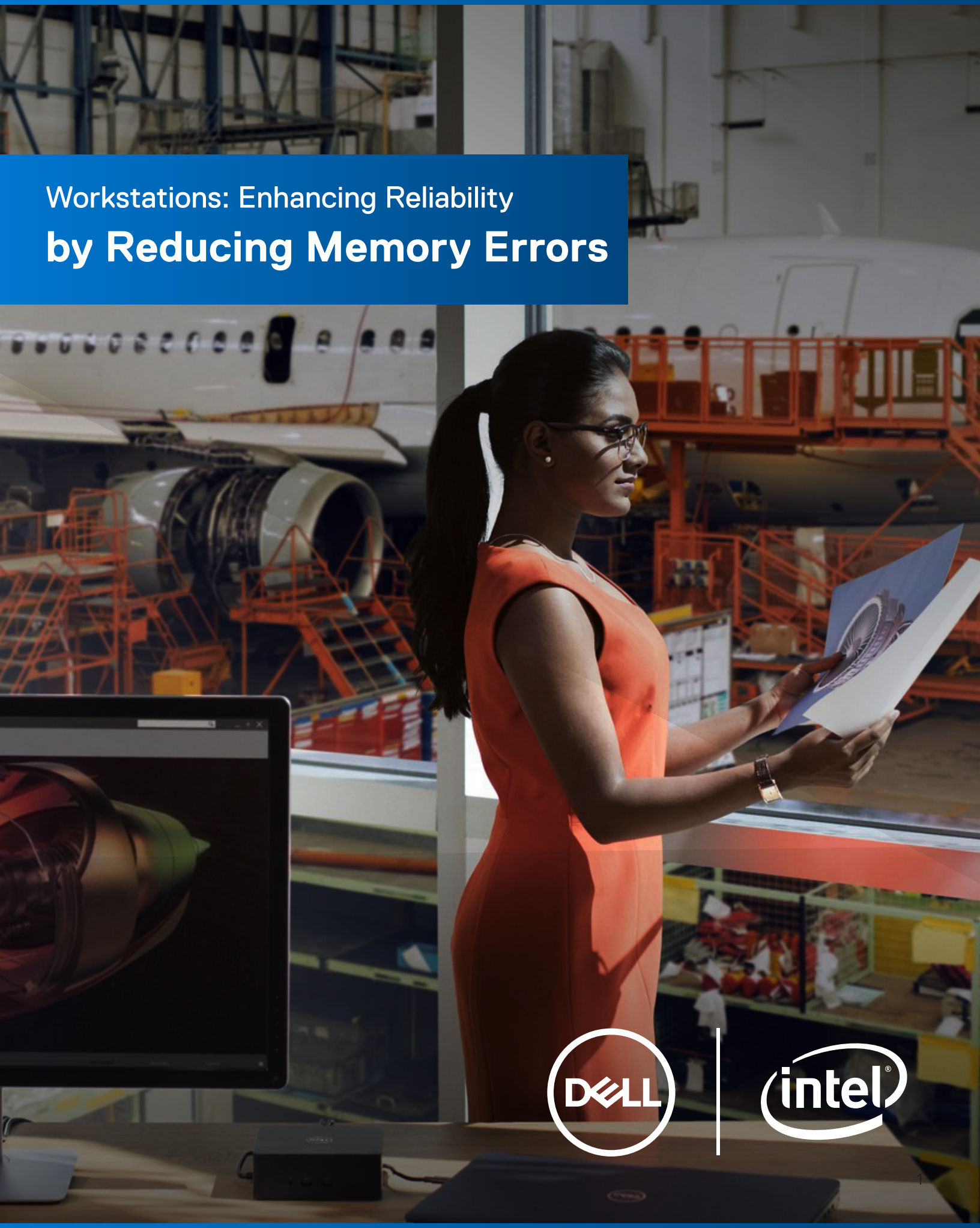


Workstations: Enhancing Reliability

by Reducing Memory Errors

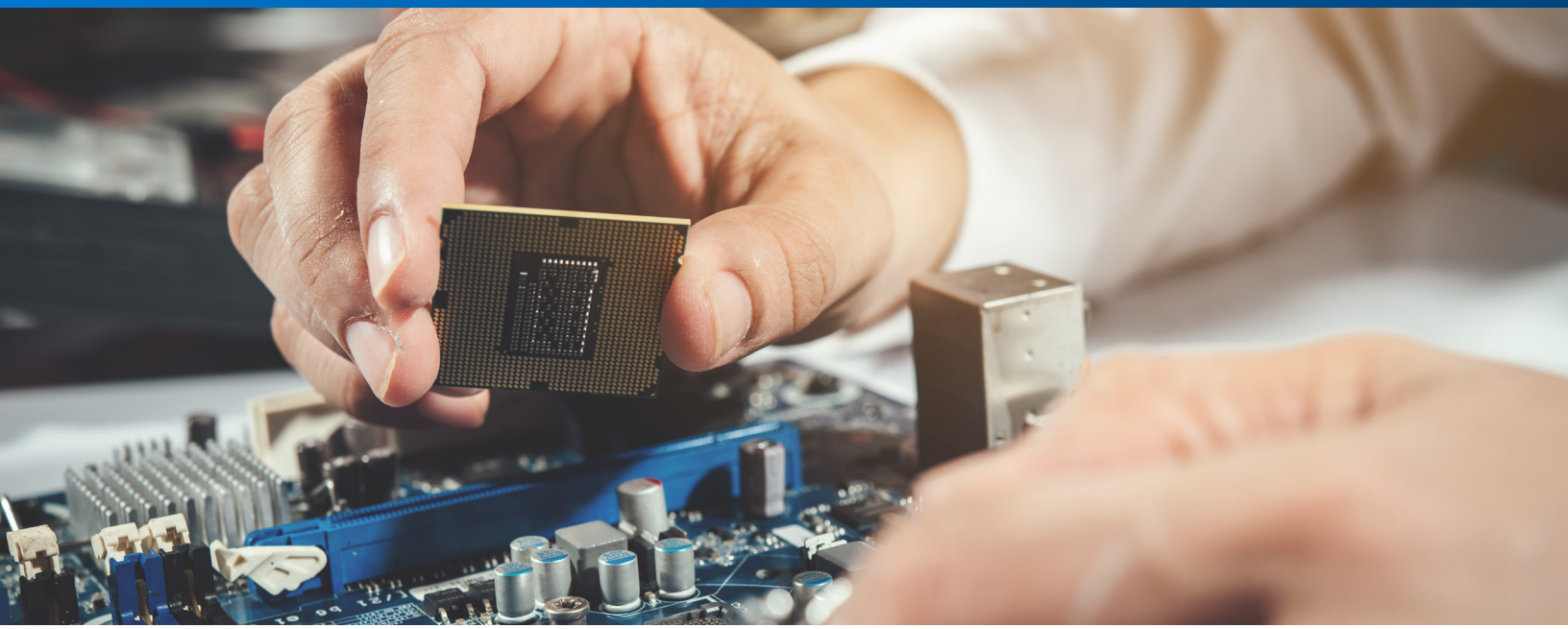
For companies that rely on high-end workstations, the demands on their systems continue to grow.

Workstations are designed for power users—engineers, content creators, financial professionals, scientific users and so forth. These knowledge workers' tasks involve computing- and data-intensive workloads, from CAD/simulation files and 3-D renderings to the analysis of large volumes of financial data—workloads that corporate PCs are not designed to handle. And with expanding content and data and the ever-increasing speed of business, those workloads are increasing.

When considering workstations, companies often focus on performance, which is critical when handling high-end workloads. But just as important is reliability—the ability of the workstation to keep running and maintain accurate data to avoid downtime and errors that at times can have a profound impact on the business. While reliability is typically not a large issue for PC users running email, word processing and web applications, it is critical for workstations.

To a great extent, reliability depends on minimizing memory-related errors—something found in every computer system. Technologies from Dell and Intel work in concert to address two key sources of memory errors, and ultimately make workstations more reliable. This reliability is a key differentiator for workstations versus PCs—and understanding these technologies and their impact on errors can help companies better assess which platform is right for them.

These technologies—Dell Reliable Memory Technology (RMT) Pro and Intel's Error Correcting Code (ECC)—are already important to power users in engineering, science and media and entertainment. In the near future, they may well become familiar to a growing range of users, as the need for workstation reliability finds its way into more types of work.



Regardless of the manufacturer or the type, almost all computer-based memory has some type of infinitesimal characteristic that has the potential to cause memory errors. These can be due to a variety of factors, such as heat, physical defects, and age. The most common errors essentially fall into one of two categories—soft errors and hard errors.

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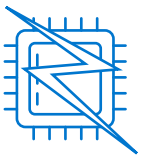
Soft errors:

Soft errors are caused by the random corruption of bits—and studies have shown that beyond the first 10 months of a dual in-line memory module's (DIMM's) life, the rate of such errors increases dramatically. In a soft error, a single bit of dynamic random access memory (DRAM) spontaneously flips to the opposite state—that is, it might flip from a 1 to a 0 when it should have remained a 1 during a memory cycle. These soft errors do not cause physical damage, and they can be corrected via a memory refresh—but they can be a source of significant problems. Depending on the situation, they can lead to a system crash. But more important, they can cause data to become corrupt, and even do so "silently," without the user being aware of it.

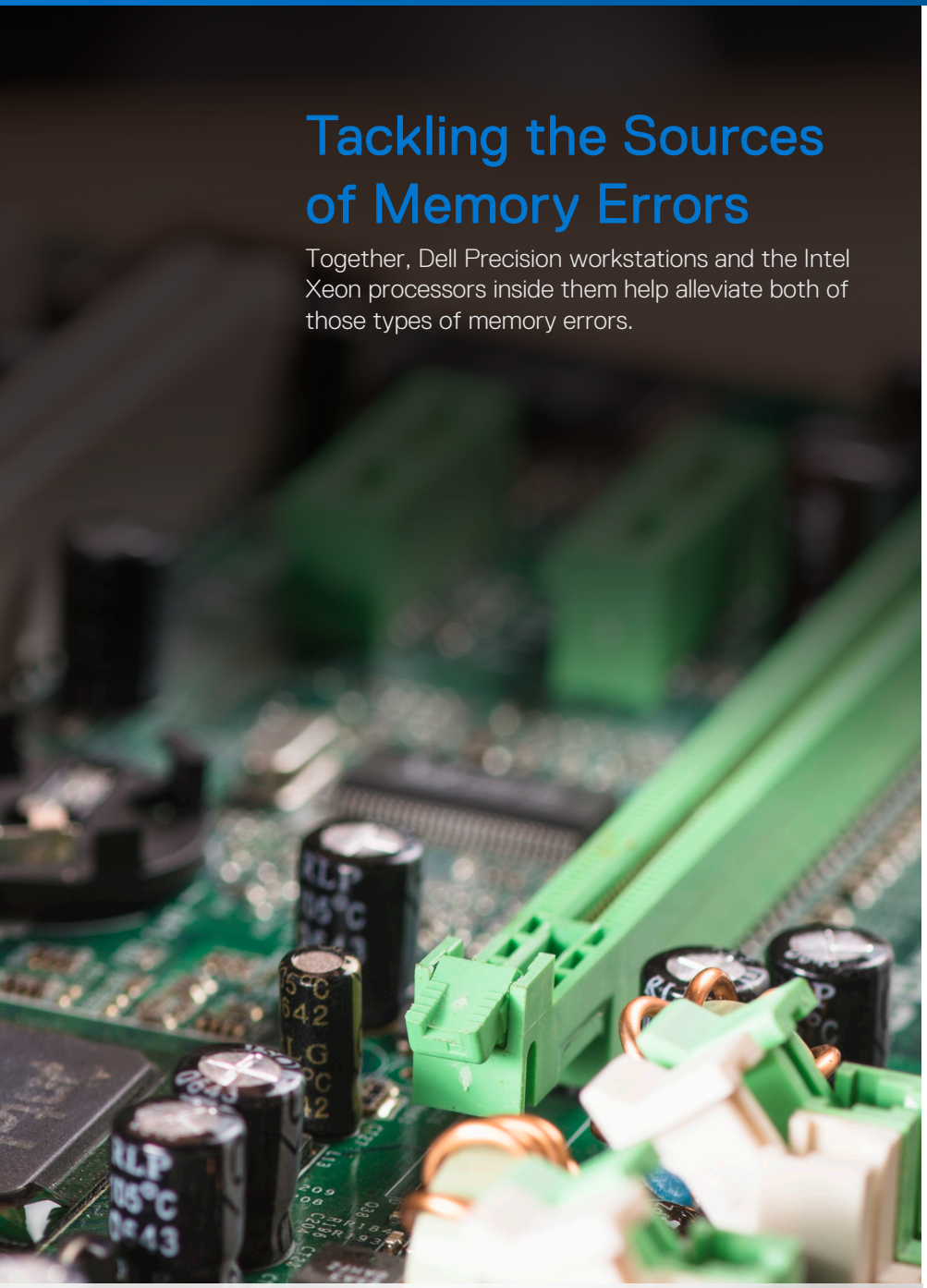


Hard errors:

Hard errors typically involve the corruption of bits in a repeatable manner because of a physical defect or anomaly within the DIMM itself. Hard memory errors can cause a machine to crash, requiring it to be rebooted. Or, they can cause applications to fail, generating a system-level error code such as a kernel panic or the well-known "blue screen." Traditionally, users have had to report these errors to IT, which would then run diagnostics to find the error. Often, that approach leads to the replacement of the entire DIMM—all because of a single bit failure.

For a standard office personal computer system, memory errors do not usually have a significant effect on the operation of application software. With workstations, however, the cost of downtime and work interruptions can add up quickly. Often, workstation users are relatively expensive talent, such as engineers, and memory problems can cut into their productivity and slow progress. For example, the interruption of long, time-bound tasks, such as media renderings or complex fluid simulations, can have a significant ripple effect. If an engineering simulation running overnight crashes due to a memory error, the problem won't be discovered until morning, and essentially cost a day of work. Ultimately, such problems can lead to project delays and missed deadlines.

Memory-related data integrity problems can lead to a different set of issues. Here, small changes can add up to big problems, particularly in industries such as life sciences and finance. For example, one "flip" in a bit could turn a $2 million account balance into about $14,000.



Tackling the Sources of Memory Errors

Together, Dell Precision workstations and the Intel Xeon processors inside them help alleviate both of those types of memory errors.

The combination of these Dell and Intel technologies addresses the two key drivers of memory errors, helping to ensure smooth, error-free operations and data integrity—that is, the reliability that is critical in workstations.

Intel offers ECC with its Xeon processors (but not on its Core line of processors). Originally designed as a data-center technology for servers running critical applications, ECC memory includes extra memory bits and an on-board memory controller that checks for memory parity. If it detects a soft, single-bit error, the ECC memory can correct it and provide the correct data on the fly so that the system continues to operate without interruption. Experience has shown that ECC can find and fix up to 99% of correctable soft errors.

Dell Precision workstations complement the Xeon ECC memory with the patented Dell RMT Pro that addresses the problems of hard errors. This technology detects hard errors and multi-bit soft errors in a DIMM, maps the defective portion of the DIMM, and reports the defect and DIMM location in the BIOS as being bad. Then, when the system is re-booted, RMT Pro essentially makes the defect area invisible to the operating system. It's as if the bad memory had never existed. Applications and critical systems functions simply bypass any marked area and continue working.

RMT Pro helps limit downtime and increase productivity. It also helps avoid the need to run diagnostics and replace entire DIMMs to eliminate what are actually small, isolated defects. That helps increase memory longevity, drives down overall maintenance costs and frees up IT support time for other efforts. And RMT Pro will alert the user when the DIMM has reached a critical level and needs to be replaced so IT can proactivity procure new memory for the system.

Building Reliability into the Workstation

ECC and RMT Pro are key to workstation reliability, but there are other factors that contribute to higher reliability, relative to the typical PC. For example, Intel Xeon processors feature a number of RAS (reliability,availability, serviceability) features that allow them to better survive CPU/memory errors, such as error detection, correction, containment, and recovery in processors, memory and I/O data paths. Intel also offers Pro technology that lets IT departments remotely manage, diagnose and update Intel-based workstations.

In addition, workstations are typically designed with reliability in mind. In Dell Precision workstations, for example, thermal engineering helps ensure that components stay cool while running compute-intensive workloads, while more robust impact resistance helps protect those components. Workstations often support RAID configurations to help increase performance and protect stored data, as well.

An especially significant factor in reliability is the certification of independent software vendor (ISV) products. This certification helps ensure that the complete system - hardware, applications and drivers—all work together as expected. It is particularly important with workstations because of the sophisticated, complex and critical nature of some of the software they run.

With that in mind, Dell and Intel spend thousands of hours working with software partners and testing applications to help ensure that their products function properly with partner products, and that support is available if problems should arise. Dell Precision workstations with Intel Xeon processors have been certified for engineering software from companies such as Bentley, PTC, Autodesk, Dassault Systems and COMSOL; media and entertainment software from Adobe, AVID and ATTO; and scientific software from EIZO, ESRI and Schlumberger—to name just a few.

An Eye on the Future

Business and technology both continue to evolve, and going forward, that is likely to prompt more companies to reassess the tools they use to perform work. For example, content files are becoming larger and more visual, software is becoming more sophisticated and complex, and large volumes of data are being used in more applications—all of which will require more memory. According to one analysis, 1 in 3 systems with just 4 GB of memory will have at least one correctable memory error in the course a year—and more memory naturally increases the odds of an error. Over time, then, a graphic designer or game creator that of uses a PC today may find it increasingly difficult to do his or her work.

Not every office worker will need a workstation, of course. But companies should monitor the changing computing needs of various types of employees as multimedia authoring, larger-scale number crunching and even technologies such as artificial intelligence and virtual reality find their way into more parts of the business. They may well find it worthwhile to move a number of PC users “up the stack” to workstations to help ensure uninterrupted operations.

As they weigh those options, companies should maintain a focus on the high reliability that is at the heart of the workstation. That will mean factoring in the growing importance of reducing disruptions and ensuring data integrity—and ultimately, having a clear understanding of the value of avoiding memory problems and the advantages that the workstation can bring to users and the company as a whole.

Visit www.DellEMC.com/Precision to learn more about Dell Precision workstations.