SciNet
Pushing scientific boundaries

To support vital scientific research in fields as diverse as astrophysics, biomedicine and climate science, SciNet beefed up its high-performance computing resources with a Lenovo supercomputer 10 times more powerful than its predecessor.

The largest supercomputing center in Canada, SciNet provides researchers all over the country with the computational resources and expertise they need to advance their understanding of the world around us. A consortium of the University of Toronto and its affiliated teaching hospitals, SciNet also provides high-performance computing (HPC) resources to Compute Canada, the country's national infrastructure for supercomputing-powered research.

Dr. Daniel Gruner, CTO at SciNet, begins: "We are a not-for-profit organization focused exclusively on the advancement of science. We're proud to welcome some of the greatest minds in Canada through our doors and provide them with the HPC resources they need to run advanced data processing, modeling and analytics jobs."

To enable researchers to crunch more data faster, SciNet teamed up with Lenovo to implement a new HPC cluster based on high-density Lenovo ThinkSystem SD530 servers with Intel® Xeon® Scalable processors.

Dr. Gruner recalls: "Our existing cluster was nine years old and starting to show its age. Calculations took too long and we could no longer support large-scale jobs. We wanted to equip researchers with much more computing power, and knew that meant implementing a new cluster.

"We set about evaluating offerings from several vendors very carefully. What set Lenovo's proposal apart was the innovative network topology design and the impressive price-performance ratio. The Lenovo system performed very well in benchmarking tests, and we liked the fact that they came up with an unusual, exciting design within our budget."

Working with a team from Lenovo Professional Services, SciNet implemented a 1,500-node cluster of Lenovo ThinkSystem SD530s with a total of 60,000 cores, interconnected with Mellanox InfiniBand EDR switches in a Dragonfly+ topology with adaptive routing.

Dr. Gruner elaborates: "The Dragonfly+ topology will make it easier and more economical to scale the cluster, so we can quickly and cost-effectively add capacity to meet evolving research requirements."

He adds: "The support we received from the Lenovo Professional Services team was outstanding. We really appreciated their attention to detail, and how hard they worked to get the cluster set up on time and on budget. And even though we had some pretty tough demands, they always made sure to deliver."

Led by the Lenovo Technical Solutions team, Lenovo Professional Services assisted SciNet through the entire delivery process, from onsite facilities assessment, design, customization, optimization and integration through to deployment. In addition to on-going support services, the Lenovo Professional Services team carries out proactive health checks to ensure that the system always performs at its best.

For the time being, SciNet is more than happy with the capacity and performance of its new HPC cluster. With a peak theoretical speed of 4.61 PFLOPS , the Lenovo solution delivers 10 times more performance than the previous cluster – using only two-thirds of the energy – making it the most powerful supercomputer in Canada.

"We're delighted with the performance of the Lenovo cluster," says Dr. Gruner. "The increase in processing power means that researchers can run bigger, more complex jobs than they would previously have been able to. Today, we can even run enormous 30,000-core jobs that would have been out of the question before."

With the Lenovo system in place, SciNet is empowering researchers to ask bigger questions, delve deeper into their data and break new ground.

One group of climate scientists is using the cluster to run oceanic modeling calculations that will help them to better understand the dynamics of heat transfer, salinity and pollutants. Oceanic simulations have never been done at such a high resolution before, giving the scientists unprecedented insight into these phenomena. Research that may one day inform government policy on climate change, or fishing industry practices, for example.

Other researchers are using SciNet resources to investigate the aerodynamics of commercial planes so that they can design more fuel-efficient aircraft. Important work on gravitational waves is also being conducted at SciNet – including some of the simulations for the Laser Interferometer Gravitational-Wave Observatory (LIGO) project, which makes direct observation of gravitational waves (ripples in the fabric of space and time predicted by Einstein) and recently won the Nobel Prize for Physics.

Dr. Gruner states: "The list of research projects that we support goes on and on. The Lenovo cluster is already in full production and open to the wider academic research community. Feedback from researchers already running jobs on the cluster has been fantastic, and we know that others can't wait to get started.

He concludes: "The size and speed of the Lenovo cluster means that we can now handle even the largest and most complex jobs, and that researchers will get results back fast. We're really excited that users will be able to conduct research on the Lenovo system that hasn't been possible in Canada before, advancing scientific knowledge."

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Solution components

Hardware

Lenovo ThinkSystem SD530 with Intel® Xeon® Scalable processor family

Lenovo Distributed Storage Solution for IBM Spectrum Scale (DSS-G)

Lenovo RackSwitch G8052 & G8272 Ethernet Networking

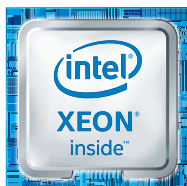Mellanox Switch IB-2 SB7800 series InfiniBand EDR switches

Software
Red Hat Enterprise Linux / CentOS
Excelero
IBM Spectrum Scale

Services
Lenovo Professional Services

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—Dr. Daniel Gruner, CTO, SciNet

Canadian research consortium SciNet implemented a powerful HPC cluster based on Lenovo ThinkSystem SD530 servers with Intel® Xeon® Scalable processors and a unique Dragonfly+ network topology that delivers 10 times the performance using only two-thirds of the energy.