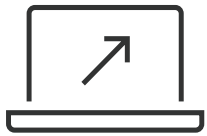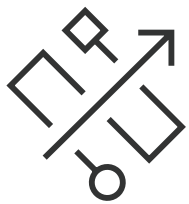# Dell EMC Ready Solutions for HPC

Dell EMC is expanding the boundaries of what's possible by advancing, democratizing and optimizing high-performance computing (HPC) — enabling more organizations to leverage their power to drive more innovations and discoveries.
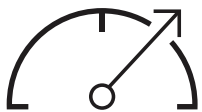
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## Go ahead. Dream big.

Discovery and innovation have always started with great minds dreaming big. With the help of increasingly powerful and sophisticated technology, you're now empowered to dream even bigger.

Every day, scientists, inventors, researchers and companies are using HPC to change our world in astonishing ways. Because of HPC, we can design, test and fly a plane before it is physically built. We can simulate dangerous weather patterns and save lives by creating early warning systems. Even something as complex as crash testing for automobiles can now be performed by a computer algorithm.

And Dell EMC is helping to facilitate the journey.

HPC used to be the domain of specialists using expensive, proprietary equipment. Now, commodity-based infrastructures make HPC tools accessible for any organization that understands their strategic advantages.

Dell EMC is helping expand the boundaries of this exciting new frontier with HPC solutions built to deliver breakthroughs faster. In fact, we're the only company in the world with an HPC portfolio that includes workstations, servers, storage, software and services.

In addition, Dell EMC HPC experts are active collaborators in the worldwide HPC community. Our goal is to advance, democratize and optimize HPC to move it into the mainstream, enabling more organizations — like yours — to leverage HPC to drive more innovations and discoveries.

All of which helps today's visionary scientists and researchers do what they do best — change the world.

## A few HPC use cases

How does your organization plan to leverage HPC technology? Dell EMC has the proven expertise in assisting the following industries with building, deploying and supporting HPC clusters:

**Research**
Quickly adopt HPC solutions 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.

**Digital manufacturing**
Optimize the performance of your software licenses with HPC solutions designed specifically for computer-aided engineering (CAE).

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

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

**Financial services**
Help these customers process trades and transactions faster and determine their financial risks and opportunities.

## Dell EMC HPC solution capabilities

Dell EMC recognizes that no two customers have the same needs and requirements. Our unique approach to HPC focuses on three areas to achieve faster results, enable discovery and drive the creation of intellectual property with price/performance optimized HPC solutions.

**Dell EMC and OpenHPC**

Dell EMC is an enthusiastic supporter of the OpenHPC Collaborative Project, and is working hard to provide a new, open source framework to support the world's most sophisticated HPC environments. Visit dellemc.com/hpc or openhpc.community to learn more.

**Solution benefits**
- **Advance HPC** by tapping into Dell EMC's world-class team of industry experts and HPC Innovation Centers to obtain a custom-built solution, fueled by user-inspired innovations.
- **Democratize HPC** with solutions designed to enable small and medium enterprises to accelerate your science, engineering and analytics initiatives.
- **Optimize HPC** with a price/performance optimized portfolio that includes everything you need for HPC — Dell EMC is the only vendor with an HPC portfolio that includes workstations, servers, storage, software and services.

### Advancing HPC

Dell EMC has the expertise, technology and partnerships to advance the state of the art for HPC solutions — from the workgroup to the TOP500. You can:

- Tap into a world-class team of industry experts with the domain expertise to design HPC solutions from desktop to petaFLOP.
- Plug into our HPC Innovation Lab — dedicated to cutting-edge research and development — or one of our many HPC Innovation Centers around the world.
- Create an HPC solution, fueled by customer-inspired innovations developed while working with some of the world's largest service providers.

### Democratizing HPC

Dell EMC Ready Solutions for HPC enable small and medium enterprises to accelerate science, engineering and analytics initiatives. You can:

- Get to answers faster — with a simplified design, configuration and ordering process that takes hours instead of weeks.
- Benefit from domain-specific designs tuned by Dell EMC engineers for specific science, engineering and analytics workloads using flexible, industry-standard building blocks.
- Enjoy the confidence of tested and validated solutions architected by Dell EMC engineering with a single point of contact for services and support.

### Optimizing HPC

Our robust portfolio of products and services is optimized for HPC and delivered by a company that will be there for you over the long haul. You can:

- Select from a price/performance optimized portfolio that includes everything you need for HPC — Dell EMC is the only vendor with an end-to-end HPC portfolio.
- Take advantage of Dell EMC management and orchestration software to maximize utilization, including hybrid cloud.
- Enjoy a full range of HPC services, from deployment and warranty to financial services.

## World-class Dell EMC HPC Innovation Centers: Breaking new ground while enabling human potential

### The Dell EMC HPC Innovation Lab

Work directly with Dell EMC HPC experts to test drive cutting-edge HPC technologies, and test and tune solutions prior to purchase — at no cost to you.

### Cambridge Solution Centre

Collaborate with University of Cambridge and Dell EMC experts to transform a "vanilla" HPC solution into a production HPC cloud computing service.

### University of Pisa

Here, university researchers share and power their work, and visitors gain insights into the latest and most efficient HPC technologies.

### San Diego Supercomputer Center

Tap into Comet — a petascale supercomputer with nearly 2,000 Dell EMC PowerEdge C6320 Servers.

### National Center for Supercomputing Applications (NCSA) Private Sector Program

Using four generations of Dell EMC HPC solutions, the Center addresses the needs of power users to help solve demanding engineering and science problems.

### Texas Advanced Computing Center

The center's Stampede 2 is a large-scale supercomputer that pushes the envelope of computational capabilities, as a strategic national resource.

### Centre for High-performance Computing, (CHPC) South Africa

The fastest computer on the African continent, CHPC's Lengau system enables new opportunities and avenues in cutting-edge research.

### The only provider with an end-to-end HPC solution portfolio

Dell EMC understands that HPC solutions are dependent on the target workload and use case. So, we take the time to understand your workloads and business goals to design an optimized solution that gets you to results, faster.

We then take a solution-level approach to your HPC project that results in an optimal solution of workstations, servers, networking, storage and software, rounded out with the services and support you need to succeed.

**Workstations and servers**

Dell EMC Precision workstations run high-demand, industry-specific applications for scientific calculations, remote visualization, 3D industrial designs, engineering simulations and digital content creation at peak performance to help you save time and control costs. Dell EMC workstations, together with accelerators, deliver breakthrough performance for parallel computing applications.

The server is the heart of the HPC cluster. Dell EMC PowerEdge servers can be configured with multiple options to meet your density, flexibility and performance needs.

## Achieve faster time-to-discovery

Dell EMC Ready Solutions for HPC:

**Dell EMC Ready Bundle for HPC**

An HPC solution that matches the unique needs of a wide variety of enterprise workloads

**Dell EMC Ready Bundle for HPC Digital Manufacturing**

A building-block approach to HPC that simplifies and speeds design for simulations, including structural analysis and computational fluid dynamics

**Dell EMC Ready Bundle for HPC Research**

An HPC solution that matches the unique needs of your research workloads more quickly and cost-effectively

**Dell EMC Ready Bundle for HPC NFS Storage**

A resilient, scalable, cost-effective storage system based on the Network File System (NFS) protocol

**Dell EMC Ready Bundle for HPC Life Sciences**

A solution architected to deliver high throughput and fast turnaround for a diverse range of fields, including drug design, cancer research, agriculture, biofuels and forensics

**Dell EMC Ready Bundle for HPC Lustre Storage**

Large-scale, high-bandwidth storage to tap the power and scalability of Intel® Enterprise Edition for Lustre® software

The Dell EMC PowerEdge C6420 Server and Dell EMC PowerEdge C6320p Server can fit up to four servers in 2U, Intel Xeon or the latest Intel Xeon® Phi™ co-processors.

The Dell EMC PowerEdge C4140 Server is an accelerator optimized, high-density 4 GPU, 2 socket, 1U rack server.

The Dell EMC PowerEdge R740xd Rack Server brings an optimal balance of performance and cost with hybrid storage options.

Dell EMC PowerEdge rack servers are designed for HPC environments with broad requirements, including more local I/O (input/output) capacity and expandability. With the latest generation processors, higher I/O, more accelerator and interconnect options, and ultra-dense designs, PowerEdge servers support a broad range of needs.

Dell EMC PowerEdge blade servers help you maximize overall energy efficiency — performance per watt and actual power consumption — while delivering tremendous system performance in high-density, cost-efficient and flexible packages.

[Dell EMC Ethernet](#)
Build small to large clusters using low-latency, high-throughput, software-defined, open networking technologies that redefine the economics of the future-ready network.

[Mellanox® InfiniBand®](#)
Maximize your Dell EMC PowerEdge server performance to get the bandwidth and speed you need for your performance-driven server and storage applications.

[Dell EMC Networking H-Series Director-Class Switches based on the Intel Omni-Path Architecture](#)
Highly integrated director-class switches give you the scalability and integration that HPC deployments need. Increase computing density, and reliability, and lower power consumption and costs.

[HPC NFS Storage](#)
Speed up your workload productivity at any scale with a Network File Storage (NFS) solution built on proven Dell products.

[HPC Lustre Storage](#)
High-speed computing and throughput for data-intensive applications such as advanced modeling, simulation and analysis.

[Dell EMC Isilon scale-out NAS (network-attached storage)](#)
The ideal storage solution for data-intensive HPC environments that require the collection, storage and transmission of large-scale data sets.

**Networking**
Due to the ever-increasing size of data sets, the network that aggregates the individual compute and storage nodes into a true cluster is increasingly important. Networking and interconnect technology is one of the key areas where Dell EMC's push toward standardization has truly simplified the HPC world. Dell EMC has a wide and balanced portfolio of network technologies, combined with interconnect and switching technologies, that provide an optimal solution for HPC environments.

**Storage**
Based on unprecedented growth in the amount of data that HPC creates, cost-effective, high-performance, scalable and resilient storage is one of the greatest challenges facing HPC facilities. Dell EMC's HPC and storage expertise provides you with options for a cost-effective and intelligent storage strategy. Dell EMC HPC storage solutions start with a single server and scale to hundreds of Dell EMC PowerVault MD storage arrays with the use of a parallel file system, or Dell EMC Isilon scale-out NAS in a single system.

**Software**
Managing a cluster environment and the applications running on it are key to any HPC system. Dell EMC can deliver diverse management suites for various operating systems, cluster management middleware, libraries, compilers and monitoring tools that allow you to get the most out of your solution and HPC applications.

[Bright Cluster Manager for HPC](#) lets you deploy complete clusters over bare metal with single-pane-of-glass management for the hardware, the operating system, HPC software and users. With Bright Cluster Manager® for HPC, system administrators can get clusters up and running quickly, and keep them running reliably throughout their lifecycle — all with the ease and elegance of a full-featured, enterprise-grade cluster manager.

## Cloud
If you're interested in cloud HPC, Dell EMC offers several options:

[Dell EMC HPC Cloud with R Systems Service](#) consists of Dell EMC processing, power, storage and memory, with white-glove HPC services and custom solutions provided by R Systems, a Dell EMC HPC Solutions Partner.

Manage multiple clouds with CycleCloud™ or Bright Computing. These management and orchestration options, combined with public cloud infrastructure such as Microsoft® Azure®, allow you to size the infrastructure to answer the technical question or computation at hand.

[Dell EMC hybrid cloud solutions](#) are the industry's most comprehensive solution portfolio — designed to support your applications, workloads and cloud models.

**TOP 500**
The List.

**The Dell EMC Zenith cluster at the Dell EMC Innovation Lab in Austin, TX ranks #292 on TOP500:[13]**

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

# 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 to underscore our technology leadership, we've attained incredible #1 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 one provider.

- #1 in both number and size of XSEDE HPC systems for U.S. open science[1]
- #1 fastest supercomputer on the African continent[2]
- #1 converged infrastructure[3]
- #1 in traditional and all-flash storage[4]
- #1 virtualized data center infrastructure[5]
- #1 cloud IT infrastructure[6]
- #1 server virtualization and cloud systems management software (VMware®)[7]
- #1 in data protection[8]
- #1 in software-defined storage[9]

## Customer successes: Real value with Dell EMC HPC

**20%–30% gain** in NCSA iForge system performance over previous generation[10]

**95% less rack** space with a GPU-accelerated HPC system at the Imperial College London[11]

**70% reduction** in storage costs by combining HPC and big data storage in one cluster at Arizona State University[12]

For more customer success stories, visit Dell.com/customers.

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[1] Dell EMC has the most systems in XSEDE, including the largest system. Systems include SDSC Comet, SDSC, TACC Jetstream, TACC Stampede, LSU SuperMIC and TACC Wranger. TACC Stampede is the largest system in XSEDE. See "XSEDE High-performance Computing."

[2] The Next Platform, "South African Lengau System Leaps Towards Petaflops," June 2016.

[3] IDC WW Quarterly Converged Systems Tracker, Q1 2017, June 2017, Vendor Revenue.

[4] IDC WW Quarterly Enterprise Storage Systems Tracker, September 2017, Vendor Revenue — EMC Q2 2017.

[5] Dell EMC Annual Report, 2015.

[6] IDC WW Quarterly Cloud IT Infrastructure Tracker, April 2017, Vendor Revenue — EMC Q4 2016.

[7] IDC WW Virtual Machine and Cloud System Market Shares 2016, July 2017.

[8] Dell EMC Pulse,"Gartner Recognizes EMC as a Leader in the 2016 Data Center Backup and Recovery Software Magic Quadrant," June 2016.

[9] IDC WW Semiannual Software Tracker, 2H2016, April 2017.

[10] Video, "National Center for Supercomputing Applications (NCSA), University of Illinois Private Sector Program," May 2015.

[11] Dell EMC case study, "Helping world-changing ideas take flight," October 2015.

[12] Dell EMC case study, "Facilitating breakthroughs with next-generation HPC," April 2015.

[13] TOP500: The List, November 2017.

## Services and financing

Dell EMC understands that your work depends on each server, interconnect and storage component being set up and configured properly. Properly deploying a cluster and storage can be a massive investment of time and resources. Dell EMC is a leader in HPC solutions — regardless of size or complexity — with a flexible delivery model that delivers faster time-to-discovery with services for optimizing HPC investments. Dell EMC Services and Dell EMC partners can provide the services you need to succeed with HPC.

### Dell EMC Professional Services

You can select Dell EMC ProDeploy to help you optimize infrastructure, minimize costly disruptions and save time. Our experts are armed with validated HPC processes and best practices to efficiently plan, design and implement HPC solutions. With proven success in thousands of implementations worldwide, you can be confident with Dell EMC as your partner.

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 EMC ProSupport offers a single point of accountability from experts with solution-specific training, along with premium hardware and software support available 24x7. ProSupport also includes next-business-day on-site service with four- and eight-hour parts and labor response options, and escalation management with customer-set severity level options.

### Dell EMC Financial Services

Let the wealth of leasing and financing options from Dell EMC Financial Services help you find opportunities when you're facing 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.

## Let's expand the boundaries of HPC together.

Contact your Dell EMC or authorized channel partner representative today to see how your organization can use Dell EMC's practical and cost-effective HPC solutions.

Find out more: dellemc.com/hpc

### Contact us

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

**DELL**EMC