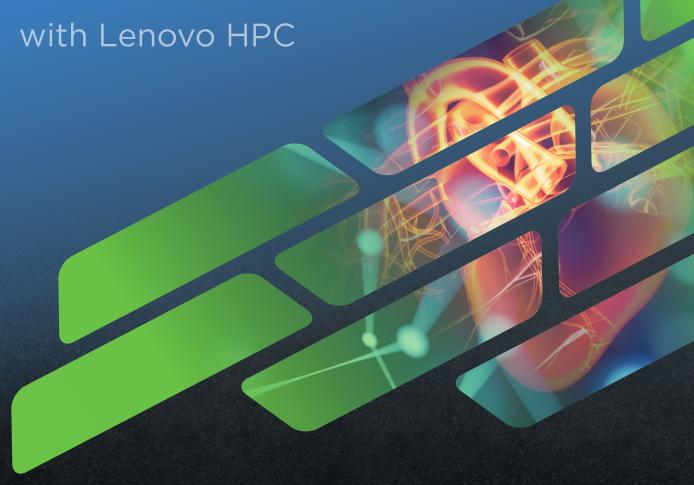# LIFE SCIENCES AND HEALTHCARE INNOVATION

with Lenovo HPC

Biomedical research, clinical trials, and product innovation in Life Sciences routinely collect, store, analyze, and share massive amounts of data. Thus, Life Sciences, specifically genomics, rely heavily on data analytics enabled by high performance computing (HPC), where both high compute and fast storage capabilities are immensely important. Advancements in HPC are making AI in healthcare possible by managing complex and compute-intensive workflows. Both HPC-enabled AI and genomics are reducing time to scientific discovery and generating the predictions necessary to make precision medicine a reality.

Lenovo provides compute as well as a data management platform tuned specifically for healthcare AI and genomics workloads.

Innovation key to future of healthcare

HPC is accelerating progress in life sciences by making it simple to access and process huge volumes of data in real time. This type of workload complexity with patient health potentially at stake requires the most powerful HPC solution available. Healthcare innovation requires high-performance compute with large memory systems, and supporting software, from an HPC system designed to deliver. Whether you're new to HPC or experienced, Lenovo will fill the IT gap to meet the challenge.

With healthcare devices and remote monitoring on the rise, data storage and management challenges are huge. A scalable Lenovo HPC solution enables greater collaboration across entire organizations with access to research results sooner. This includes improved patient data processing from remote monitoring devices and electronic health records, drug trial data collection and storage, and personalized treatments matched to a patient's genetic background.

Along the way, the additional workload capacity from Lenovo HPC systems help support advanced analytics needed to process the data from these activities as well as the growing numbers of wearable health devices being used. The flexibility and expandability of Lenovo HPC help position you for future growth as the volumes of data collected and the need for integration across devices increase. Using Intel® Xeon® Scalable Processor, Lenovo can deliver highly customized healthcare target HPC systems.

Life Science is **evolving** towards the need for fast storage and fast networking to handle the influx of real-time data from research, experimentation, devices, and collaborative organizations. This includes:

• The increasing need for massive, fast, distributed storage solutions.

• The processing of massive datasets for deep/ machine learning, including image processing for radiology and other imagery.

• The expanded use of modelling and simulation to reduce risk and better predict patient outcomes.

• The modernization and optimization of disparate healthcare software.

• The need for enhanced security and protection of patient data.

These trends and their related challenges are more suitable to the power of an on-premise Lenovo HPC solution than purely the cloud. Utilizing Intel® Parallel Systems Studio, software can be optimized to run optimally on a Lenovo HPC Solution.

HPC increases efficiency of data management

Lenovo HPC high-speed, tiered storage systems with Elastic Storage Management provides highly scalable data access and lifecycle management to improve the efficiency of your sequencing and data analysis pipeline. This solution gives you the ability to collect, store, share, retrieve, and analyze large datasets efficiently regardless of format.

Based on the IBM Spectrum Scale file system, built with Intel® SSDs, Lenovo's DSS-G HPC storage solution is capable of managing petabytes of data and billions of files across distributed applications with fast communication and is recommended as an integral part of your software-defined storage strategy. Integrated with high-speed networking infrastructure, Lenovo HPC systems enable you to integrate massive datasets and deep/machine learning into existing applications.

Expand workflow efficiency

Don't let out-of-date infrastructure hold back your innovation and research. Lenovo HPC powers optimal workflow acceleration and allows for parallel analysis of data, expanding on your existing IT infrastructure to increase workload processing capacity, and better position yourself for future growth. For example, modularity inherent in Lenovo storage solutions make the systems expandable to any size. The integration approach of Lenovo HPC also helps to simplify your infrastructure to further reduce costs while increasing capacity.

Lenovo can provide complete infrastructure delivery at the rack level, with a single point of support for compute, storage, and interconnection fabric to simplify deployment and implementation. With support for workloads such as genetic sequencing, structural biology for drug discovery etc., Lenovo HPC will help modernize your IT and power cost-effective AI-based solutions. In the end, Lenovo will help you achieve the scalability needed to increase the highest levels of quality without increasing costs.

Life sciences and patients depend on modernized IT

Healthcare and life sciences organizations are incorporating data analytics and AI tools with the goal of performing real-time patient data analyses and treatment outcome predictions. Newer IT solutions are needed to improve drug discovery, innovative treatment, and precision medicine to deliver diagnoses and treatment regimens based on a patient's genetic makeup. Additionally, the overall time to analysis can be dramatically improved.

Lenovo HPC system infrastructure is improving big data analysis and end-to-end processes with real results, such as genome assembly. Lenovo is particularly well positioned as we offer integrated, best-in-class, compute and storage solutions specifically tailored for genomics and intelligent orchestrators for healthcare AI. In addition, Lenovo collaborates with Intel on AI in healthcare to leverage the best software and ecosystem development by two industry leaders.

Life sciences HPC ROI proof points

Recent research by Hyperion has shown that, on average, for each $1 invested in HPC in life science, $160 revenue is generated and $41 of profit.

ROI with Lenovo HPC systems has been 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, and oil and gas than in other segments.

In all, a scalable Lenovo HPC solution enables greater collaboration across entire organizations, with access to research results sooner, reducing costs while improving outcomes in life science research and patient success. It's already the trusted solution for 17 of the top 25 Research Universities.

Lenovo HPC benefits and differentiators

Lenovo, the leading vendor on the TOP500 list of the world's fastest supercomputers, offers high-performance and large memory systems, software, and solutions to meet the diverse needs of pharmaceutical, genomics, healthcare companies, and other organizations such as government, academic, and non-profit institutions. These include Intel® Xeon® Scalable processors, fast data storage, built on Intel® SSDs, to drive advanced real-time data analytics, and technology that can massively scale-out while maintaining enterprise-class security standards to minimize risk. Additionally the innovative high-speed interconnect fabric for mission critical performance and reliability continues to drive big data and patient analytics, leading to innovative new solutions in Life Sciences.

Lenovo HPC solutions for Life Sciences 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.

Case studies in success

Lenovo HPC solutions are already being used by organizations to power big data analytics, accelerate time-to-results and improve patient outcomes across the Life Sciences. For example, Caris Life Sciences, a leading biosciences company, evaluated available Lenovo HPC technology based on its ability to analyze patient data as quickly as it can be collected. With terabytes of data generated and then analyzed each day, only solutions that supported massively parallel compute workloads were considered.

In 2015, the Chinese government released guidelines on the establishment of a hierarchical medical system. The guidelines state that, according to the level of urgency of patients' condition and the complexity of their treatment approaches, patients should receive medical services at different levels of hospitals. The E-Health system developed by Lenovo Research's AI Lab is a vertical business solution in the smart health sector, providing an intelligent, medical image diagnostic assistance solution. It can contribute to the hierarchical medical treatment system by providing tumor detection services at grassroots hospitals, thus lessening the burden of big hospitals. By analyzing huge amounts of cancer screening data, E-Health can reduce the misdiagnosis rate of cancer and contribute to cancer diagnosis and treatment.

E-Health is enabled by cutting-edge deep learning algorithms and powerful cloud computing capability and integrates the professional expertise of medical experts. On the one hand, E-Health reduces both doctor's workloads and misdiagnosis cases. On the other hand, it can automatically provide diagnosis suggestions by analyzing image data intelligently.

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 your applications and research. Coupled with access to experts for your particular research 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, with the Xeon Scalable Processor, 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 from Lenovo, including Intel® Omni-Path® Architecture and InfiniBand fabric solutions.

• 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.

Lenovo HPC is a proven solution that leads the way for faster, more thorough research and diagnosis. As risks and guesswork are left behind in favor of big data and intricate simulations, optimized HPC and AI with support from a Lenovo specialist team will put you ahead. Lenovo delivers high levels of performance, with a simplified and streamlined HPC solution to help you quickly scale up when events occur without putting pressure on your internal teams.

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