Dell EMC Ready Solutions for HPC Research

Make discoveries faster with the convergence of artificial intelligence and high performance computing

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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, data analytics and AI have long been considered separate disciplines, they are converging as the industry recognizes that HPC is required to power the latest data analytics and 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.

This convergence of 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 EMC 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 EMC has been a leader in the advanced computing space for over a decade, with proven products, solutions and expertise. Dell EMC has a team of data 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 EMC Ready Solutions for HPC

The advantage in today’s marketplace goes to the data-driven enterprise. For many organizations, high performance computing is — or is becoming — 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 data analytics and a wide range of other workloads. Dell EMC Ready Solutions for HPC simplify design, configuration and ordering of systems with standardized building blocks that are tested for research applications.

Solutions customized for your environment

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

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Do any of these challenges sound familiar?
“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 or a balance of both. The Dell EMC 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 high performance computing solution can deliver the throughput and capacity needed to manage rapid data growth and increased workload demands. Dell EMC Ready Solutions 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 HPC technologies prior to general availability in the HPC and AI Innovation Lab.

Dell EMC Ready Solutions for HPC Research
Dell EMC has invested to create a portfolio of Ready Solutions designed to simplify the configuration, deployment and management of high performance computing 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.

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

“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 percent. And, of course, the queue times have been very low.”

—Lev Lafayette, platforms computing and training officer, University of Melbourne

*Dell EMC case study, “HPC and Cloud: Breaking new ground with a hybrid system for academic research,” October 2017.*
Solution overview

**Optimize investments**

**Scale easily**

When speed to results matters, Dell EMC experts can help build an HPC solution that addresses complex research challenges. Dell EMC HPC solutions leverage a flexible building-block approach to easily scale over time. Scale by adding resources such as memory or hard drives inside PowerEdge servers. Add external storage with Dell EMC PowerVault storage arrays, or Isilon scale-out network-attached storage (NAS). Dell EMC 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 EMC.

**Reduce risk**

Dell EMC is committed to helping more people make more innovations and discoveries than any other technology provider in the world. That’s why Dell EMC engineers and industry experts work in collaboration with Dell EMC 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 at [hpcatdell.com](http://hpcatdell.com). Test your code via one of the Dell Technologies’ worldwide Customer Solution Centers, and/or in the Dell EMC HPC and AI Innovation Lab. Around the world, more than 30,000 Dell EMC Services experts are available every step of the way with consulting, education, deployment, management and support.

**Customer success stories**

**University of Kentucky**

| 60% lower licensing fees | US$ millions avoided in infrastructure costs | 30 days → 12 hours faster cycle times |

Read the case study: [HPC tailored to research needs with OpenStack® cloud](http://example.com).

**Texas Advanced Computing Center (TACC)**

| 20X analytics acceleration | 99% reduction in I/O latencies | 100% workload acceleration |

Read the case study: [HPC big data analytics, a potent research tool](http://example.com).

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

| 1+ PFLOPS total peak performance | 4X capacity boost |

View the case study video: [MIT Lincoln Laboratory](http://example.com).

- [The University of Cambridge](http://example.com) uses HPC and AI to solve some of today’s most demanding data-driven simulation challenges — from those involving medical imaging and genomic analysis to the mapping of exoplanets.
- [Swinburne University of Technology](http://example.com) inspires a new generation of scientists with an HPC system that can compress 31 million years of calculations into a single second.
- [The MIT Lincoln Laboratory](http://example.com) provides 1.7 petaflops peak performance to accelerate government research in autonomous systems, device physics and machine learning.
- [TGen](http://example.com) uses advanced computing to fight rare diseases.

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## Dell EMC Ready Solutions for HPC Research Specifications

The options below serve as a starting point for a customizable, yet validated solution. A Dell EMC 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).

### PowerEdge Servers

<table>
<thead>
<tr>
<th>Compute nodes</th>
<th>Choice of:</th>
<th>R440, R640, R740/xd, R840, R940, M640, C4140, C6420</th>
<th>R6515, R7515, R6525, R7525, C6525</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processors</td>
<td>Intel® Xeon® Scalable</td>
<td>AMD® EPYC™ 7000 series</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Accelerator nodes</th>
<th>Choice of:</th>
<th>C4140, R740</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processors</td>
<td>Intel® Xeon® Scalable</td>
<td>AMD® EPYC™ 7000 series</td>
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</table>

### Software

<table>
<thead>
<tr>
<th>Software</th>
<th>Bright</th>
<th>Red Hat® Enterprise Linux®</th>
<th>Bright Cluster Manager®</th>
<th>Mellanox OFED NVIDIA CUDA®</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intel Fabric Suite (IFS) Omni-Path</td>
<td>Dell EMC Deployment Toolkit</td>
<td>Dell EMC OpenManage</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>OpenHPC</th>
<th>Red Hat Enterprise Linux</th>
<th>Mellanox OFED</th>
<th>IFS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note: OpenHPC does not have accelerator support</td>
<td>Dell EMC Deployment Toolkit</td>
<td>Dell EMC OpenManage</td>
<td></td>
</tr>
</tbody>
</table>

### Networking

<table>
<thead>
<tr>
<th>Omni-Path (OPA) for Intel-based servers</th>
<th>Host fabric interface (HFI)</th>
<th>Intel Omni-Path HFI adapter 100 series 1 port PCIe x16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switches</td>
<td>Dell EMC Networking H1000 Edge series: H1048 and H1024</td>
<td>Dell EMC Networking H9100 series</td>
</tr>
<tr>
<td>IFS driver stack</td>
<td>10.9</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>InfiniBand® (IB)</th>
<th>IB host channel adapters</th>
<th>Rack: Mellanox ConnectX®-6 HDR 100 Mellanox ConnectX-5 EDR single port or Mellanox ConnectX-3 FDR dual port</th>
<th>Mellanox ConnectX-3 small form factor (SFF) for blades: FDR or FDR10 mezzanine cards HDR: Mellanox ConnectX-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>IB switches: HDR, FDR and EDR</td>
<td>Rack: Mellanox SwitchX®-6xxx series Mellanox SB 77xx and 78xx series Mellanox MSB 78xx series Mellanox QM 87xx series</td>
<td>Mellanox M4001F or M4001T supported on M640 blades HDR: Mellanox QM-8700 series</td>
<td></td>
</tr>
<tr>
<td>IB drivers</td>
<td>Mellanox OFED</td>
<td>Mellanox OFED</td>
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<table>
<thead>
<tr>
<th>Ethernet</th>
<th>NICs</th>
<th>1, 10, 25, 40GbE (full and low profile)</th>
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<tbody>
<tr>
<td>Dell EMC PowerSwitch</td>
<td>Z and S series switches</td>
<td></td>
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<thead>
<tr>
<th>Storage</th>
<th>NFS</th>
<th>Dell EMC Ready Solutions for HPC NFS Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lustre®</td>
<td>Dell EMC Ready Solutions for HPC Lustre Storage</td>
<td></td>
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<tr>
<td>Isilon</td>
<td>Dell EMC Isilon Scale-out NAS</td>
<td></td>
</tr>
<tr>
<td>SAS RAID controller</td>
<td>PERC 10</td>
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Solution overview

Services and financing

Dell EMC is there every step of the way, linking people, processes and technology to accelerate innovation and enable optimal business outcomes.

- **Dell EMC Big Data Vision Workshop** focuses on big data for business leaders. We have a unique methodology to identify and prioritize a single use case with a combination of implementation feasibility and business value. It’s a three week engagement that applies research, interviews and data science expertise and techniques to the organization — culminating in a one–day workshop for your team to identify and agree on a use case and path forward. This approach sets Dell EMC apart from the “bring in a bunch of technology and see what it can do” approach that’s pushed by many vendors.

- **Dell EMC Consulting Services** are delivered by certified experts to help you get the business value of advanced computing. The services include an 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 at each step.

- **Dell EMC Education Services** offers courses and certifications in data science and advanced analytics through self–paced online labs and instructor–led workshops.

- **Dell EMC Deployment** experts have the experience, expertise and best practices to enhance your success with data analytics, HPC and AI solutions. With a proven track record of success in thousands of engagements worldwide, you can rely on Dell EMC as your partner.

- **Dell EMC Support** experts can provide comprehensive hardware and collaborative software support 24x7 for optimal system performance and minimized downtime. ProSupport includes next-business-day on-site service with four- and eight-hour parts-and-labor response options, and escalation management with customer-defined severity levels. You can also opt for ProSupport Plus to get a technology service manager, who serves as a single point of contact for your support needs.

- Once the HPC cluster is deployed, **Dell EMC Remote HPC Cluster Management** services help keep it running smoothly with proactive monitoring and management of the entire HPC solution.

- **Dell Financial Services** offers a wealth of leasing and financing options to help you find opportunities when your organization faces decisions regarding capital expenditures, operating expenditures and cash flow.

Solution highlights

- **Dell EMC PowerEdge Servers** enhance performance across the widest range of applications with highly scalable architectures and flexible internal storage.

- **Dell EMC Ready Solutions for HPC NFS Storage** is reliable, easy to administer and has very good performance within certain boundaries.

- **Dell EMC Ready Solutions for HPC Lustre Storage** customers to tap into the power and scalability of Lustre with simplified installation, configuration and management features.

- **Bright Cluster Manager for HPC** enables the deployment of clusters over bare metal with a management view that spans the hardware, operating system, software and users.

“We test every piece of hardware, believe it or not, Dell EMC is the only server that can hold up to the type of work that we are pounding on these boxes. Other boxes will fail, and we will end up with them down. And so a big reason that we have Dell EMC servers is because they are bulletproof — you can drop them on their head and they still run — and they are fast.”

—Christopher Sullivan, Assistant Director for Biocomputing, Center for Genome Research and Biocomputing, Oregon State University

Dell EMC case study, “Revving up research,” June 2019.
Why choose Dell EMC for data analytics, HPC and AI

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

- Come in for an executive briefing and collaborate on ways to reach your business goals.
- Dell Customer Solution Centers are staffed with computer scientists, engineers and Ph.D.s who are 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 EMC 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 EMC 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.

Dell Customer Solution Centers

Our global network of 21 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 Customer Solution Centers reduce the risks associated with new technology investments and can help improve speed of implementation.

Dell EMC HPC and AI Centers of Excellence

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

Dell EMC 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, and Bangalore Customer Solution Centers. Dell EMC 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.

Dell EMC HPC and AI Innovation Lab

The Dell EMC HPC and 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, two powerful supercomputers, and sophisticated storage and network systems. It’s 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 engineers HPC and AI solutions, tests new and emerging technologies, and shares expertise including performance results and best practices.

“Our turn-key system removes the complexity from the installation, management and use of artificial intelligence frameworks, and has enabled CSIRO to speed up its time to market for scientific outcomes, which will in turn boost Australia’s competitiveness in the global economy.”

—Andrew Underwood, Dell EMC Field CTO

“The goal is always to push the boundaries of knowledge and inspire the next generation of scientists. With this new system from Dell EMC, I believe we can do that.”

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

Proven results
Dell EMC 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 EMC.

∙ #1 in servers
∙ #1 in converged and hyper converged infrastructure (HCI)
∙ #1 in storage
∙ #1 cloud IT infrastructure

See Dell Technologies Key Facts.

Take the next step, today
Don’t wait to find out how Dell EMC can simplify and speed your adoption of tested, validated solutions for research applications and workloads. Contact your Dell EMC or authorized channel partner representative for more details right away.

Contact us
To learn more, visit dellemc.com/hpc or contact your local representative or authorized reseller.