Return on Innovation:
Making Individuals More Productive

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Executive Summary

The value proposition for equipping technical and creative professionals has drastically changed. The unprecedented combination of economic pressure and technological advancement has rewritten the rules of how to do more with less. Teams may forego new hires or do the same work with fewer staff, yet they can avail themselves to new tools and techniques. The challenge then becomes how to equip these valuable and fewer number of professionals to be more productive and innovative.

The buyer of workstation technology is faced with a choice: use last year's value set to judge technology and purchase it at bargain prices, or invest in the latest high-performance solutions providing the option of new, more productive workflows.

The benefits of last year's technology and value sets are known quantities. By comparison, new workstation technology is described by early adopters with terms such as "visual supercomputer" or "the perfect storm in workstation technology." This new technology makes it possible to change the way top technical and creative professionals work.

Productivity is improved by more than just speeding up the application; this new technology enables improvements in their design process and unleashes their creativity as well.

The provable return on investment for such computers is without recent precedent. Not only are there directly measurable increases in productivity, but entire workflows can be reorganized to take better advantage of specialized knowledge. The result is innovator empowerment.

It is now possible to put previously unavailable capabilities inside a single technical workstation at an affordable price. The resulting price/performance improvement will in most cases provide the user with exceptional application performance. This upgrade becomes even more beneficial when considering the improvements as a result of workflow changes. Return on investment (ROI) in a new computer workstation becomes measured in days instead of months or years.

The foundation for this change is the revolutionary design of the Intel® processor 5500 with the Nehalem Microarchitecture; it has become the base technology for many productivity-enhancing products and processes. At the professional level this processor was introduced as part of the Intel® Xeon® processor 5500 series with a host of new Intel technologies. The makers of technical graphics software are using these technologies as a foundation for new applications and features with speed and capabilities never seen before. As a package, the combination of workstation, software, and peripherals is becoming known as the digital workbench.

HP workstations and its hardware and software partners are at the heart of this change. Each HP workstation is rigorously tested and certified as a unit. These are not off-the-shelf bundled components but finely tuned systems. Each subsystem—CPU, memory, graphics processing unit, storage, user input, and data I/O—is selected for both best-of-class capabilities and total system compatibility. Each workstation is then tested and certified with application software.

In its ability to deliver price/performance benefits, enable new workflows, and improve individual and group productivity, the digital workbench is the next-generation productivity tool for technical and creative professionals.

The likely result, as explained in this document, is measurable productivity improvements that can go much higher than previous analysis involving just raw workstation performance.

Leaner Staffs, Changing Workflows: Empowering the Specialist

A recent Reed Construction Media survey of technical professionals found that two-thirds of technical professional service firms questioned are either doing more work with the same number of people or doing roughly the same work as before but with fewer staff. These workload changes are forcing technical professional firms to question every assumption regarding the use of technology as a way to increase productivity.

Based on your personal knowledge, what is the size of your firm's staff today compared to 2 years ago?		
The same	74	33%
More than 20% reduced	39	17%
10-20% reduced	44	19%
1- about 10% reduced	21	9%
Increased by 1- about 10%	19	8%
Increased 10-20%	22	10%
Increased more than 20%	8	4%
Total	**227**	**100%**

Source: BD+C Productivity Survey, October 2009

One assumption coming under close scrutiny is the contribution of specialists. In every technical field there are individuals who are valued for their expertise and treated as in-house consultants.

Every technical profession has its specialists. Manufacturing has analysts who apply the laws of physics to the performance of complex machines. Construction has engineers who make sure the effects of gravity don't turn a bridge or a skyscraper into a death trap. Oil and gas exploration has geophysicists who can read the layers beneath the earth's surface and know where to drill or dig. Digital media and entertainment has artists whose creative vision makes the difference between animation and art. These professionals offer their firms experience, skill, and creativity based on years of training and practice. Often these people are more than the final arbiter; they are also an important source of innovation in the firm.

Today's challenge is to move these valued professionals more into the workflow mainstream, to make each member a full contributor from start to finish. Not only is there unprecedented economic incentive to do more with less; there is also an unprecedented expansion of productivity available due to revolutionary advances in computer processing power.

Whether the business is architecture, energy exploration, design engineering, digital media and entertainment or another demanding technical field, the value proposition for equipping technical and creative professionals has changed drastically.

Today these specialists are served by a variety of sophisticated software products. In most cases, these programs are more demanding than the software used by others in the same profession. For example, it requires much more computer processing time to analyze a part than to model it. Rendering a scene is much more demanding on the computer than drawing it. The increased need for processing power, and the skill required to run these applications and sometimes interpret the results are reasons many of these specialists are focused in separate groups.

New Technology Challenges the Workflow Status Quo

From both the software and hardware sides of IT, there are new technologies that make it possible to reinvent professional workflows. There are new technical genres being named to describe some of the changes. Architecture and construction are embracing Building Information Modeling (BIM), which combines 3D design with embedded engineering data and construction costs. Manufacturing is adopting new concepts such as Product Lifecycle Management (PLM), simulation-driven product development, digital prototyping, and the more routine use of advanced physical analysis. Digital media and entertainment is now using real-world physics as the standard by which objects in motion are created.

The leading vendors of technical graphics software are increasingly offering their software as suites as opposed to stand-alone programs. Some suites are single-vendor offerings, such as Autodesk® Inventor® Professional with Algor® analysis software or Adobe® Creative Suite®. Others are collaborative suites in which two or more software vendors work together to provide a compatible work environment.

Digital workbench is defined as the combination of 2D/3D application software, desktop hardware, productivity tools like video conferencing, software that optimizes your workstation and add ins to your application to customize it. Please indicate the areas where you need more emphasis. (1 = OK today, and 4 = need significantly more emphasis)				
Top number is the count of respondents selecting the option. Bottom % is percent of the total respondents selecting the option.	OK today	Needs more emphasis	Needs significantly more emphasis	N/A
2D/3D application software	31 14%	62 27%	26 11%	79 35%
Desktop hardware	42 19%	46 20%	20 9%	67 30%
Productivity tools	25 11%	57 25%	32 14%	70 31%
Software that optimizes your workstation	33 15%	52 23%	32 14%	64 28%
Add-ins to your application to customize it	24 11%	47 21%	26 11%	77 34%
Application training	25 11%	61 27%	46 20%	69 30%

Source: BD+C Productivity Survey, October 2009

Such multi-vendor suites include the CADCAM™ Test Suite for PCB design, bundled by Mentor Graphics; the ANSYS® SpaceClaim® Direct Modeler; and a wide variety of specialized bundles from Dassault Systèmes SolidWorks and its network of solution-provider partners.

These software suites are selected to provide a complete workflow, and are optimized to make moving data between applications as seamless as possible. Standardizing on such suites improves interoperability, reduces training time, and increases total efficiency.

From the hardware side, the newest generation of microprocessor technology offers much more than the familiar promise of "a little faster, a little better, a little cheaper." There is a revolution in CPUs that offer added processing cores and radically improved graphics processing throughput. The new technology allows users to run more than one application simultaneously. So analysis, for instance, can be run in the background while design is run in the foreground with no performance degradation. The specialist can be doing both design and analysis and consulting on the results of others. Before designs are complete they can be analyzed and rendered. New collaboration tools can be used to share both screen images and telepresence during the design process.

This new technology makes it possible to mainstream the contributions of top technical and creative professionals. The provable return on investment for such computers is without recent precedent. Not only are there directly measurable increases in productivity, but entire workflows can be reorganized to take better advantage of specialized knowledge. The result is innovator empowerment and the possibility of reorganizing technical workflows.

Digital Workbench: Redefining the Value Proposition of Workstation Technology

Recent gains in computer processing power are allowing firms to take a fresh look at how to best equip technical and creative experts.

One way to view the new generation of technology is not to put software, hardware, and peripherals into categories but to think of them as an integrated whole. A term starting to come into use for this is 'digital workbench.' The phrase originated from science laboratories, but is starting to spread

throughout the technical and creative professions. On a digital workbench, integrated software suites are fine-tuned for performance on a workstation that is certified for the required tasks. Within this thought process one can also think of it as adding tools to the digital workbench to improve productivity, rather than just application suites. This is where the power of the workbench concept comes to play, as a view of the entire setup of desktop tools and the impact it has on professional productivity.

Hardware and software vendors are partners in making sure the digital workbench is a unified system and a proper fit. A digital workbench in product development would do more than computer-aided design, for example, it would be a station for digital prototyping, analysis-driven design, and design-based simulation. Some of the add-on tools will improve productivity as well.

The value decision point becomes about maximizing the value of the creative/technical professional who sits at the digital workbench all day. A multi-core workstation has the power to run a simulation in the background while the engineer is still doing design work in another window; it also provides tools for instant collaboration, or in tuning the workstation to keep it operating at its maximum performance, instead of either tying up two (or more) computers or waiting for the simulation to finish.

In so many technical fields, the work process is interrupted by the need to transition from one stage to another. When multiple tasks can be performed on the same digital workbench by the same person, the transitions are minimized and the total workflow becomes more fluid.

Much innovation is the result of seemingly random explorations, the 'what if' sense of inquiry. When a computer system is fast enough, it becomes possible to take the time to explore new ideas and designs, to allow the random nature of creativity the freedom it needs.

Intel and HP, Digital Workbench Partners

April 2009 saw the debut of the next-generation hardware that is the foundation for today's digital workbench. The new Intel Xeon processor 5500 Series multiple-core processors have been given a completely new Micro-architecture. These new processors can:

- Adapt to changing workloads on the fly by reallocating CPU workloads across cores when appropriate;
- Automatically "Turboboost" processor frequency when workload requires and conditions allow, essentially overclocking the CPU when heat and power are within certain specifications;
- Lower energy costs by automatically adjusting power states;
- Run both 64-bit and 32-bit applications at peak efficiency;
- Move data in and out of the CPU to more efficiently and more rapidly run applications;
- Use Hyperthreading to effectively double the number of cores operating on an application that needs them;
- Use the latest PCI Express® graphics technology.

HP adds significant value to Intel Xeon 5500 Series processors by matching them to a complete system fine-tuned for speed and whole-system performance engineering. HP constantly gauges performance by benchmarking subsystems and the entire workstation against previous models and competitive products.

One notable new Microarchitecture feature is the new Intel® QuickPath® Technology, which directly connects system memory to the processor, directly connects the processors together, and provides a more direct connection from the processors to the system I/O via the Intel 5520 motherboard chipset.

Graphics Processors: The Second Engine in the Digital Workbench

The graphics subsystem is as important to the digital workbench as the CPU. Today's Graphics Processing Units (GPUs) are a far cry from the video boards of the first PC workstations. They are now sophisticated partners in the digital workbench, with separate programmability that many state-of-the art technical software products utilize.

HP offers a full array of high performance graphics cards from ATI (the FirePro® line) and NVIDIA® (the Quadro line). All HP-approved GPUs have achieved workstation ISV certification by one or more software vendors. Workstation

certification by a software vendor is the seal of approval assuring the highest level of compatibility and support for the selected software products. These graphics systems all come with the same warranty as the workstation. There is also dedicated technical support from both HP and the graphics vendor.

Digital Workbench Digital Productivity Tools

One of the concepts of the digital workbench is to add personal productivity tools to improve the user experience. One of the tools HP offers is its exclusive HP Performance Advisor, a software application designed to analyze the leading technical software applications to make sure each software product's settings are optimized to the workstation. This free HP utility helps customers setup and maintain their systems in top working condition when used with complex applications such as CAD, CAE, and DME. Its foundation is the technical testing and knowledge HP acquires when testing applications on workstations to help ensure their top performance.

A workstation's performance can be improved over time by maintaining graphics drivers; reporting problems to software vendors and installing upgrades; managing memory usage to keep files at a minimum and/or to maintain enough main memory to avoid frequent read/writes to disk; and periodically checking subsystem performance and upgrading when appropriate. HP Performance Advisor greatly simplifies all of these tasks and much more, making it easy to maintain peak performance on a workstation throughout its life. For instance:

- Graphics driver section of HP Performance Advisor, organizes all graphics driver information to determine which driver should be used for application stability and speed. This data is updated from a secure HP database each time the tool is run. Application certified graphics drivers can be upgraded with two clicks, rather than the difficulty of searching the web. Also, common certified drivers for multiple applications can be quickly found.
- A detailed configuration report, which can be printed or saved for future reference. HP Performance Advisor gathers and organizes system data into one simple window. This window contains all the system and application information necessary to report system details to both HP and CAD vendor support organizations when seeking support. Send this plus the problem; it is one click-and-save rather than searching through numerous menus and tabs.
- The memory section allows users to visually track memory usage by applications so the user understands those applications and functions within the application that are driving memory usage. It identifies both physical and virtual memory so memory needs can be matched to the work. It also allows memory usage recording over time. Larger files and files which require frequent disk access slow user productivity. This tool makes specific memory needs simple to manage.
- HP Performance Advisor has another section for OS tuning, which modifies Microsoft Windows™ parameters for CAD or other complex applications, and reports on helpful parameter descriptions.

HP Performance Advisor has several other features like a resource collector to understand subsystem needs, and special tuning features unique to some applications like NX™ and AutoCAD. ® It is important to update HP Performance Advisor periodically as features are added on a regular basis, as it will help maintain the workstation.

In the normal case new Workstations are optimized upon arrival in the IT department and sent to the engineer's desk. During the life of the Workstation, optimization parameters can and will change. HP Performance Advisor assures that the HP Workstation remains optimized over the complete lifecycle of the system even as applications and workloads change over time.

Unmatched Collaboration Options

HP also offers technologies for desktop collaboration and sharing. One is HP's proprietary Remote Graphics Software, a powerful 3D desktop access utility that allows sharing the user's desktop with others in real time across different desktops, giving each viewer a 'just like local' experience.

Suitable for both 2D and 3D applications, RGS works in multiple operating systems and allows multiuser remote

collaboration. Using this technology will often eliminate the time-consuming need for file sharing among offices, a leading cause of unintended changes, or the IP dangers of compressing and saving files for uploading or downloading so the information can be shared.

Since this is true desktop sharing, users can access their own desktop remotely, with the same look and feel as if they were in front of it. Thus from home on any low powered PC they can access their workstation through Remote Graphics Software and restart another rendering run or an analysis run, or even capture a late night burst of creativity.

More Powerful Input

Workstation users are rightly fussy about their choice of input tools. HP offers a variety of USB- and PS/2-compatible scroll mice, optical mice, and trackballs.

Beyond the familiar offerings, HP also offers the HP SpacePilot Pro™ from 3Dconnexion. This remarkable fourth-generation 3D input device has been proven by 3Dconnexion to considerably improve user productivity, depending on the application and the amount of time the user works in a 3D environment.

The HP SpacePilot Pro provides intelligent control with refined sensing technology, extendable speed keys and an ergonomic design. It supports 100+ applications including a full list of profession 3D and productivity applications. This device can increase user productivity by reducing mouse movements by up to 21%, which can help reduce the risk of repetitive stress injuries. Customers who buy their SpacePilot Pro from HP can utilize special integrated technologies.

Regular software updates from 3Dconnexion keep the SpacePilot Pro tuned to the specifics of the user's software.

The Virtual CAD Machine: Unmatched Speed and Productivity Increases

Some users must run multiple high-performance software products simultaneously—sometimes on multiple operating systems. These advanced users have in the past required multiple workstations or a workstation and timeshare access to a remote supercomputer. New certified software that works with HP Z Series workstations makes it possible to run these multiple products and multiple operating systems on one HP Z Series workstation. Such products allow multiple versions of Microsoft Windows and various distributions of Linux to run simultaneously.

Independent tests conducted by leading technical publications on HP Z Series workstations confirm these initial stunning results. Such noted technical news outlets, both print and online, including *Dvice.com*, *Desktop Engineering*, *Animation World Network*, *VEKTORRUM*, and *MCADcafe.com* have published benchmark results that have to be read to be believed.

The Final Justification

As companies compete, their technology choices have increasingly powerful consequences. Companies can either upgrade their thinking or risk being left behind. It is possible today to significantly improve individual productivity through a holistic approach to computing deployment based on the notion of the digital workbench. In the final analysis today's technical professionals need a total solution that delivers more bang for the buck than ever before, provides more than just a giant leap in performance but also provides capability for changing workflows, and tools that improve users personal productivity. They need a true digital workbench.

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CREDITS AND SOURCES
The following groups have been cited or quoted in the development of this White Paper. *Building Design + Construction* thanks these groups for their work.
Animation World Network
VEKTORRUM,
Dvice.com
MCADcafe.com
Reed Construction Media

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