# 5 Ways a Workstation Can Benefit Your Bottom Line

Examine the ROI of workstations with Intel® Xeon® processors for professional computing applications, compared with that of standard PCs, and you'll find that the workstation makes better financial sense.


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**Professional workstations** today can benefit a company's bottom line as much as they can benefit user productivity — but many businesses simply aren't aware of their value and overall financial advantages. This whitepaper explains the return on investment (ROI) of professional workstations versus standard PCs for graphics-intensive applications including CAD, design simulation, visualization, manufacturing, and media and entertainment (M&E).


The criteria that go into the purchase of a computer are no different than for any other capital asset. In the end, any business purchase should be measured on the return it delivers in exchange for the investment it requires: the return on investment (ROI).

When it comes to machines taxed with professional-caliber computing workloads, the workstation is design-focused to deliver the best possible ROI. Modern workstations are purpose-designed and purpose-built to optimize both sides of the ROI equation — maximizing return in the form of higher productivity, while minimizing investment with a lower total cost of ownership (TCO) than standard PC platforms thanks to a variety of features that PCs cannot deliver:

- Professional-grade Intel® Xeon® processors with two to four times higher throughput than standard PCs.
- Professional-caliber GPUs offer superior, application-specific graphics performance.
- Automated performance tuning software such as Dell Precision Optimizer.
- Lower postpurchase costs due to better reliability and manageability that can lead to much lower TCO.

Simply put, when it comes to high-demand, visually intensive applications in architecture and construction, civil engineering, manufacturing, GIS, and digital media and entertainment (M&E), workstations deliver more output from project staff with a lower outlay of total dollars: It's a win-win that yields a definitive ROI advantage over conventional PC platforms.

## GET MORE DONE IN LESS TIME

Let's explore that "R" in ROI, the return in the form of maximum productivity. How much faster could the project get done if that model/simulate/render design cycle could run a few minutes faster, or a designer could converge on the optimal design parameters more quickly, dropping a few cycles all together? Over the life of the system, the costs of *not* investing in a workstation can easily swamp whatever modest savings came on the day of purchase.

## #1: INCREASE YOUR POWER

Workstations offer two to four times the CPU processing throughput of a PC. In the age of multicore computing architectures, the more processing cores that are available to work, the more quickly the work gets done. More effectively multithreaded applications are not only exploiting more plentiful CPU cores to execute faster, but a multitude of cores is even more valuable to that ultimate multitasker: the actual computing professional.

Businesses in architecture, engineering, design, and content creation thrive not by plodding through one-at-a-time workflows. Competing successfully in today's business climate means designers need to keep more than one plate spinning at a time — running structural integrity analysis while kicking off a high-quality rendering, modeling a wing while simulating airflow for turbulence. The more compute tasks a designer can manage at one time, the shorter each design iteration is, and the quicker the eventual product gets to market.

Now consider that the Intel® Xeon® Processor E5-2600 v2 series CPUs, available only on workstations such as Dell Precision, offers as many as 12 processing cores, twice what the fastest PC CPUs can offer. And for those with the most daunting computational demands, only workstations such as the Dell Precision T5610 and T7610 can accommodate two CPU sockets, yielding up to four times the throughput of a PC-class CPU. Workstations deliver maximum performance for each application while unleashing the designer's own aptitude for multiprocessing.

## #2: SUPERIOR GRAPHICS PERFORMANCE

It's past time to dispel the common myth that consumer-grade graphics processing units (GPUs) are just as capable of handling CAD and M&E workloads as professional-grade GPUs. While the two products draw off the same core hardware and software technology, the professional GPU is shaped differently to deliver the performance and accuracy specific to professional CAD and M&E applications.

But it's a matter of performance as well, as the choice of graphics can mean a dramatic and critical drop in performance. Consider 3D rendering in AutoCAD, for example. Its Conceptual style employs the Gooch shader, created specifically to render technical illustrations. Gaming GPUs have little reason to render a fast, high-quality Gooch shader, but workstation-caliber GPUs do.

To strike an even more stark contrast, consider 2D. While cutting-edge games abandoned 2D a long time ago, it remains a staple visual mode in architecture and construction. That's why a gaming-focused GPU, for example, isn't equipped to quickly and accurately render Smooth lines in AutoCAD. Without a certified GPU under the hood, performance for such rendering doesn't just slow a tad, it plummets. That's because a package like AutoCAD turns off hardware acceleration all together and render in software, should it detect a non-certified GPU.

It's not just hardware that makes graphics different for pros, it's the driver as well. Optimal driver design takes into account which types of drawing is called most frequently and fast-tracks those code paths. Those paths are different for games than they are for an elevation-rendering or stress-analysis tool, and shorter paths mean less execution overhead per drawing call. As a result, professional drivers are slower on games, and gaming drivers are slower on CAD.

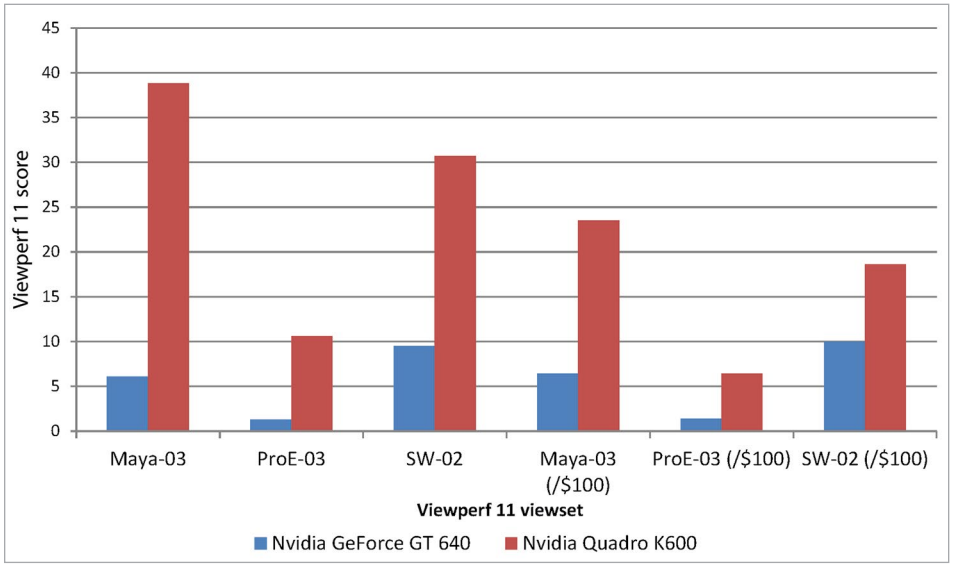


*Figure 1. Workstation GPUs are faster than gaming GPUs on professional applications — often a lot faster.* Source: Dell and Cadalyst.

Add it all up, and a workstation GPU can dramatically outperform a consumer or gaming focused card, rendering the workloads most commonly faced in CAD, GIS, and M&E. Consider the relative performance of NVIDIA's consumer-oriented GeForce GT 640 card when stacked up against the company's professional-geared Quadro K600. The workstation-optimized Quadro card thumped the gaming card soundly on the SPECviewperf 11 graphics benchmark, particularly for viewsets specific to Autodesk Maya, PTC Pro/ENGINEER, and SolidWorks (figure 1). Even when taking into consideration the K600's modestly higher pricing, the Quadro still thoroughly outperforms the GeForce when it comes to typical professional rendering workloads.

## #3: PROVEN, PRODUCTIVITY BOOSTING FEATURES

Most look at benchmark results and hardware performance specs to get an idea of the increased speed they might see when taking advantage of a new workstation. But, just as often, productivity gains come from key design features unique to workstations.

**Productivity-maximizing display technology.** Few technology advancements can match the productivity boost of multi-display technology. Now driving four (or more) inde-

pendent displays from a single card, workstation GPUs let professionals manage more tasks at a time. Desktop management software exclusive to workstation GPUs allows customized, multi-display environments tailored to users' preferences and workflows.

And, consider 10-bit display precision. While the vast majority don't care about it, it's a must-have for many in media and entertainment, and it's only available on workstation-class GPUs. Ditto for features such as *framelock* and *genlock*, critical in enabling multi-monitor wall displays and pixel-precise digital stream mixing for real-time media applications. If your workflow requires them, nothing else but a workstation will handle the job.

**Compute accelerators tackle the most demanding workflows.** Compute acceleration processors such as Intel® Xeon Phi™ coprocessor are specifically architected to speed the type of system-throttling computation found in high-demand professional workflows. Think core mechanical design tasks like finite element analysis (FEA) and computational fluid dynamics (CFD) or raytraced rendering, craved by architects, product stylists and studios alike. Intel® Xeon Phi™ coprocessor can churn through engineering simulations and raytraced renderings in a fraction of what was previously achievable, and both come delivered and supported in workstations such as Dell Precision.

**Maximize productivity with performance tuning software.** Hardware is only half the solution. The supporting software and tools to use it effectively is what ultimately delivers on the promise of productivity, and only workstations come delivered with — and supported by — unique management tools designed to tune the hardware specifically for professional use. Tools such as Dell's Precision Optimizer dynamically tune Precision components for optimal performance running many common professional-caliber applications. In Dell-administered benchmarks after Dell Precision Optimizer tuning, scores for PTC Creo 2.0, AutoCAD, SolidWorks, and Siemens NX showed speed-ups between 7% and 43% as compared to out-of-the-box performance (figure 2).

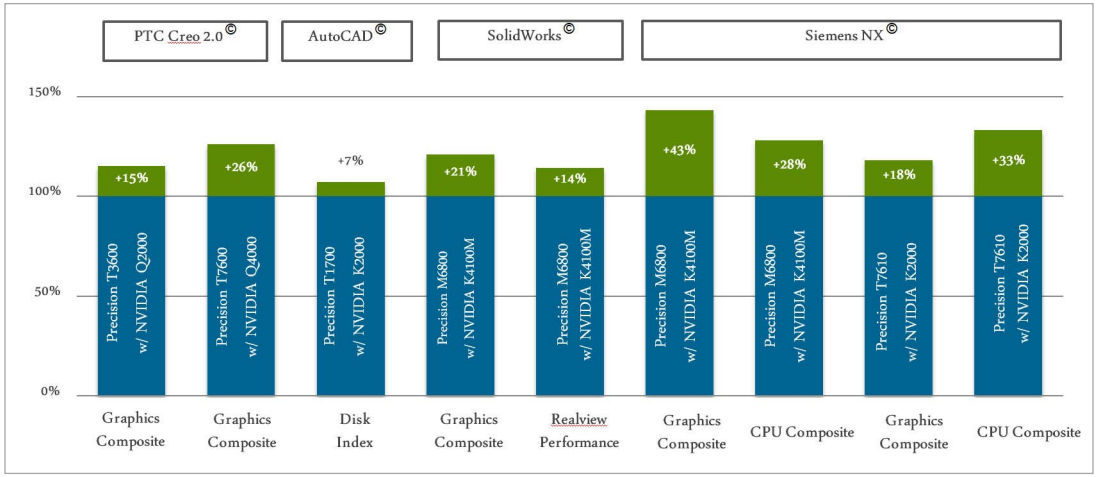


*Figure 2. Dell's Precision Optimizer delivers dynamic, real-time performance benefit and it's only available on workstations. Note that test results are a weighted geometric mean of optimized configuration samples, compared to factory-installed default settings. Benchmarks are industry standard applications using SPEC committee and other industry standard benchmarks.* Source: Dell.

**The Investment: The lowest total cost of ownership.** The investment in a workstation is most often lower than for any alternative computing platform, including consumer and corporate focused PCs. How is that? Aren't workstations more expensive than a vanilla PC? At first blush, yes, but in the end, the answer is typically no. There are two important considerations that can quickly turn the TCO argument in favor of the workstation. One, the sales prices of workstations have dropped dramatically over time, making them far more competitive today than in years past. Two — and far more importantly — the TCO of a hardware asset is most often dominated by costs incurred after initial purchase, costs a workstation is designed to minimize or avoid all together.

## #4: SUPERIOR TCO

The relatively recent renaissance in the workstation platform has yielded a machine that is far more economically priced than its ancestors that started powering businesses 30 years ago. Today's workstation shares a common technology core with PCs, servers, and supercomputers, and that's a good thing. Workstation builders now benefit from access to both best-of-breed silicon technology *and* economy of scale, a win-win combination that has delivered dramatically higher capability at far lower price points.

Sure, for applications that cannot sacrifice an ounce of throughput or reliability — and there are more than a

few —a $5,000 or $10,000 workstation provides the ultimate no-compromise computing tool. But today those price tags are the exception, not the rule. With starting prices similar to standard PCs or laptops, workstations such as the Dell Precision T1700 tower and the Dell Precision M2800 mobile models are anything but the exorbitantly priced machines of the past.

Still, don't confuse the initial costs to purchase an asset with total costs incurred over its lifetime. The workstation is a machine that's not about being the least expensive on the day the IT department deploys it. It's about delivering the best possible ROI between the time it's deployed until the day IT retires it, including all the costs associated with maintenance, repairs, and lost work time due to system outages. Accordingly, reliability has always been the hallmark of workstation design, manifested in an array of unique features, like ISV certification, self-detecting and correcting memory, precise engineering, and top-quality components.

**ISV certification.** The workstation's unmatched reliability starts with certification from the Independent Software Vendors (ISVs) that matter most, such as Autodesk, Dassault Systèmes, and Adobe. How does a workstation achieve ISV certification? The answer is simple: testing, and lots of it. The workstation OEM and the ISV team up to put new system configurations through exhaustive testing, at both system and board (for example, graphics card) levels. The end result is a system the ISV stands behind, one proven to run their mission-critical applications. And on the flip side, ISVs will understandably be less responsive to reported bugs or reliability issues arising on non-certified PCs.

**Robust hardware.** From its selection of components to the etch on its circuit boards, from the chassis enclosure to the cooling and airflow design, a workstation build is inherently more robust and reliable than a PC's. Consider professional-caliber Quadro GPUs from NVIDIA, available across the Dell Precision workstation line, for example. The cards feature gold-plated, PCI Express fingers, for maximum mechanical and electrical integrity. Chips endure thorough qualification and life-testing, across voltage, frequency, temperature to virtually eliminate failures in the field. Cards pass stringent stress testing, including tolerance to shock and vibration, while undergoing extensive thermal qualification, to ensure the hardware can stand up to harsh environments.

Maximum-availability Intel® Xeon® processors supporting Error Correcting Code (ECC) can detect and correct single-bit errors occurring in memory. Such errors are more common than one might think, with a Google study finding that one in three computers will encounter at least one recoverable memory error in its lifetime. That error might mean the difference between a successful overnight mechanical stress or air flow simulation on an ECC-equipped workstation, or throwing away the results produced by a vanilla PC and pushing the schedule back a day. What's a few hours or a day cost, and what does that do your ROI?

Dell's Reliable Memory Technology (RMT) reduces the penalty for memory errors even further. Should RMT detect a persistent memory error, RMT identifies the defective memory and removes it from visibility by the operating system, effectively making bad memory never existed. Not only does that avoid future data corruption or system crashes, it saves time and money — no calling and waiting for IT personnel, diagnostic runs, and servicing the faulty DIMM.

Engineering the chassis may not be the most glamorous aspect of computer design, but it can play a significant role in reducing cost of ownership and raising productivity. Sturdy and tool-less retention mechanisms make for quick servicing and less prone to damage from shock. Integrated handles make Dell Precision workstations less likely to drop in the first place. Carefully engineered airflow and comprehensive thermal monitoring to minimize hotspots, hotspots that can lead to component failure.

A workstation's typically higher-efficiency power supplies not only cut electric bills, they reduce heat, reduce noise, and maximize expansion capabilities. Even something as subtle as an advanced workstation's reduction of a few decibels of ambient office delivers proven benefits in end-user productivity.

Getting ISV-certified system and graphics means the ultimate in confidence the IT department won't face any obscure bugs or compatibility issues. Technologies like ECC virtually eliminate crashes and errors due to storage or memory failure.

## #5: EASE OF MANAGEMENT

While certainly a drain on IT service costs, flaky hardware isn't the primary culprit for downtime, not even close. Rather, "80% of outages (through 2015) impacting mission-critical services will be caused by people and process issues, and more than 50% of those outages will be caused by change/configuration/release integration and hand-off issues," according to estimates by research firm Gartner.

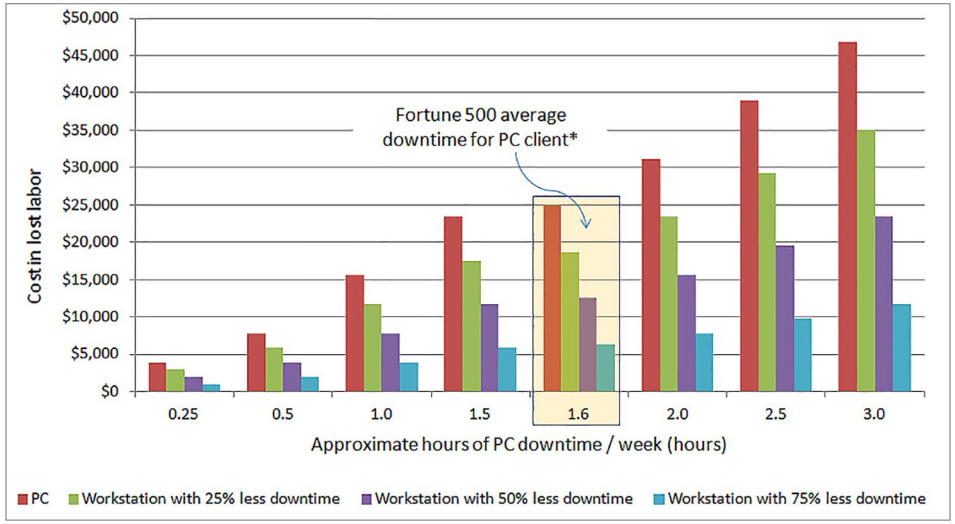


*Figure 3. The workstation's aptitude for cutting downtime can lead to dramatic savings in TCO.*
Source: Cadalyst, Dunn and Bradstreet.

Many IT managers won't even consider the performance merits of new hardware until they're convinced that an adequate, long-term infrastructure to support the platform is there. After all, the benefits of increased performance and productivity won't mean anything, if the solution is difficult to deploy, manage, and operate reliably for what could be an extended-duration installation.

**Trusted, long-term solutions with extended support cycles.** In that context, consider a workstation-long lifecycle, driver stability, and high-priority 24/7 technical support to be base-level requirements. If that foundation isn't in place, the rest is pretty much moot. How much faith do you have on your machine's reliability on day one? Or how about on day 1,095 (the end of a three-year lifecycle)? Workstations are built for the long deployment cycles that many professional-caliber solutions demand.

Workstation suppliers such as Dell provide extended warranties and committed support for models and SKUs that would have been long forgotten had they carried a corporate or consumer PC brand. A hardware failure on a PC that can't be remedied because it was end-of-life'd last year will blow any PC's ROI proposition apart.

## At Ford, Hardware Investment Pays Off in Innovation

At Ford Motor Company, continual investment in computing power is paying off. The company has increased its computing power by about 50% every year for at least eight years, and that investment is yielding faster, better, and less costly design testing and, ultimately, increased innovation.

A Wall Street Journal article, "Design Revolution Sweeps the Auto Industry" (October 20, 2013), highlights how automakers are tapping advances in computer-aided engineering (CAE) software and investments in computer hardware to power digital design simulation that can quickly develop and analyze numerous design iterations and minimize reliance on physical prototypes — cutting weeks of time and millions of dollars from the design process.

The result: innovation. Whereas the time and expense involved in developing new parts once discouraged vehicle makers from looking at many daring or innovative designs that could yield small gains in fuel economy, today these companies are using computers to run through dozens of design possibilities in the time it once took to produce a single physical prototype, according to the article, and the best ideas are adopted quickly. Only a few years ago, it might have taken as long as eight months to get from the idea for a new cylinder head to the building of a prototype, and it would have cost millions of dollars. Using computer simulation, designers at Ford came up with the most efficient design possible in just a few days, and the process cost thousands of dollars instead of millions — savings that make design risks worth taking.

## THE MODERN WORKSTATION

The modern workstation shares genes with sister PC and server platforms, yet its DNA remains unique, reflecting a conscious and specific attention to the computing priorities of high-demand professionals in design, manufacturing, and entertainment. It's the only high-performance client built around dual-socket ready Intel® Xeon® processors. It's engineered for expansion and upgrade, not only supporting the demands of today, but scaling into the future. And with unmatched reliability, durability, and manageability — ingrained in its design, construction, testing, and ISV certification — it's built to last well into that future.

**Forgo a workstation and risk the financial consequences.** PCs don't share such traits, and their lack could easily impact a company's bottom line. Bear in mind that a single designer experiencing 1.6 hours of downtime a week (according to a Dunn and Bradstreet survey of Fortune 500 companies) could cost a business $10,000 per year, assuming a professional with burdened cost of $100 per hour. Now consider how that figure might compare if that designer had a machine specifically built for reliability running professional-caliber, mission-critical applications. Even if a workstation eliminated just 25% of the downtime — a conservative figure — it's clear that outfitting highly compensated staff with vanilla PCs could end up costing far more in the end.

**Even one PC failure can render any ROI argument moot.** The impact of even one untimely hardware failure may extend far beyond making or breaking the ROI of one particular capital expenditure — it could literally mean the difference between a corporate bottom line that's inked in black or one in red. Imagine an engineer faced with a tight schedule, compelled to cut a simulation short or run with simpler parameters because a PC couldn't handle the workload. What's the cost if that short-cut results in a hydrology simulation for a multi-million dollar construction site failed to pick up a subtle, worst-case run-off scenario? Or it meant a structural integrity simulation that allowed a catastrophic failure mechanism to creep into the design of a brake assembly? Can any business really afford to find out? ◆

With more than 30 years of engineering, marketing, and management experience in the semiconductor industry, **ALEX HERRERA** is a consultant focusing on high-performance graphics and workstations. Author of frequent articles covering the business and technology of graphics, he is responsible for the Workstation Report series published by Jon Peddie Research. He continues to advise companies competing in fields related to high-performance graphics and client-centric computing.