

# High Performance Computing and AI Solutions Portfolio

Technology and expertise to help you make innovation real.

# Go ahead. Dream big.

## 463 exabytes

of data will be created  
each day by 2025<sup>1</sup>

## 99% accuracy

identifying tropical cyclones,  
weather fronts and atmospheric  
rivers using AI and HPC<sup>2</sup>

## 87% of CEOs

say they will invest in  
AI initiatives this year<sup>3</sup>

Discovery and innovation have always started with great minds dreaming big. As data analytics, high performance computing (HPC) and artificial intelligence (AI) continue to converge and evolve, they are fueling the next industrial revolution and the next quantum leap in human progress. And with the help of increasingly powerful technology, you can dream even bigger.

Dell Technologies will be there every step of the way, with the technology you need to power tomorrow's discoveries and the expertise to bring it all together, today.

### The convergence of HPC and AI is driven by data

The data-driven age is dramatically reshaping industries and reinventing the future. As vast amounts of data pour in from increasingly diverse sources, leveraging that data is both critical and transformational. Whether you're working to save lives, understand the universe, build better machines, neutralize financial risks or anticipate customer sentiment, data informs and drives decisions that impact the success of your organization — and shapes the future of our world.

Data analytics, HPC and AI are technologies designed to unlock the value of your data. While they have long been treated as separate, the three technologies are converging as it becomes clear that analytics and AI are both big-data problems that require the power, scalable compute, networking and storage provided by HPC.

Formerly the domain of specialists using expensive, proprietary supercomputers, recent advances in compute, networking and storage technologies have made HPC — and thus data analytics and AI — available using small clusters and workstations. This changes the game for more traditional HPC and puts AI within reach for a wider range of users. For example, enterprises that have been collecting data for years can now analyze historical data using AI algorithms to gain faster market insights, increase efficiency and recognize higher return on investment (ROI) for data-driven investments.

That's why organizations of all sizes and in a broadening array of industry verticals are leveraging powerful HPC solutions to run the data analytics and AI applications that help them answer bigger questions and make more amazing discoveries, faster, to keep pace with competition that's coming from every angle.

<sup>1</sup> Visual Capitalist, "[How Much Data is Generated Every Day?](#)" April 2019.

<sup>2</sup> Earth Institute at Columbia University, "[Artificial Intelligence—A Game Changer for Climate Change and the Environment](#)" June 2018.

<sup>3</sup> Help Net Security, "[CEOs and business leaders trust AI, but employees are more cautious](#)," May 2019.



“We want our customers to be able to do things with hpcDIRECT that they can’t do by themselves, so it’s really important to have vendor partners like Dell EMC to enable us on the hardware side to be able to physically push the envelope.”

“Frankly, if Dell EMC wasn’t there to do that, well, we’d have to build it ourselves. We’re used to doing that, but we have become comfortable with the way Dell EMC supports the type of innovation that Verne Global is all about.”

—Tate Cantrell, CTO  
Verne Global

## The expertise, technology and partnerships to advance the state of the art for HPC solutions

Dell Technologies is helping expand the boundaries of this exciting new frontier with high performance computing solutions designed to help you solve complex problems faster than ever. In fact, we’re one of the only companies in the world with a portfolio for data analytics, AI and HPC that spans workstations, servers, networking, storage and services. In addition, Dell HPC and AI experts are active innovators and collaborators in the worldwide technical community dedicated to advancing HPC and AI. Our goal is to enable more organizations like yours to leverage advanced data analytics and AI to do what you do best — change the world.

## HPC solutions for workgroups to the TOP500

With an extensive portfolio, years of experience and an ecosystem of curated technology and service partners, Dell Technologies provides Ready Solutions and Architectures, workstations, servers, networking, storage and services that reduce complexity and provide the HPC performance and efficiency required for data analytics and AI.

### Ready Solutions

Dell EMC Ready Solutions for HPC, AI and Data Analytics are optimized rack-level systems with servers, software, networking, storage and services designed to let you “just add data.” These scalable architectures are built with best in class solution stacks to deliver speed, confidence and savings.

- **Dell EMC Ready Solutions for HPC** are scalable systems tested and tuned for specific vertical-market applications such as life sciences, digital manufacturing and research.
- **Dell EMC Ready Solutions for AI** help make AI simpler with designs enabling you to get faster, deeper insights delivered with proven AI expertise.
- **Dell EMC Ready Solutions for Data Analytics** speed time to insight with architectures, integrated systems and services optimized for big data analytics.
- **Dell EMC Ready Solutions for HPC Storage** make it easier to unlock the value of your data with scalable systems for NFS, Lustre, PixStor and/or BeeGFS storage.

### Ready Architectures

#### Reference architectures and configurations

Dell EMC engineering-tested reference architectures provide guidance to build and operate workload or application-optimized systems. These point-in-time technical white papers provide key considerations, best practices, system diagrams and performance test results.

### Workstations

#### Dell Precision workstations

[Dell Precision workstations](#) deliver state-of-the-art personal computing, including extensive memory, outstanding processors and graphics to run scientific calculations, remote visualization, 3D industrial designs, engineering simulations and digital content creation at peak performance to help you save time and control costs.

### Servers

Future-proof your information technology with [PowerEdge servers](#). Built for scale-out workloads like HPC, AI and data analytics, Dell EMC PowerEdge servers deliver high-performance computing with the latest processors, accelerators, memory and NVMe storage. You can scale efficiently and predictably with a wide range of configuration and connectivity options.



## Server Accelerators

PowerEdge servers accommodate from one to 16 accelerators inside.

- GPUs can offload portions of a workload, while the remainder of the code runs on the CPU, improving overall application performance by an order of magnitude.
- FPGAs can execute certain types of algorithms up to 1,000X faster than traditional solutions with less CPU time consumed<sup>4</sup> FPGAs can be programmed at the hardware to accelerate specific tasks.
- IPU<sup>5</sup>s hold the complete machine learning model inside the processor accelerator to lower the cost of accelerating AI training and inferencing by up to 100X.<sup>5</sup>
- See performance results at [hpcatdell.com](http://hpcatdell.com).

The [Dell EMC PowerEdge T640 Server](#) delivers fast insights with two processors and up to four GPU accelerators under your desk, or in a rack. With up to 32x 2.5" hard drives, up to eight NVMe drives and 2x 10GbE connections, this server capacity can grow with your data and your team.

The [Dell EMC PowerEdge C4140 Server](#) is a two-processor server with up to four NVIDIA V100 GPUs in just 1U! This server has a patented interleaved GPU design to optimize both space and airflow for maximum compute performance. The PowerEdge C4140 is available with NVIDIA NVLINK™ direct GPU-to-GPU interconnect designed to speed communication between GPUs an order of magnitude faster than PCIe.

The [Dell EMC PowerEdge C6420 Server](#) has up to four independent two-processor servers in 2U with up to 16 DIMMs, up to 24x 2.5" hard drives and M.2 boot storage. It's also available with direct contact liquid cooling (DCLC) to support higher-wattage processors for increased performance, energy efficiency and rack-level density.

The [Dell EMC DSS 8440 machine learning server](#) is a two-processor server with up to 16 accelerators, a high-performance switched PCIe fabric for rapid I/O, and up to 10 local NVMe and SATA drives for optimized access to data. The DSS 8440 has an open architecture, based on industry-standard PCIe fabric, allowing for customization of accelerators, storage options and network cards.

Custom [modular data centers](#) and [edge data centers](#) are self-contained units that can feature power, cooling, gateways and can host up to several racks of IT. They are designed with the security, environmental and performance capabilities to be placed in remote locations where real estate space is limited.

## Software

VMware®

With [VMware](#), you can capture the benefits of virtualization for HPC workloads while delivering performance that is comparable to bare-metal. The VMware approach to virtualizing HPC adds a level of flexibility, operational efficiency, agility and security that cannot be achieved in bare-metal environments—enabling faster time to insights and discovery.

<sup>4</sup> XILINX, "Solution Advantages," December 2019.

<sup>5</sup> Graphcore, "Accelerating Next Generation Artificial Intelligence."



“[The Great Lakes cluster] is an example of where we were able to come up with a unique solution with Dell EMC and its partners to make sure that we weren't overinvesting but were able to meet the needs of our different user bases. We are grateful for that.”

—Brock Palen,  
Director of Advanced  
Research Computing –  
Technology Services,  
University of Michigan

#### Bright Cluster Manager®

[Bright Cluster Manager](#) lets you deploy clusters over bare metal with single-pane-of-glass management for the hardware, software and users. 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.

#### OpenHPC

Dell EMC supports the [OpenHPC Collaborative Project](#), a community effort to aggregate a number of common ingredients required to deploy and manage HPC clusters including provisioning tools, resource management, I/O clients, development tools and a variety of scientific libraries.

#### Data Science Provisioning Portal

Dell EMC's Data Science Provisioning Portal provides self-service access to hardware resources along with a comprehensive set of AI libraries and frameworks such as TensorFlow, reducing the steps it takes to configure a data scientist's workspace to just five clicks to obtain faster, deeper AI insights.

#### Modular Data Center Management

Dell EMC Modular Data Centers have a command center to monitor and manage IT, cooling and power modules. The MDC programmable logic controller interfaces with the infrastructure subsystems and communicates to the network operations center, or building management system via Modbus remote terminal unit or TCP.

#### Systems Management

Dell EMC [OpenManage](#) software can discover, monitor, manage, update, and deploy your PowerEdge server infrastructure from nearly anywhere. Dell EMC [storage software](#) provides data management, local and remote protection, and ecosystem integration.

#### Networking

Dell EMC's open networking enables IT managers to build an application-agnostic infrastructure and simplify data center management with standard automation tools and standards-based open platforms.

#### Dell EMC switches

[Dell EMC PowerSwitch S5200-ON Series Switches](#) provide state-of-the-art, high-density open networking 25GbE top-of-rack and 100GbE spine/leaf switches to meet the growing demands of today's HPC/AI compute and storage traffic.

[Dell EMC Networking Z9100-ON Series Switches](#) are 10/25/40/50/100GbE fixed switches for high performance computing environments. With 32 ports of 100GbE, 64 ports of 50GbE, 32 ports of 40GbE, 128 ports of 25GbE or 128 ports 10GbE and two SFP+ ports of 10GbE/1GbE/100MbE, you can conserve rack space and simplifying migration to 100Gbps.

#### Mellanox InfiniBand

[Mellanox® SB7800 series Switch IB-2™ InfiniBand® EDR 100Gb/s Switches](#) deliver high bandwidth with low latency for the highest server efficiency and application productivity — ideal for HPC applications. You can get 36 ports at 100Gb/s per port, and can scale out to hundreds of nodes.

#### Gen-Z Consortium

Dell is a founding member of the [Gen-Z Consortium](#), dedicated to creating a next-generation interconnect that will bridge existing solutions while enabling unbounded innovation.

“The HPC & AI Innovation Lab gives our customers access to cutting-edge technology. Customers can bring us their workloads, and we can help them tune a solution before the technology is readily available.”

—Garima Kochhar,  
Distinguished Engineer

## Data Storage

Unprecedented growth in the amount of data created by analytics, artificial intelligence and other high performance computing makes fast, scalable and resilient storage an imperative.

### Direct-attached storage (DAS)

The [Dell EMC PowerEdge R740xd Server](#) has highly expandable memory (up to 3TB) and impressive I/O capability to match. Extraordinary storage capacity options make it well suited for data-intensive applications that require greater storage while not sacrificing I/O performance.

The [DSS 7000](#) series lowers your cost per gigabyte for storage while helping you meet the needs of an exascale future. It packs up to 90 hot-serviceable 3.5-inch drives in 4U. Available with either one or two server nodes, the DSS 7000 can deliver up to 1.26PB of storage to tackle demanding storage environments.

### Network-attached storage (NAS)

[Dell EMC Isilon scale-out NAS](#) storage, with the Isilon OneFS operating system, is ideal for data-intensive environments requiring collection, storage and transmission of large-scale data sets. Choose from all-flash, hybrid and archive NAS with up to 924TB capacity, 250K IOPS and 15 GB/s per chassis.

### Object storage

[Dell EMC ECS](#) is available in multiple consumption models — software defined, as a turnkey appliance, or as a service. ECS empowers organizations of all sizes to economically store and manage unstructured data at any scale, for any length of time. Starting at 60TB, the EX300 can grow to exabyte scale while the EX3000 scales to 8.6PB per rack.

### Storage-Area Network (SAN) storage

[Dell EMC PowerVault ME4 Series](#) provides entry-level block storage that scales to 4PB and supports native iSCSI, Fibre Channel and SAS. These simple, fast, affordable storage arrays are designed for versatility, with choice of drive types, 2U or 5U base systems and expansion enclosures.

“Dell EMC Isilon gives us a simple scale-out solution to manage and consume petabytes of data and to expedite genome processing from weeks to hours. When it comes to research that saves lives, where seconds matter, we rely on Dell EMC.” —James Lowey, CIO, TGen



## VMware for HPC

With [VMware® for HPC](#), you can capture the benefits of virtualization for HPC workloads.

The [latest vSphere edition](#) has been custom-built with big data analytics and HPC workloads in mind.

See a [VMware HPC system design](#) that demonstrates how virtualization and HPC technologies work together to deliver a secure, elastic, fully managed, self-service, virtual HPC environment.

**“The cloud computing augments what we are able to do. That was enabled through the Dell partnership with Alces. They aren’t looking just at the hardware environment. They bring in other companies . . . so the overall solution is exactly what the customer requires.”**

—Cliff Addison, Advanced Research Computing, University of Liverpool



## Multi-Cloud

Leveraging a multi-cloud approach spanning a variety of public, private and hybrid cloud resources, Dell Technologies cloud solutions allow organizations to transform IT by improving IT agility, controlling costs and reducing business risk.

### Dell Technologies Cloud

[Dell Technologies Cloud](#) is a set of cloud infrastructure solutions, combining the power of VMware and Dell EMC infrastructure, that is designed to make hybrid cloud environments simpler to deploy and manage. Improve your cloud experience with a consistent operating model and simplified management across private, hybrid and public clouds.

### Flex on Demand

[Flex on Demand](#), together with Dell Technologies Cloud Platform, improves cloud economics via a consistent hybrid cloud that delivers public cloud agility on-premises, optimizes cloud utilization, and is tailored to suit your business priorities.

### Partner Cloud

Dell Technologies [Cloud Service Providers](#) provide infrastructure as a service (IaaS), platform as a service (PaaS), software as a service (SaaS), managed services and more. IT resources can be extended to Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform and 4,200+ cloud partners via subscription or lease.

[R-Systems](#) helps organizations build highly intelligent public, private and hybrid cloud environments. Specializing in high performance computing, this team is experienced in cloud architecture construction, re-platforming, application development, SaaS and PaaS platform migration.

[Verne Global's hpcDIRECT](#) is powerful, agile and efficient cloud for high performance computing and artificial intelligence. Whether deployed as stand-alone compute or used as an on-demand HPC extension, hpcDIRECT beats hyperscale alternatives on both performance and price.

[DXC Technology](#) can help you work in harmony with applications on-premises, in the cloud and at the edge. With DXC, you can adopt and scale cloud solutions globally while integrating with your traditional IT infrastructure. Rapidly modernize applications, migrate the right workloads, and securely manage your hybrid environment.



“For people who need to do analytics or machine learning and process lots of data, we are bringing together on one system high levels of compute and high levels of I/O... With all those things together, this machine can be used to deliver data-centric research to new and emerging communities.”

—Dr. Paul Calleja, Director of Research Computing Services, University of Cambridge

## Services

From design and implementation to support and systems management, Dell Technologies offers a comprehensive services portfolio for data analytics, HPC and AI, including on-premises and managed systems, as well as those in the cloud. Dell partners with you every step of the way, linking people, processes and technology to accelerate innovation and enable optimal business outcomes.

- [Consulting](#) provides [data analytics and AI](#) services from strategy through to implementation and ongoing optimization, and helps bridge the people, processes and technology needed to achieve desired business outcomes at speed and scale. This includes implementing and operationalizing AI technologies and helping you accelerate your data engineering capabilities.
- For those just getting started with HPC and AI, [ProConsult Advisory Services](#) assess and plan transformations that will achieve measurable outcomes aligned to your vision and strategy, in six weeks or less, using our proven AS-IS/TO-BE methodology.
- [Education Services](#) offers courses and certifications in data science and advanced analytics. Through self paced online labs and instructor led workshops, the Deep Learning Institute provides training on the latest techniques for designing, training and deploying neural networks across a variety of application domains.
- [ProDeploy](#) leverages a global team of dedicated HPC specialists with the experience, expertise and best practices to enhance your success with Dell EMC solutions. Our deployment model provides you with comprehensive, proven system implementation along with design validation, benchmarking and product orientation.
- [ProSupport](#) can provide comprehensive hardware and collaborative software support 24x7 for optimal system performance and minimized downtime. The ProSupport Add-on for HPC provides solution-aware support with specific entitlements for Dell EMC Ready Solutions for HPC, AI and Data Analytics, including access to dedicated HPC solution experts to help manage the complexities of supporting multi-vendor systems.
- With [Remote Cluster Management service](#), highly skilled experts will proactively manage and maintain your HPC system and applications so that you can focus on your core business.

## Financing

A wealth of leasing and financing options from [Dell Technologies Financial Services](#) can help you find opportunities when facing decisions regarding capital expenditures (CapEx), operating expenditures (OpEx) and cash flow. Dell offers a wide range of payment options to make it easier than ever to meet your needs.

- Take advantage of financing and leasing opportunities across the Dell Technologies portfolio.
- Dell Business Credit allows your business to make IT purchases based on your technology timeline and allows you to leverage other lines of credit for non-technology purchases.
- With PC as a Service, adopt a convenient solution that combines hardware, software, PC lifecycle services and financing into one all-encompassing service – providing a single, predictable price per seat per month.
- Consolidate software licenses and billing in a simple agreement, making annual spend more predictable and cost-effective. For the ultimate flexibility, freely add or exchange software titles and pre-pay for anticipated future capabilities.



“There are a lot of advantages to working with Dell. We laid out our requirements and the people at Dell took those requirements and developed exactly what we needed... It was very nice to be able to hand this off to people who are experts in the field, who understood what our requirements were, and who could give us a product that actually met those requirements.”

—Thomas McCauley,  
Caterpillar autonomous  
mining program

## Why choose Dell Technologies for HPC and AI

### Dell is different

Dell Technologies is committed to advancing data analytics, AI and HPC, and we've dedicated resources toward that goal.

- Come in for an [executive briefing](#) and collaborate on ways to reach your business goals.
- 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 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.

### 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 Customer Solution Centers help reduce the risks associated with new technology investments and can help improve speed and ease 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 and Bangalore. Dell Technologies experts are available to collaborate and share best practices as you explore the latest technology and get the information and hands-on experience you need for your advanced computing workloads.

### HPC & AI Innovation Lab

The [HPC & AI Innovation Lab](#) in Austin, Texas, is our flagship innovation center. Housed in a 13,000-square-foot data center, it gives you access to thousands of Dell EMC servers, two powerful HPC clusters, 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 data 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, these Centers of Excellence provide a network of resources based on the wide-ranging know-how and experience in the community.

## Mastercard turns

# 2.2B

cards

# 160M

transactions an hour

# 52B

transactions a year into intelligence with 1.9M rules to help protect customers from fraud

## 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.

- #1 in servers<sup>6</sup>
- #1 in converged and hyper converged infrastructure (HCI)<sup>7</sup>
- #1 in storage<sup>8</sup>
- #1 cloud IT infrastructure<sup>9</sup>

See [Dell Technologies Key Facts](#).

## Customer successes

- [Mastercard®](#) is using AI to protect their customers from fraud.
- [Caterpillar®](#) is leveraging autonomous mining vehicles.
- [Ziff.ai](#) does image, voice and video recognition using AI-enabled algorithms.
- [AeroFarms®](#) is using image recognition and classification to adjust nutrients, light and other factors to improve crop yield, taste and texture.
- At [Simon Fraser University](#), scientists are tracking viruses by their DNA to contain and treat outbreaks faster.
- [University of Pisa](#) is using deep learning technologies from Dell for DNA sequencing, encoding DNA as an image.
- [OTTO Motors®](#) is using autonomous vehicles/robots in supply chain fulfillment/inventory management.
- [Epsilon®](#) uses AI for marketing services and real-time content.

<sup>6</sup> IDC Vendor Revenue, "WW Quarterly Server Tracker," September 2019.

<sup>7</sup> IDC Vendor Revenue, "WW Quarterly Converged Systems Tracker," September 2019.

<sup>8</sup> IDC Vendor Revenue, "WW Quarterly Enterprise Storage Systems Tracker," September 2019.

<sup>9</sup> IDC Vendor Revenue, "WW Quarterly Cloud IT Infrastructure Tracker," September 2019.

## Let's get started

Learn more about how you can quickly deploy an HPC system that's ready to power AI and data analytics workloads. Contact your Dell or authorized partner sales representative, join the HPC Community at [dellhpc.org](http://dellhpc.org), and visit [dell EMC.com/hpc](http://dell EMC.com/hpc) to learn more.

## Contact us

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

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