factor

Product Fit

- The Compaq Professional Workstation AP200 is ideal for price sensitive customers not requiring multiprocessor support or a great deal of expandability, such as those using 2D or entry-3D applications.
- The Compaq Professional Workstation AP400 and AP500 are excellent choices for MCAD customers who require multiprocessor support and mid-3D graphics. Users desiring the greater expandability and on-the-floor design of a minitower may prefer the Professional Workstation AP500 versus the AP400. However, the more value-conscious buyers may prefer the Professional Workstation AP400 systems since they are slightly lower priced than comparable AP500 models.

AEC

AEC deals with the design of structures, such as manufacturing plants.

Segment Characteristics

- Market for Intel-based Windows NT solutions now stronger than for UNIX based solutions
- Since many architectural firms are relatively small, customers tend to be fairly price sensitive

Product Requirements

- Entry 3D graphics for modeling, such as when doing architectural walk-through applications
- Latest processor to enhance speed of interactivity; multiprocessing support currently not important since applications tend to be single-threaded

Product Fit

- Due to the price sensitivity of the AEC segment, the Professional Workstation AP200 will most likely be the product of choice for customers.
- For customers who require greater expandability than offered by the AP200, the Professional Workstation AP400 or AP500 may be the better choices.

Computer Aided Engineering (CAE)

After an object has been designed using CAD software, it is then subjected to various types of computer analysis to ensure the overall integrity of the design. This analysis, generally known as Computer Aided Engineering, includes stress or finite element analysis, vibration analysis, and thermal analysis. In all instances, a design is treated as a collection of points with various physical inputs applied to those points. The effect of inputs or changes at those points on the design is determined mathematically. These applications are very system resource intensive and require the highest processor, memory, and disk subsystem performance. The analysis can be done at the designer's workstation, or the work can be distributed to a group of computers.

In a *non-distributed environment*, the analysis is done on the same workstation on which the design was developed. In this environment, the designer requires a workstation with 3D graphics to develop the initial model, as well as the highest performance subsystems to perform the resource-intensive analysis work.

In a *distributed model environment*, the analysis is done on a series of computers. In one instance, a small engineering firm might connect all their workstations to their network, and at night, use the processing power of each to analyze the model. In another instance, a larger engineering firm may have a pool of dedicated computers (an "analysis farm") to perform the analysis. This dedicated cluster of computers is often in a back room and may be rack mounted.

Segment Characteristics

- Strong UNIX install base and infrastructure
- Floating-point intensive applications
- May be performed by computers in a back room analysis farm or on a computer at the designer's desk

Product Requirements

- Very resource intensive applications that require processor scalability and high memory expandability
- Backroom machines need fast processors, memory expandability beyond 512MB, 2D graphics, and minimal slot/bay expandability
- Machines used at designer's desk must satisfy 3D mechanical modeling requirements, as well as have the power to run resource intensive analysis applications

Product Fit

- With dual-processor support, system memory expandable up to 1GB, mid-3D graphics controller, and a rack mountable design, the Compaq Professional Workstation AP500 is a very competitive choice for many CAE users.
- In many cases, however, CAE users' high-end requirements for processor scalability, memory expandability, and disk subsystem performance will be best met by products within the Compaq Professional Workstation Scalable Performance Line or the Extreme Performance Line. These workstations are designed to provide maximum power for the resource intensive analysis applications within the CAE segment.

Digital Content Creation (DCC)

DCC primarily deals with 2D and 3D desktop publishing or web authoring, 2D and 3D animation/rendering, and video editing.

2D and 3D Desktop Publishing or Web Site Development , and 2D and 3D Animation/Rendering

The largest segment (by system units) of the DCC market focuses on creative content creation for print and electronic publishing and web site development. High-end PCs or workstations are used to create 2D graphics, illustrations, and layouts (some 3D for web authoring).

Animation/rendering refers to the final creation of a computer-generated 2D or 3D-animation sequence. An animation sequence is essentially a series of still pictures shown in rapid succession to create the perception of motion. In computer-generated 3D animation, a designer initially models the animation sequence in a simplified 3D shading environment, which involves applying light to the design, and then adds various surfaces and textures to achieve the desired effect in the scene. When the sequence is complete, the final shading (or final render) is done with much more accurate lighting and shading equations and algorithms. In this process, the software renders each frame separately, effectively creating a series of still pictures. The pictures are then strung back together and transferred to a playback medium, such as a disk file or videotape. This process requires 3D graphics for the design portion, while the final render may require multiple processors and extensive memory expandability. As with analysis applications, the final render may be done on an individual designer's machine, or if especially resource-intensive, sent to a backroom "render farm" where the rendering process is done in batch mode by dedicated workstations.

Segment Characteristics

- Rapidly growing marketplace
- Major applications already ported to Windows NT
- Game authoring is highest growth segment
- Animation market growing, driving greater demand for workstation products
- Most companies in this segment are fairly small, and thus some tend to be price sensitive

Product Requirements

- Fast 2D or 3D graphics depending on overall application requirements
- Latest processor to enhance speed of interactivity; multiprocessing support is currently not a key requirement since most applications are still single-threaded. Notable exceptions are Adobe Photoshop and Kinetix 3D StudioMAX, which are multithreaded.
- Expandability of slots and bays sometimes highly desired
- Typically prefer minitower form factor

Product Fit

- The Compaq Professional Workstation AP200 is most appropriate for price sensitive customers not requiring multiprocessor support, such as users performing basic 2D/3D desktop publishing, web site development, or animation applications.
- The Compaq Professional Workstation AP400 and AP500 are very attractive platforms for customers who need multiprocessor support or mid-3D level graphics. The Professional Workstation AP500 would be especially well-suited for users who desire high expandability of slots and bays.

- With dual processor support, memory expandability to 1GB, and rack-mountable design, the Compaq Professional Workstation AP500 provides a highly competitive final rendering solution. The AP500 also supports mid-3D graphics, which is required if both design and rendering are done on the same workstation. In many high-end rendering applications, however, the users' requirements for high processor scalability, high memory, slots/bays expandability, and maximum disk subsystem performance will be best met by products within the Compaq Professional Workstation Scalable Performance Line or the Extreme Performance Line.

Video Editing

Video editing refers to using a computer to edit video footage. The editing includes adding computer generated effects (including 3D animation), as well as traditional editing functions of deleting and moving scenes around (often called non-linear video editing). This application requires expandability for adding audio/visual drives, video capture boards, and other specialized peripherals.

Segment Characteristics for Video Editing

- Most major applications moving to Windows NT. Mac is still the leading platform.
- Explosive growth, almost all Intel/Windows NT-based
- Relatively low output quality required

Product Requirements for both Animation/Rendering and Video Editing

- 3D graphics
- Multiprocessing capabilities; many animation applications already multi-threaded
- Multiprocessing support and memory expandability especially important for final render applications
- Slot and bay expandability for video editing options and storage

Product Fit

The Compaq Professional Workstation AP500 provides an expandable workstation with high-speed processor technology for those customers requiring excellent performance for their design and editing applications. In particular, the Professional Workstation AP500 is well suited for the needs of users running video editing applications. These users often need greater expansion than what is offered by the Professional Workstation AP200 or the AP400.

Electronic Design Automation (EDA)

EDA involves using the computer to design and simulate the performance of electronic circuits on a chip or system board.

Printed Circuit Board (PCB) Layout

Printed Circuit Board (PCB) layout is the process of placing components on a printed circuit board and determining the most optimal way to connect the components. This requires 2D graphics and fast processor performance.

Segment Characteristics for PCB Design

- PCB segment is still very Windows[®] 95 centric; strong movement to Intel/Windows NT occurring
- PC “power users” looking for greater functionality to meet increasing PCB software requirements

Product Requirements for PCB Design

- Latest processor
- Strong Intel/Windows NT support
- Fast 2D graphics

Product Fit

- The Compaq Professional Workstation AP200 is the optimal choice for customers performing PCB layout, with or without ASICs in the board design.
- The Professional Workstation AP400 or AP500 may be useful for these same customers, but is more likely to be used when the customer requires greater expansion capabilities. However, the more value-conscious buyers may prefer the Professional Workstation AP400 systems since they are slightly lower priced than comparable AP500 models.

Integrated Circuit Design (IC Design) and Application Specific Integrated Circuit (ASIC) Design

Integrated circuit design in EDA is the process of designing a chip at the actual transistor level. The chip's behavior is modeled in software and tested. The design is then transferred to silicon. The work is very resource intensive due to the number of transistors involved. Multiple processor support and 1GB+ memory expandability are critical.

ASIC design is similar to IC design; however, it is accomplished for a specific application. Often not a completely custom design, ASICs may use existing circuit libraries and other tools to simplify the work. Like IC design, multiple processor support and 1GB+ memory expandability are critical for ASIC design.

Segment Characteristics for IC Design and ASIC Design

- Strong UNIX installed base requires large memory configurations and processing power
- Highly resource intensive applications may wait until Merced (future Intel processor technology) to be ported to Windows NT
- Verification/layout applications have been slow to migrate to Windows NT due to their resource-intensive nature

Product Requirements for Integrated Circuit/ASIC Design

- Very resource intensive – requires fastest processor available
- Multiprocessing capabilities (scalability), memory bandwidth, and expandability

Product Fit

The Professional Workstation Scalable Performance Line and Extreme Performance Line are targeted at users performing integrated circuit and ASIC design. With their processor scalability and memory expandability, the Scalable Performance Line and Extreme Performance Line products are more suited for customers running these system resource intensive applications.

SUMMARY

The Compaq Professional Workstation Affordable Performance Line provides customers within the finance, CAD/CAE, Digital Content Creation, and EDA segments a broad range of product choices. Since users in each of the targeted application segments have distinct feature requirements dictated by the complex applications they run, matching Professional Workstation products with the appropriate segment is an important element in ensuring customer satisfaction.

APPENDIX

Table 3: Feature Comparison of Compaq Professional Workstation Affordable Performance Line with Deskpro EN and Deskpro EP Series

Feature	Deskpro EN Series	Deskpro EP Series	Professional Workstation AP200	Professional Workstation AP400	Professional Workstation AP500
Processor	Pentium II 333MHz/66, 350MHz/100, 400MHz/100, 450MHz/100	Pentium II 350MHz/100, 400MHz/100, 450MHz/100	Pentium II 350MHz/100, 400MHz/100, 450MHz/100	Pentium II 350MHz/100, 400MHz/100, 450MHz/100	Pentium II 350MHz/100, 400MHz/100, 450MHz/100
L2 cache	512K	512K	512K	512K	512K
Dual Processor Support	No	No	No	Yes	Yes
Form Factor	Desktop or Minitower	Towerable Desktop	Convertible Minitower	Desktop	Minitower
Rackable	No	No	No	No	Yes
Bays	4 - 2 open (DT) 5 - 3 open (MT)	5 - 2 open	5 - 2 open	5 - 2 open	7 - 4 open
Slots	5 - 2 open (DT) 8 - 5 open (MT) depending on model	6 - 2 or 3 open depending on model	6 - 2 or 3 open depending on model	6 - 5 open	6 - 5 open
Standard/Maximum RAM	32MB, 64MB, 128MB/ 384MB	64MB, 128MB/ 384MB	64MB, 128MB/ 384MB	64MB, 128MB/ 1GB	64MB, 128MB/ 1GB
DIMM Slots	3	3	3	4	4
Type of Memory	Unregistered SDRAM non-ECC or ECC	Unregistered SDRAM non-ECC or ECC	Unregistered SDRAM ECC	Registered SDRAM ECC	Registered SDRAM ECC
Hard Drives	4.3GB or 9.1GB Wide Ultra SCSI (7200rpm), Up to 14.4GB Ultra ATA (5400rpm), Up to 13.5GB Ultra ATA (5400rpm)	4.3GB or 9.1GB Ultra SCSI (7200rpm), Up to 14.4GB Ultra ATA (7200rpm), Up to 13.5GB Ultra ATA (5400rpm)	4.3GB Wide-Ultra SCSI (7200rpm), 6.4GB Ultra ATA (5400rpm)	4.3GB Wide-Ultra SCSI (7200rpm), 4.3GB Wide Ultra SCSI (10,000 rpm), 6.4GB Ultra ATA (5400rpm)	4.3GB Wide-Ultra SCSI (7200rpm), 4.3GB Wide Ultra SCSI (10,000 rpm), 6.4GB Ultra ATA (5400rpm)
SCSI (or Interfaces)	Wide-Ultra SCSI (PCI board) on some models	Wide-Ultra SCSI (PCI board) on some models	Wide-Ultra SCSI (PCI board) on some models	Integrated Wide-Ultra SCSI	Integrated Wide-Ultra SCSI
NIC	Compaq/Intel 10/100 Ethernet PCI card on most models	Compaq/Intel 10/100 Ethernet PCI card on some models	Compaq Fast Ethernet NIC NC3121 PCI card (10/100)	Compaq Fast Ethernet Embedded NIC NC3121 (10/100)	Compaq Fast Ethernet Embedded NIC NC3121 (10/100)
2D Graphics (Base)	ATI Rage Pro Turbo 2X (AGP), or Matrox Millennium G200 (AGP)	ATI Rage Pro Turbo (AGP), or Matrox Millennium G200 (AGP)	ELSA GLoria Synergy+ (AGP)	Matrox Millennium II, ELSA GLoria Synergy+ (AGP), or STB MVP Pro-128	Matrox Millennium II or ELSA GLoria Synergy+ (AGP)
2D Graphics Memory Standard/Max	ATI 4MB/8MB, Matrox 8MB/16MB	ATI 2MB/4MB, Matrox 8MB/16MB	Synergy+ 4MB/8MB	Matrox 4MB/16MB, Synergy 8MB/8MB, STB 4MB per port with 4ports	Synergy+ 4MB/8MB
3D Graphics	NA	NA	NA	Diamond Fire GL 4000, Compaq PowerStorm 300 (AGP)	Compaq PowerStorm 300 (AGP)

Feature	Deskpro EN Series	Deskpro EP Series	Professional Workstation AP200	Professional Workstation AP400	Professional Workstation AP500
Multi-Display Support	Yes - Matrox	Yes - Matrox	Yes - Matrox (optional), ELSA	Yes - Matrox, ELSA, STB	Yes - Matrox, ELSA
CD-ROM	24X or 32X Max IDE	32X Max IDE on some models	32X Max IDE	32X Max IDE	32X Max IDE
Diskette Drive	1.44MB	1.44MB	1.44MB	1.44MB	1.44MB
Mouse	2 button	2 button	3 button	3 button	3 button
Audio	Integrated ESS 1869 16-bit PremierSound audio	ESS 1869 16-bit audio with PremierSound ISA board on some models	ESS 1869 16-bit audio with PremierSound ISA board	Integrated ESS1869 16-bit PremierSound Audio with 5-stage equalizer	Integrated ESS1869 16-bit PremierSound Audio with 5-stage equalizer
Operating System Support	Preinstalled with Windows 95/98 or Windows NT 4.0 Supports Windows NT 3.51, DOS/Windows 3.1, OS/2	Preinstalled with Windows 95/98 or Windows NT 4.0 Supports Windows NT 3.51, DOS/Windows 3.1, OS/2	Preinstalled with Windows NT 4.0 Supports Windows NT 3.51, Windows 95 and Windows 98, Solaris	Preinstalled with Windows NT 4.0 Supports Windows NT 3.51, Windows 95 and Windows 98, Solaris	Preinstalled with Windows NT 4.0 Supports Windows NT 3.51, Windows NT Server 4.0, Windows 95 and Windows 98, Solaris
Management Features	Intelligent Manageability, DMI compliant, ACPI enabled, Remote Wakeup & Shutdown	Intelligent Manageability, DMI compliant, ACPI enabled, Remote Wakeup & Shutdown	Intelligent Manageability, DMI compliant, ACPI enabled, Remote Wakeup & Shutdown	Intelligent Manageability, DMI compliant, ACPI enabled, Remote Wakeup & Shutdown	Intelligent Manageability, DMI compliant, ACPI enabled, Remote Wakeup & Shutdown
CAD, DCC, Finance, EDA ISV Testing and Certification	No	No	Yes	Yes	Yes
PC-to-UNIX Interoperability SW Testing	No	No	Yes	Yes	Yes
Serviceability	Quick release cover and drive latches, expansion board cage with green lift levers, slide-out system board, and tilt drive cage, diagnostic LEDs on system board	Easily removable cover; Compaq Drivelock mechanism with green latches for easy-to-remove drives, diagnostic LEDs on system board	Easily removable cover; Compaq Drivelock mechanism with green latches for easy-to-remove drives	Quick removable cover with tool-less entry; slide-out system board, removable I/O cage	Quick removable cover with tool-less entry; slide-out system board, removable I/O cage and drive cage
Warranty	3-yr, 1-yr On-Site	3-yr, 1-yr On-Site	3-yr, 1-yr On-Site	3-yr, 1-yr On-Site	3-yr, 1-yr On-Site