Dell EMC HPC and AI Innovation Lab

Developing innovative high performance computing and artificial intelligence 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 and AI Innovation Lab in Austin, Texas.

Working with the HPC community to go further, faster

The Dell EMC HPC and AI Innovation Lab encompasses a 13,000-square-foot data center devoted to HPC and artificial intelligence (AI). 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 and AI 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 and AI Innovation Lab, Dell EMC

**Using the Dell EMC HPC and AI Innovation Lab**

**Typical HPC and AI 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 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 EMC to bring Intel’s leadership technologies to the HPC market. Dell’s position as one of our largest and fastest-growing HPC customers for Intel Xeon Scalable Processors, Omni-Path Architecture, and other platform ingredients, along with their investment to expand the Dell EMC HPC and AI Innovation Lab demonstrates their commitment to rapidly expand the ecosystem for HPC.”

—Patricia Damkroger, Vice President, Data Center Group and General Manager, Extreme Computing Group, Intel

Dell EMC HPC and AI Innovation Lab

The showpieces of the HPC and AI Innovation Lab are two powerful Intel® processor-powered clusters named Zenith and Rattler, which are being continuously expanded and improved. In addition to the Zenith and Rattler clusters, the HPC and AI Innovation Lab has an extensive collection of processor models, RAM sizes, a full spectrum of Dell EMC server models, and various types of adapters (FPGA, GPU, network and others) 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 a 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 and next-generation Intel Xeon® processors.

<table>
<thead>
<tr>
<th>Component</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servers</td>
<td>422x PowerEdge C6420 Servers 160x PowerEdge C6320p Servers 4x PowerEdge R740 Servers with Intel Arria FPGAs</td>
</tr>
<tr>
<td>Processors</td>
<td>Intel Xeon Gold (C6420) Intel Xeon Phi™ (C6320p)</td>
</tr>
<tr>
<td>Memory</td>
<td>192GB at 2,666MHz per node (Xeon Gold) 96GB at 2,400MHz per node (Xeon Phi)</td>
</tr>
<tr>
<td>Operating System</td>
<td>Red Hat® Enterprise Linux® 7.4</td>
</tr>
<tr>
<td>Host channel adapter (HCA)</td>
<td>Intel Omni-Path Host Fabric Interface</td>
</tr>
<tr>
<td>Storage</td>
<td>480TB Dell EMC Ready Solution for HPC NFS Storage 960TB Dell EMC Ready Solution for HPC Lustre Storage</td>
</tr>
</tbody>
</table>

As of October 2018.

The Dell EMC Zenith cluster ranks #396 on TOP500:1

- Cores: 27,088
- Rmax: 1.0311 PFLOPS
- Rpeak: 1.61 PFLOPS

1 TOP500: The List, “Dell EMC HPC Innovation Lab - Zenith.”
“Dell EMC’s HPC and AI Innovation Lab is enabling new levels of applications efficiency and innovative research capabilities. Together, we are helping to 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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<thead>
<tr>
<th>Component</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Servers</td>
<td>88x PowerEdge C6420</td>
</tr>
<tr>
<td></td>
<td>32x PowerEdge C4140</td>
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<tr>
<td>Processors</td>
<td>Intel Xeon Gold</td>
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<tr>
<td>Accelerators</td>
<td>NVIDIA Tesla GPUs</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 7.4</td>
</tr>
<tr>
<td>HCA card</td>
<td>Mellanox Enhanced Data Rate (EDR) InfiniBand®</td>
</tr>
<tr>
<td>Storage</td>
<td>240TB Dell EMC Ready Solution for HPC NFS Storage</td>
</tr>
<tr>
<td></td>
<td>872TB Dell EMC Ready Solution for HPC Lustre Storage</td>
</tr>
</tbody>
</table>

As of October 2018.
“Dell has been one of the important leaders in the high performance computing industry from the technology side for several years... High performance computing is a community, and that's where this kind of leadership in different areas becomes important because that focus becomes a nexus of innovation and collaboration in the industry.”

—Addison Snell, Analyst, Intersect360 Research

To learn more, watch HPC: A Nexus of Innovation and Collaboration.

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 hyper-converged infrastructure
- #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 services and financing

Dell EMC HPC Services

From design and implementation to support and systems management, Dell EMC offers a comprehensive services portfolio for HPC clusters, including on-premises and managed systems, as well as those in the cloud.

Dell EMC Services for High Performance Computing

Dell Financial Services

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

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

Learn more about Dell Financial Services.

Learn More

Learn more about the Dell EMC HPC and AI Innovation Lab


Get the Labs’ latest results at HPCatDell.com

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

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1 Dell EMC has the most systems in XSEDE, including the largest system. Systems include SDSC Comet, SDSC, TACC Jastream, TACC Stampede, LSU SuperMIC and TACC Wrangler. TACC Stampede is the largest system in XSEDE. See “XSEDE Resources.”


5 Dell EMC Annual Report, 2015.

6 IDC WW Quarterly Cloud IT Infrastructure Tracker, June 2018, Vendor Revenue — Q1 2018.


Dell EMC case studies
HPC Matters in Industry and in Academic Research
Cat® trucks get the job done with the help of an HPC cluster from Dell EMC
Simon Fraser University: A Super Cedar

See more case studies at dell.com/poweredge-stories.

Find out more and get started today
Request access to the HPC and AI Innovation Lab
All the data and expertise in the Dell EMC HPC and AI 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 and AI Innovation Lab today.

What analysts and the media are saying

For more information, visit dell.com/hpc and dell.com/innovationlab.