Advantages of HP personal workstation use in financial IT environments

Use of technology found in personal workstations generally improves return on IT investment in financial IT environments as compared to business desktop PCs. Elements of this improved ROI include higher levels of reliability, performance, and applications support.
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Executive Overview

Typical IT environments in financial institutions manage large volumes of high value transactions. For organizations to compete in this marketplace, they must make use of information technology effectively to ensure accuracy and security as well as to drive down operating costs.

IT managers are sometimes tempted to use low-cost PCs as a hardware platform for various financial applications, such as those found on the trading floor or in front office venues. While these platforms certainly have their place, critical financial applications significantly benefit from the technical robustness and capabilities of personal workstations. This paper describes the advantages of personal workstations in financial IT environments.

Personal workstations (especially those from HP) employ distinctly different technologies than those found in commodity PCs. In the case of HP workstations, many of these technologies are specifically chosen to provide the performance and reliability required by the financial industry. These technologies include enhanced implementations of standard Intel® processors and chipsets (including multiprocessor implementations), error detection and correction circuitry on memory subsystems, and expanded I/O subsystems.

Another major distinction of workstations is that of packaging and chassis design. The electromechanical design of HP workstations supports more and higher powered I/O cards, disk subsystems and multiple displays. Moreover, HP has tailored the packaging of one workstation model – the HP workstation xw6200 – specifically for the trading floor, providing a powerful multiprocessing system in the smallest enclosure in the industry.

Complementing superior workstation design and features are additional business benefits. HP makes specific investments in service and support of workstations and workstation applications, as well as tools for lifecycle and infrastructure management. HP has also initiated the formation of a Workstation Financial Advisory Council (WFAC) to facilitate collaboration on design of future generations of HP workstation products and solutions for the financial industry.

In summary, the Workstation Global Business Unit (WGBU) of HP, and in particular, HP personal workstation products, provide distinct advantages to financial industry customers, especially when compared to the benefits offered by use of traditional commodity PCs.
Introduction

Front office and trading activities require high levels of reliability and data integrity at a reasonable cost. Trading floor equipment must provide similar levels of reliability, while also supplying the highest levels of performance—given the environmental constraints of a crowded trading floor.

An IT professional managing this kind of environment has primary concerns about:

Reliability—systems must have the smallest amount of downtime possible (even when planned for activities such as moves, adds and changes). Of particular importance is reliability of internal system components (e.g., memory) to minimize data corruption or service interruptions.

Processing Power—highest levels of performance must be available at specific price points.

Environment—management of new and existing equipment within the constraints of the trading floor environment. Concerns include system packaging issues (footprint, cooling, acoustics, expansion and upgradeability), furniture requirements, placement of numerous monitors, and thermal management.

Connectivity options—the ability of a workstation to manage a large number of displays (usually four or more), and/or multiple network connections.

This paper illustrates the advantages of using personal workstations to address these concerns (especially when compared to use of a traditional desktop PC). The goal of this paper is to help IT departments make a choice that provides the best return on investment, and the best hardware match available for users’ applications. Additionally, this paper highlights when and why dual-processor workstations have a distinct advantage in the financial industry.

Comparison of Workstation and PC Technologies

Financial professionals prefer to use the highest-quality, highest-performing tools. Such tools best deliver short turn-around on data analysis, what-if scenario calculations, and database management functions. The features of a personal workstation provide this kind of toolset; these features are discussed (and contrasted to that of a PC) below.

Processor Implementations

The processor implementation is one distinction between workstations and PCs. Almost all desktop PC systems use the Intel® Celeron® or Pentium® 4 processor, while personal workstations use the Pentium® 4 or the multiprocessing Intel® Xeon® processor. The workstation processor implementations provide a tremendous advantage in support for higher performance (e.g., Intel’s Performance Acceleration Technology), dual processors, and reliability features (e.g., ECC memory).

Multiprocessing

One of the biggest advantages that workstations offer is multiprocessing. Adding a second processor in an existing enclosure a very cost-effective mechanism for increasing performance with only a small incremental investment. In a throughput sensitive environment (requiring many applications to be run simultaneously—which is common in this environment), an additional processor provides 1.5 to 2 times the processing power of a single-processor system (see Figure 1). This means that a financial trader, for example, gets results quicker, and is able to manage larger (more accurate) models than with a single-processor workstation.
Figure 1. Performance Improvements using the dual processing capabilities of the HP xw6200 Workstation.

Further, some financial applications (even Microsoft Office applications) are multi-threaded - able to use multiple processors simultaneously. This feature increases performance of a single application, reducing time-to-solution for complex calculations such as Monte Carlo simulations.

Figure 1 illustrates performance of a benchmark (“FinBench”) that is designed to model real-world stresses that financial applications place on workstation subsystems. FinBench performs 4 concurrent Monte Carlo simulations, and is a close representation of the types of loads placed on workstations in this environment. As Figure 1 illustrates, the benefits of the additional processor are significant.

Memory Subsystems

ECC Memory

Workstations typically support Error Checking and Correction (ECC) memory, a server-like feature that provides protection against soft errors in the memory that could lead to process and application failures. ECC memory is important to data integrity and system reliability because it detects and corrects “soft” (transient) single-bit memory errors—errors that are inherent to all DRAM-based systems1. If a desktop user is primarily running email and word processing applications, data integrity issues may not be too important, however, when each transaction may be worth millions of dollars, a zero flipped to a one (or vice-versa) could be disastrous.

Figure 22 illustrates an expected yearly error rate for a collection of systems, each with 1 GB of memory. The statistics rely on DRAM specification called a “FIT”—1 device fails in 1 billion hours. For a single DIMM with a 10,000 FIT, a soft error occurs every 3-4 months (for reference, the calculated average time between 2-bit soft errors is measured in millions of years). A customer with many systems with multiple DIMMs per system will experience a much higher overall failure rate, based on the total number of DIMMs. Further, this effect is compounded at elevated temperatures, common in many financial environments due to the close proximity of large amounts of IT equipment.

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1 These errors are most often caused by high-energy sub-atomic particles (cosmic rays) striking atoms in the DRAMs.

2 Please see “ECC and Soft Error Rate in a Real Customer Environment”, Hewlett-Packard, May, 2003.
Figure 2. Memory errors per year for non-ECC memory. Note that for ECC memory, the number is always zero.

The significance of these errors to end users depends upon many factors, including the pattern of application memory usage, which bit in a word is affected, and the sensitivity of the calculations to a single bit error. Taking these factors into account, perhaps 2% to 15% of soft errors will affect the result of a customer calculation significantly—resulting in incorrect answers, system crashes, or unpredictable application behavior.

For financial customers, whose success depends largely on the integrity of their data, ECC-based workstations provide dramatic improvements in data integrity. When considered in the context of down time, opportunity cost, and liability, the added benefit of superior data integrity makes a workstation with ECC an excellent investment for many customers.

I/O Subsystems

Additional I/O performance, flexibility, and capacity are important to financial applications and the large files that they often manipulate. Most HP workstations allow the flexibility of a wide range of disk subsystems, ranging from low-cost Serial ATA drives and interfaces to extremely high performance 15,000 RPM Ultra320 SCSI drives. Hard drives with higher rotational speeds reduce latency and increase data transfer bandwidth beyond that available on a PC.

In many cases, the use of very high performance disk subsystems has a significant benefit to application performance, and thus directly influences the productivity of the user. Figure 3 compares performance for different disk interface technologies (SCSI, parallel, and serial ATA) relative to a baseline SATA 7200 RPM drive using two benchmarks:

- File Server DriveMark 2002 – Intel-defined playback of disk access patterns; 80% read, 100% random.
- Web Server DriveMark 2002 – Similar to File Server DriveMark, but 100% read with few large block accesses.

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3 For additional information, please see "Performance Briefs: PATA, SATA & SCSI Disk Drive Performance", Hewlett-Packard, January, 2004
Figure 3. Relative performance of different disk technologies

The SCSI 15K drive is as much as 2.5x faster than the 7200 RPM drive and about 30-35% faster than the 10K drives. For those that need the best performance, regardless of cost, SCSI 15K is a great choice. The SATA 10K drive is also fast and represents excellent price/performance.

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, and USB 2.0). Since these standard ports are often on the main system board, PCI slots are available for other purposes such as expansion cards used in non-linear video editing or RAID controllers.

Figure 4. Illustrating the benefit of Native Command Queueing (NCQ)

You can see that a SATA drive with native command queuing offers 7-8% performance benefits over a SATA drive without NCQ when there are multiple outstanding I/O operations.
Operating Environments

Although both a business desktop PC and a workstation are likely to run very similar (if not identical) operating systems, such as Microsoft® Windows® 2000, or Red Hat Linux, there are still particular advantages that workstations possess.

**MS Windows**

Microsoft Windows is by far the most popular workstation operating system. 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 that provides the foundation for 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, and
- A single point of support.

HP also provides Windows OS bug fixes on preinstall and recovery media, and makes both available on the web.

**Linux**

While most financial customers are MS Windows users, there are some situations where Linux is employed – for example, in certain IT management environments.

For those situations, HP provides a “one-stop” 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. The result: if your choice is Linux, HP has the products and experience to directly influence your bottom-line cost of ownership.

**Packaging and Chassis Design**

HP Personal Workstations differ from business desktop PCs in another important way—that of chassis design. The workstation chassis must accommodate more and more powerful I/O cards, larger memory and disk capacities, and higher-performing (hotter) processors—all in an enclosure suitable for the trading floor. Further, the workstation must be designed for security, ease of serviceability, and upgradeability.

Of particular import to applications on the trading floor are the high reliability features built-in to these workstations; heat management, reliability, and ruggedness are key design goals. For example, the entire xw line of HP workstations is designed using sophisticated Computational Fluid Dynamics (CFD) modeling tools to perform in-depth modeling of airflow within the system (see Figure 5). The CFD tools help predict unevenness in cooling capability that could result in component overheating, or predict wasted energy caused by areas of unwanted airflow.

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*In this case, using computers to model airflow.*
There are additional areas where HP design engineers make decisions to manage the power dissipated inside the workstation:

- **Power regulation:** Components within the power supply and on the motherboard are chosen to provide the best combination of efficiency and price.
- **Fans:** The use of efficient fans and the strategic control of these fans assure that the fans themselves contribute as little additional heat load to the system as possible.
- **Customer Choice in Components:** HP offers a wide variety of options to make sure that the customer can choose components such as monitors and graphics cards that provide required performance without excess power dissipation.
- **Energy Star Compliance:** Reduces power consumption under idle conditions\(^5\).

Finally, HP workstations are equipped with larger power supplies than that of business desktop PCs. This increases efficiency as well as eases upgradeability.

**Other HP Personal Workstation Advantages**

While product features are an important part of the decision to buy a workstation, other important factors have a strong impact on return on IT investment. These include product reliability, tools for lifecycle management, and vendor service and support.

**Reliability**

Reliability is critical to organizations supporting professional users. In worst cases, design cycles, schedules, or revenue return could be put at risk by systems that provide anything less than solid performance and stability. Although HP workstations are available with strong support packages,

\(^5\) More information on Energy Star is available at: http://www.energystar.gov/
HP believes that it is better to build stability and reliability in our products so that support needs are minimal.

HP qualifies specific applications and thoroughly tests hardware, firmware, and operating system combinations. If a new graphics card is added to the HP’s Leadership Graphics Program, users can be sure that it has been thoroughly qualified in HP labs and that software drivers are fully tested.

HP reliability and compatibility testing adheres to rigorous, comprehensive, and elaborate test processes. These include shaking, vibration, temperature, drop tests, display hinge tests, and keyboard tests. Other tests include:

Dust: Fine dust is sprinkled into components, which are then subjected to rigorous reliability tests.
Shock: Computers are subjected to electric shock and then booted to test for damage or degradation.
Humidity: Humidity chambers simulate potential storage conditions, such as three months storage in a humid Singapore warehouse and followed by deployment in a 70-degree air-conditioned environment.

Every system must pass these tests, ensuring that each system will arrive in working order with the internal cards and components seated firmly and properly in their intended locations.

**Lifecycle Management**

HP has extensive experience in developing and working with partners to create software that facilitates management of an entire enterprise. This expertise is especially evident in the suite of manageability products that HP is able to provide customers. Financial customers that need to manage the entire lifecycle of their clients (see Figure 5) need a sophisticated and complete toolset.

**Figure 5.** HP understands and helps customers manage the entire product lifecycle.

The HP Client Manager Software (based on an integrated portfolio of solutions) assists HP customers in managing the hardware aspects of their client computers—including in-depth hardware information tracking, alert monitoring, diagnostics, and driver/BIOS management. Pre-configured Web reports are included to help analyze, plan, and check status on management
tasks. Policies can be set to automate tasks when triggered by a notification condition. The solution offers full integration with Microsoft Systems Management Server (SMS) and data sharing with other third-party client management tools.

Service and Support

HP offers industry-leading, proactive, flexible support services that enable small and medium businesses to large enterprises to have a worry-free experience not only with their HP equipment, but also with other vendors’ applications and products that are part of an HP solution. This ensures that businesses will stay up and running and that data will be available and protected.

HP provides a support hotline that routes calls to a workstation-specific support team. This team is intimately familiar with the HP workstation product line, as well as the kinds of issues that workstation users face.

As another example of innovation for customers, 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.

Collaboration

Customer partnerships are highly valued by HP. In the financial market segments, the partnership extends to collaborating with customers to help set the standards for the next generation of HP workstation products. To that end, HP recently formed HP Workstation Financial Advisory Councils (WFAC) in both New York City and London. This series of meetings, launched on December 3, 2002 in NYC, and February 4, 2003 in London, joins key financial customers with executive management from HP’s Workstation Global Business Unit (WGBU). The event focuses on in-depth discussions of the future of HP’s traditional workstation portfolio and the evolving trend and product requirements in the financial community. It also ensures continued satisfaction of financial customers and provides a feedback forum for other technology discussions.
Popular HP Workstations in Financial Industries

HP is the acknowledged leader in providing workstations to the financial market segment. International Data Corporation (IDC) estimates that in 2004, HP was responsible for 50% of the revenue in this market - far outpacing Dell and IBM who represented 38% and 9% respectively. Further, IDC estimates that HP (and prior to their merger, Compaq) has collectively sold nearly 200,000 workstations in and around customers' trading floors since 1997.

Figure 6 shows members of the xw line of HP workstation family that are popular in various segments of the financial industry. In many cases, these workstations have features that are specifically designed for this industry, including expandability, packaging size, and multiprocessing capabilities.

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<th>Risk analysis/Quantitative analytics</th>
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<td><strong>HP Workstation xw6200</strong></td>
<td><strong>HP Workstation xw8200</strong></td>
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<td>- Microsoft Windows XP Professional</td>
<td>- Microsoft Windows XP Professional</td>
<td>- Microsoft Windows XP Professional</td>
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<td>- Dual Intel Xeon 3.6 GHz processors</td>
<td>- Dual Intel Xeon 3.6 GHz processors</td>
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<td>- 2 GB 533 MHz ECC DDR-2 memory</td>
<td>- 2 GB 400 MHz registered ECC DDR-2 memory</td>
<td>- 4 GB 400 MHz registered ECC DDR-2 memory</td>
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<td>- 76 GB SATA HD</td>
<td>- 76 GB SATA HD</td>
<td>- 160 GB SATA hard drive</td>
</tr>
<tr>
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<td>- 2x HP L1955 19-inch Flat Panel monitors</td>
<td>- HP L2035 20.1-inch Flat Panel monitor</td>
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Conclusions

The best reason to buy a workstation is to improve productivity and increase return on investment. The differences between a workstation and a business desktop PC discussed in this paper promote this improved productivity and ultimately improved return on investment. The differences between the products yield the following reasons to choose a workstation:

- Better system reliability.
- Improved application stability.
- Enhanced performance.
- Greater expandability.

Thorough application and operating system testing and certification, design for performance and best-in-class 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.

Lastly, investing in HP workstations is an investment in future productivity. HP continues to lead the industry in research in workstation technology related to financial market segments, including R&D projects to develop more compact and powerful systems, and remote workstation technology that will reshape the way IT resources are deployed in financial environments.
For more information

Useful URLs

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