DE247 Digital Engineering

MAKING THE CASE

FOR A HIGH-POWERED ENGINEERING WORKSTATION

A SPECIAL SUPPLEMENT IN PARTNERSHIP WITH

Lenovo

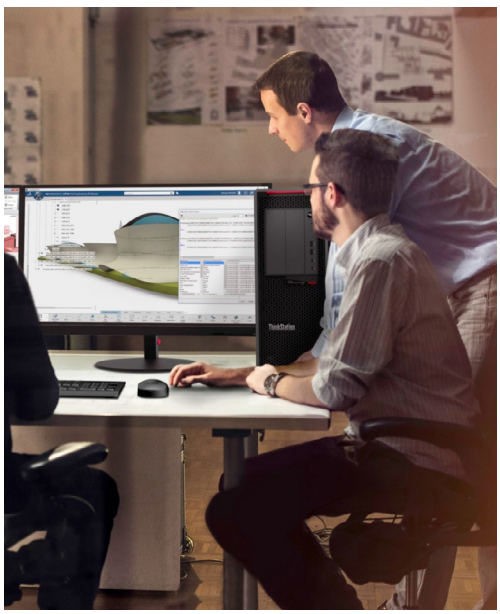
NVIDIA

A NEW WAY TO WORK

Solving complex engineering problems requires high-powered workstations

One needs only to look around to see why engineering workflows and development processes have become so complex. Whether the task is designing a modern vehicle sporting semi-autonomous operation and sophisticated electronics or creating a medical device packed with sensors and circuitry, the lines have blurred between engineering disciplines and require a collection of high-performance tools to get the job done.

It has now become more critical than ever that cross functional teams work together seamlessly across Industrial Design, Electrical and Mechanical Engineering out to production planning in the factory. Today's complex products combine mechanical components with software and electronics controls, requiring constant collaboration in highly iterative development cycles. Given the interconnected nature of products, engineers are continuously working in concert with other functions along with customers, suppliers, and partners to ensure all elements of a product are coordinated and to avoid late-stage surprises or design disasters.



To get it all done, the typical engineering team relies on a wide range of tools to design, engineer, and digitally test product concepts prior to—and sometimes in lieu of—creating labor-intensive and costly physical prototypes. For example, engineers can quickly simulate and test mechanical performance of key components to predict critical failure modes and make multiple design iterations, then using their own 3D printers or an on demand manufacturing platform they can source high quality physical prototypes for final design validation.

New AI-infused shape optimization and generative design software can help speed the development of novel product concepts, coming up with organic shapes and lattice structures that would be impossible for any human to replicate. There are many simulation and analysis software packages that let engineering teams explore the real-world physics behind their offerings before they cut metal or injection mold T1 samples—whether it's Finite Element Analysis (FEA) to optimize structural integrity, Computational Fluid Dynamics (CFD) to map out airflow, or highly specialized frequency analysis physics in areas like electromagnetics (CEM).

Once a product design is hardened, another set of digital tools enters the mix. Powerful rendering and visual effects capabilities allow engineers to add a high degree of realism to their digital designs, helpful in conducting virtual design reviews before committing to building products. Additive manufacturing and Computer-Aided Manufacturing (CAM) simulation and management software paves the way for the digital thread to connect all the way through to the production process. And throughout, Product Lifecycle Management (PLM) and other data management and collaboration platforms serve as the backbone, delivering access to a centralized repository of critical design data while supporting and facilitating digital workflows across the ecosystem of product stakeholders.

While engineers are immersed in design and development, they are also juggling the demands of regular office work. Email, project scheduling, creation of documents, and participation in video conferences and customer meetings are part of the everyday grind, requiring engineers to balance use of traditional enterprise productivity tools with their high-performance design software. With teams regularly tasked to do more and facing greatly accelerated time-to-delivery schedules, it's critical that engineers be able to easily and effectively multi-task between resource-intensive applications so they remain productive without impacting the business.

DATA AND PERFORMANCE-HUNGRY WORKLOADS

With this expanded tool set comes a much more sophisticated data management problem. As engineers become more fluent with the tools, and CAD software becomes more advanced, the 3D model is evolving into a highly detailed data set, expanding from the parameters of a single component into a feature-rich representation of all integrated systems. At the same time, engineering teams are producing a wealth of simulation data as they ramp up use of more sophisticated multiphysics analysis while democratizing CAE capabilities to a broader audience in order to expand the design space, iterate faster, and shrink costs.

As a result of all this activity, the data sets are growing exponentially and the workflows are getting ever more complex. Engineers are highly dependent on their workstations in order to stay productive, and many times, older models simply can't keep up, becoming a bottleneck to new and sophisticated workflows. Next-generation workstations offer a solution, providing increased compute power, through the use of state-of-the-art CPUs and GPUs cores, to help engineers optimally multi-task when using resource-hungry simulation and rendering programs.

Specifically, advanced workstations like the ThinkStation P620 leverage more powerful GPUs such as the NVIDIA RTX A6000 to deliver the productivity boost engineers need to keep pace with demanding workflows and increased multi-tasking. Users of existing high-performance workstations may think they are well equipped to squeeze optimal performance from their applications given the horsepower of their current hardware. But the truth is, there's a new CPU/GPU combination that can best performance and boost productivity in a way that drives continuous innovation.

Lenovo's ThinkStation P620 workstation buttressed with the NVIDIA RTX A6000 GPU is a game changer for how engineers work. The combination of the two technologies allow users to wrangle large-scale 3D models and simulation data sets with ease, turbocharge simulation solve times, and accelerate rendering cycles so there is no more limbo waiting on the system to perform complex tasks. In addition, the duo supports the most advanced levels of multi-tasking so engineers can easily model, run simulations, and toggle between office productivity apps simultaneously without any hit on

LENOVO'S THINKSTATION P620 WORKSTATION BUTTRESSED WITH THE NVIDIA RTX A6000 GPU IS A GAME CHANGER FOR HOW ENGINEERS WORK.

WORKSTATION AT WORK

As engineers tend to the complexity of modern-day product design, they are increasingly reliant on more sophisticated tool sets, which allow for extensive work to be done in the digital space with the aim of increasing innovation.

Rendering: Rendering and visualization tools have made huge strides helping engineers bring digital designs to life when collaborating with customers or design partners. Sophisticated rendering allows engineers to show off contours and how lighting reflects off a car, for example, or take a walk through an aircraft cabin to showcase seat spacing and layout. Rendering has other, less engineering-oriented functions: Life-like depictions are an essential tool for customer design reviews, to conduct product walkthroughs, and even as a highly realistic vehicle for promoting and marketing a product.

Lenovo's ThinkStation P620's high clock speeds and up to 64-core AMD Threadripper Pro processors, working together with the new RTX A6000 GPU, can take rendering and visualization performance to the next level. Ray tracing, a technique used for extremely high-resolution, realistic imaging, can benefit from significantly faster rendering speeds with the P620/RTX A6000 combination. Moreover, the technologies vastly accelerate real-time visualization of massive, complex models of buildings, large-scale products, even digital replicas of cities.

Consider the performance of KeyShot, a popular rendering tool. NVIDIA RTX GPU RT Cores and optimized rendering software transform ray tracing. Large, ultra-fast graphics memory enables rendering of large scenes. NVIDIA RTX GPU Tensor Cores accelerate AI denoising, speeding up rendering and other AI-augmented tasks and applications, while at the same time, delivering optimal memory capacity, bandwidth, and GPU utilization for real-time 8K visual creation. When running on a ThinkStation P620 equipped with an NVIDIA RTX A6000 GPU, KeyShot 10 per-

forms 101x faster than the CPU base.[1] There are marked performance gains running KeyShot on a Lenovo ThinkPad P15 mobile workstation equipped with an NVIDIA RTX GPU as well, although, understandably, slightly less dramatic.

Simulation: Much effort has gone into making simulation tools less expensive and more accessible so they can be used continuously throughout the design cycle and by the average design engineer--not just a few select exercises conducted by simulation experts. Yet in order to promote more pervasive use of simulation, workstations must handle robust workloads without being tied up for hours, sometimes even overnight. Historically, it's not unusual for an engineer to be sidelined while his or her workstation churns through complex simulations and delivers analysis results.

Recognizing the shortfall, simulation software vendors have rearchitected their tools to take advantage of GPU acceleration, which delivers a significant boost when it comes to solve times. That's increasingly important as computational power needs increase. The reason? While boosting the number of CPU cores will improve simulation performance, there is a point where there are diminishing returns. That's where GPU horsepower comes into play. A high-powered workstation equipped with a GPU that sports thousands of cores and ultra-fast GDDR6 memory affords workstation users faster performance while achieving greater fidelity in simulation results, especially in light of the exponential growth of model sizes and data sets.

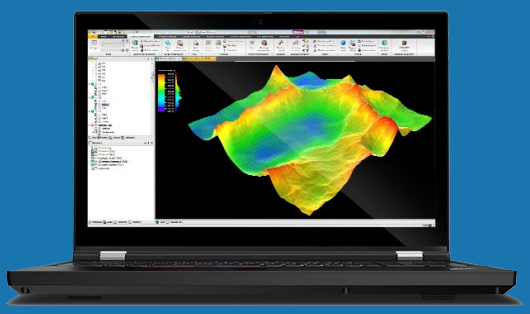
Multi-tasking: The conventional engineering workflow has been highly linear, in part because of the horsepower limitations of previous-generation workstations. Limited capabilities meant there were restrictions on the ability to use modeling, simulation, and rendering applications simultaneously, which introduced unnecessary lags into the development cycle and took a bite out of engineering productivity. A high-powered workstation such as the Lenovo ThinkStation P620, equipped with the GPU computing power and large GPU memory of the NVIDIA RTX A6000, changes that dynamic, enabling data- and compute-intensive multi-application engineering workflows.

WHEN RUNNING ON A THINKSTATION P620 EQUIPED WITH AN NVIDIA RTX A6000 GPU, KEYSHOT 10 PERFORMS 101X FASTER.

For example, with adequate horsepower, an engineer could be modeling in CAD or generative design software while also running a live simulation for a client design review happening via a video conference. In addition, virtual reality (VR), another graphics-intensive workload, is gaining traction as a way to communicate more effectively with design partners. As more firms turn to remote work and the need for collaboration grows, it's critical to have the right horsepower to support advanced multi-tasking that spans a wide array of workloads.

[1]Reference system CPU: Intel Core i7-6900K CPU @3.20GHz, 8 Cores. Scores based on reference system performance, i.e., score of 1 is the same as reference system, score of 2 is 2x performance of reference system, etc.

READY FOR REMOTE WORK



There's been a sustained push for mobile engineering tools, but the events of 2020 catalyzed the need for systems and applications that support remote work. When the COVID-19 pandemic bore down this spring, companies across the globe sent workers home, accelerating a shift to technology platforms that allow employees, including engineering teams, to work from anywhere, whether that's at home, in a remote office, or from a client site when on the road.

Engineers' mobile computing requirements are quite different than their enterprise colleagues. Unlike so many that need a basic laptop and Internet connection to do their work, engineers must have access to heavy-duty compute and GPU horsepower along with fast memory and other high-end features to ensure their graphics- and compute-heavy applications run effectively on the road. An inadequately-equipped system could compromise engineering productivity and innovation.

Lenovo's line of mobile workstations can put those fears to rest. Models like the ThinkPad P15 mobile workstation support a myriad of NVIDIA Quadro GPUs, from the Quadro T1000 to the high-end Quadro RTX 5000, providing a comparable experience on the road or working from home that engineers are accustomed to with their office workstations.

For example, the ThinkPad P15 15-inch mobile workstation can be equipped with a variety of processor configurations. At one end is a model, which features a 10th Generation Intel Core i7-10750H Processor running at 2.60 GHz, up to 5.00 GHz with Turbo Boost and including six cores, 12 threads, and a 12 MB cache, to the high-end model stocked with a 10th Generation Intel Core i9-10885H Processor with vPRO running at 2.40 GHz and up to 5.30 GHz with Turbo Boost technology and including eight cores, 16 threads and a 16 MB cache. In addition to the high-end processors, these models can be outfitted with between 8 GB and 16 GB of DDR4 2933Mhz high-speed memory and up to 512 GB PCIe SSD storage and include accessories like a fingerprint reader and a 720p HD camera.

Another offering in the expansive mobile workstation portfolio from Lenovo is the ThinkPad P1, its thinnest and lightest 15-inch workstation at .7-in. thin and 3.76 lbs. This model can be configured with up to 10th Generation Intel Core i9-10885H 8 Core Process with vPro or the Intel Xeon W-10855M 6 Core Processor with vPro along with NVIDIA GPUs up to NVIDIA® Quadro® T2000, up to 64 GB of DDR4 2666 MHz memory, and up to 4TB M.2 NVMe SSD storage. The ultra-portable workstation, sporting a signature black carbon fiber finish, has also been ISV certified for the leading CAD, simulation, and other data-intensive design applications. There is also the ThinkPad P15v, incorporating 10th Gen Intel Core and Xeon processors, NVIDIA Quadro professional graphics, up to 16 GB of DDR4 2933 MHz memory, and up to a 512 GB PCIe SSD, for the more cost-conscious buyer.

Lenovo's breadth of mobile workstation offerings gives engineers flexibility and choice to configure a system that is customized to meet their specific mobile computing needs.

[You can check out the full Lenovo workstation portfolio here.]

VIRTUALIZATION CALLING?

Given that most engineers are power users, there's a virtualization option in Lenovo's arsenal that can solve performance challenges. Using a standard Internet connection, the Mechdyne TGX Remote Desktop provides like-local performance for individual and collaborative experiences no matter where you are.

The remote workstation solution leverages virtualization capabilities to:

- Deliver low-latency connectivity and reduced network bandwidth.
- Work remotely in resolutions at 4K or higher.
- Deliver real-time keyboard and mouse response for consistent, local-like experience.
- Secure sensitive data and licensed software like CAD and design applications on office workstations or centralized serversny of the ThinkPad P Series platforms.

A TURBO-CHARGED BOOST FROM PCIe GEN4

State-of-the-art CPUs and GPUs can do a lot to turbo-charge data-intensive engineering applications, but something more is needed to achieve optimal performance from these core tools. Enter the PCIe interface, a local I/O mechanism used to interconnect the various system components, from CPUs and GPUs to high-end SSD storage.

The latest incarnation of the interface is PCIe Gen 4, which creates a superhighway to increase data handling and hand-offs between the CPU, GPU, and other system components. Compared to the earlier PCIe 3.0 version, PCIe Gen 4.0 dramatically increases performance up to 16 GTs per lane with total bandwidth gains by up to 64 GB—approximately double the throughput of the older version.

Lenovo's ThinkStation P620 is currently the only commercially-available workstation to take advantage of PCIe Gen 4 technology—in this case, the ability to deploy up to 128 lanes of PCIe 4.0 bandwidth to accelerate data-intensive simulation and rendering applications. Through its ability to fully exploit PCIe Gen 4, the P620 can fully maximize the potential of the RTX A6000 GPU for critical engineering applications. For example, support for the PCIe 4.0 interface enables the P620 to deliver faster data transfer, decreased latency, and increased frame rates for high-performance, high productivity rendering jobs. Case in point: KeyShot 10 performs 101x faster than the CPU base on a ThinkStation P620 equipped with an RTX A6000 GPU. Simulation workflows will enjoy similar performance benefits thanks to the improved interconnection between the P620's CPUs and GPUs, along with other multi-threaded applications.

The ThinkStation P620's support for PCIe 4.0 also delivers performance increases that are critical for high-speed interfaces. The end result is a workstation environment primed to deliver a smooth transition for 4K and 8K video, enabling four times sharper video footage and real-time rendering. At the same time, the Lenovo workstation's support for PCIe 4.0 also ensures improved data access capabilities for real-time insights—another advantage for bolstering the engineering and product development journey.

For more information, visit solutions.lenovo.com/pc-solutions/workstations

THINKSTATION P620: ENGINEERING POWERHOUSE

The ThinkStation P620 hits a variety of performance benchmarks: It's the first professional workstation to support PCIe Gen 4, a high-performance I/O mechanism, and the first AMD Threadripper Pro workstation, delivering a dual-CPU experience in a single-processor systems tuned for multithreaded engineering applications.

Through support for PCIe Gen 4, the ThinkStation P620 uniquely maximizes the power of NVIDIA's latest GPU technology to deliver unparalleled speed and graphics quality for simulation, real-time rendering, AI, and other data-intensive engineering applications.

Processor Options
- AMD Ryzen™ Threadripper™ Pro 3945WX Processor (4.00 GHz, up to 4.30 GHz Max Boost, 12 Cores, 24 Threads, 64 MB Cache)
- AMD Ryzen™ Threadripper™ PRO 3955WX Processor (3.90 GHz, up to 4.30 GHz Max Boost, 16 Cores, 32 Threads, 64 MB Cache)
- AMD Ryzen Threadripper™ PRO 3975WX Processor (3.50 GHz, up to 4.30 GHz Max Boost, 32 Cores, 64 Threads, 128 MB Cache)
- AMD Ryzen Threadripper™ PRO 3995WX Processor (2.70 GHz, up to 4.30 GHz Max Boost, 64 Cores, 128 Threads, 256 MB Cache)

Weight
- 27.48 kg/60.58 lbs

Operating System Options
- Windows 10 Pro
- Ubuntu® Linux®
- Red Hat® Enterprise Linux® (certified)

Graphics Options
- NVIDIA® RTX™ A6000 48GB
- NVIDIA® Quadro® RTX™ 4000 8GB
- NVIDIA® Quadro® P2200 5GB
- NVIDIA® Quadro® P620 2GB

Total Memory
- 16 GB DDR4 3200MHz
- 32 GB DDR4 3200MHz (2 x 16 GB)

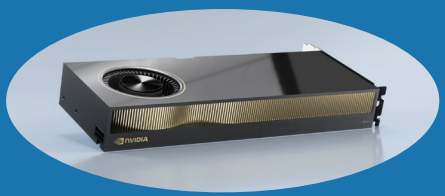
The ThinkStation P620 can accommodate up to 512 GB of memory, and supports 8, 16, 32 and 64 GB DIMMs.

Memory DIMM Capacity
- Supports up to 8 DIMMs

Hard Drive
- 3.5-in. SATA HDD, SATA 6Gb/s (7.2K RPM), 1TB/2TB/4TB
- M.2 PCIe SSD, PCIe 3.0 NVMe, 256GB/512GB/1TB/2TB
- M.2 PCIe SSD, PCIe 4.0 NVMe, 256GB/512GB/1TB

Network Capabilities
- 10GB of built-in 10GbE onboard

Security
- ThinkStation Diagnostics 2.0
- ThinkShield support



NVIDIA RTX A6000

Built on the NVIDIA Ampere architecture, the GPU supports:

Second-generation RT cores: Delivers up to 2x the throughput of previous generations in addition to concurrent ray tracing, shading, and compute.

Third-generation Tensor cores: Provides up to 5x the throughput of the previous generation, up to 10X with sparsity, with support for new TF32 and BF16 data formats.

New CUDA cores: Delivers up to 2x the FP32 throughput of the previous generation for significant increases in graphics and compute.

Memory: 48GB of GPU memory expanded to 96GB using NVLink to connect two GPUs.

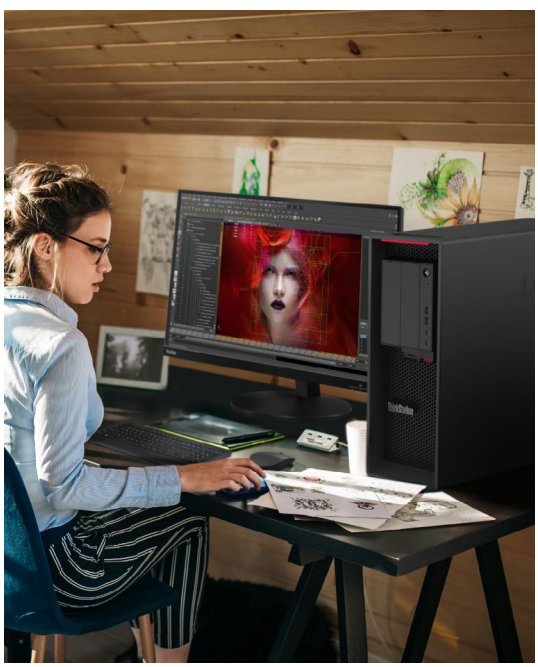
Virtualization: Support for NVIDIA Virtual Workstation software.

PCIe Gen 4: Delivers twice the bandwidth of the previous generation helping to accelerate data transfers to the GPU for data-intensive workloads like hybrid rendering and video streaming.

IN CLOSING

Increasing product complexity is mounting pressure on engineering organizations to rely on more data-and graphics-intensive applications to get the job done.

AI-driven 3D modeling, advanced multiphysics simulation, and sophisticated real-time rendering are becoming a regular part of the engineering workflow, increasing the need for robust system performance to ensure optimal productivity. Along with hard-core design tasks, organizations are breaking down silos and collaborating more regularly across the different engineering domains in addition to working in close concert with customers and suppliers. As a result, engineers need a robust workstation platform tuned for advanced multi-tasking to avoid getting hung up for hours or days on end trying to process the demands of mixed, high-performance workloads.



The Lenovo ThinkStation P620 and NVIDIA RTX A6000 come together to create a workstation platform uniquely and optimally tuned to handle the sophisticated demands of advanced engineering workloads. Unlike older workstations that may buckle under the strain of modern-day tasks, the P620 and RTX A6000 combo ensure engineers have the horsepower they need to be the engine for sophisticated design and unparalleled innovation.

Learn more about the Lenovo ThinkStation P620 here.