



# Dell HPC & AI Innovation Lab

Dedicated to designing solutions while staying on the leading edge of new and emerging technologies



## 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 HPC solutions to keep pace with the speed of innovation.

That's why Dell Technologies is committed to enabling more organizations in industry, research and government 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 Dell an industry leader in HPC clusters, storage, networking and software. We've built a nexus of collaboration in the industry, exemplified by the Dell HPC & AI Innovation Lab in Austin, Texas.

## Working with the HPC community to go further, faster

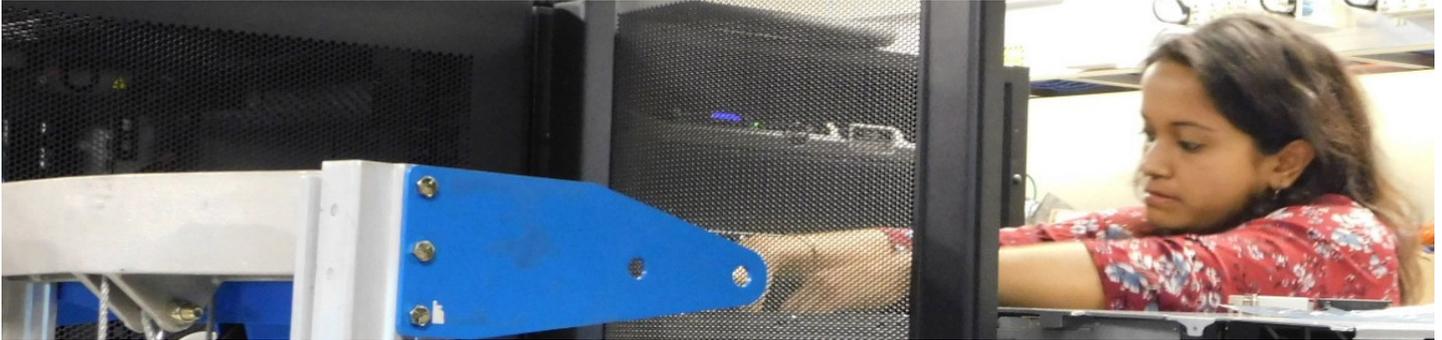
The Dell HPC & AI Innovation Lab encompasses a 13,000-square-foot data center devoted to high-performance computing and artificial intelligence (AI). It houses thousands of servers, a TOP500 cluster, a wide range of storage and network systems.

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 subject matter experts who actively partner and collaborate with customers and other members of the HPC community. The team gets and provides early access to new technologies, integrates and tunes clusters, benchmarks applications, develops best practices, and publishes their results.

When you engage with the Lab, you work directly with these experts to design a 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 results faster. And that means your organization can recognize a better return on HPC investments.

**“The HPC & AI Innovation Lab gives our customers access to cutting-edge technology from Dell, Intel, AMD, Mellanox, NVIDIA, Bright Computing and more. Customers can bring us their workloads and we can help them tune a solution before the technology is readily available.”**

—Garima Kochhar, Distinguished 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,  
Director

HPC & AI Innovation Lab,  
Dell Technologies

## Using the Dell HPC & AI Innovation Lab

### Typical HPC & AI Innovation Lab projects

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

- Cluster comparison: Test your workload on three different 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 and processor speed optimizes application performance.
- Accelerator test comparison: Find out which accelerator works best for your needs.
- Efficiency tuning: Determine the optimum basic input/output system (BIOS) and other settings and configurations for your applications.
- Network testing: Figure out which HPC network is best for your application performance requirements.
- Storage system optimization: Build and test HPC storage and file systems, tiered or otherwise, for optimum performance.

### Industry expertise

This team of cross-disciplinary engineers often build systems for the following industries.

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

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

**Computer aided engineering and design (CAE/CAD):** Reduce software licensing cost with HPC systems tuned for digital manufacturing.

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

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

“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 HPC & 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  
Organization, Intel

## Dell Technologies HPC & AI Innovation Lab

The HPC & AI Innovation Lab has three powerful clusters: Zenith, Rattler and Minerva, which the team continuously expands and improves. In addition, the HPC & AI Innovation Lab has an extensive collection of processor models, RAM sizes, a full spectrum of Dell EMC servers, switches, storage, accelerators and adapters available for testing and exploring configurations.

### Zenith

The Zenith cluster is the result of a partnership between Dell and Intel®. On the [TOP500](#) list of fastest supercomputers in the world, teams use it for benchmarking, workload evaluations and a wide range of artificial intelligence, high performance data analytics and high performance computing projects.

Zenith includes Intel Xeon® Scalable Processors, Omni-Path fabric architecture, data center storage solutions, FPGAs, adapters, software and tools. Projects underway include [image classification to identify disease in X-rays](#), [MRI scan matching to thoughts and actions](#), and [building faster neural networks to drive recommendation engines](#).

Component	Configuration
Servers	422x PowerEdge C6420 servers 160x PowerEdge C6320p servers 4x PowerEdge R740 servers with Intel FPGAs
Processors	2nd generation Intel Xeon Scalable processors Intel Xeon Phi™
Memory	192GB at 2,933MHz per node (Xeon Gold) 96GB at 2,400MHz per node (Xeon Phi)
Operating System	Red Hat® Enterprise Linux® 7
Host channel adapter (HCA) card	Intel Omni-Path Host Fabric Interface
Storage	480TB Ready Solutions for HPC NFS Storage 2.68PB Ready Architecture for HPC Lustre Storage 174TB Isilon F800 all-flash NAS storage

As of November 2019.



The Zenith cluster ranks on the TOP500 list of the fastest supercomputers in the world

<sup>1</sup> TOP500: The List, “[Dell EMC HPC Innovation Lab - Zenith](#).”



“Dell’s HPC & AI Innovation Lab is enabling new levels of application efficiency and innovative research capabilities. Together, we are helping 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 Technologies, Mellanox®, Bright Computing® and NVIDIA®. The system is designed to showcase extreme scalability by leveraging GPUs with NVLINK™. Rattler not only accelerates traffic between GPUs inside servers, but also between servers with Mellanox interconnect. Teams use this system for application-specific benchmarking and workload characterizations.

Dell and Mellanox Technologies have a long history of collaboration, contributing 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, HPC outreach and education.

Component	Configuration
Servers	88x PowerEdge C6420 servers 32x PowerEdge C4140 servers
Processors	2nd generation Intel Xeon Scalable processors
Accelerators	NVIDIA GPUs
Memory	192GB at 2,666MHz per node
Operating System	Red Hat Enterprise Linux 7
HCA card	Mellanox Enhanced Data Rate (EDR) InfiniBand®
Storage	240TB Ready Solutions for HPC NFS Storage 1.2PB Ready Architecture for HPC Lustre Storage

As of June 2019.

**Minerva**

The Minerva system results from collaboration with AMD® and Mellanox, featuring PowerEdge C6525 servers with second-generation AMD® EPYC™ processors, Mellanox InfiniBand HDR100 and NFS storage. This cluster highlights the latest server engineering designed to take advantage of the latest cores, memory bandwidth and PCIe Gen4 throughput technologies. Engineering, partners and customers access the system for benchmarking, application characterizations, and solution optimization.

Component	Configuration
Servers	90x PowerEdge C6525
Processors	2nd generation AMD EPYC processors
Memory	256GB at 3,200 MT/s per server
Operating System	Red Hat Enterprise Linux 7
HCA card	Mellanox High Data Rate (HDR) 100 InfiniBand
Storage	175TB Ready Solutions for HPC NFS Storage

As of November 2019.

“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

## Why choose Dell Technologies

### Dell Technologies is different

We are committed to your success with HPC and AI.

- Come in for an [executive briefing](#), and collaborate on ways to reach your business goals.
- In addition to the [HPC & AI Innovation Lab](#), the [Customer Solution Centers](#) and [Centers of Excellence](#) are available with subject matter experts in a variety of disciplines.
- We are committed to [providing you with choice](#). We want you to get what you need and have a great experience working with us. If we don't have what you need, we'll tell you who does. If we can't do it, we'll tell you someone who can. We believe in being open, and we [publish our performance results](#).
- Dell Technologies is the only company in the world with a portfolio that spans from workstations to supercomputers, including servers, networking, storage, software and services.
- Because Dell offers such a wide selection of solutions, we can be trusted advisors without trying to sell a one-size-fits-all approach to your problem. That means Dell has the expertise to understand a broad spectrum of challenges and how to address them.

### Proven results

Dell Technologies holds leadership positions in some of the biggest and largest-growth categories in the IT infrastructure business, and that means you can confidently source your IT needs from Dell Technologies.

- #1 in servers<sup>1</sup>
- #1 in converged and hyper-converged infrastructure (HCI)<sup>2</sup>
- #1 in storage<sup>3</sup>
- #1 cloud IT infrastructure<sup>4</sup>

See [Dell Technologies Key Facts](#).

### Customer Solution Centers

Dell Technologies' global network of dedicated [Customer Solution Centers](#) are trusted environments where world-class IT experts collaborate with you to share best practices, facilitate in-depth discussions of effective business strategies, and help your business become more successful and competitive. These Customer Solution Centers can reduce the risks associated with new technology investments and can help improve speed and ease of implementation.

### HPC & AI Centers of Excellence

As data analytics, HPC and AI converge and the technology evolves, Dell Technologies' worldwide HPC & AI innovation centers provide thought leadership, test new technologies and share best practices. They maintain local industry partnerships; and have direct access to Dell and other technology creators to incorporate your feedback and needs into technology and solution roadmaps. Through collaboration, [Dell HPC & AI Centers of Excellence](#) provide a network of resources based on the wide-ranging know-how and experience in the community.

<sup>1</sup> IDC [WW Quarterly Server Tracker](#), Vendor Revenue, March 2019.

<sup>2</sup> IDC [WW Quarterly Converged Systems Tracker](#), Vendor Revenue, September 2018.

<sup>3</sup> IDC [WW Quarterly Enterprise Storage Systems Tracker](#), Vendor Revenue, March 2019.

<sup>4</sup> IDC [WW Quarterly Cloud IT Infrastructure Tracker](#), Vendor Revenue, January 2019.



## Let's get started

All the data and expertise in the Dell HPC & AI Innovation Lab is for you, to help you reduce the risk in making technology decisions, and enhance application-system performance so your teams can reach answers faster, and help you optimize HPC return on investment.

You are invited to access the Lab to evaluate technologies, see how scaling affects workloads, and compare various technologies. Simply contact your Dell Account Executive and let them know you would like to access 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 analytics, AI or HPC project. Contact your Account Executive to request access to the [HPC & AI Innovation Lab](#) today. Review the team's findings in their blogs, performance reports and white papers at [hpcatdell.com](#).

Join the HPC and AI Community at [dellhpc.org](#), visit [dellemc.com/hpc](#) and [dellemc.com/ai](#) to learn more.

## Contact us

To learn more, [contact](#) your local representative or authorized reseller.