Dell EMC HPC Innovation Lab
Developing innovative high-performance computing technologies through community collaboration for world-class HPC systems
You’ve got the power

High-performance computing (HPC) gives you the power to break new ground, make important discoveries, and solve some of the most important challenges of our time. But there are always bigger questions — and bigger data sets — on the horizon, requiring enhanced HPC solutions to keep pace with the speed of innovation.

That’s why Dell EMC is committed to enabling more organizations in industry, research, government and education to use HPC solutions for more innovations and discoveries than any other HPC systems vendor in the world. This passion for innovation has helped make us an industry leader in HPC clusters, storage, networking and software. We’ve built a nexus of communication and collaboration in the industry, exemplified by the Dell EMC HPC Innovation Lab in Austin, Texas.

Working with the HPC community to go further, faster

The Dell EMC HPC Innovation Lab encompasses a 13,000-square-foot data center devoted to HPC. It houses thousands of servers, a TOP500 cluster, sophisticated storage and network systems.

But the lab is more than world-class infrastructure. Bringing together HPC operational excellence and expertise, it is staffed by a dedicated group of computer scientists, engineers and Ph.D. subject matter experts who actively partner and collaborate with customers and other members of the HPC community. The team gets early access to new technologies, integrates and tunes high-performance compute clusters, benchmarks applications, develops best practices, and publishes white papers.

When you engage with the lab, you will work directly with these Dell EMC experts to design an HPC solution for your unique HPC workloads. The opportunity to develop and test your configuration with an expert team prior to deployment reduces risk, and because your HPC system is tuned for optimized performance from day one, your team can get to research faster. And that means your organization can recognize a better return on HPC investments (HPC ROI).

“The HPC Innovation Lab gives our customers access to cutting-edge technology, like the latest-generation Dell EMC products, Scalable System Framework from Intel, InfiniBand gear from Mellanox, NVIDIA GPUs, Bright Computing software, and more. Customers can bring us their workloads and, we can help them tune a solution before the technology is readily available.”

—Garima Kochhar, Systems Sr. Principal Engineer
“Our lab is staffed by engineers with advanced degrees and many years of industry experience in domains such as mechanical engineering and bioinformatics. We also have engineers with computer science backgrounds, providing expertise in file systems, interconnects and HPC management tools.”

—Onur Celebioglu, HPC Engineering Director and head of the HPC Innovation Lab, Dell EMC

Using the Dell EMC HPC Innovation Lab

Typical HPC Innovation Lab projects

While the list of potential projects is virtually limitless, some common projects include:

- Cluster comparison: Test your workload on our two main clusters to see which one delivers the best performance.
- System parameter sweep: Set up a system test bed to find out what combination of core count, system RAM, processor speed and so on optimizes application performance.
- Graphics processing unit (GPU) test comparison: Find out which GPU works best for your needs.
- Efficiency tuning: Determine the optimum basic input/output system (BIOS) and other settings and configurations for your workload.
- HPC network testing: Figure out which HPC network is best for your performance requirements.
- HPC storage system optimization: Build and test HPC storage and file systems, tiered or otherwise, for optimum performance.

Industry expertise

Research: Quickly develop HPC systems that match the unique needs of a wide variety of workloads, involving complex scientific analysis.

Blogs: Dell TechCenter High Performance Computing

Life sciences: Accelerate time-to-insight for a range of applications, including drug design, cancer research, agriculture, forensics, genomics and bioinformatics.

Blog: Advancing Healthcare Innovation through High Performance Computing

HPC manufacturing: Maximize the performance of your software licenses with HPC systems tuned just for the manufacturing industry.

Blog: High performance computing drives innovation for manufacturers

High-performance data analytics (HPDA): Explore the possibilities of machine learning, deep learning and artificial intelligence (AI) with benchmarked and optimized HPDA configurations.

Blog: Deep Learning Performance with P100 GPUs

Oil and gas: Fuel the algorithms that will revolutionize oil and gas exploration by precisely pinpointing oil and gas reserves.

Blog: HPC: Fueling Innovation in the Oil and Gas Industry
We’re excited to collaborate with Dell to bring advanced systems to market. Dell’s position as our largest and fastest-growing customer for Intel Enterprise Edition for Lustre, their work on Omni-Path Architecture and next-generation Intel Xeon Phi, and their initiatives to expand the Dell Innovation Lab demonstrate their commitment to rapidly expanding the ecosystem for HPC."

—Charles Wuischpard, Vice President and General Manager, HPC Platform Group, Intel

**Dell EMC HPC Innovation Lab**

The showpieces of the HPC Innovation Lab are two powerful Intel® processor-powered HPC clusters named Zenith and Rattler, which are being continuously expanded and improved. In addition to the Zenith and Rattler clusters, the HPC Innovation Lab has an extensive collection of processor bins, RAM memory, a full spectrum of Dell EMC server models, and various types of adapters (GPU, network and others), which are available to help in testing and exploring configurations.

**Zenith**

The Zenith cluster is the result of a partnership between Dell EMC and Intel. It serves as benchmarking system for internal teams as well as a showcase for evaluations.

In addition to being the first major original equipment manufacturer to join the Intel Fabric Builders program, Dell EMC is working closely with Intel to support its Intel Scalable System Framework, which includes Intel Omni-Path Fabric technology, next-generation Intel Xeon® processors, the Intel Xeon Phi™ processor family and Intel Enterprise Edition for Lustre.

<table>
<thead>
<tr>
<th>Component</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servers</td>
<td>324 x PowerEdge C6420 Servers</td>
</tr>
<tr>
<td>Processors</td>
<td>Intel Xeon Gold processors&lt;br&gt;20 cores per processor, 40 cores per node&lt;br&gt;Processor base frequency: 2.4GHz&lt;br&gt;AVX Base: 1.6GHz</td>
</tr>
<tr>
<td>Memory</td>
<td>192GB at 2,666MHz per node</td>
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<tr>
<td>Operating System</td>
<td>Red Hat® Enterprise Linux® 7.3</td>
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<tr>
<td>Kernel</td>
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<tr>
<td>System profile</td>
<td>PerfOptimized&lt;br&gt;- Turbomode: Enabled&lt;br&gt;- Cstates: Disabled&lt;br&gt;- Node interleave: Disabled&lt;br&gt;- Logical processor: Disabled&lt;br&gt;- IO-Nonposted Prefetch: Disabled</td>
</tr>
<tr>
<td>Host channel adapter (HCA) card</td>
<td>Intel Omni-Path Host Fabric Interface (OP HFI)</td>
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<tr>
<td>Intel Omni-Path Fabric Host Software (IFS)</td>
<td>10.5.1.0.2</td>
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<tr>
<td>Storage</td>
<td>480TB Dell EMC Ready Bundle for HPC NFS Storage&lt;br&gt;960TB Dell EMC Ready Bundle for HPC Lustre Storage</td>
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As of November 6, 2017

The Dell EMC Zenith cluster ranks #292 on TOP500:

- Cores: 23,328
- Rmax: 805 TFLOPS/s
- Rpeak: 1.3 PFLOPS/s

“With this new investment, Dell’s HPC Innovation Lab will now enable new levels of applications efficiency and innovative research capabilities. Together we will help build the solutions of the future.”

—Gilad Shainer, Vice President of Marketing, Mellanox Technologies

**Rattler**

- The Rattler cluster is the result of a partnership among Dell EMC, Mellanox®, Bright Computing® and NVIDIA®. The system is designed to showcase extreme scalability by leveraging the offloading capabilities and advanced acceleration engines of the Mellanox interconnect — as well as provide application-specific benchmarking, and characterizations for customers and partners.
- Dell EMC and Mellanox Technologies have a long history of collaboration and leadership in the HPC community. Together we have contributed HPC clusters — along with numerous best practices and application case studies — to the HPC Advisory Council, enabling the HPC community to use best-in-class systems for application optimization and overall HPC outreach and education.

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<td>OpenFabrics Enterprise Distribution (OFED)</td>
<td>MLNX_OFED_LINUX-3.4-2.0.0.0</td>
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As of November 6, 2017

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Why Dell EMC for HPC?

The combination of Dell and EMC brings together two industry-leading companies with strong reputations for value and innovation. And just to underscore that we are a technology leader, we’ve attained incredible leadership positions in some of the biggest and largest growth categories in the IT infrastructure business — and that means you can confidently source all your IT needs from one provider.

- #1 in both number and size of XSEDE HPC systems for U.S. open science
- #1 fastest supercomputer on the African continent
- #1 converged infrastructure
- #1 in traditional and all-flash storage
- #1 virtualized data center infrastructure
- #1 cloud IT infrastructure
- #1 server virtualization and cloud systems management software (VMware®)
- #1 in data protection
- #1 in software-defined storage

Complete your HPC solution with Dell EMC services and financing

Dell EMC HPC Services

Optimize your infrastructure, minimize costly disruptions and save time with HPC deployment and cluster management services and Dell EMC Partner services.

- Dell EMC HPC Deployment Services
- Dell EMC HPC Cluster Management Services

Dell EMC Financial Services

Let the wealth of leasing and financing options from Dell EMC Financial Services help you find opportunities when your organization faces decisions regarding capital expenditures, operating expenditures and cash flow.

Dell EMC offers a wide range of payment options to make it easier than ever to meet your needs.

Learn more about Dell EMC Financial Services.
Learn More

Learn more about the Dell EMC HPC Innovation Lab

Get the Labs’ latest results and ask questions in Dell TechCenter > High Performance Computing.

Join the Dell EMC HPC Community
Dell EMC web page: Dell EMC HPC Community

Learn more about Dell EMC HPC offerings
Dell EMC web page: dellemc.com/hpc

Dell EMC TACC case study

See more case studies at dell.com/customers and select or search for “HPC.”
Find out more and get started today

Request access to the HPC Innovation Lab

All the data and expertise in the Dell EMC HPC Innovation Lab is for you, to help you reduce the risk in making technology decisions, enhance performance so your research teams can reach answers faster, and help you optimize HPC ROI.

You are invited to use these clusters to evaluate technologies, see how scaling affects workloads, and compare various technologies. Simply contact your Dell EMC Account Executive and let them know you would like to get access to the lab. They will arrange for you to talk with an HPC specialist about what you would like to do.

There’s no need to put off planning your next HPC project. Contact your Dell EMC Account Executive to request access to the HPC Innovation Lab today.

Find out what analysts and the media are saying


For more information, visit dellemc.com/hpc and the Dell EMC HPC Innovation Lab.