DELLEMC   **AMD**

AEC 2.0

Six Trends in Architecture, Engineering and Construction That Are Driving Today's Workstation Choices

Advanced design and engineering tools, such as certified high-performance workstations, can not only boost user productivity and streamline workflows but also transform the client experience with powerful VR capabilities while providing distinct competitive advantages

Although digitization is transforming just about every industry worldwide, its effects are especially evident in the architecture, engineering and construction (AEC) professions. Until about 40 years ago, paper drawings reigned, with miniature 3D scale models painstakingly built to help clients visualize what their substantial investments would bring. That's not to mention how AEC professionals used slide rules to perform the numerous architectural and engineering calculations required to design and engineer complex structures.

Back then, the AEC process, from concept through building construction and commissioning, was labor-intensive, highly iterative, time-consuming and error-prone. Then technology came into play, with terminal-based, computer-aided design (CAD) solutions that cost hundreds of thousands of dollars per seat license. Next up were workstation makers—such as Apollo Computer, founded in 1980—that grew fast by selling their much more powerful wares into engineering, graphics and scientific markets.

A watershed occurred in 1982, when Autodesk launched AutoCAD, which enables computer-aided design on desktop PCs for a small fraction of what previous CAD solutions cost. AutoCAD started the AEC industry on its way to today's 3D design capabilities, enormous computational power, and increasingly immersive visualization experiences that virtual reality (VR) and augmented reality (AR) now offer. When AutoCAD debuted, the IBM PC was barely a year old, so processing power and display capabilities were far from what they are today.

Array Technology, founded in 1985 and bought by AMD in 2006, introduced graphics accelerator cards to offload the burden of CAD graphics processing chores from the CPUs of host PCs. In 1998, Dell introduced its first Precision workstation, targeting the AEC market as well as other markets involving product development and animation. Together, these two companies offer AEC professionals the technology tools to stay ahead of their ever-rising client expectations and their competition.

■ AEC 2.0: Revolutionizing how structures are designed and built

Today, these technologies have evolved to what was once considered supercomputing capabilities, and their advancements are accelerating. Workstations that were state-of-the-art just five years ago are being eclipsed by what's now available. Newer, multicore chipsets are clocking faster, with much greater

data throughputs. Solid state drives (SSDs) enable quick retrieval of the large data sets that 3D, VR and AR applications need to manipulate to do their magic. In effect, today's technologies are ushering the AEC industry into a new phase—what might be called AEC 2.0.

Even peripherals, such as the Dell Canvas touch screen display, are changing the creative experience for both users and AEC clients. The Dell Canvas is a great tool for drawing review and markup as it provides a large screen interface with touch and pen capabilities that mimics a traditional markup environment. One benefit is that design issues can be identified and changes made much sooner in a project's development phase, when they cost much less to execute.

Technological advancements like these are revolutionizing how the AEC industry develops and builds structures. AEC firms need to be ready to upgrade their toolsets to achieve better designs, easier collaboration among stakeholders, more productivity by their users, and the optimal performance of their structures throughout their life cycles. Three sets of users are especially affected:

- **Architects,** who must envision and design structures to meet the needs of their clients and, in the case of commercial projects, those of their users

Dell Precision Workstations

Dell Precision workstations offer a full portfolio of desktop, tower, all-in-one, rack and mobile form factors, plus scores of options for CPUs, storage types and graphics accelerators, including a wide variety of powerful AMD Radeon Pro graphics cards.

These powerful machines can deliver the right tools for any AEC job, and they are optimized for the specific software applications that AEC professionals use most. They can be tailored to a diverse range of professional roles, workflows and environments.

Dell Precision workstations are renowned across the AEC industry for:

- **Intelligent performance—**Featuring Dell Precision Optimizer, machine learning, VR-ready mobiles and more

- **Mission-critical reliability**—Featuring Dell Reliable Memory Technology and error-correcting code. Mil spec–tested. Highly secure and manageable

- **Groundbreaking innovation**—First VR- and AI-ready workstations. Creating new categories of options, including Canvas touch screen displays and 1U rack workstation configurations.

- **Mechanical, electrical and plumbing (MEP) engineers**, who must design and engineer the operational systems supporting the buildings being designed

- **Visualization specialists**, who must help their colleagues and clients experience planned structures, often before construction, using sophisticated photo-realistic rendering and AV/VR technologies for visualization

◼ Six trends that are driving today's workstation choices for AEC professionals

As AEC 2.0 unfolds, six trends have emerged that are impacting workstation selection and, to an extent, the types of graphics accelerator cards those workstations need. The six trends are:

1. **Global markets driving competition.** While most AEC firms are small organizations with fewer than 50 employees,[1] technology can enable them to extend the reach of their practice and client base just about anywhere in the world. But the key to succeeding in expanding their markets beyond local projects is to boost active collaboration across stakeholders—especially among clients.

Broadband connectivity has enabled easy and low-cost (or free) web conferencing, so CAD and computer-aided engineering (CAE) files can be shared, but bandwidth is still insufficient for VR experiences. That's why mobile workstations, with all the power of their desktop and tower cousins, can help AEC firms take virtual walk-through capabilities to their clients, wherever they may be—in their offices, on job sites or even conference rooms of hotels.

2. **Green-building initiatives.** Designing, engineering and building structures to minimize their environmental impact and to be resource-efficient throughout their life cycles offer compelling economics. In fact, respondents to a 2017 global survey by the World Green Building Council report that green buildings have lower operating costs along with a 7 percent boost in building value compared to traditional structures.[2]

One leading AEC firm aims to go beyond performance-driven design to create regenerative buildings that produce more energy than they use. The trend toward green design is raising client expectations about buildings being dynamic, not static, assets.

In choosing workstations to design and engineer green buildings, AEC professionals understand that computational power is critical for executing all the calculations necessary. Users will want to maximize their CPU core count, starting with a single-socket and moving to a dual-socket architecture for even greater performance.

3. **Visualization capabilities.** Virtual reality (VR) is changing and accelerating AEC development cycles. Architects and their MEP engineering colleagues as well as their clients can use VR to conduct virtual walk-throughs of buildings in the planning stages. This way, reviews can be more complete with higher-quality feedback, resulting in fewer iterations and revisions to plans.

What's more, design issues can be flushed out earlier in the development stage, costing less to remedy than later when MEP is being layered on or, worse, after construction has started. Six Sigma quality systems spawned the "Rule of Tens" that suggests the cost for an unidentified error increases by a factor of 10 from one value-added level to the next.

AMD Graphics Cards

AMD has long been a leading provider of graphics accelerator cards and a partner with Dell EMC in supplying those cards for Dell Precision workstations.

The graphics processing units (GPUs) on AMD cards are designed, engineered and manufactured to provide the greatest memory bandwidth possible, as measured in gigabytes per second (GB/s), for a typical AEC firm's tight budgets.

High GB/s speeds provide users with the ability to hold the geometric datasets and associated assets like texture maps and are standard on AMD Radeon Pro and WX models. The high-performing memory bandwidth of AMD cards also supports VR and AR, an increasingly important AEC requirement.

Few things can tank user productivity more easily than running out of memory while manipulating objects in design and rendering software. That's also why, like Dell EMC, AMD works closely with AEC software developers to ensure its cards are optimized to run their applications at peak performance.

GPU speeds, measured in trillions of floating point operations per second (TFLOPS), are also critical. The larger the model detail, the more calculations must be completed by the card every time the user interacts or rotates the model. In this area, AMD cards are known for delivering among the best available price-performance.

Powerful workstations with equally powerful graphics accelerator cards are required to provide these needed VR capabilities. Dell Precision 7000 Series 17-inch mobile workstations with AMD Radeon Pro graphic accelerators were the world's first VR-ready laptops, enabling AEC professionals to take VR capabilities to their clients' offices or building sites to share with their construction partners.

4. **Collaborative development.** Technology, especially visualization, is enabling collaborative stakeholder interaction like never before, both in person and at a distance. This can help compress the traditional iterative cycles involved in designing, engineering, building and commissioning structures—and possibly eliminate some of the cycles, too. Real-time sharing and manipulation of CAD and CAE files as well as documentation can also streamline project development and execution.

   In years to come, as AEC teams continue to use CAD and CAE in their work, a machine-learning application driven by artificial intelligence (AI) algorithms on their workstations can make real-time suggestions about the most efficient designs, given parameters of available components, costs, construction feasibility, and lifecycle serviceability and support.

   The results of more collaborative development and AI-driven machine learning? Better-performing structures built more quickly, with fewer changes and, potentially, less cost.

   Because of the amount of interactivity that occurs with collaborative development, the best performance—measured in frames per second—comes from maximizing the CPU frequency and using multithreaded graphics accelerator cards. Dynamic clocking of CPUs, like the "turbo" mode provided by Dell Precision workstations, can help by boosting a CPU's frequency as much as five times from an 800 MHz baseline to close to its 4 GHz theoretical specification.[3]

5. **Anywhere/anytime mobility.** AEC professionals have traditionally been desk-bound, but getting out into the field and taking drawings and simulations to clients and construction sites require uncompromised mobile technology that doesn't fall short on performance. Busy clients appreciate the convenience of having their AEC professionals come to them with everything needed to conduct a comprehensive project review and even a virtual walk-through of the project.

   Although powerful mobile workstations such as the Dell Precision 7000 Series models with AMD graphics accelerators inside have been available for years now, taking work-in-progress to client premises can still set an AEC firm apart from its competitors. In addition, MEP engineers can take their drawings to construction sites and check that the installation of their systems is being done is to spec. They can also update drawings to as-built versions, taking into account physical changes required due to unforeseen circumstances.

6. **Building Information Modeling (BIM).** By providing a digital model of a structure's physical and functional characteristics, BIM offers a way for all stakeholders—AEC professionals, their clients and, after construction, the management teams of their buildings—to share facility information during its full life cycle. BIM can start at the earliest pre-design concept stages and extend for decades of occupied use, all the way through to demolition. In manufacturing, such a product model is called a "digital twin" and serves as a virtual proxy for the physical object.

BIM has a bright future in the AEC industry because it can help reduce project time, errors, costs and waste, while improving efficiency, predictability, visibility, integration and, ultimately, building performance. Although BIM-based projects rely heavily on database technology to hold all the information associated with a facility, workstations still have important roles to play as endpoints to access BIM data and to manipulate associated files or analyze data to seek ways to improve a facility's performance.

■ Profound changes will continue, creating new opportunities and challenges

The AEC industry is undergoing profound changes as the result of these six trends. Of course, technology is driving many of these developments; in others, perennial goals, such as continuous quality improvements and reductions in costs and time, are drivers. Green-building initiatives, in particular, reflect growing environmental concerns that are here to stay.

But, no matter what's behind these trends, they offer new opportunities for AEC firms worldwide—and challenges, too. To capitalize on those opportunities, address the challenges and not get left behind, the AEC industry must become more creative, efficient and client-responsive.

The way forward is through the use of advanced design and engineering tools that can boost productivity and streamline workflows with the support of certified high-performance workstations. Dell Precision workstations with powerful AMD graphics cards are ready to help.

For much more detail on workstation specifications, see the comprehensive, 12-page Dell EMC white paper, *Five Keys to Ensure Workstation Choices Will Drive Transformational Productivity Gains and Provide a Sharper Competitive Edge* [URL NEEDED.]

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[1] "76% of architects practices are fewer than 10 people," Just Practising, February 2010. www.justpractising.com/its-about-money-stupid/76-of-architects-practices-are-less-than-10-people/

[2] "World Green Building Trends 2016," World Green Building Council. February 2016. www.worldgbc.org/news-media/world-green-building-trends-2016

[3] "Intel Turbo Boost Technology - How It Affects Processor Speed" https://www.dell.com/support/article/us/en/04/sln298588/intel-turbo-boost-technology-how-it-affects-processor-speed?lang=en