

Why choose a Personal Workstation?



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Introduction

Professionals prefer to use the highest-quality, highest-performing tools. Such tools best enable the talents of an engineer, animator, analyst/trader, or a programmer, allowing them to express themselves, their vision, and their skills to the greatest effect. The result is that organizations employing these tools get products to market more quickly, and with higher quality than organizations that employ lesser tools.

One of the key tools used by any professional today is their desktop computer system—a system that may range from a low-end PC to a high-end workstation. Workstations are designed to meet the requirements of a number of specific markets and applications. Typical application areas that benefit from the advantages of a personal workstation include:

- **Power office users:** day-to-day users that perform complicated and data-intensive office functions. This includes graphics, video and web design (Adobe Photoshop/Illustrator/After Effects/Premier/Dreamweaver/Flash), complex linked calculations, database storage/access and spreadsheet manipulations (Microsoft Office suite), not to mention areas where there is a high degree of collaboration with engineering organizations (graphics and/or database management software).
- **Design and simulation in engineering and manufacturing:** including Mechanical Computer Aided Design (MCAD), Computer Aided Engineering (CAE), and Electronics Computer Aided Design (ECAD)—from aeronautics to automotive, industrial design to product prototyping and simulation.
- **Digital Content Creation (DCC) and entertainment:** for worry-free graphical performance in modeling, animation, rendering, non-linear video editing, and graphic arts.
- **Financial applications:** where quad and higher monitor support ensures that the maximum amount of information is on hand in real time to keep pace with today's busy markets; and/or where computationally intensive financial analysis is required.
- **Geographical Information Systems (GIS):** requires desktop systems with high-end capacities for modeling, topological overlays, data acquisition, and integration for all kinds of surveys.
- **Architecture, engineering, and construction (AEC):** the planning for a major project is usually carried out with the help of workstations such that clients and engineers alike can see the final outcome long before ground is broken, thanks to photo-realistic rendering.
- **Public Sector:** State, local, federal and international agencies require workstations for a broad variety of tasks, ranging from GIS and CAD type work to meeting security and law-enforcement needs. Law enforcement particularly requires the high performance and reliability of a workstation on which to conduct cyber-media forensics and analysis which will stand up in court.

Generally, the kinds of users that place heavy demands on their personal computing system need to get a job done quickly, error-free, and at the lowest cost possible. Characteristics of systems that will help accomplish this include:

- Reliability
- Superior return on investment
- High performance
- Robust and reliable applications
- Professional high-performance graphics
- Professional service and support

This paper helps users with tougher computing demands determine if a personal workstation is right for them. It will help IT departments make a choice that provides the best return on investment, and the best hardware match available for users' applications.

Workstation Advantages

A review of the specific features of a workstation provides background for making a decision on whether a workstation is the right choice. These features can be broken down into product features, operating environments (software), graphics, and packaging/chassis design.

Product Features

More Processing Power

The tough computational demands of workstation applications often requires the use of high-performance processors such as the AMD® Opteron™ and Intel® Xeon® processors. These processors support multiprocessing (having more than one processor on the system bus), and generally allow multi-core (having more than one processor core in a single socket). For example, a typical high-end workstation configuration has two dual core processors, resulting in four processor cores in a single enclosure¹.

All modern operating systems that run on workstations (e.g., Microsoft® Windows® and Linux) take advantage of multiple processor cores, either through multitasking (running multiple applications simultaneously) or multithreading (running parts of a single application simultaneously). The use of multiple processor cores in either environment allows for balancing the processing load between processors and reducing overall application time-to-solution and increasing user response time.

For example, Adobe® Photoshop has computationally intense effect filters that can be applied faster when the computation is shared across multiple processor cores – the more cores, the better the performance. Plus, having additional cores allows the user to both improve Photoshop response time while also offering additional compute resources to multitask with other applications at the same time. The upcoming Microsoft Office Excel 2007 spreadsheet tool has also been optimized to take advantage of multiple processor cores, and the powerful floating-point capabilities of the AMD Opteron and Intel Xeon processors provide excellent support for the power office user.

Finally, the choice of processor technology and wide range of configuration options allow personal workstation users to “match the power to the problem;” to select the processor technology that best fits the needs of specific applications.

32- and 64-bit Processing

The performance and processing capacity of newer processors allows users to utilize a 64-bit address space, greatly increasing problem solving capabilities². Workstations with these processors and an appropriate operating system (e.g., Microsoft Windows XP Professional x64 Edition, Linux) can handle traditional 32-bit applications side-by-side with large, 64-bit capable applications³.

¹ Dual Core is a new technology designed to improve performance of multithreaded software products and hardware-aware multitasking operating systems and may require appropriate operating system software for full benefit; check with software provider to determine suitability; Not all customers or software applications will necessarily benefit from use of this technology.

² 64-bit requires a computer system with a processor, chipset, BIOS, operating system, device drivers, and applications enabled for Intel 64-bit processor will not operate (including 32-bit operation) without a 64-bit enabled BIOS. Performance will vary depending on your hardware and software configurations. See www.intel.com/info/em64t for more information including details on which processors support Intel EM64T or consult with your system vendor for more information.

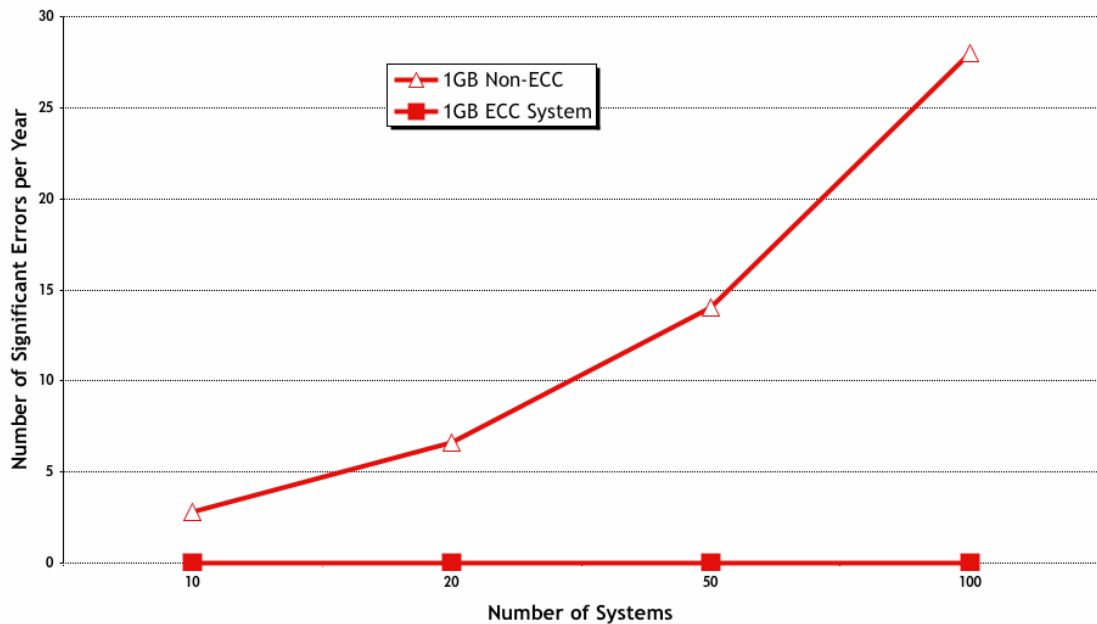
³ See “Advantages of 64-bit Processor Technology in Workstation Applications,” HP, July 2005.

More Robust Memory Subsystems

Plenty of memory is important to ensure the balance between application, data, and operating system requirements, especially in a 64-bit environment. For example, large physical memory is required to work interactively with larger models or to "render to RAM" for a fast preview of a movie frame or model.

However, computer memory is susceptible to "soft errors"—errors caused by events that occur naturally and are nearly impossible to eliminate. As the amount of memory grows, both by amount of memory in individual systems and aggregate memory within an organization, the probability of soft memory errors increases. A soft memory error can easily result in corrupted data, application execution errors, or even system crashes.

Figure 1. Memory errors per year for non-ECC memory. Note that for ECC memory, the number is always zero.



To eliminate the effects of soft memory errors, workstations typically support Error Checking and Correction (ECC) memory, a server-like feature that contains circuitry that automatically detects and corrects single-bit errors. As shown in Figure 1, ECC memory eliminates single-bit soft memory errors. In addition, higher end workstations also support registered DDR-SDRAM⁴. Registered memory allows larger and more cost-effective memory configurations.

High Performance and Expandable I/O Subsystems

Additional I/O performance and capacity are important to workstation applications and the large files that they often generate. Many workstations use hard drives with higher rotational speeds—this reduces latency and increases data transfer bandwidth. For example, personal workstations routinely employ disk technology such as 15,000 rpm SCSI or 10,000 rpm SATA 3 Gb/s drives. Workstations also use higher-performance interfaces, for example Ultra320 SCSI.

Workstations can manage a large number of connected devices and, in some cases, have high-bandwidth buses to ensure the fastest data transfer rates. Workstations usually have a large complement of PCI slots and standard I/O ports (such as Gigabit Ethernet, Firewire 800 and USB

⁴ Double Data Rate Synchronous Dynamic Random Access Memory

2). Many workstations also support integrated SATA 3 Gb/s with RAID capability and integrated multi-channel SCSI controllers. Since these standard ports are often integrated onto the main system board, PCI Express slots are freed for other purposes such as expansion cards used in non-linear video editing.

Other I/O benefits include providing multiple PCI Express lanes (at 5.0 Gbits/sec per lane, bidirectional) for PCI Express cards, and especially the high performance of the x16 (8 Gbytes/sec bidirectional) channels for graphics support.

Operating Environments

Workstations often possess a number of advantages when using operating systems, such as Microsoft Windows XP, or Red Hat Linux.

Microsoft Windows

Microsoft Windows operating systems are by far the most popular workstation operating systems. Windows is the standard, with the greatest amount of mature applications ported and optimized. In addition, Microsoft Windows allows simultaneous use of standard productivity suite software along with other applications. The workstation group within HP has a dedicated Windows R&D team with over twenty years of experience and provides the foundation of enabling, testing and supporting Windows on all HP workstation platforms.

Examples of the solutions that this team has developed specifically for workstations include:

- A single boot on initial power-on.
- A recovery process set up to boot to recovery by default.
- A recovery process that loads all correct drivers by default.
- A single point of support
- HP provides OS bug fixes on preinstall, recovery media and availability on the web.

Linux®

Customers looking for an UNIX-like environment, high levels of programmability, or lower licensing costs are often interested in Linux. HP was the first vendor to offer pre-configured, fully tested and supported Red Hat Linux on workstations, and has in-depth experience with desktop and clustered Linux implementations.

HP has a dedicated Linux R&D team that has 20+ years of experience developing UNIX® libraries and device drivers, The team provides a foundation for enabling, testing, and supporting Linux on HP Workstations.

HP allows users to customize their own Linux image. The new HP Installer Kit for Linux facilitates the installation of various Linux operating systems, allowing users to make their own image, and to customize Linux to meet their needs. Preloaded/preconfigured Linux is also available for those users that prefer their workstations to run right out of the box. HP qualifies and delivers an engineered solution of Red Hat Linux tailored to each HP Workstation platform. This includes the latest driver updates.

HP provides a single point of support for hardware, operating system, and warranty concerns. In addition, HP offers extremely flexible support solutions for Red Hat Linux by reducing the number of necessary releases. HP's technical support people are well versed in Linux technology, permitting them to assist customers with a wide variety of questions or issues.

The HP Linux R&D team works closely with the leading Independent Software Vendors, graphics vendors, Red Hat, and other open-source providers to provide reliable, turn-key solutions. HP meets regularly with major graphics vendors to discuss issues relevant to accelerated OpenGL graphics on HP workstations. Accelerated graphics drivers are closed source and are not in Red

Hat distribution because Red Hat will only support open source drivers. The HP closed source drivers match users' performance demands and provide higher levels of software quality.

HP provides a Linux solution on workstations that offers the freedom and flexibility of an open source development technology combined with the convenience of a single point of accountability. HP is a strong supporter of the Linux Standards Base and is active in strengthening the open source community through organizations such as the Open Source Development Lab, Free Standards Group, GNOME Foundation, KDE League, and Apache Foundation.

ISV certification

ISV certification is a critical factor for HP workstations, and may be a key reason to purchase a workstation. HP can offer certified application support through the power of its relationships with IHVs (Independent Hardware Vendors) and ISVs (Independent Software Vendors). HP has excellent relationships with leading application and hardware vendors so they can offer powerful application solutions for popular application areas such as:

- Mechanical Computer-aided Design (MCAD)
- Mechanical Computer-aided Engineering (MCAE)
- Digital Content Creation (DCC)
- Financial markets
- Oil and gas
- Geographic information systems (GIS)
- Software development
- Scientific research
- Electronic Design Automation (EDA)

HP supports an extensive list of application vendors for each of these industry segments, and works closely with these vendors to ensure a high-quality, highly optimized application on HP workstations.

HP engineers are often on-site at leading ISVs to ensure that their workstations will pass the most rigorous tests. For example, some application regression tests may require as many as 10,000 iterations to ensure completeness. This work has two goals—the first is to ensure that an ISV's application is certified on the workstation—passing a battery of tests to ensure that the possibility of any software/hardware conflicts are minimized. The second is to achieve the best application performance possible on HP Workstations.

ISV certification delivers a high degree of compatibility of the application on the HP hardware, and promotes the maximum possible application performance. In addition to the ISV performance testing, industry-standard or publicly available benchmark tests are used to measure actual application performance in an environment as close as possible to what the user will experience.

Optimization of subsystems and BIOS settings enables the compatibility of some applications and hardware solutions. All of this effort provides a high-level of assurance to the user that the application will run at top performance on the HP workstation.

Performance Tuning Framework.

The Performance Tuning Framework performs configuration optimizations based on a database of tuning options for specific applications. For example, some applications are able to take advantage of a feature in Windows XP that allows applications to address over 2 GB of memory—the framework recognizes these applications and automatically configures the system and the application to recognize the extra memory.

This software framework will guide your system setup, allowing a "custom" configuration that best matches the workstation to user requirements. This customization facilitates availability of the latest graphics cards and drivers and removes some memory restraints. It can be downloaded at no charge.

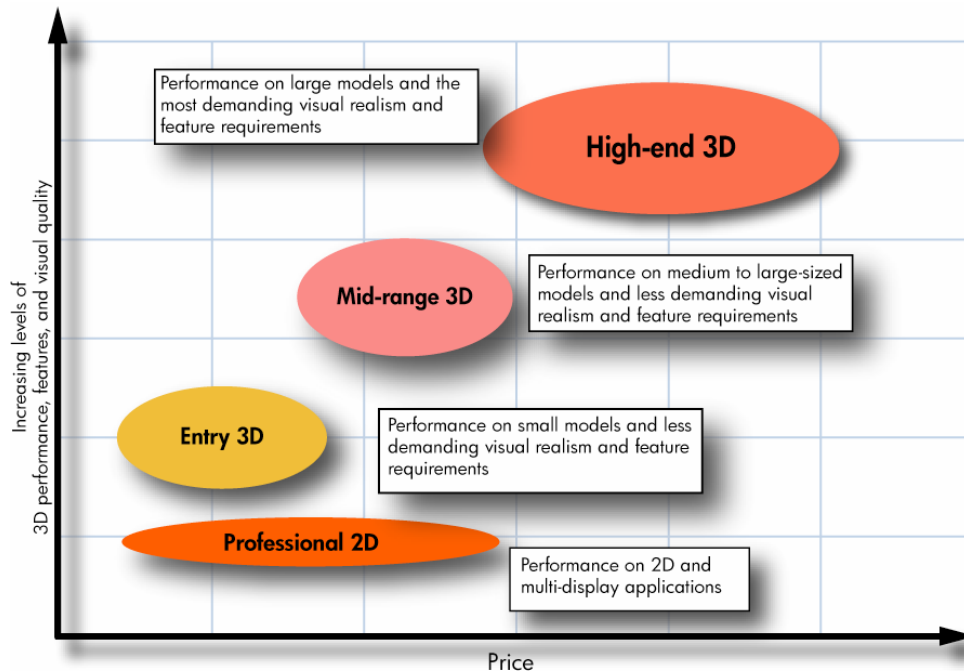
The framework also manages the organization of graphics drivers. It determines the best fit of the latest graphics driver to the selected applications, enabling important performance options if applicable. Further, the framework provides ongoing optimizations by automating the download, installation, and configuration of the most appropriate driver version.

The Framework's extensible design permits new configuration functionality and application support to be easily integrated over time. To facilitate the delivery of such new features, the Framework automatically updates itself when newer versions become available.

High-end Graphics

The graphics card plays a large part in defining the role of a workstation, as shown in Figure 2.

Figure 2. Workstation graphics segment positioning.



Workstations are designed to support the most powerful graphics cards. For example, these cards may offer 256 or 512 MB of fast DDR memory, have additional graphics pipelines and engines, and support higher graphics processing unit clock speeds. Workstations are able to support the additional power and cooling requirements of these cards. Further, most personal workstations are able to support multiple graphics cards—especially important where many displays are required, or a single display can take advantage of parallel graphics processing like NVIDIA's Scalable Link Interface (SLI)⁵.

HP has over 20 years experience in providing superior graphics technology—through seven generations of graphics accelerators development and across three operating systems. This Leadership Graphics Program combines HP's graphics expertise with available products to provide the industry's most expansive, fast, and flexible set of graphics solutions.

⁵ See <http://www.slizone.com/>

Current personal workstation products have a wide range of graphics devices available as either a standard offering (integrated with the workstation), or an “HP Tested and Certified” product—one that isn’t offered as an integrated option but is still completely tested and certified to work in an HP personal workstation.

HP’s Leadership Graphics Program is unique to the industry in:

- Expertise
- Strategic partnerships/ISV certification
- Feature and performance leadership
- Time-to-market advantage
- Broad product portfolio with a single point of support

HP has consolidated many of its graphics tests into a certification test suite. This test suite is distributed to graphics vendors for incorporation into their test plan. This has a noticeable increase in reliability and stability of industry-standard graphics products.

Finally, professional workstation-class graphics cards offer options that no low-end card can easily match, such as multi-monitor support for up to eight monitors, or multiple I/O options for professional video or TV connections.

Packaging and Chassis Design

Personal Workstations are noteworthy in another important way—that of chassis design. The workstation chassis must accommodate increasingly powerful I/O cards (and more of them), larger memory and disk capacities, and more and higher-performing (hotter) processors. Further, the workstation must be designed for security, ease of serviceability and upgradeability.

Because availability of a workstation and its applications is critical, serviceability is a primary concern to a corporation’s IT department. Serviceability means the ease with which internal workstation components may be accessed for upgrade, repair or replacement, and involves multiple facets of component access, including unobstructed access to components, tool-free removal of PCI and graphics cards, optical drives and hard drives. HP innovations in packaging are directly applicable to reduced deployment costs, increased efficiency of IT staff, and improved performance of service teams.

Another highly relevant workstation design element is that of acoustics and thermal management. HP workstations support active fan control technology that optimizes the fan speed for each system. The fans will adjust to actual power load, ambient air temperature, and CPU temperature to find the quietest fan setting with adequate cooling. This ensures that systems in more demanding environments get all of the cooling required to keep them running reliably.

Workstations also come standard with large power supplies. This allows for easier upgrades, while still maintaining power margins that provide a high level of reliability.

Why Choose a Workstation?

Given the array of product features, we can describe a set of reasons to choose a workstation. These reasons and their associated product features are described in detail in the following sections.

Higher System Reliability

Workstations are typically equipped with highly reliable technology. Features such as error checking and correcting (ECC) memory, larger power supplies, and more sophisticated cooling mechanisms ensure greater expandability while maintaining high reliability. Moreover, workstations are designed for quick (and often “toolless”) upgrades and repairs.

Applications and operating environments also exhibit a higher degree of reliability on a workstation. Programs such as the ISV certification program and on-site engineers (described below) greatly enhance the reliability of the software on a workstation.

Better return on investment

Workstations are designed to provide the IT organization with a better return on investment through a longer life cycle. Features that provide a longer life cycle include:

- Greater built-in expansion room for additional memory. Workstations typically have more memory slots, and accept higher density memory.
- A larger number of I/O slots. The large number of high performance I/O slots mean the workstation can support more peripherals, and can be redeployed for a longer life cycle.
- Processor upgradeability. In some cases, the workstations are upgradeable to higher-performance processors in-place, very effectively lengthening the useful life of the system.
- Toolless chassis design. The toolless chassis design means ease and flexibility of upgrading, reducing downtime.
- Larger power supplies. Larger power supplies in workstations mean that the system can be upgraded or expanded with additional I/O cards and/or high-end graphics cards.

Enhanced performance

Workstations are designed from the ground up for performance. Multiple features come together to provide enhanced performance for demanding workstation applications:

- More processor cores. More processors provide more aggregate performance, especially with today’s multitasking applications.
- More and faster I/O channels. Workstations support many more and higher performance I/O channels.
- More memory. Memory is a key requirement for running large models and increasing performance of interactive sessions.
- Applications Performance Tuning Framework. HP Performance Tuning Framework automatically manages graphics drivers and performs configuration optimizations to maximize performance and reliability (see below).
- 32- and 64-bit operating environments. A 64-bit processor allows users to generate much larger models and to manage a much greater amount of data in memory, instead of working the data back and forth to disk. With a 64-bit address space, personal workstations can efficiently utilize tens of gigabytes of physical memory.

Robust and reliable applications

ISV certification

Performance Tuning Framework.

The Performance Tuning Framework performs configuration optimizations based on a database of tuning options for specific applications.

HP has developed a configuration and application-tuning framework for technical workstation users who want to configure and tune their machines for optimal performance with certain third-party applications.

This framework is a utility that administrators can run on their workstations. The utility performs configuration optimizations based on a database of tuning options for specific applications. For example, some applications are able to take advantage of a feature in Windows XP that allows applications to address over 2 GB of memory—the framework recognizes these applications and automatically configures the system and the application to recognize the extra memory.

This software framework will guide your system setup, allowing a “custom” configuration that best matches the workstation to user requirements. This customization facilitates availability of the latest graphics cards and drivers and removes some memory restraints. It can be downloaded at no charge.

The framework also manages the organization of graphics drivers. It determines the best fit of the latest graphics driver to the selected applications, enabling important performance options if applicable. Further, the framework provides ongoing optimizations by automating the download, installation, and configuration of the most appropriate driver version.

Today’s workstations are composed of an infinite number of combinations of hardware and software components, operating systems, and applications. System setup is a very difficult task, given the enormous number of configuration possibilities. To reduce complexities, systems are frequently set up without considering the specific needs of the individual user.

The Framework’s extensible design permits new configuration functionality and application support to be easily integrated over time. To facilitate the delivery of such new features, the Framework automatically updates itself when newer versions become available.

Professional Graphics

The superiority of the graphics subsystems in workstations, as detailed in a previous section, clearly provides an advantage for graphic-intensive applications. Specifically, benefits of the HP workstation graphics include:

- 20+ years of experience in integrated graphics technology.
- Strategic partnership/ISV certification of graphics cards.
- High-performance, large memory graphics card support.

Remote Graphics

Exclusive to HP workstations, HP Remote Graphics Software is an advanced utility that allows a user to remotely access and share a graphics workstation desktop and all of its applications and datasets using the Internet. Underlying HP Remote Graphics Software is innovative multiple-patented HP technology. The core of this technology is a smart digital image compression method and a rapid image processing algorithm. With this technology, users can remotely access both 2D and 3D graphics across a network, while keeping performance and image quality high and network usage to a minimum.

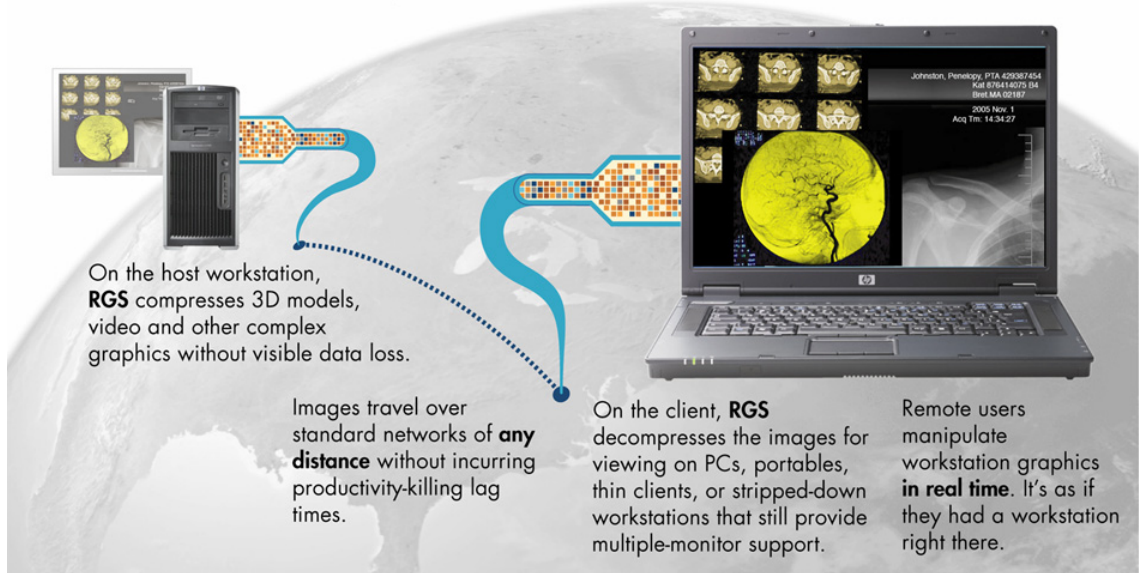
With HP Remote Graphics Software allows:

- Remote access to 2D & 3D graphics workstations

- Access to applications on different platforms such as Windows, Linux, and HP-UX
- Multi-user collaborations

How far do you want to roam?

HP's patented **Remote Graphics Software** delivers the power and speed of graphics workstations to remote users anywhere in the world.



Service and Support

HP offers industry-leading proactive, flexible support services that enable SMB customers to have a worry-free experience not only with their HP equipment, but also with other vendors' applications and products. This ensures that businesses will stay up and running and that data will be available and protected.

Conclusions

The best reason to buy a workstation is to improve productivity and increase return on investment. Some of the reasons to select a workstation include:

- Reliability
- Superior return on Investment
- High Performance
- Robust and Reliable Applications
- Professional High-performance Graphics
- Professional Service and Support

Application and operating system testing and certification, performance and graphics are also all critical elements of the users' productivity. All of these are important considerations when choosing the right product for your application and business requirements.

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