



Solution Flyer

SUSE Linux Enterprise Server for
High Performance Computing
SUSE Enterprise Storage

A Simplified Path to High Performance Computing with SUSE and Lenovo

In today's competitive environment, standing out from the competition is a data-driven task that requires massive processing power. From complex simulations and modeling to analyzing large data sets with artificial intelligence (AI), workloads are demanding more robust infrastructure. That's why enterprises are increasingly turning to high performance computing (HPC). You can capture the power of supercomputing without the customized systems and laborious setup of the past with a cluster of Intel-based, x86 systems running Linux.

SUSE and Lenovo HPC at a Glance:

- + Award-winning HPC systems with exceptional performance and energy efficiency
- + Simplified administration with a management platform that lets your data experts focus on their jobs
- + Preinstalled, configured and tested rack solutions for rapid deployment
- + Built-in enterprise support for important HPC software to reduce the cost of ownership

Products:

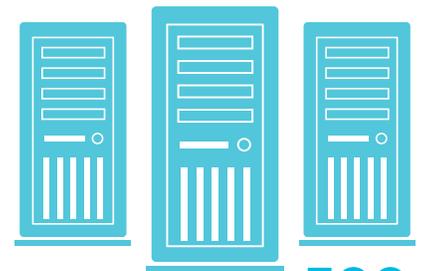
SUSE Linux Enterprise Server for
High Performance Computing
SUSE Enterprise Storage
Lenovo ThinkSystem servers
Lenovo Distributed Storage Systems
Lenovo Scalable Infrastructure
Lenovo Intelligent Computing Orchestrator

High performance computing was once a world dominated by research laboratories and institutes of higher education, which were the only places with the funds and patience to create the custom supercomputers that made up the HPC market. But now you can capture the benefits of HPC much more easily. By teaming up with Lenovo and SUSE, you get a powerful and efficient HPC solution with strong enterprise support.

HPC can offer your enterprise a way to run computationally and data-intensive workloads and process large volumes of information to improve business outcomes, innovation and competitiveness. The key to successfully bringing HPC to your enterprise is picking the right partners. By teaming up with Lenovo and SUSE you get a complete solution that prioritizes ease of use, plus provides support for crucial open source HPC packages. That way you can focus on your business and rely on the HPC expertise of Lenovo and SUSE.

Expertise in Supercomputing... and Today's HPC

Lenovo and SUSE both have extensive experience in the HPC world. Lenovo is one of the fastest growing providers of HPC hardware according to supercomputing's top 500 list. More of the world's top 500 supercomputers in Italy, Spain, Norway,



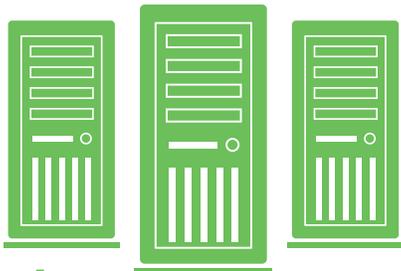
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Germany, Denmark and China are built on Lenovo hardware than any other platform.¹

SUSE has been at the forefront of HPC's move to Linux. Half of the top 50 supercomputers in the world run on SUSE Linux Enterprise Server. But the two company's HPC experience doesn't stop at supercomputers. Lenovo and SUSE are both founding members and major contributors to OpenHPC, a group dedicated to easing HPC adoption through the setting of open standards.



1/2 of the top 500 supercomputers in the world run on **SUSE Linux Enterprise Server**

The Lenovo and SUSE HPC teams have worked together for years. When Lenovo recommends HPC software packages, the SUSE team can quickly adopt those packages into the SUSE HPC module so the partners' joint customers can take advantage of the newest features.

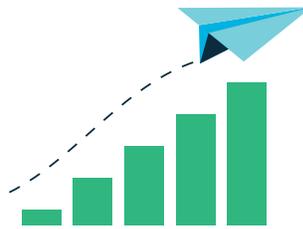
A Powerful, Energy-Efficient HPC Infrastructure

That expertise plays out in the benefits you get when you choose a SUSE and Lenovo HPC solution.

POWERFUL ENOUGH TO TACKLE DEMANDING WORKLOADS

The combined Lenovo and SUSE solution offers support for the most complex HPC workloads so you can:

- *Design products with computer-aided engineering*
- *Sequence genomes*
- *Develop the AI applications of the future*
- *Perform consumer trend monitoring, searching or profiling*
- *Design and place wind turbines*
- *Model seismic activity or other complex geological problems*
- *Analyze financial data for indicators of fraud*



SUSE Linux Enterprise Server is optimized for HPC workloads. It comes with a native POSIX thread library and advanced multipathing I/O capabilities to help boost performance. It delivers support for the latest in hardware innovation so you can take advantage of the dense compute capabilities of Lenovo hardware.

You can pair the solution with various fabrics, including Ethernet, Infiniband and Intel Omni-Path Architecture. Lenovo and SUSE can also help you with a wide array of storage options from ultra-high-speed drives to software-defined storage.

ENERGY EFFICIENT AND AFFORDABLE

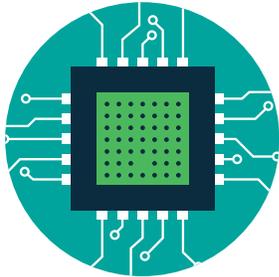
Lenovo has long been an innovator in water-cooling technology to reduce the cost and environmental impact of HPC systems. In fact, Lenovo worked with the Leibniz Supercomputing Centre (Leibniz-Rechenzentrum, or LRZ) to create the world's first warm-water-cooled supercomputer, which also runs on SUSE Linux Enterprise Server. There are now more than 18,000 nodes around the world up and running with direct-water-cooling technology from Lenovo.

Lenovo engineering means you get powerful, high-capacity HPC infrastructure in a small footprint. This condensed form factor, combined with Lenovo's innovative energy efficient solutions, can help you control data center costs without sacrificing performance.

As an example, Barcelona Supercomputing's MareNostrum 4, which is based on the latest ThinkSystem servers and SUSE Linux Enterprise Server, is ten times faster than its predecessor, but uses only 30 percent more energy.

SUSE Linux Enterprise Server includes the SUSE HPC Module, which contains a selected set of the most in-demand tools and components used in HPC environments. The selection is inspired by, but not limited to, what is available at the OpenHPC community project. Unlike community distributions of HPC software, this module comes with full SUSE support. This support means that you don't have to endure the lengthy or challenging aspects of finding help through community support. It's another way the solution can help you control costs and focus on your business goals.

¹ www.top500.org/lists/2017/11/



EASY TO USE AND MANAGE

Keeping you focused on your goals—and keeping your data scientists and researchers focused on their tasks and not on the management of a cluster—is one of the most important benefits of the Lenovo and SUSE solution.

Lenovo Intelligent Computing Orchestrator (LiCO) simplifies cluster administration so you can efficiently manage HPC and AI workloads. Your users can spend their time scheduling and running jobs, rather than managing the cluster.

Between LiCO and the SUSE HPC Module, you get the software you need to run your HPC cluster. You can avoid cobbling together a software stack from various vendors or open source projects and be confident you have best-of-breed solutions for running large parallel processing tasks.

Expert configuration and implementation services ensure that all components work together seamlessly and further take the burden off your experts so they can focus on using your HPC systems to push the boundaries of your field.

2 *ITIC*, ITIC 2017 Global Reliability Survey Mid-Year Update, June 14, 2017.

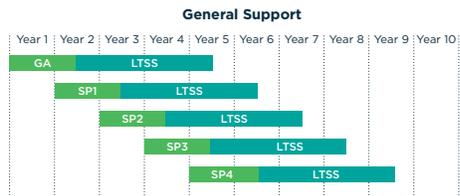
3 *Ibid.*

Solution Components

SUSE LINUX ENTERPRISE SERVER FOR HIGH PERFORMANCE COMPUTING

SUSE Linux Enterprise Server is the only Linux distribution which includes supported HPC packages within the distribution. These packages, contained in the SUSE High Performance Computing Module, are updated on a more frequent schedule than the base operating system to help you keep up with rapidly evolving HPC technologies.

SUSE Linux Enterprise Server also offers extended service pack support. This gives each operating system service pack an additional year of support. That means you can plan upgrades when it's best for your system, not when your operating system demands.



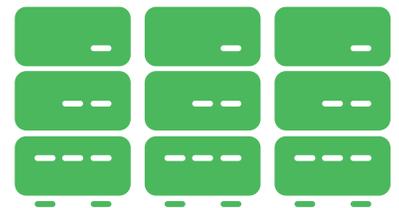
SUSE PACKAGE HUB

The SUSE Package Hub offers access to additional HPC packages that are frequently requested by HPC users and supported by the open source community. This includes the popular container engine Singularity. See all the available packages at <https://packagehub.suse.com/>.



SUSE ENTERPRISE STORAGE

SUSE Enterprise Storage allows you to deploy a unified block, object and file storage environment. It has a flexible, cluster-based design for graceful and inexpensive upgrades and near-linear scaling. Combined with Lenovo Distributed Storage Solutions, it makes an excellent archive for HPC systems.



LENOVO THINKSYSTEM SERVERS

Lenovo x86 servers achieved the highest reliability ratings among all competing x86 platforms², and Lenovo has been rated number one in Technical Service and Support customer satisfaction.³

The Lenovo ThinkSystem family offers a wide array of dense HPC hardware options, from water-cooled compute nodes such as the ThinkSystem SD650 to GPU-enabled nodes such as the ThinkSystem SD530. Additionally, the ThinkSystem family provides comprehensive storage options including the ThinkSystem SR650 with a unique AnyBay design, allowing for flexible configurations.

LENOVO DISTRIBUTED STORAGE SOLUTIONS

Lenovo Distributed Storage Solutions (DSS) offer dense storage options with the low latency and high data integrity HPC systems demand. For active HPC storage, DSS for IBM Spectrum Scale delivers a high-performance, scalable building-block approach to HPC storage needs.

With a Lenovo and SUSE HPC infrastructure, you can capture the power of supercomputing without the customized systems and laborious setup of the past.

www.suse.com

“We have relied on SUSE Linux Enterprise Server in high-performance computing for approximately 15 years, and have always been very satisfied with the operating system.”

HERBERT HUBER

*Division Head of Super Computing
Leibniz Supercomputing Centre*

LENOVO INTELLIGENT COMPUTING ORCHESTRATION (LICO)

LiCO is an integrated software suite for HPC and AI workloads. It is built on an OpenHPC software base and features an easy-to-use interface for users to submit and manage HPC jobs. It includes HPC workflow templates and application libraries, as well as AI frameworks and templates.

LENOVO SCALABLE INFRASTRUCTURE (LESI)

Through LeSI, Lenovo can develop, configure, build, deliver and support an integrated HPC solution to free up your teams. LeSI leverages decades of Lenovo server experience to reduce the complexity of

deployment. You can select configured systems over factory-integrated solutions or fully end-to-end supported solutions that match best-in-industry components with optimized solution design.

An Easier Path to HPC

To remain competitive, you need an infrastructure that can handle the computational demands of modern simulations, AI, data analysis and more. An HPC solution based on Lenovo and SUSE can give you that high performance infrastructure with the energy efficiency and ease of use to maximize your return on investment and help your organization succeed.

“The Lenovo solution delivers between six and nine times more performance than the previous environment, enabling us to run many more simulations to uncover how changes in climate affect all our lives.”

KARSTEN KRAMER

*Head of IT
Potsdam Institute for Climate Impact Research*

Learn More about SUSE Linux Enterprise Server for High Performance Computing at: www.suse.com/products/server/hpc/

Website: suse.com/lenovo

E-mail: lenovo@suse.com

