

# WHITE PAPER

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Prepared By  
Workstation Marketing

Compaq Computer  
Corporation

## Contents

<b>The New Compaq Professional Workstations.....</b>	<b>3</b>
<b>Highly Parallel System Architecture.....</b>	<b>3</b>
<b>Processor Technologies..</b>	<b>5</b>
<b>Pentium Pro.....</b>	<b>6</b>
<b>Pentium II.....</b>	<b>6</b>
<b>Graphics.....</b>	<b>8</b>
<b>16X Maximum IDE CD-ROM.....</b>	<b>16</b>
<b>PremierSound Audio.....</b>	<b>16</b>
<b>Universal Serial Bus (USB).....</b>	<b>17</b>
<b>Chassis and Serviceability Features .</b>	<b>17</b>
<b>Enhancements to the Workstation Software Platform.....</b>	<b>19</b>
<b>Compaq SmartStart for Workstations.....</b>	<b>19</b>
<b>UNIX/Host Interoperability.....</b>	<b>20</b>
<b>Management Features ...</b>	<b>21</b>
<b>Questions and Answers.</b>	<b>22</b>

## The Compaq Professional Workstation 6000 and 8000 Key Technologies White Paper

*The purpose of this paper is to provide an overview of the Key Technologies incorporated into the new Compaq Professional Workstation 6000 and 8000 products. This paper concentrates on covering those new features and technologies that have unique customer benefits.*

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## The Compaq Professional Workstation 6000 and 8000 Key Technologies White Paper

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**THE NEW COMPAQ PROFESSIONAL WORKSTATIONS**

The Compaq Professional Workstation 6000 and 8000 are powerful, industry standard workstations specifically designed to deliver leading performance with today's demanding CAD/CAE, digital content creation, and financial analysis applications. Along with the Compaq Professional Workstation 5000, the new Compaq Professional Workstations are backed by strong partnerships with leading ISVs to provide highly integrated and optimized solutions, which can be confidently deployed in the most demanding, business critical environments. The Compaq Professional Workstation product line combining powerful industry standard components, strong partnerships with leading ISVs, and traditional Compaq quality and reliability, gives users the time to market advantage they need to succeed.

Though the physical appearance of the Professional Workstation 6000 and 8000 is very similar, they are targeted at very different markets whose computing requirements lead to some key feature differences between the products. The Compaq Professional Workstation 6000 combines performance and expandability to meet the needs of a broad set of users. In particular, it is targeted at users in the CAD/CAE and DCC segments who may require more expandability than that provided by the Compaq Professional Workstation 5000. The Compaq Professional Workstation 6000 supports up to two Pentium II 266MHz or 300MHz processors with a 512KB L2 cache. Combined with the Compaq Highly Parallel System Architecture, this workstation provides customers with industry leading system performance.

The Compaq Professional Workstation 8000 is an industry standard, advanced multiprocessing workstation specifically designed for the most resource intensive applications in the CAE and DCC markets. The Compaq Professional Workstation 8000 supports up to four Pentium Pro 200MHz processors with 512k cache. It also supports up to 3GB of memory, which is the highest memory expandability of any product in the NT/X86

workstation market. By combining support for up to 4 processors, 3GB of memory, and the Compaq Highly Parallel System Architecture, the Compaq Professional Workstation 8000 delivers the highest level of performance available for multithreaded CAE and DCC applications running on Windows NT.

**Workstation Target Markets**

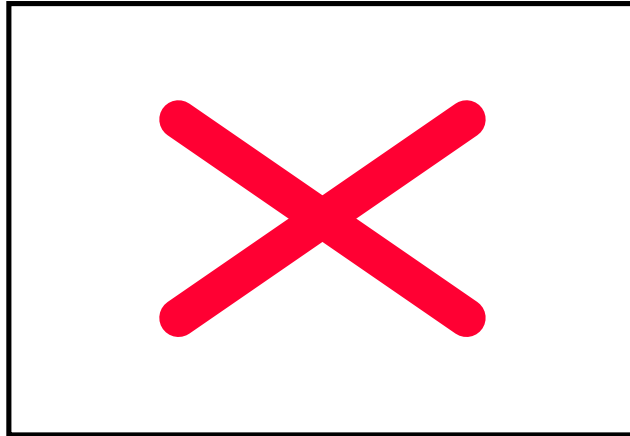
Product	Finance	CAD	CAE	DCC
Compaq Professional Workstation 5000	✗	✗		✗
Compaq Professional Workstation 6000		✗	✗	✗
Compaq Professional Workstation 8000			✗	✗

**HIGHLY PARALLEL SYSTEM ARCHITECTURE**

The Compaq Professional Workstation 6000 and 8000 have been designed with a Highly Parallel System Architecture that maximizes system bandwidth to improve performance in demanding applications. Most workstations in the NT/X86 market support two CPUs to process instructions concurrently. However, overall system bandwidth is limited since each CPU must compete for access to critical subsystems such as memory and I/O whose bandwidth has not been correspondingly increased.

The Highly Parallel System Architecture used with the Compaq Professional Workstation 6000 and 8000 addresses the need for greater overall system bandwidth by utilizing dual memory controllers, dual-peer PCI buses, and advanced multiprocessing support.

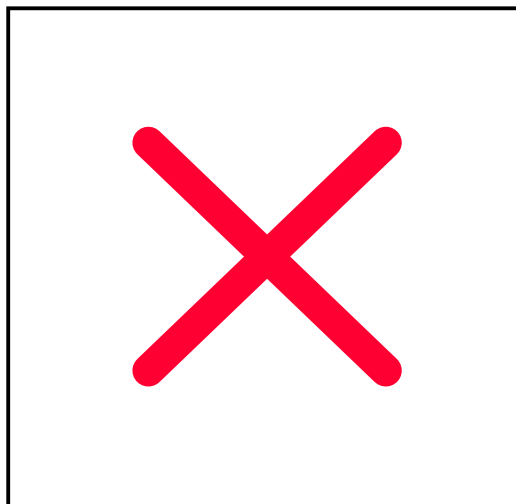
**Diagram 1: The Highly Parallel System Architecture.**



**Dual Memory Controllers**

The Compaq Professional Workstation 6000 and 8000 use dual memory controllers that can process memory requests in parallel, significantly increasing overall memory bandwidth. Other workstations in the NT/X86 market offer memory bandwidth of either 267MB/second or 533MB/second depending on the chipset used. The Compaq Professional Workstation 6000 and 8000 use two memory controllers, each with a bandwidth of 533MB/second. Therefore, total memory bandwidth increases to 1.07GB/second- two to four times that of other systems.

**Diagram 2: Dual Memory Controllers Architecture.**

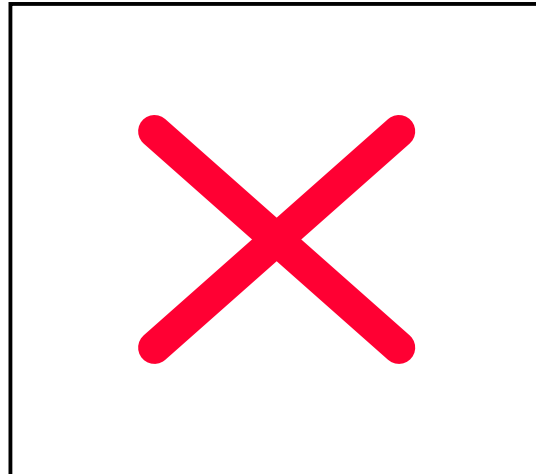


**Dual-Peer PCI Buses**

The Compaq Professional Workstation 6000 and 8000 also use dual-peer PCI buses to increase system I/O bandwidth. A single PCI bus provides I/O bandwidth of 133MB/second that must be shared by many key peripherals such as the graphics controller, hard drive, and NIC. With dual-peer PCI buses, each bus can provide peak bandwidth in parallel with the other controller, allowing an aggregate I/O bandwidth of 267MB/second. This implementation provides twice the bandwidth of single bus architectures. Also, dual PCI buses allow key peripherals to be connected to separate buses to balance overall system throughput. The dual PCI buses also allow for greater system I/O integration and expandability by supporting up to 12 PCI devices which is twice the number supported on single bus implementations. This allows the Compaq

Professional Workstation 6000 and 8000 to deliver six PCI-based I/O expansion slots while also integrating other PCI components such as the SCSI and network controllers on the system board.

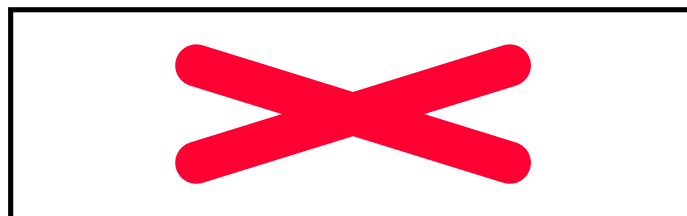
**Diagram 3: Dual PCI Buses.**



**Optimized Multiprocessing Support**

Finally, with dual memory controllers and dual peer-PCI buses, both new workstations are able to deliver optimized multiprocessing support. Both the Intel Pentium II and Pentium Pro processors enable multiprocessor support by including circuitry in the processor that determines how multiple processors can share the CPU bus. However, most multiprocessing implementations in the NT/X86 workstation market take advantage of this support by simply adding an additional processor to an already existing desktop design. Compaq takes multiprocessing to the next step with the Highly Parallel System Architecture by enhancing memory and I/O bandwidth as well. Multiprocessor Systems designed without the Highly Parallel System Architecture will quickly encounter a bottleneck as the multiple processors try to access the other system resources, such as memory and I/O subsystems, that have not been enhanced to accommodate the additional data traffic. The Highly Parallel System Architecture significantly reduces these bottlenecks by incorporating enhanced subsystem resources, such as dual memory controllers and dual peer-PCI buses, to accommodate the increased data traffic from the multiple CPUs.

**Diagram 4: Multiprocessing Support**



**PROCESSOR TECHNOLOGIES**

The Compaq Professional Workstation 6000 and 8000 use Intel's newest processors which incorporate Dynamic Execution and the Dual Independent Bus architecture technologies to provide the highest performance next generation processors.

**Dynamic Execution**

The Pentium Pro and Pentium II processor design is based on Intel's Dynamic Execution technology that combines three advanced processing techniques to increase the performance.

The three techniques are multiple branch prediction, dataflow analysis and speculative execution.

Multiple branch prediction means that the processor looks ahead several steps in the software and predicts which groups of instructions are likely to be processed next. This increases the amount of work delivered to the processor, improving how efficiently the processor is used and ultimately, system performance.

Dataflow analysis analyzes which instructions are dependent on each other's results, or data. This technique allows an optimized schedule of instructions to be created so they can be processed in the most efficient order.

Speculative Execution means that the instructions are then carried out based on the schedule created by the dataflow analysis. Thus, the entire processor's superscalar processing power is kept busy, boosting overall software performance.

This combination of new technologies enables the Pentium Pro and Pentium II processors to deliver the processing performance workstation applications require.

### **Dual Independent Bus Architecture**

Both the Pentium Pro and Pentium II use Intel's Dual Independent Bus architecture providing two (dual) independent buses versus the single bus architecture of the Pentium processor. The dual buses are the L2-cache-to-processor bus and the processor-to-main-memory system bus. This design delivers up to three times the bandwidth of a single bus architecture processor because the buses can work independently which essentially doubles the throughput. This technology will enable the evolution of today's 66MHz system memory bus to the faster 100MHz system memory bus in 1998.

## **PENTIUM PRO**

The Pentium Pro processor is utilized in the Compaq Professional Workstation 8000. This workstation comes standard with two Pentium Pro processors and supports *up to four*. The Pentium Pro processor family is Intel's current generation of processors for high-end desktops, workstations and servers. This product family consists of processors running at clock speeds of 150Mhz to 200Mhz with cache sizes of either 256KB or 512KB. Because of the performance requirements for workstations, the Compaq Professional Workstation 8000 uses only the 200MHz processor with the 512k cache.

The integrated L2 cache on the Pentium Pro runs at the same speed as the core processor speed. For example, if you have a 200MHz processor, the cache is also running at 200MHz. Additionally, the 512KB cache version provides improved scalability compared to the 256KB cache version in CAE and animation rendering applications that have large datasets. Scalability, as used here, refers to the realized gain in the workstation's performance with each additional processor. Customers will realize a greater performance improvement with each additional processor added to the system by using the 512KB cache version compared to the 256KB cache version because the increased cache size holds more instructions which reduces memory bus traffic.

For additional information on the Pentium Pro architecture, please access the Intel Website at <http://www.intel.com/procs/ppro/info/index.htm>.

## **PENTIUM II**

The Compaq Professional Workstation 6000 uses the Pentium II processor, which is Intel's newest processor that incorporates P6 technology along with Intel's new MMX processor instruction set. Formerly code named "Klamath", the Pentium II will come in 233MHz, 266MHz and 300MHz versions with the 512KB cache. Once again, because performance is a primary

requirement for workstation customers, the Compaq Professional Workstation 6000 will only use the 266MHz/512KB and 300MHz/512KB processors.

To improve ease of manufacturability, the Pentium II uses a new form factor. Instead of the traditional single chip package, the Pentium II comes with the processor and cache mounted on a PCB (substrate). The PCB, processor and L2 cache are enclosed in a Single Edge Contact (S.E.C.) cartridge. Instead of a socket, the Pentium II now plugs into a slot using the S.E.C. cartridge. This new form factor is similar to a video game cartridge in appearance and measures approximately 4.9" wide by 2.1" high by 0.5" deep.

The Pentium II provides some enhancements over the Pentium Pro. The MMX instruction set improves performance of multimedia processing in MMX-enabled applications. Additionally, the Pentium II uses industry standard SRAMs for the L2 cache. However, the SRAMs run at half the core frequency of the processor. The replacement of the full-speed secondary (L2) internal cache (Pentium Pro) with the industry standard SRAM cache improves manufacturability, however, this new design takes longer to access the cache versus the Pentium Pro. Although, with its larger L1 cache and high clock speeds (266MHz and 300MHz versus 200MHz for the Pentium Pro), a single processor Pentium II system will outperform a single processor Pentium Pro system in most applications.

The new design also places some limitations on scalability. Pentium II systems will only be able to support up to two processors and will be limited to 512MB of addressable system memory. The Pentium II's L2 cache is capable of addressing only 512MB of system memory so adding memory beyond this amount will significantly degrade system performance.

Please refer to the Performance Whitepaper on Genesys, Busidesk and our website for additional information explaining the performance distinctions between the Compaq Professional Workstation 6000 using the Pentium II and the Compaq Professional Workstation 8000 using the Pentium Pro.

### **MMX**

MMX (MultiMedia Extensions) is the name for the 57 multimedia instructions Intel has added to its new generation of processors. These multimedia extension instructions are expected to significantly improve performance on CPU-intensive multimedia applications. MMX is tailored to audio, video, and other multimedia tasks. An MMX-equipped workstation will use one instruction to execute a task it may take a Pentium Pro up to 16 instructions to perform. Because multimedia operations such as video and audio use a number of redundant instructions, MMX achieves some efficiencies by using a technique called SIMD (Single Instruction Multiple Data), which saves on clock cycles by using a single instruction to perform these redundant functions on multiple sets of data.

The greatest benefits of MMX will be demonstrated in playback applications such as games, where 3D effects and video/audio processing are critical for realism and are usually done without the benefit of dedicated hardware. Additionally, some professional applications such as Adobe PhotoShop also benefit because their filter and effects functions are parallelized with MMX, which greatly increases the performance of the application.

For additional information on MMX, please access the Intel Website at <http://developer.intel.com/drg/mmx/Support/faq.htm>.

### **Pentium II vs. Pentium Pro**

Each of these processors provides unique advantages that make them appropriate for use in different applications. The new Pentium II processor is the best choice for most applications because of its higher processing frequency and MMX technology. However, although the Pentium Pro runs at a slower clock speed than the Pentium II, it provides better performance for compute intensive applications that take advantage of multiprocessing and large memory

configuration capabilities such as those in CAE and 3D animation final rendering. The Pentium Pro processor design allows the Compaq Professional Workstation to support up to four processors and 3GB of system memory to meet the requirements of computational intensive applications. To understand the benefit of these capabilities the SPECrate benchmark can be used to measure the system's capacity for processing jobs of a specified type in a given amount of time. This benchmark does not measure the speed of the processor, but rather, measures the amount of work the system can accomplish in the allotted time. The SPECrate results for the Compaq Professional Workstation 6000 with two Pentium II processors is 191 while the results for the Compaq Professional Workstation 8000 with four Pentium Pro processors is 300, indicating the additional performance benefit achieved through the scalability of the Pentium Pro processor.

## GRAPHICS

Three graphics solutions are available for the Compaq Professional Workstation 6000 and 8000. All are PCI local bus implementations designed to maximize system performance and have been tested to ensure optimum compatibility and reliability.

- For 2D applications, the Compaq Professional Workstation 6000 and 8000 include the new Matrox MGA Millennium II graphics controller which provides fast 2D windowing for applications such as financial analysis and software development. This graphics controller comes standard with 4MB WRAM and is upgradable to either 8MB or 16MB of WRAM.
- For 3D graphics needs, the Compaq Professional Workstation 6000 and 8000 include models with the ELSA GLoria-L or Diamond Fire GL 4000 graphics controllers.
  - The GLoria-L delivers new levels of price/performance for a broad range of 3D graphics environments. The GLoria-L uses the GLINT 500TX processor from 3Dlabs, and comes standard with 8 MB of Frame Buffer VRAM memory and 8 MB of Z-Buffer and texture DRAM memory. The Z-Buffer memory, used for texture, stencil, and Z-Buffering, is upgradable to 16 MB.
  - The Fire GL 4000 is the high performance, 3D graphics solution for users working in demanding, true color environments. The Fire GL 4000 uses the high performance REALimage rendering engine from Evans and Sutherland along with specialized graphics memory from Mitsubishi. This controller comes standard with the maximum memory configuration which is 15MB 3D-RAM for frame buffering and Z-buffering and 16MB of Cache DRAM (CDRAM) for texture memory. It provides true color resolution (16million colors) at up to 1280 x 1024 resolution.

### Compaq Graphics Driver Compatibility

All three controllers are high-performance graphics solutions, optimized for Windows NT applications that require up to 16.7 million color processing and high resolutions. The drivers for each are developed by their respective manufacturers, and have been thoroughly tested to ensure compatibility with existing applications.

### The Matrox MGA Millennium II

Select models of the Compaq Professional Workstation 6000 and 8000 use the MGA Millennium II graphics controller, which is the latest 2D graphics controller from Matrox. Building on their success with the MGA Millennium, Matrox has improved the design by adding larger memory capacities and improved 3D graphics capabilities to provide better 2D and 3D graphics performance. While the Millennium II provides minimal 3D capabilities, the Compaq



Professional Workstation 6000 and 8000 use it to target users who need fast 2D windowing in the targeted application segments.

The Millennium II controller for Compaq Professional Workstations comes standard with 4 MB of WRAM memory. The accelerator is memory-upgradable to 8 MB or 16 MB to provide greater color depth in higher resolution modes. To reach the larger memory configurations, Compaq offers a 4MB and 12MB memory upgrade options.

Color and resolution support for the Millennium II are:

**Table 1  
Maximum Color Support  
MGA Millennium II  
Single-Buffer Mode**

Resolution	4 MB WRAM	8 MB WRAM	16 MB WRAM
1800 x 1440	256	65,536	65,536
1920 x 1200	256	65,536	65,536
1920 x 1080	65,536	16.7 million	16.7 million
1920 x 1035	65,536	16.7 million	16.7 million
1600 x 1200	65,536	16.7 million	16.7 million
1600 x 1024	65,536	16.7 million	16.7 million
1280 x 1024	16.7 million	16.7 million	16.7 million
1152 x 882	16.7 million	16.7 million	16.7 million
1024 x 768	16.7 million	16.7 million	16.7 million
800 x 600	16.7 million	16.7 million	16.7 million
640 x 480	16.7 million	16.7 million	16.7 million

**Matrox MGA Millennium II Technical Specifications**

The main enhancements Matrox has implemented in the MGA Millennium II are:

- PCI 2.1 compliant
- PC 97 compliant
- 3D texture mapping
- 16-bit or 32-bit z buffer
- 250MHz RAMDAC to support resolution up to 1920 x 1200
- Memory expandability up to 16MB WRAM for higher 3D resolution
- Bus mastering with scatter/gather to free-up the CPU for other processing tasks and improve overall system performance in a multitasking environment
- Larger PCI input FIFO buffer for improved 2D and 3D performance (32 double word vs. 64 double word FIFO)

**Table 2: MGA Millennium II technical specifications**

Controller	Matrox MGA 2164W
Bus Type	PCI
RAMDAC	TVP 3026 250 MHz
Memory Type	WRAM
Memory Amount	4 + 4 or 12 MB
Max Memory	16 MB
Memory Speed	50 ns
Data Path	64-bit
Controller Clock Speed	50 MHz
Max Vertical Refresh Rate	200 Hz
Max Horizontal Scan Rate	113 KHz
Max Pixel clock	250 MHz
Video Features: Interface Multimedia Connector MPEG HW Acceleration Scaling Color Space Conversion	VGA Feature Connector Optional Multimedia module* Yes – on the optional module* Yes Yes
Engine Acceleration: BitBLT Line Draw Polygon 3D Autodesk Display list driver Heidi drivers support for 3D Studio Max	Yes Yes Yes Yes Yes Yes
Operating Systems	Windows 95 Windows NT 3.51/4.0

\* Available from Matrox

### The ELSA GLoria-L

Select models of the Compaq Professional Workstation 6000 include the GLoria-L graphics controller to deliver new levels of price/performance for customers running 3D CAD and animation applications. This is the same 3D controller used in the Compaq Professional Workstation 5000. A recently released OpenGL device driver significantly improves performance compared to the levels first published on the Compaq Professional Workstation 5000.

The ELSA GLoria-L graphics controller provides an optimized hardware pipeline for acceleration of floating-point intensive 3D graphics, including hardware support for texture mapping which is required by certain applications in the CAD/CAM and animation arenas.

The GLoria-L uses dual-ported Video RAM (VRAM) for the frame buffer. The GLINT processor used on the GLoria-L also has a separate DRAM-based Z-buffer for Z-coordinates (the third dimension in 3D), alpha data (e.g., transparency and fog effects), stencil buffer, and texture maps. The GLoria-L also incorporates the S3 ViRGE processor for VGA boot support, which has its own dedicated DRAM-based frame buffer. The GLoria-L is DRAM memory-upgradable, PCI-based, and supports resolutions as high as 1600 x 1280. It is also capable of processing 16.7 million colors in resolutions up to 1152 x 864.

The GLoria-L comes standard with 8 MB of VRAM frame buffer memory, 8 MB of DRAM Z-buffer/texture memory for the GLINT processor, and 1 MB DRAM Frame Buffer memory for the S3 ViRGE VGA processor. The Z-buffer/texture memory is upgradable to 16 MB DRAM to provide greater Z-buffer and alpha depth in higher resolution modes, and texture-mapping memory. Compaq offers an 8-MB Z-buffer/texture memory upgrade option. The maximum

resolutions, colors, and refresh rates are outlined in the chart below; lower resolutions are selectable:

**Table 3: GLoria-L double buffered resolutions**

<b>Double Buffered Capabilities Resolution; Max Colors</b>	<b>GLoria-L Max Hz</b>
1600 x 1280; 32k	77
1280 x 1024; 32k	113
1152 x 864; 16M	149
1024 x 768; 16M	160

**GLoria-L Features**

Features of the GLoria-L graphics controller include:

- Support for major industry 3D APIs, including
  - OpenGL -- Open Graphics Library is a software interface to graphics hardware developed by Silicon Graphics Inc.
  - Direct3D – A set of APIs for real-time 3D graphics that are an addition to the Microsoft DirectX interactive media technologies. They provide a comprehensive 3D solution for software developers building interactive media programs and games
  - Heidi – 3D API from Kinetix (an AutoDesk company) that provides an immediate 2D and 3D mode drawing interface for 3D Studio Max.
  - Display list drivers – Provide performance acceleration for AutoCAD R13 and Microstation.
- On-board VGA support with S3 ViRGE chip for full-screen DOS box support on Windows NT Workstation 3.51 and 4.0.
- GLoria Setting- an applet which allows the user to optimize the performance of the Gloria-L for a specific application with the click of a button. This applet automatically optimizes the Gloria-L for a specified application by changing the driver parameters to values that “Tune” it for that application. All users have to do is select their program from a list that is provided. The supported applications include Pro/E, AutoCAD, SoftImage, and 3Dstudio Max.
- Hardware accelerated 3D, 32-bit Z-buffering for realistic depth perception and texture mapping.
- Full, 32-bit double buffering for smooth animation by allowing the next image to be created in off-screen memory while displaying the current image.
- Gouraud shading for smooth surfaces.
- Texture mapping for creating realistic images.
- Fog for fading effects, atmospheric effects, and depth-queuing.
- Anti-aliasing to provide smooth colors for rendered scenes by blending the colors of neighboring pixels.
- Alpha-blending for creating transparent effects such as an object behind a window.
- 500,000 Gouraud-shaded, depth-buffered, 25-pixel triangles per second with 32-bit color, 32-bit Z-buffer, dithering, stenciling, clipping, and fogging enabled.
- 12.5 million texture-mapped pixels per second with full per-pixel perspective correction using a dual processor configuration.

**Elsa GLoria-L Technical Specifications**

**Table 4: Gloria-L technical specifications**

3D/2D Controller	3DIabs GLINT Delta + 500TX
VGA Controller	S3 ViRGE
Bus Type	PCI
RAMDAC	IBM RGB526DB 220 MHz
Memory Type	VRAM & DRAM
Frame Buffer Memory Amount	8 MB VRAM
Z-Buffer and Texture Mapping Memory Amount	8 MB DRAM (GLINT) upgradable to 16MB, 1 MB DRAM (S3)
Memory Speed	60 ns VRAM, 50 ns DRAM (GLINT) 70 ns DRAM (S3)
Data Path	64-bit (GLINT) 32-bit (S3)
Controller Clock Speed	50 MHz (GLINT 500TX) 40 MHz (GLINT Delta) 50 MHz (S3)
Max Vertical Refresh Rate	200 Hz
Max Pixel clock	200 MHz
Hardware Accelerated 3D:	
32-bit Z-buffering	Yes
Gouraud shading	Yes
Stencils	Yes
Texture mapping	Yes
Operating Systems	Windows 95 Windows NT 3.51 Windows NT 4.0

**The Diamond Fire GL 4000**

Select models of the Compaq Professional Workstation 6000 and 8000 include the new Diamond Fire GL 4000 graphics controller which delivers high performance 3D graphics capabilities for users working in demanding, true color environments such as 3D animation, visualization, simulation, and mechanical CAD.

The Fire GL 4000 uses the Mitsubishi 3DPro chipset based on the REALimage rendering technology from Evans & Sutherland to deliver a very high level of 3D performance. It provides hardware acceleration for OpenGL 1.0 (NT 3.51 only), OpenGL 1.1 (NT 4.0 only), and HEIDI (NT 3.51 and 4.0). Support for Direct3D and HEIDI under Windows 95 will be available at a later date.

The Fire GL 4000 delivers industry leading 3D graphics performance by combining a comprehensive set of hardware acceleration features including rasterization, texture mapping and triangle set-up with the new 3D-RAM and CDRAM memory architectures.

3D-RAM is a new technology used for the Frame buffer and Z-buffer memory on the Fire GL. This design includes a small arithmetic logic unit in the DRAM that performs a number of the calculations locally. This improves performance by reducing traffic to and from memory.

The Fire GL uses CDRAM (Cache DRAM) for the texture memory. This technology provides a small SRAM cache built into the DRAM. This high-speed cache provides a buffer for texture

between the controller and the DRAM memory, which reduces data access times and ultimately, increase graphics performance.

With all of the Fire GL's high performance features, it can deliver performance exceeding the throughput capabilities of the PCI bus. One component of the Highly Parallel System Architecture in the Compaq Professional Workstation 6000 and 8000 is dual peer-PCI buses, which eliminates the potential PCI bus bottleneck to provide improved throughput and overall system performance when compared to single bus implementations.

The Fire GL 4000 comes standard with 15 MB of 3D-RAM for frame buffer and Z-buffer memory, 16MB of CDRAM for texture memory, and 1 MB DRAM Frame Buffer memory for the CIRRUS Logic 5446 VGA controller. The maximum resolutions, colors, and refresh rates are outlined in the chart below; other resolutions are selectable:

**Table 5: Fire GL 4000 double buffered resolutions**

<b>Double Buffered Capabilities</b> <b>Resolution; Max Colors</b>	<b>Fire GL 4000</b> Max Hz
<b>1280 x 1024; 16M</b>	85
<b>1024 x 768; 16M</b>	100
<b>800 x 600; 16M</b>	120
<b>640 x 480; 16M</b>	120

**Fire GL 4000 Features**

Features of the Fire GL 4000 graphics controller include:

- Support for major industry 3D APIs, including
  - OpenGL -- Open Graphics Library is a software interface to graphics hardware developed by Silicon Graphics Inc. The Fire GL supports OpenGL 1.0 under Windows NT 3.51 only and OpenGL 1.1 under Windows NT 4.0 only.
  - Direct3D -- A set of APIs for real-time 3D graphics that are an addition to the Microsoft DirectX interactive media technologies. They provide a comprehensive 3D solution for software developers building interactive media programs and games. Fire GL 4000 support for this API under Windows 95 will be provided at a later date.
  - Heidi -- 3D API from Kinetix (an AutoDesk company) that provides an immediate 2D and 3D mode drawing interface for 3D Studio Max. Support for Windows NT 3.51 and 4.0 is available immediately. Support for Windows 95 will be provided at a later date.
  - BigFocus Display list drivers -- Provide performance acceleration for AutoCAD R13.
  - 3D-Win -- 3D viewer software for AutoCAD R13, Windows NT and OpenGL
- On-board VGA support with CIRRUS Logic 5445 VGA chip for full-screen DOS box support on Windows NT Workstation 3.51 and 4.0.
- Hardware accelerated 3D, 24-bit Z-buffering for realistic depth perception and texture mapping.
- Full, 32-bit RGBA double buffering for smooth animation by allowing the next image to be created in off-screen memory while displaying the current image.
- Gouraud shading for smooth surfaces.
- Texture mapping for creating realistic images.
- Fog for fading effects, atmospheric effects, and depth-queuing.
- Anti-aliasing to provide smooth colors and removes jagged lines for high quality, realistic rendered scenes.
- Alpha-blending for creating transparent effects such as an object behind a window.
- Bilinear and trilinear mip mapping
- 2,000,000 Gouraud shaded, textured polygons per second (25 pixel triangles) with lighting, z-buffering, blending, and fogging enabled.

- 60 million bilinear MIP-mapped pixels per second.
- 30 million trilinear textured pixel per second.

**Diamond Fire GL 4000 Technical Specifications**

**Table 6: Fire GL Technical specifications**

3D/2D Controller	3DPro (Mitsubishi/Evans & Sutherland)
VGA Controller	CIRRUS Logic 5446
Bus Type	PCI
RAMDAC	220 MHz Texas Instruments TVP3026
Memory Type	3D-RAM and CDRAM
Frame Buffer and Z-buffer Memory Amount	15MB 3D-RAM
Texture Mapping Memory Amount	16MB CDRAM
Memory throughput	3D-RAM- 10ns CDRAM- 15ns
Data Path	64-bit (3Dpro) 32-bit (CIRRUS)
Controller Clock Speed	70MHz
Max Vertical Refresh Rate	120Hz
Max Pixel clock	220MHz
Hardware Accelerated 3D:	
32-bit Z-buffering	Yes
Gouraud shading	Yes
Stencils	Yes
Texture mapping	Yes
Trilinear mip mapping	Yes
Operating Systems	Windows NT 3.5 1/4.0 Windows 95*

\* Available at a later date.

**Degrees of 3D**

Although the Millennium II has improved its 3D capabilities as compared to the original Millennium graphics controller, there are significant differences between it and the two full-featured 3D graphics solutions offered on these workstations. The new features in the Millennium II are support for texture mapping and Gouraud shading along with 32-bit Z-buffering. The Millennium II does not support fogging, alpha-blending, depth-queuing, mip mapping, anti-aliasing and bilinear interpolation making it inappropriate for applications in the CAD and DCC segments that require this level of 3D functionality.

Additionally, the Millennium II's 3D capabilities are implemented mainly through software (i.e. drivers). Thus, those functions not supported by the hardware graphics controller must be emulated in software and processed by the CPU. This has a significant impact on performance and makes it far slower than a hardware-based implementation such as the Gloria-L or Fire GL.

The 3D graphics capabilities of the Millennium II make it appropriate for 3D games, viewing 3D websites, and entry-level CAD where rudimentary, low cost 3D capabilities are needed.

The Gloria-L and Fire GL 4000 deliver all of the 3D functionality listed above, mainly through hardware, which takes a significant load off of the processor to deliver excellent 3D graphics performance.

The two 3D graphics controllers provide customers with a range of solutions for their applications in the CAD and DCC segments. The Gloria-L is a full-featured 3D graphics controller that delivers excellent 3D price/performance for applications in the CAD and DCC segments. The Fire GL 4000 is a high-performance graphics controller designed for customers working in demanding, true color environments. Some of the key distinctions between these two 3D graphics controllers are:

**Table 7: Gloria-L and Fire GL features**

	<b>EISA GLoria-L</b>	<b>Diamond Fire GL 4000</b>
<b>Maximum Resolution</b>	1600 x 1280 at 256 colors	1280 x 1024 – true color, double buffered
<b>Multiple Monitor Support</b>	Yes	No
<b>Display Memory</b>	8MB VRAM	15MB 3D-RAM for Display and Z-buffer memory
<b>Texture Memory</b>	8MB DRAM Z-buffer and texture memory, upgradable to 16MB	16MB CDRAM
<b>Maximum Double Buffered Resolutions</b>	1152 x 864 x 24bpp	1280 x 1024 x 24bpp
<b>Performance</b>	500,000 Gouraud-shaded, depth-buffered, 25-pixel triangles per second with 32-bit color, 32-bit Z-buffer, dithering, stenciling, clipping, and fogging enabled	2,000,000 Gouraud shaded, textured polygons per second (25 pixel triangles) with lighting, z-buffering, blending, and fogging enabled

**Monitors**

The recommended monitors for Professional Workstations are the Compaq P70, 17” and QVision 210, 21” and the new Compaq TFT500 Flat Panel Monitor.

The Compaq P70 monitor, designed for the most demanding applications provides:

- State-of-the-art Trinitron-based design for crystal clear images
- Trinitron® CRT (15.6” Viewable) providing corner-to-corner focus
- Supports resolutions up to 1600 x 1200 @ 65 Hz and 1280 x 1024 @ 85 Hz
- 0.26 mm Aperture Grill pitch
- TCO-95 compliant
- Colorific Software support
- On-screen display with advanced user controls
- New ergonomic design
- AssetControl

The Compaq QVision 210 monitor - The QVision 210 - A powerful combination of performance features for demanding technical and professional users that provides:

- Larger 21” (19.5” Viewable) Display
- Delivers 60% larger viewing area than a 17” monitor
- Supports resolutions up to 1600 x 1200 @ 75 Hz and 1280 x 1024 @ 85 Hz, high resolutions ensure sharp images while maximizing productivity
- 21” CRT with .26 mm dot pitch for crisper images and finer detail
- On-Screen-Display and user controls for advanced screen adjustments including tilt, pin cushion, pin balance, parallelogram, color temperature and language selection
- PC World Magazine’s Best Buy Award in January and November 1996

The Compaq TFT500 Flat Panel Monitor provides an unprecedented combination of size and performance for the flat panel revolution.

- 15.1" (38.3 cm) viewable Active Matrix Display
- Wide viewing angle: 120 degrees horizontal and 80 degrees vertical
- 1024 x 768 resolution
- USB Hub with 3 downstream ports for connecting USB peripherals
- TCO-95 compliant
- low power requirements (<40 watts)
- Light weight (20 lbs.)
- detachable base
- Optional Desk Arm Mount
- Wall mountable.

### 16X MAXIMUM IDE CD-ROM

All models of the Compaq Professional Workstation 6000 and 8000 include a 5.25", half-height auto-slot load 16X Maximum CD-ROM Drive using the new Constant Angular Velocity (CAV) technology. Previous CD-ROMs included a tray or caddy to hold the CD. This CD-ROM uses a slot-load mechanism, similar to car stereos, where the CD slides directly into the slot in the CD ROM drive. Additionally, previous CD-ROM technology used Constant Linear Velocity (CLV) technology which allowed the disc to rotate at a faster rate while reading the inner tracks and a slower rate when reading the outer tracks. Conversely, the CAV technology, used in the new products, spins the disc at a fixed rate and the data transfer rate increases as it moves toward the outer tracks. This is the same technology that is used for hard drives where it has demonstrated excellent performance in high data transfer and fast access times. Using this technology enables reliable CD ROM speeds above 8X. The 16X CAV CD ROM dramatically increases the access time performance of the CD-ROM in the Compaq Professional Workstation 6000 and 8000.

#### Technical Specifications

<b>Access Time</b>	<b>Average = &lt;100 MS</b>
<b>Transfer Rate</b>	<b>1200 - 2400 KB/second</b>

### PREMIERSOUND AUDIO

The Compaq Professional Workstation 6000 and 8000 include Compaq's *PremierSound* audio solution. The *PremierSound* design incorporates a high performance, custom designed loudspeaker, a ported (bass reflex) enclosure for extended low frequency output, a low distortion amplifier (less than 0.3 % at the rated power of 3  $W_{rms}$ ), and 5 bands of fixed equalization with the ESS Audio 16-bit solution to provide a complete, optimized audio solution.

The high performance loudspeaker and the ported enclosure are designed in conjunction with the equalization to provide crisp, clean, wide bandwidth audio from a small, integrated mono solution. The low frequency capability of the enclosure and speaker are dramatically better than typical business audio solutions.

The five stages of fixed equalization are used to "tune" the audio system to the acoustic environment, lower distortion and smooth the response of the speaker. The tuning allows us to shape the frequency response to provide exceptionally clear, natural, voice quality, whether under a desk or in a rack.

The result is a well-balanced audio system capable of delivering clean, undistorted output at a level needed to support an office environment.



To utilize the audio capabilities, volume controls, headphone and microphone connections are conveniently located on the front of the chassis above the speaker, and line in/out and microphone connections are provided on the back of the chassis.

The software driver for the PremierSound audio solution is part of the standard workstation software platform that is used for all Compaq Professional Workstations. SmartStart automatically installs this audio solution for the customer during set-up.

## UNIVERSAL SERIAL BUS (USB)

Both the Compaq Professional Workstation 6000 and 8000 include two Universal Serial Bus (USB) ports.

USB is a peripheral bus standard developed by a group of PC and telecom industry leaders including Compaq, DEC, IBM, Intel, Microsoft, NEC and NORTEL. USB enables hot plug and play of computer peripherals outside of the workstation eliminating the need to install cards into expansion slots and then having to reconfigure the system. Workstations equipped with USB will allow peripheral devices to be automatically configured as soon as they are physically attached - without the need to reboot or run setup. USB also allows up to 127 devices to run simultaneously with peripherals such as monitors and keyboards acting as additional plug-in-sites, or hubs.

USB peripherals will include telephones, modems, keyboards, mice, CD-ROM drives, joysticks, tape and floppy drives, scanners, and printers. USB has a 12 Mbits/sec data rate, compared to 115.2Kbits/sec for serial ports and 2Mbits/sec for enhanced parallel ports. This improved transfer rate will accommodate a new generation of peripherals, including MPEG-2 (compressed data) video based products and digitizers.

Drawing its intelligence from the host workstation, USB will detect when devices are added and removed. USB automatically determines what host resource each peripheral needs, including driver software and bus bandwidth, and makes those resources available without user intervention.

Currently, there are different ways to implement USB. The Compaq Professional Workstation 6000 and 8000 implement the OpenHCI USB interface. OpenHCI reduces CPU overhead for USB devices compared to other implementations and is fully compatible with UniversalHCI.

Currently, Microsoft NT Workstation 4.0 does not support USB, but future versions are expected to include USB drivers that will allow the workstation to recognize USB peripherals.

Please refer to the Universal Serial Bus whitepaper for additional information on this topic.

## CHASSIS AND SERVICEABILITY FEATURES

The chassis for Compaq Professional Workstation 6000 and 8000 has been designed to optimize both expandability and serviceability. Both systems come standard in a 10 bay minitower form factor. The main features of this workstation chassis are:

- 10 bays (7 available; 1/3 height bay occupied by 3.5" floppy drive, 1/2 height bay occupied by CD-ROM and one 1" hard drive cage bay occupied by 2GB or 4GB hard drive), 2-5.25" and 5-3.5" available
- Hard drive cage supporting up to 6- 1" hard drives or 4- 1.6" hard drives
- Locking removable media door and front bezel to inhibit unauthorized access to drive bays
- Volume, Microphone and Headphone jacks located on the front of the chassis
- Easy access (tool-less) to internal components through small access panel on the top or large access panel on the side of the workstation

- Quick access to all system components through modular design and simple levers to remove the entire processor cage or I/O cage.
- Tool-less access to I/O slots for easy addition of PCI and ISA cards.
- Optional rack conversion kit available for both the Compaq Professional Workstation 6000 and 8000. Both systems are 5U allowing for up to 8 workstations in a standard Compaq 42U rack. This provides customers with a high density, space saving solution for compute intensive applications such as a render farm for 3D animation, or analysis workstations being used for finite element analysis.
- Complete access through front and rear only. Simplifies service and upgrades, especially in a rack configuration.

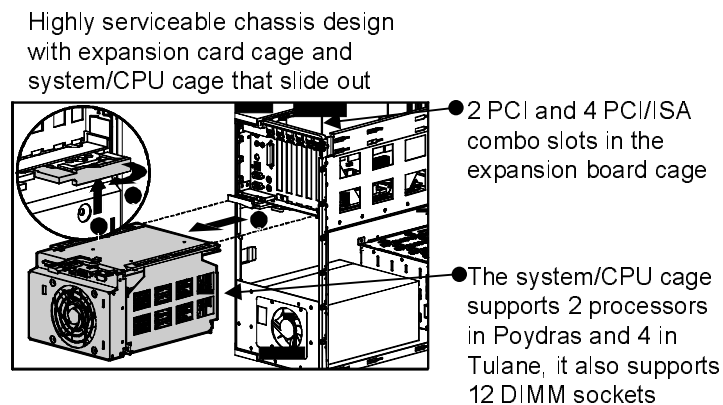
Compaq continues to deliver products that lower the total cost of ownership. The flexible new Compaq Professional Workstation 6000 and 8000 chassis design continues that focus by including features that provide for maximum serviceability and ease of maintenance. Some of the main serviceability features are:

**Easy access to internal components.** This minitower chassis provides front, rear, top, and side access for service or upgrade tasks. Most of the major chassis elements are removable without the use of tools. This reduces the time it takes to access the internal components of the system and enables upgrades and maintenance to be performed quickly.

**Removable I/O cage.** Access to the PCI and ISA slots is done easily with access from the top by removing the small access panel or access from the back of the workstation. Access from the back of the workstation is made easy because the entire I/O cage is rail-mounted in a lever-actuated quick release cage that allows its quick removal and replacement. This allows for quick and easy installation of additional expansion boards.

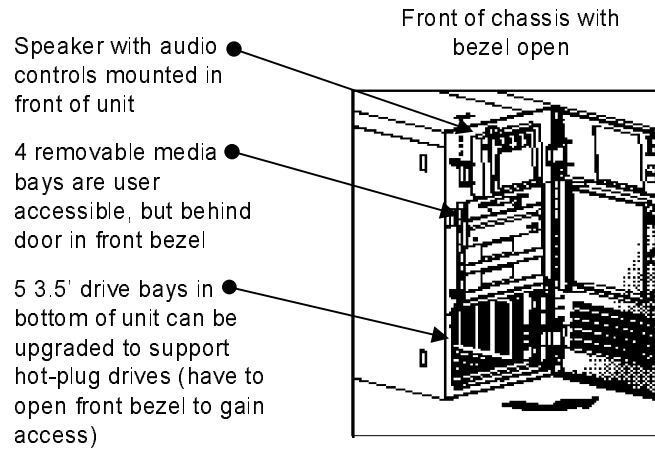
**Removable processor and memory cage.** The processors and memory are located in the processor and memory cage. This cage, similar to the I/O cage, is easily removed from the back of the workstation because it is also rail-mounted in a lever-actuated quick release cage. Simply pull the lever and slide the processor and memory cage out from the back of the workstation. This allows for quick and easy upgrades of both system memory and processors.

**Diagram 5-1: Serviceable Chassis Design**



**Lockable, removable front bezel.** Access to the front of the system is made easy with a removable front bezel. This bezel provides easy access to the removable media bays and the hard drive cage.

Diagram 6-2: Serviceable Chassis Design



**Rackable.** The ability to reconfigure a Compaq Professional Workstation 6000 or 8000 quickly and easily from a minitower to a rack and back to a minitower enclosure provides for end-of-life redeployment and protection of the hardware investment.

Overall, the Compaq Professional Workstation 6000 and 8000 minitower is designed for easy access to components, which reduces the down time associated with upgrades and field replacement, reduces the required skill level for performing routine maintenance, and therefore helps to reduce the total cost of ownership for Compaq Professional Workstations.

## ENHANCEMENTS TO THE WORKSTATION SOFTWARE PLATFORM

The workstation software platform is consistent across all workstation products including the Professional Workstation 5000, The Compaq Professional Workstation 6000, and The Compaq Professional Workstation 8000. As a result, customers can rely on a single software platform to deploy any Compaq workstation product.

This section will highlight the enhancements to the workstation software platform that were made since the introduction of the Professional Workstation 5000. For a complete overview of the software platform, please refer to the Compaq Professional Workstation Software Platform White Paper.

## COMPAQ SMARTSTART FOR WORKSTATIONS

SmartStart for Workstations provides flexible, optimized installation and integration of the operating system, support software, and interoperability applications.

The following table describes enhancements that were made to SmartStart for Workstations.

**Table 8: Enhancement to SmartStart for Workstations**

Feature	Function	Benefit
<b>Pre-Install Inspect</b>	<b>NEW</b> – Recognition and support of SCSI hard drive attached to Compaq SMART Array Controllers.	Enables customers to use SmartStart on disk array configurations.
<b>Hardware Setup and Configuration</b>	<b>NEW</b> – Setup has been enhanced to support Boot Order Control for the Compaq SMART Array Controllers.	Allows workstations to boot from a Compaq SMART Array Controller.
<b>Workstation Optimization Manager (Optimizer)</b>	<b>NEW</b> – Optimizer now automatically installs Matrox, ELSA, and ESS Win NT drivers. <b>NEW</b> – By removing unnecessary prompts and billboards, Optimizer's performance has been improved by 67%.	Saves installation time by preventing the user from having to locate and load drivers manually. Optimizer installs software faster.
<b>Try and Buy Applications</b>	<b>NEW</b> – Hummingbird UNIX interoperability software now supports both Windows NT 4.0 and 3.51.	It is no longer necessary for customers to request the Windows NT 4.0 version.
<b>Translations</b>	<b>NEW</b> – SmartStart for Workstations has been translated into Japanese, German, French, Dutch, and Italian.	Supports customers requiring targeted languages other than English.

**Transition of Windows NT 3.51 Device Drivers to the Compaq Web Site**

SmartStart for Workstations handles the hardware preparation and automatic driver installation for Windows NT 4.0. With SmartStart for Workstations 1.1, Windows NT 3.51 users can continue to use SmartStart to prepare their hardware for operating system installation. However, appropriate Windows NT 3.51 device drivers are only available from the Compaq Web site. Once downloaded, customers can automatically install device drivers using the Compaq SSD for Windows NT setup program. This program will detect the hardware and automatically install the right drivers. Detailed Windows NT 3.51 installation instructions are included on the Compaq Web site.

**UNIX/HOST INTEROPERABILITY**

Compaq understands the need to access information and applications on UNIX and other corporate networks. To deliver high-performance interoperability solutions, Compaq continues to partner with Hummingbird Communications Ltd. Hummingbird develops world-class PC internetworking and document distribution software solutions designed for seamless integration with corporate networks.

Compaq includes Hummingbird PC X server and Network File System (NFS) solutions as well as TCP/IP application suites for Windows NT as integral components of Compaq's workstation software. You can access networked information and applications, such as:

- **UNIX applications from NT desktops:** Hummingbird Exceed 5 for Windows NT, the industry's leading PC X server software, enables NT users to access and display UNIX, VMS, Ultrix, and supercomputer applications in windows on the NT desktop.
- **UNIX OpenGL 3D applications from NT desktops:** Hummingbird Exceed 3D is an OpenGL X Window System extension. When used in combination with Exceed 5 for Windows NT, Exceed 3D facilitates access and display of compute intensive network-based distributed 3D applications.
- **IBM applications from the NT desktop:** Hummingbird Exceed 5 and NFS Maestro for Windows NT include TN3270 for client-IBM MVS and VM connectivity as well as TN5250 for client IBM AS 400 and System 38 connectivity.
- **Files resident on UNIX Network File System (NFS) from NT desktops:** Hummingbird NFS Maestro and Maestro Solo provide high-performance connectivity of Windows NT clients to NFS servers.

All Hummingbird applications included on the SmartStart for Workstations CD now include support for both Microsoft Windows NT 4.0 and 3.51.

## MANAGEMENT FEATURES

The Professional Workstation provides asset, fault, performance, security, and support software management features. The table below illustrates enhanced management functionality.

**Table 9: Enhanced workstation management functionality**

<b>Management Software</b>	<ul style="list-style-type: none"> <li>• <b>NEW</b> - The <b>Compaq Management CD</b> is shipped with every unit. It includes Compaq Insight Manager and the Compaq Systems Management Toolkit for remote workgroup management. (Compaq management software used to be included on the SmartStart for Workstations CD)</li> <li>• <b>NEW</b> - <b>Compaq Setup</b> has been updated to support Boot Order Control for workstations configured with a Compaq SMART Array Controller.</li> </ul>
<b>Fault</b>	<ul style="list-style-type: none"> <li>• <b>NEW</b> - <b>SMART<sup>1</sup> SCSI Hard Drive Predictive Fault Monitoring</b> – Compaq Insight Manager now provides continuous polling of the Wide-Ultra SCSI hard drive to detect predictive faults.</li> </ul>
<b>Performance</b>	<ul style="list-style-type: none"> <li>• <b>NEW</b> - <b>PCI Bus Utilization</b> – Compaq Insight Manager now provides real-time PCI bus utilization rates.</li> </ul>
<b>Support Software</b>	<ul style="list-style-type: none"> <li>• <b>NEW</b> – The <b>Compaq SSD for Windows NT SoftPAQ</b> is now available from the Compaq Web site as either a complete driver package for workstations and servers, workstations only, or as individual device drivers for video, audio, SCSI, and NIC. This repackaging of the SSD represents reduced download times. For example, using a 28.8kbps modem, customers can download an updated SCSI driver, with NT SSD setup and auto-install capabilities, in just 4 minutes versus the 24 minutes it takes to download the entire NT SSD.</li> <li>• <b>NEW</b> – Downloadable Compaq SSD for Windows NT SoftPAQs no longer require the user to create diskettes prior to installation. This translates into a time-savings of up to six minutes for the workstation-only NT SSD.</li> </ul>

<sup>1</sup> Self-Monitoring, Analysis and Reporting Technology

# APPENDIX:

## QUESTIONS AND ANSWERS

### System Design

**Q. Will the new Highly Parallel System Design provide improved system performance for all applications?**

**A.** This new design does provide improved performance for most workstation class applications that stress the system's processing power, as well as memory and I/O subsystems. To ensure the best possible performance memory should be placed in both the system board and memory expansion board DIMM slots. Since the memory slots on the system board and the memory slots on the memory expansion boards are associated with separate memory controllers, splitting the memory between these two areas allows for concurrent access to the dual memory controllers which increases performance in demanding applications. This is especially true for customers using large data sets in the CAD/CAE and DCC segments.

**Q. Is this new design a proprietary Compaq design?**

**A.** The Highly Parallel System Architecture design is based on industry standard components. Thus, if customers need to upgrade components such as memory or hard drives, they are not limited to Compaq-specific solutions.

### Processors

**Q. What is the expected upgrade path for the Compaq Professional Workstation 6000?**

**A.** Intel is currently indicating that future versions of the Pentium II processor will have faster clock speeds along with larger cacheable address spaces. The future processors will also use the Single Edge Contact cartridge design making them compatible with the Compaq Professional Workstation 6000 design.

**Q. What is the expected upgrade path for the Compaq Professional Workstation 8000?**

**A.** Currently, Intel has not indicated they will provide an upgrade to the 200MHz Pentium Pro processor. And since the processor form factor has significantly changed beginning with the Pentium II, it is highly unlikely that the Pentium Pro series will be extended beyond the current 200MHz processor.

**Q. Is the Compaq Professional Workstation 8000 upgradable to the Pentium II processor?**

**A.** Although it is possible to replace the Compaq Professional Workstation 8000 system board with a Compaq Professional Workstation 6000 system board, which uses the Pentium II processor, this is not a recommended or supported upgrade.

### Usage

**Q. Can either the Compaq Professional Workstation 6000 and 8000 be deployed as a server?**

**A.** Although several features of the Compaq Professional Workstation 6000 and 8000 have been leveraged from server technologies, these workstations are not supported as servers. Among the major differences between a server and these workstations are:

- Compaq servers support multiple network operating systems while the Compaq Professional Workstation 6000 and 8000 primarily support Microsoft Windows NT Workstation (with some support for Windows 95 and Solaris)
- Servers provide redundant features for high availability. These features are not included with the Compaq Professional Workstations since they are not particularly useful in the targeted applications.
- The workstations provide capabilities such as 3D graphics which are not available or required for the server products
- These workstations are tested and certified to run specific applications such as CAD and 3D animation. Servers are designed to support deployment into environments such as file and print, database and application servers.

## System Board

- Q. What chipset does the Compaq Professional Workstation 6000 and 8000 use?**
- A. The Compaq Professional Workstation 6000 and 8000 use an standards based solution from Reliance Computer Corporation (RCC). This solution is available to other OEMs and is fully X86 compatible. It is implemented on The Compaq Professional Workstation 6000 and 8000 to enable the Highly Parallel System Architecture.
- Q. Is Compaq the only company using the RCC chipset in its workstation products?**
- A. Currently, Compaq is the only NT/X86 workstation provider using this chipset.
- Q. Will Compaq continue to support the RCC chipset in future workstation products?**
- A. Compaq will continue to evaluate new technologies as they become available. As always, those technologies that provide the best performance using the target segment applications will be incorporated in future workstation products.
- Q. What advantages does the RCC chipset provide over the Intel 440FX chipset in the Compaq Professional Workstation 5000?**
- A. The RCC chipset allows for the use of dual memory controllers. This represents a significant feature of the highly parallel architecture implemented in the Compaq Professional Workstation 6000 and 8000. This design provides a significant bandwidth improvement over traditional workstation designs using the 440FX chipset.

## Memory

- Q. Is the Compaq Professional Workstation 5000 memory interchangeable with the memory on the Compaq Professional Workstation 6000 and 8000?**
- A. No. However, the Compaq Professional Workstation 6000 and 8000 use the same memory as the ProLiant 2500.
- Q. Do the Compaq Professional Workstation 6000 and 8000 support Synchronous DRAM (SDRAM)?**
- A. No. By interleaving EDO memory, the Compaq Professional Workstation 6000 and 8000 achieve the same transfer rate as SDRAM while maintaining customer investment in EDO memory.
- Q. What are the benefits of having DIMM slots on the system board and a memory expansion board?**

- A. The memory architecture design in the Compaq Professional Workstation 6000 and 8000, includes dual memory controllers. To maximize performance, one memory controller is dedicated to the DIMM slots on the system board and the other memory controller is dedicated to the memory expansion board.

Additionally, the combination of the system board and memory expansion board provides a total of twelve DIMM slots. This design enables expansion of the Compaq Professional Workstation 8000 system memory to 3GB using 256MB DIMMs and also allows customers to reach higher memory levels using less expensive, 16-bit technology. For example, a customer with 256MB of memory installed (four-64MB DIMMs) in a Compaq Professional Workstation 6000 can add eight more 32MB DIMMs to reach the maximum system memory. This is significantly less expensive than using higher density memory.

## Bus Technology

- Q. Do the Compaq Professional Workstation 6000 and 8000 provide support for infrared?**

- A. Infrared has been included in the design of the Compaq Professional Workstation 6000 and 8000. Currently, infrared is supported with Windows 95 and is expected to be supported in future versions of Windows NT. In addition to operating system support, customers will need to purchase a transceiver that plugs into the IR port. This transceiver is a readily available Compaq option.

## Graphics

- Q. Do the Compaq Professional Workstation 6000 and 8000 support Intel's Advanced Graphics Port (AGP)?**

- A. AGP is a forthcoming technology that is currently not available for implementation. Once available, AGP will provide for optimized transferring of texture data directly from main memory to the frame buffer. Today, the ELSA Gloria-L and the Diamond Fire GL 4000 have local texture memory providing a very tightly coupled high bandwidth path between texture memory and the frame buffer.

- Q. Do the Compaq Professional Workstation 6000 and 8000 use the same 2D graphics solution as the Compaq Professional Workstation 5000?**

- A. The Compaq Professional Workstation 5000 uses the Matrox MGA Millennium while the Compaq Professional Workstation 6000 and 8000 use the next generation Matrox MGA Millennium II.

- Q. Have there been any enhancements to the ELSA Gloria-L since it's introduction with the Compaq Professional Workstation 5000?**

- A. ELSA has delivered a new OpenGL device driver significantly improving performance compared to the levels first published on the Compaq Professional Workstation 5000. For example, the original CDRS score published for the Compaq Professional Workstation 5000 was 10.5. With the new driver the CDRS score is now 20.2 for the Compaq Professional Workstation 5000. The new driver will be available with SmartStart 1.1 or on Compaq's website at [www.compaq.com](http://www.compaq.com).

- Q. Why is Compaq offering both the Gloria-L and Fire GL 3D graphics controllers?**

- A. The Gloria-L, which is also available in the Compaq Professional Workstation 5000, offers tremendous price/performance for 3D graphics users in the CAD and DCC segments who need to work in a variety of screen resolutions and color depths.



The Fire GL 4000 is based on technology from Evans and Sutherland (E&S). E&S has been a leading supplier of graphics technology in the RISC/UNIX world for 30 years and is now bringing their expertise to the NT/X86 platform. The new Fire GL 4000 provides high-performance 3D capabilities for customers working in demanding, true color environments.

**Operating Systems**

**Q. What level of support will Compaq provide for operating systems?**

A. The matrix below provides our operating system support plan:

Operating System	Testing	Certification	Install, Config & Setup	Usage	Management Support	Hummingbird Support	LEX
Microsoft Windows NT Workstation 4.0 and 3.51	Compaq	Microsoft	Compaq	Compaq	Full	Full	No
Microsoft Windows 95	Compaq	Microsoft	Compaq	Compaq	POST Compaq Utilities	Hummingbird	No
SunSoft Solaris Intel Edition	SunSoft	SunSoft	SunSoft	SunSoft	None	None	No

**Q. Is there a difference between the Win NT operating system supplied with a Compaq Professional Workstation 6000 versus a Compaq Professional Workstation 8000?**

A. Yes. The Compaq Professional Workstation 6000 includes a version of Win NT 4.0 that supports up to two processors. The Compaq Professional Workstation 8000 includes a version of Win NT 4.0 that supports up to four processors.

**Software Installation and Set-up**

**Q. What specific drivers and utilities will SmartStart for Workstations install?**

A. SmartStart for Workstations will now automatically install all the drivers required to make the workstation operational. These drivers include: ELSA Gloria-L 3D Graphics, Matrox MGA Millennium II 2D Graphics, ESS 1868 Audio Support, NetFlex-3, and Integrated Wide-Ultra SCSI. The following Compaq files are also installed: Integration Manager, License Manager, Release Notes, Safety and Comfort Guide, and the Workstation Reference.

**Q. How does a customer install the management software?**

A. There are setup programs located on the Compaq Management CD for Compaq Insight Manager as well as the Insight Management Agents.

**Q. Since Windows NT Workstation 3.51 is no longer supported by SmartStart, how does a customer install it?**

A. Instructions for installing Windows NT 3.51 are posted to the Compaq Web site in the Technical Help and Services section under Downloadables. The basic steps are as follows: (1) Prepare workstation by booting SmartStart to validate the diagnostic partition and run Setup; (2) Install Win NT 3.51; (3) Download the latest NT SSD from

the Web site and run Setup to automatically install required Win NT device drivers; (4) Install appropriate Compaq utilities.

**ISVs**

**Q. Have any other ISV relationships been formed since the introduction of the Compaq Professional Workstation 5000?**

**A.** In October 1996 Compaq announced relationships with leading ISVs in the CAD, finance and digital content creation market segments. We are continuing to build on this portfolio of solutions and have added a host of new vendors. In addition we are announcing an expanded offering in the mechanical design automation space with an emphasis on Computer -Aided Engineering CAE. The following is a current list of those ISVs we have working relationships with:

<u>CAD</u>	<u>CAE (new)</u>	<u>DCC</u>
AutoDesk	Ansys* (new)	Adobe*
Bentley	Fluent* (new)	Kinetix*
EDS	MSC* (new)	Macromedia
Intergraph (new)	Mechanical Dynamics, Inc (new)	Mental Images*
PTC	PTC* (new)	
SDRC	SDRC (new)	
Solidworks (new!)		

**FINANCE**

Infinity (new)	NeoVision Hypersystems, Inc (new)
MarketNet	Numerical Algorithms Group (new)
NAG *(new)	Applix (new)
Bloomberg (new)	
Dow Jones Markets	
Reuters	
Midas-Kapiti (new)	
Visual Numerics, Inc *(new)	

\* Indicates participation in the MP initiative