

# Validated Designs for HPC Research

Make discoveries faster with artificial intelligence  
and high performance computing

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## 5 PFLOPS supercomputer

serves 50,000 scientific researchers<sup>1</sup>

## 180X

faster training of AI models<sup>2</sup>

“Using our HPC cluster from Dell [Technologies], we are able to complete calculations that are 10 times larger than what has previously been possible – and more cost-effectively.”<sup>3</sup>

— Dr. Alistair Basden,  
HPC Technical Manager,  
Durham University

## Move quickly from raw data to actionable insights

To make discoveries, researchers must be able to draw actionable insights from massive amounts of data used to simulate complex systems. For decades, High Performance Computing (HPC) has been a powerful tool for scientific and academic research institutions, speeding workloads and improving time to results. Now, rapid advancements in processing power combined with massive amounts of real-time data are enabling adoption of artificial intelligence (AI) for research institutions across a variety of use cases.

While the advanced computing techniques of HPC, analytics and AI have long been considered separate disciplines, they are converging as the industry recognizes that HPC is required to power the latest AI algorithms. Today, increasingly powerful HPC systems can deliver the throughput and capacity needed to address complex research challenges such as handling massive amounts of data from simulations, sensors and scientific instruments to model, render and analyze, filter, classify and measure scientific data, and manage the time-criticality of research projects.

These advanced computing techniques gives researchers the power to accelerate the pace of discovery, creating more opportunities to break new ground, make important discoveries and solve some of the most important challenges of our time.

## Dell Technologies has what you need

### Expertise and guidance

Technology is emerging quickly, so your team may not have had time to design, deploy and manage solution stacks optimized for emerging workloads. While AI might seem like the latest IT trend, Dell Technologies has been a leader in the advanced computing space for over a decade, with proven products, solutions and expertise. Dell Technologies has a team of analytics, HPC and AI experts dedicated to staying on the cutting edge, testing new technologies and tuning solutions to your applications to help you keep pace with this constantly evolving landscape.

### Dell Technologies Validated Designs for HPC

For many organizations, HPC is an important source of competitive advantage. An optimized HPC solution delivers the compute, throughput and capacity needed to manage the rapid data growth and increased workload demands presented by advanced analytics and a wide range of other workloads. Validated Designs are workload-optimized rack-level systems with servers, software, networking, storage and services to scale faster with the confidence of an engineering-tested solution while enabling business without boundaries.

### Solutions customized for your environment

Dell Technologies uniquely provides an extensive portfolio of technologies to deliver the advanced computing solutions that underpin successful analytics, HPC and AI implementations. With years of experience and an ecosystem of curated technology and service partners, Dell Technologies provides innovative solutions, workstations, servers, networking, storage and services that reduce complexity and enable you to capitalize on the promise of HPC and AI.

<sup>1</sup> Dell Technologies case study, “[Architecting for mixed workloads at massive scale](#),” March 2020.

<sup>2</sup> Dell Technologies case study, “[Building powerful AI models](#),” August 2020.

<sup>3</sup> Dell Technologies case study, “[A Universe of data](#),” accessed November, 2021.

**“We have roughly 800 researchers on the system, spread out over 300 different projects. The number of jobs we’re putting through the system has been quite impressive for the size of the system. The throughput has been extraordinarily good. The overall usage allocation has been close to 100%. And, of course, the queue times have been very low.”<sup>4</sup>**

— Lev Lafayette,  
Platforms Computing  
and Training Officer,  
University of Melbourne

### Common challenges

**“We need to be sure we’re getting the required performance from our budget.”**

Budgets tend to be tighter for academic and research institutions than for commercial enterprises. To optimize budget, it’s critical to match HPC resources to requirements to avoid costly overprovisioning. Choose a solution stack tailored for your unique requirements — one that is based on performance, efficiency and/or a balance of both. The Dell Technologies HPC team can help optimize investments on limited budgets with the ability to tune solutions for specific workloads.

**“We have trouble providing the immense computational power and storage capacity required for research.”**

Researchers need fast, accurate results to investigate, understand and predict increasingly complex phenomena. A balanced HPC solution can deliver the throughput and capacity needed to manage rapid data growth and increased workload demands. Dell Technologies Validated Designs for HPC make it easy to scale with modular, IT building blocks designed for research applications.

**“Performing design, deployment, integration and performance tuning is complex.”**

Deploying a fast, reliable HPC solution can be a significant investment of time and IT resources, with a chance for errors. Aspects of HPC solutions are interconnected and impact the overall success, performance and productivity of the solution. Dell Technologies reduces risk by allowing customers to test and tune solutions prior to purchase in worldwide Customer Solution Centers. Customers and partners can also evaluate new HPC technologies prior to general availability in the HPC & AI Innovation Lab.

## Dell Technologies Validated Designs for HPC Research

Dell Technologies has invested to create a portfolio of Validated Designs to simplify the configuration, deployment and management of HPC clusters. These trusted designs have been optimized, tested and tuned for a variety of key use cases. They include the servers, storage, networking, software and services that have been proven in our labs and in customer deployments to meet workload requirements and customer outcomes. The modular solution building blocks provide a customized yet validated approach for deploying new clusters, scaling or upgrading their existing environments.

Validated Designs for HPC Research have been engineered to optimize investments with purpose-built designs, created to scale easier with modular building blocks, and to reduce the risk of potential software and hardware issues.

### Optimize investments

Dell Technologies Validated Designs for HPC Research are built with flexible, industry-standard building blocks of compute, networking and storage tested and tuned by Dell Technologies engineering with HPC applications. These purpose-built HPC building blocks are then tailored to speed deployment, help eliminate potential software and hardware issues, and optimize performance. Dell Technologies also offers consulting, education, deployment, support and remote management services to optimize solution productivity and efficiency.

<sup>4</sup> Dell Technologies case study, [The University of Melbourne](#), accessed November 2021.

## Optimize investments

## Scale easily

## Reduce risk

### Scale easily

When speed to results matters, Dell Technologies experts can help build an HPC solution that addresses growing research challenges. Dell Technologies HPC solutions leverage a flexible building-block approach to easily scale over time. Scale by adding resources such as memory or hard drives inside Dell EMC PowerEdge servers. Add external storage with Dell EMC PowerVault storage arrays, or PowerScale scale-out network-attached storage (NAS). Dell Technologies is an industry leader in creating HPC solutions — regardless of size or complexity — that deliver fast setup with a wide range of optional services. With proven success in thousands of implementations worldwide, you can be confident growing with Dell Technologies.

### Reduce risk

Dell Technologies is committed to helping more people make more innovations and discoveries than any other technology provider in the world. That's why Dell Technologies engineers and industry experts work in collaboration with Dell Technologies customers and partners to design, deploy and scale HPC solutions for research applications. It not only saves time, it also reduces the risk of potential hardware and software issues. See performance test results for yourself at [hpcatdell.com](http://hpcatdell.com). Test your code via one of the Dell Technologies' worldwide [Customer Solution Centers](#) and/or in the [HPC & AI Innovation Lab](#). Around the world, more than 35,000 full-time Services and Support experts are available every step of the way with consulting, education, deployment, management and support.<sup>5</sup>

### Customer success stories

#### European Council for Nuclear Research (CERN)

**4X**  
performance  
increase

**300** servers can be  
deployed in 30 minutes

**5%** energy usage  
from CPUs, reduced  
from 20%

View the case study video: [CERN](#)

#### Texas Advanced Computing Center (TACC)

**38.7**  
PFLOPS

**#1** fastest academic  
supercomputer

**16K** plus Intel  
Xeon processors

Read the case study: [A New 'Frontera'](#).

#### Lincoln Laboratory at MIT TX-Green System

**1+ PFLOPS** total peak performance

**4X** capacity boost

View the case study video: [MIT Lincoln Laboratory](#).

- [Durham University](#) uses efficient and scalable HPC to support cosmological studies and other scientific investigations.
- [Swinburne University of Technology](#) inspires a new generation of scientists with an HPC supercomputer that enables advanced cosmological research.
- [TGen](#) uses advanced computing to fight rare diseases.

See more [customer case studies](#).

## Technical specifications

The options below serve as a starting point for a customizable, yet validated solution. A Dell Technologies HPC specialist can assist you with designing an HPC solution for your specific needs and environment. See performance test results at [hpcatdell.com](http://hpcatdell.com) and on the [InfoHub](#).

### HPC Research



Explore Virtual Rack at <http://esgvr.dell.com/>

Specifications	
<b>PowerEdge Servers</b>	
AMD® EPYC™ processors	R6515, R6525, R7515, R7525, C6525, XE8545
Intel® Xeon™ Scalable processors	R650, R750, R750xa, C6520
Accelerators	NVIDIA® A100, A40, or AMD® Instinct™ Mi100
Adapter	Mellanox® ConnectX-6 HDR
NICs	1, 10, 25, 40, 100GbE
<b>Switches</b>	
Top of rack	NVIDIA Quantum™ QM8700 series HDR
Management	PowerSwitch S, N and Z series Ethernet
<b>Software (optional, tested, recommended)</b>	
Operating system	Red Hat® Enterprise Linux®
Cluster management	Bright Cluster Manager® / OpenHPC
Server management	iDRAC Enterprise and OpenManage
<b>Storage</b>	
Dell Technologies Validated Designs for HPC NFS, BeeGFS® or PixStor™ Storage Dell EMC PowerScale Family with OneFS	
<b>Services</b>	
Consulting, education, hardware deployment and support, remote management, cloud options, financing	

### Solution highlights

- [Dell EMC PowerEdge servers](#) enhance performance across the widest range of applications with highly scalable architectures and flexible internal storage.
- [Validated Designs for HPC Storage](#) include designs for NFS, PixStor or BeeGFS, all created to speed deployment of HPC storage systems with confidence while saving resources.
- [Bright Cluster Manager](#) enables the deployment of clusters over bare metal with a management view that spans the hardware, operating system, software and users.

“Many people are excited about being able to evolve neural networks in ways that are inspired by biology, and it’s increasingly clear that we need a different type of hardware to do that. And that’s what we have with the Zenith cluster in the Dell Technologies HPC & AI Innovation Lab”<sup>6</sup>

— Dr. Pierre Bellec,  
Associate Professor,  
University of Montreal

## Services and financing

Dell Technologies partners with you every step of the way, linking people, processes and technology to accelerate innovation and enable optimal business outcomes.

- [Services for High Performance Computing](#) are delivered by certified experts to help you get the business value of advanced computing. The services include assessment, workshop, testing, proofs of concept and production implementation. These experts help determine where advanced computing is a good fit for your organization. They also help you build your own internal team of experts through knowledge transfer.
- [Deployment Services](#) help you streamline complexity and bring new IT investments online as quickly as possible. Leverage our 30-plus years of experience for efficient and reliable solution deployment to accelerate adoption and return on investment (ROI) while freeing IT staff for more strategic work.
- [Support Services](#) driven by AI and deep learning will change the way you think about support with smart, ground-breaking technology backed by experts to help you maximize productivity, uptime and convenience. Experience more than fast problem resolution—our AI engine proactively detects and prevents issues before they impact performance.
- [Payment Solutions](#) from Dell Financial Services help you maximize your IT budget and get the technology you need today. Our portfolio includes traditional leasing and financing options, as well as advanced flexible consumption products.
- [Dell Technologies APEX](#) offers a simple approach that gives you a wide range of consumption models, payment solutions and services so you can optimize for a variety of factors while realizing more predictable outcomes.
- [Managed Services](#) can help reduce the cost, complexity and risk of managing IT so you can focus your resources on digital innovation and transformation while our experts help optimize your IT operations and investment.
- [Residency Services](#) provide the expertise needed to drive effective IT transformation and keep IT infrastructure running at its peak. Resident experts work tirelessly to address challenges and requirements, with the ability to adjust as priorities shift.

## Why choose Dell Technologies

We’re committed to advancing analytics, HPC and AI, and we’ve dedicated a great deal of resources toward that goal.

- Schedule an [executive briefing](#) and collaborate on ways to reach your business goals.
- Dell Technologies [Customer Solution Centers](#) are staffed with computer scientists, engineers and 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. 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 Technologies offers such a wide selection of solutions, we can act as your trusted advisor without trying to sell you a one-size-fits-all approach to your problem. That range of solutions has also given us the expertise to understand a broad spectrum of challenges and how to address them.

<sup>6</sup> Dell Technologies case study, “[Paving a new path to AI-driven neuroscience](#),” March 2020.

“In general, in HPC strong scaling is very difficult to achieve, but we managed to achieve 121 times faster performance with 200 nodes in a strong scaling scenario. It takes more than one month to train such a transformer model on a single node. By using 200 nodes, we managed to reduce the training time to just six hours.”<sup>7</sup>

— Dr. Valeriu Codreanu,  
Senior HPC Consultant  
for SURFsara

## Customer Solution Centers

Our global network of dedicated Dell Technologies [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. Dell Technologies Customer Solution Centers reduce the risks associated with new technology investments and can help improve speed of implementation.

## AI Experience Zones

Curious about AI and what it can do for your business? Run demos, try proofs of concept and pilot software in Singapore, Seoul, Sydney, Bangalore and other [Customer Solution Centers](#). Dell Technologies experts are available to collaborate and share best practices as you can explore the latest technology, get the information and hands-on experience you need for your advanced computing workloads.

## HPC & AI Innovation Lab

The [Dell Technologies HPC & AI Innovation Lab](#) in Austin, Texas, is the flagship innovation center. Housed in a 13,000-square-foot data center, it gives you access to thousands of Dell EMC servers, three powerful supercomputers, and sophisticated storage and network systems. It's 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 engineers HPC and AI solutions, tests new and emerging technologies, and shares expertise including performance results and best practices.

## HPC & AI Centers of Excellence

As analytics, HPC and AI converge and the technology evolves, Dell Technologies worldwide HPC & AI Centers of Excellence 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 their roadmaps. Through collaboration, [Dell Technologies HPC & AI Centers of Excellence](#) provide a network of resources based on the wide-ranging know-how and experience in the community.

## 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 information technology needs from Dell Technologies.

- #1 in servers<sup>8</sup>
- #1 in converged and hyper-converged infrastructure (HCI)<sup>9</sup>
- #1 in storage<sup>10</sup>
- #1 enterprise infrastructure<sup>11</sup>

See [Dell Technologies Key Facts](#).

<sup>7</sup> Dell Technologies case study, “[Building powerful AI models](#),” August 2020.

<sup>8</sup> IDC, [WW Quarterly x86 Server Tracker, 2Q2021](#). Vendor Revenue & Shipments, September 9, 2021.

<sup>9</sup> IDC, [WW Quarterly Converged Systems Tracker](#). Vendor Revenue, March 2021.

<sup>10</sup> IDC, [WW Quarterly Enterprise Storage Systems Tracker, 2Q2021](#), September 9, 2021.

<sup>11</sup> IDC, [WW Quarterly Enterprise Infrastructure Tracker: Buyer and Cloud Deployment, 2Q2021](#). Vendor Revenue, October 1, 2021.

<sup>12</sup> Dell Technologies case study, [Swinburne University](#). Accessed November 2021.

“The goal is always to push the boundaries of knowledge and inspire the next generation of scientists. With this new system from Dell [Technologies], I believe we can do that.”<sup>12</sup>

— Jarrod Hurley,  
Professor of Astrophysics,  
Swinburne University  
of Technology

## Take the next step, today

Don't wait to find out how Dell Technologies can simplify and speed your adoption of engineering tested, validated solutions for research applications and workloads. Contact your Dell Technologies or authorized channel partner representative for more details right away.

### Contact us

To learn more, visit [delltechnologies.com/hpc](https://delltechnologies.com/hpc) or [contact](#) your local representative or authorized reseller.

