



LENOVO HPC DRIVES SCALE AND INCREASED OUTPUT

The use of IT in manufacturing has evolved from simple accounting (materials in, finished goods out) to computer-controlled robotics. Speed of implementation and expansion, as well as maintaining quality control are key to keeping up with changing demands and competitive pressures. Today, companies across multiple industries are turning to High Performance Computing, (HPC), solutions to give themselves an edge. The stakes have been raised, and any system in manufacturing must be able to analyze vast amounts of complex datasets, as well as power 3D modeling and simulations to optimize the entire process from design through production, and work across the entire value chain. See how Lenovo's HPC including servers, storage, security, services, and support, helps deliver solutions that are both powerful and flexible.

HPC rises to meet top manufacturing challenges

There are complex challenges for IT in manufacturing, driven by the use of robotics, integration of distributed sensor networks, and the need for low-latency communications. These along with the use of new materials (such as new alloys and composites) that require advanced modeling and simulations to predict performance, increased competition and demand for shortened design cycles, result in the challenges quickly outgrowing the capabilities of traditional IT.

These are all part of what's been called **Industry 4.0**, and it's the focus of IT providers to overcome these challenges. Lenovo HPC solutions were specifically designed to meet the challenging workloads that modern manufacturing demands. Once thought to be only needed in academia and for advanced research, leaders such as Intel® have declared that **HPC is for everyone**, and that includes manufacturing.

The Integrated HPC solutions for Lenovo enable Industry 4.0, meeting the needs head on. And the capabilities HPC provides are delivering on the promise of the **digital twin in manufacturing**.

modeling and simulations to optimize entire processes from design through manufacturing, while working across the entire value chain. Connect existing systems, suppliers, and customers together through Lenovo HPC systems to deliver on advanced manufacturing processes, materials analysis, fluid dynamics, and impact analysis.

Lenovo offers a range of HPC solutions that are both powerful and flexible so you can deploy low-cost, high-performance engineering clusters for computer-aided engineering (CAE), and drive remote 3D virtual desktop infrastructure (VDI) for greater modeling access at lower cost. Using a domain-specific, building-block approach for implementation, Lenovo HPC offers simulation software and standards support, such as **ANSYS**, with ease of deployment. Lenovo also supports other critical solutions including 3D virtual desktop (VDI).

Modernizing IT infrastructures and systems

The demands and challenges of Industry 4.0 and the digital twin in manufacturing require new IT solutions to ensure your business is ready to produce new products with advanced processes as needed. Don't let out-of-date infrastructure hold back your manufacturing processes. Lenovo HPC solutions seamlessly integrate with your existing systems to increase workload capacity. Lenovo can provide complete infrastructure delivery at the rack level, with a single point of support for compute, storage, and interconnection fabric. With the added support for varied workloads such as simulation, CFD, thermodynamics etc., Lenovo HPC will help modernize your IT and enable your business to deliver new services as needed.

Lenovo HPC system infrastructure, built on Intel® Xeon® Processors, is improving big data analysis and end-to-end processes with real results. Lenovo is particularly well positioned to offer, best-in-class, compute, interconnect and storage solutions tailored for the varied workloads manufacturing systems demand.

Lenovo HPC delivers on the digital twin

The digital twin, where systems provide a complete digital representation of products, help manufacturers go from trial-and-error to a **science-based optimization** process to explore trade spaces, component performance and interaction, manufacturing process efficiencies, and complete life cycle operation. While the concept has been around for decades, the **convergence of key areas of technology** promise to make it reality, including advanced analytics, ultra-high scalability, IoT and high-speed connectivity, and fast distributed storage systems. While Lenovo is already delivering the integrated HPC compute, storage, and networking systems to deliver the digital twin, **enterprises need to take notice** and begin or expand their implementation.

Powering advanced engineering analysis with HPC

Consider a Lenovo HPC solution that scales as your manufacturing needs grow. Speed of implementation and expansion are key qualities to keep up with changing demands and fluctuations in your manufacturing line output. With it, you can power 3D

Return on investment is quicker with HPC

Recent research by **Hyperion** has shown that, on average, for each \$1 invested in HPC in manufacturing, \$83 revenue is generated and \$20 of profit. ROI with Lenovo HPC systems can be achieved through greater innovation, process optimization, and the creation of new solutions and research opportunities.



The research above revealed that a larger number of innovation examples exist in general research, manufacturing, academia, finance, life sciences, oil and gas than in other segments, and that overall profits increase when HPC systems are used in manufacturing.

With access to results sooner and reduced costs with improved modeling and simulations, a scalable Lenovo HPC solution both increases collaboration across your organization and augments your manufacturing processes. Additionally, the increased systems integration Lenovo HPC offers allows you to focus on process optimization, not hardware assembly.

Lenovo HPC benefits and differentiators

Lenovo HPC delivers high-performance and large memory systems, software, and solutions to meet the demanding challenges of product design, engineering, and manufacturing applications. These include Intel® Xeon® Scalable Processors, fast data storage utilizing Intel® SSDs, and technology that can massively scale-out while maintaining enterprise-class security standards to minimize risk.

Intel® Omni-Path® high-speed fabric interconnect for mission critical performance and reliability combined with Lenovo ThinkSystem Servers drive big data and analytics, leading to innovation and efficiency in manufacturing and material analysis.

Lenovo HPC solutions for manufacturing are designed with a building-block approach to simplify management and enable customized expandability. This strategy provides a high-performance data center with simplification and standardization. To achieve this, Lenovo has partnered with other leaders in the IT industry. For example, the converged infrastructure of the Lenovo HPC portfolio combines advanced data storage clusters with the maximum flexibility and workload processing of Intel®

Select Solutions driven by Intel® Xeon® Scalable Processors. Additionally, Lenovo partners with **SUSE** to provide a fully supported set of the most in-demand tools and components used in HPC environments.

Artificial Intelligence in manufacturing

Integrating new technologies and artificial intelligence (AI) into manufacturing systems along with data and predictive maintenance promises to minimize the use of raw materials, improve process efficiency and optimize entire supply chains. Smart manufacturing powered by Lenovo HPC and AI solutions reduces defects and downtime, improving quality, and increasing overall production speed.

Companies are **beginning to drive advances in business intelligence** with AI and machine learning algorithms. However, driving intelligent behavior and simulations that are aimed to prove out new manufacturing processes and the use of new materials through AI requires new IT solutions. Lenovo has experts in such as Data Scientists working to deliver AI solutions that meet the current and future needs of the industry. In addition, Lenovo brings the power of two industry giants by collaborating with Intel to optimize AI for manufacturing; from hardware with accelerators to framework optimization and software ecosystem development.





Case studies in success

Lenovo is the **leading vendor on the TOP500 list** of the world's fastest supercomputers and its HPC solutions are already being used by organizations to power Industry 4.0, deliver on and improve manufacturing outcomes. For example, **Calloway Golf** turned to Lenovo when they faced manufacturing challenges. Calloway Golf Company is an American global sporting goods company that designs, manufactures, markets and sells golf equipment, golf accessories and golf lifestyle-related products worldwide.

The Artificial Intelligence (AI) revolution is here, and it has the power to transform everything from daily life to the production line. With support from the Lenovo AI Innovation Center and access to ThinkSystem servers, **Mark III Systems is helping its clients** harness the power of AI to improve manufacturing quality and efficiency.

Blue Chasm, the digital development arm of Mark III Systems has focused on making AI more accessible to developers and the industry. In manufacturing and engineering analysis, data is arriving in volumes and at speeds too great for people to solve problems with. AI-based processes are the only way to keep up. For example, AI models are being implemented to analyze images from the manufacturing line, in real-time, to look for many things such as potential defects during the manufacturing process. These AI models are constantly being refined and rebuilt, with build times reduced from hours to minutes using a Lenovo HPC system.

Lenovo has complimented Mark III Systems expertise in modeling with AI by delivering high -performance infrastructure, so that developers can focus on solving use cases. Developing AI solutions presents a unique set of challenges, as most companies don't have the knowledge and experience to know where to begin. Support from the Lenovo AI Innovation Center can cut the learning curve drastically.

Lenovo HPC Solutions

Customers building clusters for AI training can benefit from a partner's guiding hand. To that end, Lenovo has developed a GUI for some of the most popular and powerful open source AI and HPC software and libraries.

Lenovo intelligent Computing Orchestration (LiCO) greatly reduces AI's complexity and improve a customer's turnaround time for both AI training and end results.

With Lenovo HPC, there's no barrier to interacting with sophisticated, award-winning computing capabilities. Instead, there's a proven full-stack solution, with a straightforward user interface, that is uniquely specified to support you. Coupled with access to experts for your particular challenges and a single point of support; you're simply able to analyze faster, from a deeper store of data, and make more insightful decisions.

The Lenovo ThinkSystem range of servers provide a flexible, agile foundation for your HPC cluster. These include:

- The ThinkSystem SD530 for large, scale-out computational fluid dynamics, impact analysis, and 3D VDI. With Lenovo's innovative Shared-IO technology, this system allows for latency gains while reducing overall interconnect costs.
- Low-latency network solutions from Lenovo, including Intel® Omni-Path® Architecture and InfiniBand fabrics.
- Lenovo LeSI (Lenovo Scalable Infrastructure) for designing, integrating and delivering complex data center solutions.
- Lenovo LiCO (Intelligent Computing Orchestrator) software stack to simplify AI and ML-based deployments in an enterprise environment.

With high-performance and highly responsive technology that can scale-out massively, partnering with Lenovo for HPC means adopting innovation faster, for more advanced AI-based analytics, improved process efficiencies, and reduced solution complexity to scale and increase production output.



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