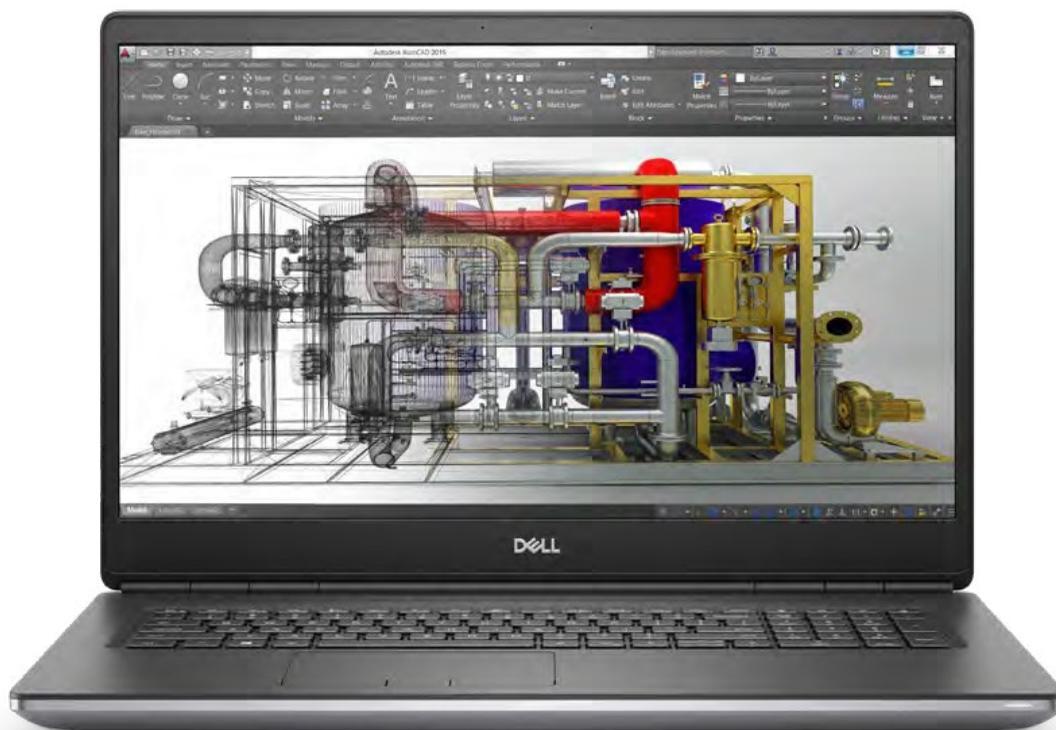# Engineering From Home

As industry grapples with extended work-from-home scenarios, the right workstation configuration can help maintain productivity for mechanical engineers and industrial designers

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mprovements in mobile technology and remote access tools have made it easier for engineers to do their work remotely, but many companies' product development processes remains largely office-bound. Challenges around the need to access large data sets and computing horsepower, as well as concerns about security and intellectual property, meant that most engineering tasks were traditionally completed within the confines of a corporate campus or office building.

As we have seen in the first half of 2020, however, the global pandemic has forced most engineers and designers into work-from-home scenarios. Most organizations were not prepared for keeping their engineering and design teams productive while working remotely.
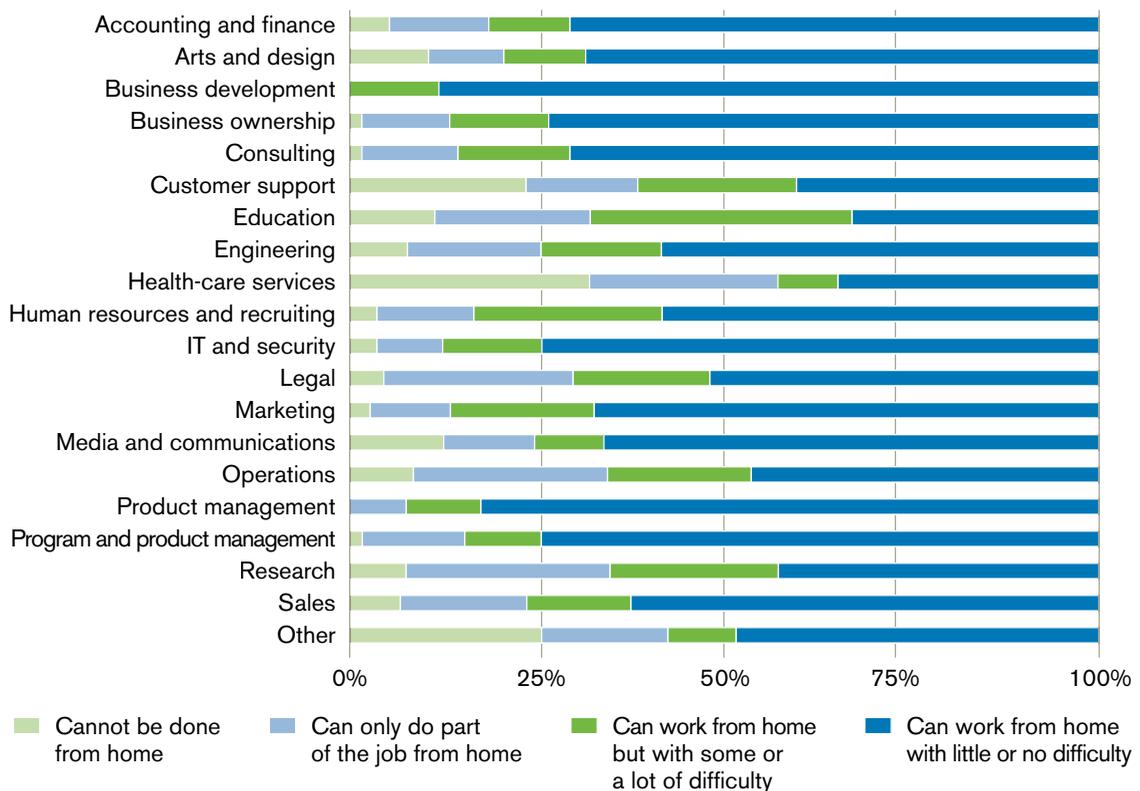
According to an April 2020 MIT survey, 34% of respondents said they had transitioned to working from home in the previous month. When added to the 15% who said they'd been working from home before the arrival of COVID-19, the numbers indicate that nearly half the U.S. workforce is working remotely to some degree. According to data from Netskope (which provides cloud security services), the percentage of knowledge workers that were working remotely during the week went from 27%

to 58% in March. By May, those figures had topped out above 60% and held steady, with roughly 2/3 of North American users working remotely.

The shift was both large and abrupt. The level of preparation for this extended work-from-home scenario varied significantly by company. Most firms have disaster preparedness plans in place for short-term disruptions caused by events like blackouts, flood, hurricanes, and other disasters. Many did not have plans in place for having their employees out of the office over the long term; in fact, quite a few companies had actively discouraged remote work up until this point. In fact, an OWL Labs survey found that only 23% of respondents worked at companies that had implemented a formal work-from-home protocol in preparation for the COVID-19 shutdown.

This was also true of many engineering departments, which found themselves attempting to complete design projects, run simulations, and collaborate with a newly dispersed group of engineers, managers, and clients. Engineering requires a level of computing horsepower that is not available on the often outdated consumer hardware many employees have at home (and which many are sharing with spouses and children).

Suitability of job for remote work by industry

Legend:
- Cannot be done from home
- Can only do part of the job from home
- Can work from home but with some or a lot of difficulty
- Can work from home with little or no difficulty

Source: Slack survey of knowledge workers, conducted March 23-27

According to a survey from Slack, the ability of knowledge workers to successfully work from home can vary significantly by industry. More than 50% of users in the engineering space reported they "can work from home with little or no difficulty." Data from Statista found that 72% of respondents in the design industry believe that they can remain effective in a work-from-home environment.

While some employees were able to load up their desktop workstations and take them home, even this stopgap solution presented a number of significant productivity challenges. Valuable data and company IP were now outside the firewall, and design and simulation files were housed on hardware no longer on the corporate network. Managing confidentiality, versioning, and release states became a nightmare for everyone involved.

This not only poses significant security and insurance risks, but also makes IT support much more difficult. In addition, for ongoing design projects, coordinating revisions is nearly impossible without a robust remote-access content management solution in place.

There are solutions available that can help engineering teams remain productive while working remotely, and help firms better prepare for future disruptions. Today's mobile workstations can provide the same performance as a desktop or tower system, while reducing some of the challenges described above. Remote access solutions can also provide a way for engineers to tap into their desktop systems even if they cannot physically return to their workspaces, and can also ensure a safe, reliable way to collaborate.

Making an investment in these mobile and remote access solutions now is important, to address both current needs and prepare for a future that will likely involve much more remote work.

While the current pandemic will eventually wind down, companies must take a hard look at their ability to enable remote work, and prepare for whatever lies ahead expecting an increasingly likely need for agility and flexibility. What's more, remote engineering challenges are likely to continue as work-from-home becomes more common in the wake of these events. A Gartner survey found that 74% of CFOs and business finance leaders said that they expect between 5% to 50% of their workforce who previously worked in the office to become permanent work-from home employees even after restrictions are eased. According to the survey, 25% expect at least 10% of workers to remain remote, while 17% of respondents expect 20% of employees will remain remote. Ultimately, Gartner's survey found that firms were able to significantly de-risk the overhead of corporate real estate and IT infrastructure.

Many companies have also discovered that their biggest fears about remote work simply never came to pass. A survey from technology vendor Metova found that 48% say they are more productive working from home, and 57% would prefer to work from home in the future. Another survey from Robert Half UAE (a staffing agency) found that 80% of workers would prefer to continue working from home after the pandemic.

Currently, many companies are relying on short-term fixes that involve cobbling together temporary remote software licenses, ad-hoc cloud access and a hodge-podge of company- and employee-owned hardware. Engineering organizations should invest in a long-term remote work solution that can provide a solid foundation for disaster response, and also enable their team to work productively from anywhere. Digitization initiatives are no longer competing for business priority and remote worker productivity has taken center stage in the conversation.

Dell Optimizer

Dell Precision workstations include a new feature called the Dell Optimizer for Precision, which leverages Artificial Intelligence (AI) software to learn how users work and then adapts to their style to create a smarter, more-personal experience. Optimizer can improve system responsiveness, application performance, battery power utilization, storage and audio performance. The IT department can monitor Optimizer remotely via a single console that is managed from WorkspaceOne or Microsoft SCCM.

Work From Home Options

A variety of remote engineering options have been available for several years now, but all have had their mettle tested during the global shutdowns in 2020. Each approach comes with caveats that may vary based on use case.

CLOUD AND SAAS SOLUTIONS

While some design and simulation software vendors have established cloud or Software-as-a-service (SaaS)-based solutions, few offer their full platforms in this configuration. There are native cloud CAD and simulation tools available, these new tools often lack the depth of features, capability and reliability designers an engineers have come to rely upon in non-SaaS offerings. These solutions can also create challenges in moving data to the cloud and back, latency and scalability issues, data security and increased strain on network resources. The use of public cloud compute capacity may also complicate software licensing and token management, depending on engineering software being used; some vendors have made the cloud transition easier than others.

For companies that engage in a large amount of simulation work on a regular basis, cloud costs can potentially be higher than relying on an on-premise HPC cluster or leveraging high-powered workstations. (Determining those costs will require a thorough evaluation of a given company's specific workloads and software solutions.)

Most engineering organizations are currently not using cloud or SaaS-based solutions either because they don't meet their current needs, or because they are restricted by regulatory requirements (i.e., defense and aerospace) or internal policies.

The public cloud can be helpful, however, in providing burst capacity to address short-term spikes in usage or the need for additional compute resources.

MOBILE WORKSTATIONS

While there are engineering roles and workflows that will always require access to high-end tower workstations, mobile workstations have advanced considerably and many have more than enough horsepower to handle day-to-day engineering and simulation tasks. CPU and GPU advancements have been incorporated into mobile workstations that are just as powerful as many tower/desktop systems.

The capabilities of these systems have increased while prices have fallen. These workstations can be easily customized and configured to optimize specific workflows (CAD functions, finite element analysis simulations or photorealistic rendering, for example), providing enhanced performance in a multi-CAD environment.

What's more, when equipped with NVIDIA Quadro GPUs, there are workstations available that have been certified for many of the leading design and engineering software packages for ID, CAD and CAE. These applications leverage GPU acceleration to greatly improve performance.

For example, Ansys Discovery leverages the NVIDIA CUDA infrastructure for massively parallel computing to enable real-time simulation. With that type of power at their fingertips, more persuasive simulation is available to engineers, which improves the overall design process.

Having the right workstation can play a critical role in remote work scenarios. In a June 2020 PwC survey, when asked what would help improve their productivity while working from home, 55% indicated they needed better hardware or equipment.

Workstations also offer an uninterrupted workflow, as designers and engineers can access all of their engineering and business applications on the same system. A workstation with a multi-core processor can easily handle single-threaded CAD tasks, in addition to any other work the engineer may need to do. With the addition of a modern GPU, the increase in available cores can enable parallel intensive tasks like photorealistic rendering and simulation.

Over the long term, these workstations can also be upgraded as the organization's needs change and evolve. This protects their initial investment and provides greater flexibility to configure the computers to match the needs of individual users.

The newly released Dell Precision 7550 and 7750 are good examples of mobile workstations that offer optimal configurations for engineering applications. Both models are available with 10th Gen Intel Core and Xeon 8-core processors with up to 128GB of 2933MHz memory and 6TB of storage. They can be equipped with up to NVIDIA Quadro RTX 5000 GPUs, and support virtual reality, 3D CAD, data science and AI applications.

REMOTE ACCESS SOLUTIONS

For modeling and simulation workflows that require access to office-bound workstations, there are remote access systems that, via a virtual private network (VPN), can enable engineers to use a mobile computer to access their office systems.

In these scenarios, only pixels are shared between the two computers. The data remains secure on the office-based workstation. That means engineers can access the data and compute power of their workstation, without over-taxing the system they are using on the road or from their homes.

For these solutions to work, companies must have a robust VPN solution in place, as well as a remote access platform installed on the office hardware. In the case of Dell Precision workstations, the TeraDici PCoIP Software client and a remote access host card can enable this type of pixels-only access from anywhere.

The advantage to this approach is that valuable corporate IP stays within the firewall. However, these solutions need to be set up in advance. In the case of a natural disaster or pandemic, when the workstation or data center are not accessible, they can't be deployed after the fact without physical access to the machines.

VIRTUALIZATION

Virtualization of the workstation is another potential solution for remote access. Remote desktop virtualization implementations house the applications and data on the remote system, with a thin client device or workstation (or multiple clients) accessing those centralized resources. For organizations, this can be an efficient and cost-effective solution for remote work

However, this data center-based approach can be expensive to power and maintain without experienced IT staff or outsourcing. For firms that have established workstation-centric workflows, virtualization could require a significant restructuring of the IT architecture.

Use Case Scenarios and Recommendations

The remote work environment will differ for each organization based on the type of engineering tasks they need to address and the size of the company. A roles-based approach to creating a robust remote work infrastructure can be helpful, then, in mapping out which combination of solutions will be required.

INDUSTRIAL DESIGNERS need sufficient computing horsepower for conceptual work, surfacing and rendering. They may also require the ability to support remote collaboration or virtual/augmented reality in order to facilitate design reviews with managers and clients. Powerful mobile workstations such as the Dell Precision 7000 Series equipped with a modern GPU can easily provide the compute resources for these users both in the office, at home, and on the road.

MECHANICAL ENGINEERS, Simulation Engineers and Electrical Engineers have some similar requirements and some which are quite different depending on the work they do. They may need to access large data sets or conduct GPU-accelerated simulations. In some cases, they may not be allowed to have that data local on their home-based machine. They may also need to access the larger horsepower of a tower system for modeling and geometry creation.

In this case, the use of a power mobile workstation may be augmented with a remote access solution so that engineers can tap into a tower system or a high-performance computing (HPC) cluster to remain productive.

At the office, **managers** that may need to review and sign-off on designs and revisions have traditionally relied on temporarily accessing a workstation for those purposes. In a remote work scenario, that simply isn't possible. Virtualization resources, which would enable short-term access for a quick review, can provide a simple solution without typing up valuable hardware or requiring additional investments.

The Future of Remote Work

As you can see, there is no one right answer for every member of the design and engineering team. Finding the right solution for each user requires an understanding of their workflows, access requirements, and the compute resources needed to do their jobs. A combination of powerful mobile workstations and remote access technologies can help organizations be better prepared and more responsive to a work environment that may look very different in the coming years.

Regardless of which route is taken to enable remote work, centralized management tools will be necessary to ensure success. Companies should be evaluating where important data will reside (in the data center, or on the workstation), what security solutions they have in place, and how they can best monitor, manage and support a distributed workforce.

IT managers should be able to centrally ensure every device, regardless of location, is fully updated with the latest security upgrades and patches, even if the hardware isn't physically available. Data should also be secure and centralized, while remaining available for remote access via secure channels..

PLAN FOR THE FUTURE
The barriers have come down in accepting remote work as a new-normal part of doing business in manufacturing and product development. Progressive companies now realize that their reservations about working from home were misplaced. Most employees are dedicated, responsible and understand their roles, regardless of location.

The 2020 pandemic should be a wake-up call for engineering organizations to permanently address their disaster recovery and remote work policies and technology. Companies should invest now in the technology and infrastructure they will need to continue being productive in the current environment, and to prepare for future disruptions.

Optimal Mobile Engineering Workstation Configurations

Updating to the latest multi-core processors and GPUs (along with upgrading to the most recent version of popular simulation software packages) can generate a 4X to 9X improvement in simulation speed. While workstation configurations will vary by user and application, there are a few general guidelines for equipping a mobile workstation with enough horsepower to handle typical design and engineering scenarios.

GPU: *Most of the major CAE simulation software packages are now taking advantage of GPU performance to accelerate performance. The NVIDIA Quadro RTX series (3000, 4000, 5000) are certified for many of these applications, and (depending on the software and the model) can cut solve times in half in some instances.*

CPU: *Many standard CAD and CAE packages are not multi-threaded. For users that work exclusively with those tools, a processor with fast single-thread performance is optimal. For simulation and rendering, if they don't take advantage of GPU acceleration, CPU cores is the traditional lever to pull to increase performance.*

RAM: *Smaller data sets may be handled with 8GB to 16GB of RAM, but the general rule of thumb is to invest in as much RAM as you can afford. This is especially as the size and complexity of models is increasing. Some simulation tools may require much larger amounts of RAM to ensure optimal performance, so check with your vendor.*

Storage: *Solid-State Drives (SSDs) provide up to 10X faster performance compared to a standard Hard Disk Drive (HDD). With prices coming down, an SSD is well worth the investment.*

Want to know more?

Additional information is available via the following resources:

Making the Case for a Workstation-Centered Workflow

Dell Precision Workstations

NVIDIA Quadro RTX Solutions

The Advanced Product Development Resource Center