

High Performance Computing Solutions Portfolio

Accelerate discovery and innovation

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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.

High performance computing (HPC) has been a powerful tool for researchers and scientists for decades. But recent rapid advancements in processing power and connectivity, combined with massive new sources of real-time information, are fueling the next industrial revolution, and the next quantum leap in human progress.

That's because, as it becomes more accessible, HPC is enabling adoption of artificial intelligence (AI) and advanced analytics in multiple industries across a variety of use cases. This convergence of HPC, AI and analytics creates more opportunities to break new ground, make important discoveries and solve some of the most important challenges of our time.

Dell Technologies is helping expand the boundaries of this exciting new frontier with scalable, flexible 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 HPC, AI and analytics that spans workstations, servers, networking, storage, rack systems and services. In addition, Dell Technologies HPC experts are active innovators and collaborators in the worldwide technical community dedicated to advancing HPC. Our goal is to enable more organizations like yours to leverage HPC to do what you do best — change the world.

Dell HPC Solutions

Millions of data points

collected and processed¹

390X increase

in productivity¹

Dell Technologies has what you need.

Expertise and guidance

Technology is evolving quickly, so your team may not have the resources to design, deploy and manage solution stacks optimized for HPC. While HPC 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 HPC, AI and analytics 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 Validated Designs for HPC

The advantage in today's marketplace goes to the data-driven enterprise. For many organizations, HPC 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 analytics and other enterprise workloads. Dell Validated Designs for HPC speed time to results with the confidence of engineering-tested systems while saving valuable time and resources.

Solutions customized for your environment

Dell Technologies uniquely provides an extensive portfolio of technologies to deliver the advanced computing solutions that underpin successful HPC, AI and analytics 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 a universe of data.

¹ HPC Wire, [AeroFarms turns millions of data points into healthy crops with Dell Technologies and Intel](#), July 2021.

“We’re changing how
we connect devices,
how we connect biological
systems, and really how
we connect people.”

— April Agee Carroll,
Vice President of R&D,
AeroFarms²

HPC workloads

How does your organization plan to leverage HPC? Dell Technologies has the proven expertise in assisting with building, deploying and supporting workload-optimized HPC solutions. The following are just a few examples.

Research

HPC helps researchers move quickly from raw data to actionable insights. There are a wide range of use cases for research HPC. Some of the more common ones include:

- **Genomics** — Get the compute power necessary to solve the mystery of the human genome.
- **Instrumentation** — Speed medical breakthroughs enabled by instruments such as cryo-electron microscopy (cryo-EM).
- **Molecular dynamics / quantum physics** — Simulate the behavior of atoms and molecules.
- **Astronomy** — Analyze data from large telescopes such as the Large Synoptic Survey Telescope (LSST), the Cherenkov Telescope Array (CTA) and the Square Kilometre Array (SKA).
- **Climate and weather modeling** — Model vast amounts of data to improve the accuracy of predictions around the formation, intensity and movement of weather systems.
- **Geosciences** — Identify patterns in geological data to predict and model vast systems with very high accuracy.

Life sciences

The computing power of HPC is the key to using medical data to save lives and protect health — better, faster and with lower costs. Use cases for life sciences organizations include:

- **Healthcare research** — Speed and improve research outcomes including genomics, proteomics, bioinformatics, cryo-EM and neuroscience.
- **Pharmaceutical** — Transform the process of drug development by speeding processes such as drug discovery, computational chemistry and molecular dynamics, precision medicine and clinical trials.
- **Healthcare providers** — Identify disease sooner and treat it more effectively and efficiently using HPC in such areas as oncology, alerts and diagnostics, medical imaging, hospital workflows, clinical decision support and personalized medicine.
- **Government** — Protect population health with advanced epidemiology and protect government resources with enhanced fraud-detection capabilities.

Digital manufacturing

Manufacturers use HPC to power the specialized software that helps create innovative products and grow share and revenue while cutting costs and improving quality. Typical workloads include:

- **Structural analysis** — Increase computational efficiency, so users can complete more analyses in less time with fewer errors.
- **Computational fluid dynamics (CFD)** — Use simulations to predict fluid behavior faster and more accurately to help keep to tight development schedules.
- **Noise, vibration and harshness (NVH)** — Identify and reduce NVH prior to prototyping to save time and costs. AI-enhanced NVH can also be embedded in products, leveraging Internet of Things (IoT) to help warn of impending failures.
- **Virtual desktop infrastructure (VDI)** — Supercharge engineering productivity with powerful HPC systems that can be used to support remote visualization for multiple users on a single, virtualized server running a variety of computer-aided engineering (CAE) applications.

² Dell Technologies case study, [A harvest full of insights](#), accessed April 2022.

“In the future, we believe data will guide every medical decision. That’s why technology will be key for every healthcare company.”

— Kiyotaka Fujii, President
of Global Healthcare,
Konica Minolta³

Oil and gas

Energy companies rely heavily on advanced computational techniques to gain a clearer picture of the earth, enabling targeted drilling, reduced acquisition costs and lower environmental impact. Typical workloads include:

- **Data processing** — Remove noise from raw data coming in from well logs, seismic, gravity and magnetic surveys to produce more accurate images and earth models.
- **Reservoir modeling and simulation** — Convert data into 3D models of the subsurface using complex algorithms highly tuned for the most sophisticated computer hardware.
- **Seismic processing and interpretation** — Make more informed drilling decisions by converting hundreds of terabytes of raw data into useful subsurface models.
- **Computational chemistry** — Reduce and manage subsurface uncertainty by enabling hyper-predictive models for identifying chemical compounds.
- **Product optimization** — Avoid wasted resources by better predicting where and how to drill to maximize value.

Financial services

Both established financial services groups and financial technology (fintech) upstarts are seeking to capitalize on new technologies to improve returns and attract and retain more customers in a competitive global marketplace. Use cases include:

- **Algorithmic and high-frequency trading (HFT)** — Get instant, actionable insights to optimize trades.
- **Risk analysis including Monte Carlo simulations** — Monitor and evaluate thousands of risk factors.
- **Pricing** — Set optimal pricing for a variety of financial products, calibrating in real time.
- **Fraud protection** — Use algorithms to detect suspicious behavior and anomalies in real time.

Media and entertainment

Multiple aspects of this industry have taken a huge leap forward with the power of HPC. Common workloads include:

- **Visual effects (VFX) and computer-generated imagery (CGI)** — Create more realistic effects, faster by speeding image modeling, animation and editing.
- **Immersive entertainment** — Enhance virtual reality (VR) and augmented reality (AR) and gaming with the power for a new generation of immersive experiences.
- **Content management and delivery** — Save time and costs using HPC power to transcode massive amounts of streaming media in real time, and push it out to millions of consumers on the devices of their choice.

Government

Use cases for federal, state and local government include:

- **Monitoring and safety** — Transform public safety by identifying incidents and alerting the authorities.
- **Cybersecurity** — Protect networks, computers, software and data from unauthorized access.
- **Emergency management** — Prioritize emergency calls and recommend responses based on multiple factors such as caller sentiment analysis, location, proximity to other callers and outcomes from similar calls.
- **Military and defense** — Advance military power and preparedness.
- **Weather modeling** — Protect people and property with more accurate weather and climate predictions.
- **Public health** — Predict and respond more quickly to public health crises.

³ Dell Technologies case study, [Realizing X-ray that moves using technology that transforms](#), accessed April 2022.

“Using Dell PowerEdge servers, we are able to increase our platform capacity in a matter of weeks versus a matter of months.”

— Jun Chen,
Senior Vice President of
Technology Services,
Epsilon⁷

Dell Technologies has a simple strategy: Transform the future with HPC/AI

Dell Technologies is committed to democratizing, optimizing and advancing HPC and AI to help our customers shape the future. The key pillars of our HPC and AI strategy are focused on making this transformative technology approachable and available to a much larger audience than ever before. Dell Technologies starts by offering a broad portfolio of innovative technologies, optimizing key parts for HPC and AI, and wrapping it all with deep expertise, industry partnerships and the services that lead to successful HPC and AI implementations.

> **Challenge:** “Deploying HPC resources takes too long and doesn’t always provide the results we expected.”

Properly deploying and tuning an HPC cluster can be a specialized, error-prone task that requires a significant investment of time and resources. In more traditional HPC settings, researchers often have to deploy their own clusters, which may not be their core competency. For organizations that are relatively new to HPC, hiring specialists can be a challenge because shortages make them both hard to find and expensive to add to the payroll. In both cases, the process for selecting, procuring and deploying HPC clusters can take weeks or months. If the system isn’t configured properly for the target workloads, performance may not be as expected. And HPC is a rapidly evolving discipline, so it can be hard to keep up with the latest advancements.

Advancing HPC: Leverage expertise to fast-track projects and success

Dell Technologies has the expertise, innovation and strategic partnerships to help you advance the state of the art for HPC, from the workgroup to the TOP500. Our field team of dedicated HPC experts are active members in the HPC community, helping us stay at the head of the curve for HPC innovation. We invite customers to collaborate with our worldwide Customer Solution Centers, Dell Technologies HPC & AI Innovation Lab — dedicated to cutting-edge research and development (R&D) — and/or with one of our many global Dell Technologies HPC & AI Centers of Excellence.

Our experts will work with you to design, test and tune solutions, with a deep understanding of optimal system design to help enhance performance for your specific workloads. And we keep an eye on the future, obtaining 2,053 patents last year, for a total of 26,189 patents.⁴

> **Challenge:** “We want to get started with or expand HPC, but we don’t have the in-house resources.”

HPC has the potential to add value for your organization on the path to AI automation. That’s why organizations across a wide spectrum of sizes and industries are starting to explore HPC — expanding HPC’s impact well beyond typical research, life sciences and manufacturing applications. But the complexity of designing, deploying and managing an HPC system can be daunting, especially for small and medium enterprises.

Democratizing HPC: Speed time to results with confidence and savings

Dell Technologies is working to democratize access to HPC, enabling small and medium enterprises to accelerate adoption with our Validated Designs for HPC. These domain-specific configurations are designed, validated and tuned by HPC engineers and workload/application experts. The result is industry-standard IT modular building blocks that offer simplified design, configuration and ordering in hours instead of weeks, with a single point of contact available for services. Validated Designs for HPC have been shown to provide 15X acceleration in value recognition,⁵ 18-20% faster deployment,⁵ and can be up and running in as little as one hour.⁶

⁴ Dell Technologies, [Key Facts](#), March 2022.

⁵ Dell Technologies, [Accelerate Discovery and Innovation with HPC](#), accessed April 2022.

⁶ Dell Technologies case study, [AI startup ZIFF.ai revs up its business](#), accessed April 2022.

⁷ Dell Technologies case study, [Epsilon](#), accessed April 2022.

“Our partnership with Dell Technologies has been a cornerstone to a lot of work that we’ve done, and has enabled TGen to stay ahead of the pack, and be a leader in precision medicine.”

— James Lowey, Chief Information Officer, TGen¹⁰

> Challenge: “We need to show value from our HPC investments.”

Researchers and lines of business alike need to show how IT is driving value. Total cost of ownership (TCO) is an important element of the return on investment (ROI) equation. Keeping TCO low starts with cost-optimized solutions for lower capital expense (CapEx). Management simplicity can help keep operational expenses (OpEx) lower over the life of the solution. And systems that are ready for hybrid cloud help future-proof investments. In addition, a single point of contact for support can streamline ordering and help avoid costly downtime.

Optimizing HPC: Maximize performance, efficiency and flexibility

Our robust portfolio of products and services is optimized for HPC, providing performance and efficiency from a company invested in your future. Dell Technologies is proud to power 16 of the TOP500⁸ supercomputers⁸ and provide solutions for a range of HPC needs. Our price-performance-optimized portfolio includes workstations, servers, networking and storage. Management and orchestration capabilities maximize utilization, including hybrid cloud, with innovations that make it possible to process gigabytes of data per hour.⁹ Plus, you can opt for a wide selection of services: consulting, education, deployment, managed services, support, and financing, with 35,000 full-time service experts available to assist you worldwide.⁴

Customer success stories

Translational Genomics Research Institute (TGen[®])

7–8 hours

instead of two weeks to process a genome

12 trillion

operations per second

1 million

CPU hours per month

Read the case study: [Groundbreaking research with life-changing results.](#)

Arizona State University

8 million

core CPU hours per month

1,300

distinct users annually

14,000

CPU cores

Read the case study: [Accelerating scientific research with high performance computing.](#)

AeroFarms[®]

Millions

of data points collected, 24/7

390X more

productivity than a commercial farm

95% less

water used for the same crop yield

Read the case study: [A harvest full of insights.](#)

- The [Cineca Human Brain Project](#) uses HPC to understand the mechanisms behind cognition, learning and plasticity.
- [Konica Minolta[®]](#) integrates Internet of Things (IoT), AI and ML to process up to 300 medical images in a single scan and animate them in minutes.
- [OTTO Motors[®]](#) uses AI to process gigabytes of data per hour.
- [Cambridge University](#) delivers HPC and analytics services to over 1,000 staff across the university. Read more [customer stories](#).

⁸ TOP500, [The List](#), June 2021.

⁹ [OTTO Motors](#), accessed April 2022.

¹⁰ Dell Technologies case study, [Setting the pace of progress](#), accessed April 2022.

Validated Designs

Cluster as a Service with VMware and Bright

Build and deploy clusters as a service with VMware vSphere and Bright Cluster Manager

Running HPC on virtualized clusters can help answer the challenges of supporting new AI, ML and other data analytics workloads. Advances in VMware® vSphere® and CPU virtualization support have closed the performance gap with bare-metal deployments and made virtual clusters built from virtual machines (VMs) and containers viable for a growing set of HPC applications. Bright Cluster Manager® simplifies building and managing heterogeneous virtualized clusters for HPC, AI/ML and analytics at enterprise scale. VMware and Bright Computing have validated this design to help you design and deploy VMware virtualized HPC clusters and offer them as a service to a variety of users.

- **Agility** — Respond instantly to user demands, automatically reassigning resources based on policies. Enable quick provisioning of self serve resources for authorized users.
- **Simplicity** — Automatically build a cluster from bare metal—setting up networking, user directories, security, DNS, and more. Even users without VMware experience can typically set up a cluster in just a few minutes.
- **Flexibility** — Manage resources across on premises, cloud and edge environments.
- **Cost savings** — Enhance utilization via virtualization while reducing administration and hardware costs and public cloud usage.

Configuration options			
Dell			Software
vSAN Ready Nodes	Networking	Storage	
<ul style="list-style-type: none"> • Based on C6520 servers (compute nodes) • Based on R440 servers (management cluster) 	PowerSwitch S4048-ON 10Gbe	PowerScale H500	<ul style="list-style-type: none"> • VMware Cloud Foundation™ • VMware ESXi™ • VMware vSAN™ • VMware vCenter Server®



GPU as a Service

The power, portability and simplicity required to make HPC and AI a reality

As HPC and AI become increasingly prevalent, forward-thinking organizations are looking for ways to streamline and simplify IT. This will enhance your ability to run traditional and advanced computing workloads side-by-side in a hybrid cloud model that provides simplicity, flexibility and cost optimization.

To help you take advantage of hybrid cloud for HPC and AI, Dell Technologies has created engineering-validated designs that incorporate servers, networking and storage along with VMware Cloud Foundation and new advanced features included in VMware vSphere. Together they provide the power, portability and management simplicity required to make HPC and AI possible.

- **Power** — Enables virtualizing accelerators on-premises or in the cloud and gives developers self-service access to acceleration.
- **Portability** — Provides a consistent Kubernetes® containerized environment for porting applications across clouds.
- **Simplicity** — Enables IT teams to run AI and other applications together in familiar VMware environments running on proven Dell PowerEdge servers, networking and storage.

Configuration options			
PowerEdge servers	PowerSwitch networking	Storage	Software
Choice of: R740xd or C4140 with NVIDIA V100 or T4 accelerators	Choice of: 10, 25 or 100GbE	<ul style="list-style-type: none"> PowerScale F800 	<ul style="list-style-type: none"> VMware Cloud Foundation with vSphere VMware NSX® VMware Tanzu™ Kubernetes Grid (TKG) NVIDIA® vCompute Server Automation with HashiCorp Terraform vSphere Provider



Government HPC, AI and Data Analytics

A unified system for high-performance simulation, AI and high-performance analytics

Converging HPC with AI and data analytics on a single system gives you the horsepower to reduce administrative burdens, better manage public health and safety, improve military systems and more to serve citizens more efficiently while freeing up employees for more complex tasks.

Essentially, the Validated Design for Government HPC, AI and Data Analytics can deliver the throughput and capacity to manage rapid data growth and increased workload demands, so agencies can maximize the benefits for taxpayers.

- **Lower TCO** — Purchase and operate a single environment instead of three separate ones.
- **Streamline and simplify** — Build a single unified architecture that supports multiple AI, HPC and analytics workloads.
- **Increase opportunity** — Use AI to augment traditional HPC workloads and vice versa while enabling new HPC, AI and analytics workloads.

Configuration options					
Dell PowerEdge servers			Networking	Storage	Software
Management nodes	Compute nodes	Accelerators			
R7525, R750, R6525, R650	XE8545, R7525, R6525, C6525, R750xa, R7525, C6520, C6525	<ul style="list-style-type: none"> NVIDIA A100, A10 or T4 AMD® Instinct™ Mi100 Intel® PAC FPGAs 	<ul style="list-style-type: none"> PowerSwitch N3248TE-ON Ethernet NVIDIA® QM8700 HDR100 InfiniBand® 	<ul style="list-style-type: none"> PowerScale F800 HPC NFS, BeeGFS® or PixStor Storage 	<ul style="list-style-type: none"> Enterprise— Bright Cluster Manager and Bright Cluster Manager for Data Science, and Data Science Laboratory Open source— Cluster management tools, Data Science Laboratory, and Omnia with Ansible® playbooks for Kubernetes and Docker®

“You want clinical results back as fast as possible, so physicians can make decisions in a more timely manner. You don’t want to wait two to three weeks to do this. You want to do it in a much faster time period.”

— James Lowey, Chief Information Officer, TGen¹¹



HPC Digital Manufacturing

Tap into the power of HPC and AI to speed design workloads.

The manufacturing sector already leads the way in applying advanced computing to power the engineering and design that help create innovative products and grow revenue while cutting costs. The mainstreaming of analytics and AI powered by HPC will revolutionize engineering to help manufacturers speed time to market with more innovative and higher quality products. And Dell Technologies is helping push the boundaries of performance with scalable, flexible solutions designed to help bring products to market faster.

- **Faster performance** — Rigorously tuned for specific applications and workloads, with a focus on efficiency, performance and reliability.
- **Easier scaling** — A flexible building-block approach helps you efficiently design, implement and scale HPC and AI solutions.
- **Reduced risk** — One source for solution design, delivery and support.

Configuration options			
Dell PowerEdge servers	Networking	Storage options	Software
Choice of: AMD EPYC™: R6525, R7525, C6525 or Intel Xeon® Scalable: R650, R750, C6520	Dell PowerSwitch S, N and Z series Ethernet and NVIDIA QM8700 series HDR	<ul style="list-style-type: none"> • Validated Designs for HPC NFS, BeeGFS, or PixStor Storage • PowerScale scale-out NAS 	<ul style="list-style-type: none"> • Bright Cluster Manager or OpenHPC™ • Red Hat® Enterprise Linux®

Altair HyperWorks

Speed computer-aided engineering (CAE) workloads.

HPC-powered analytics and AI are revolutionizing CAE, helping manufacturers speed time to market with higher-quality products. A Validated Design created specifically for Altair® HyperWorks® software enhances performance for CAE workloads ranging from model-based systems design and early geometry ideation to detailed multiphysics simulation and optimization.

Configuration options					
Dell PowerEdge servers			Networking	Storage	Software
Infrastructure servers	Compute building blocks	Operational storage			
R650	R650, R750 or C6520	R740xd	<ul style="list-style-type: none"> • PowerSwitch • N3248TE-ON Ethernet • NVIDIA® QM8790 HDR InfiniBand 	<ul style="list-style-type: none"> • PowerScale A200 scale-out NAS or • Validated Design for HPC BeeGFS High Performance, or PixStor Storage 	<ul style="list-style-type: none"> • Altair HyperWorks • Altair PBS Professional

¹¹ Dell Technologies case study, [Groundbreaking research with life-changing results](#), October 2021.

Validated Designs for HPC
Solution Overview

ANSYS

Speed CFD simulations and finite element analysis workloads.

Many manufacturers use ANSYS® software for CFD simulations and finite element analysis (FEA) workloads. That’s why Dell Technologies offers a Validated Design for ANSYS software, including ANSYS CFX®, Fluent® and Mechanical™. This solution was designed and configured specifically for ANSYS digital manufacturing workloads, to enhance performance for CFD and FEA applications that are critical for virtual product development.

Configuration options				
Dell PowerEdge servers		Networking	Storage options	Software
Infrastructure servers	Compute building blocks			
R650 or R6515	R650, R6525, R750, R7525, C6520, C6525	<ul style="list-style-type: none"> Dell PowerSwitch N3248TE-ON Ethernet NVIDIA QM8790 HDR InfiniBand 	<ul style="list-style-type: none"> PowerScale A300 or F600 scale-out NAS Validated Design for HPC BeeGFS High Performance, or PixStor Storage 	<ul style="list-style-type: none"> ANSYS CFX ANSYS Fluent ANSYS Mechanical Bright Cluster Manager

LSTC LS-DYNA

Speed FEA and simulation workloads.

Manufacturers in the automotive, aerospace, construction and other industries use LS-DYNA® from Livermore Software Technology Corporation (LSTC) to perform complex FEA workloads. LS-DYNA is a multi-purpose explicit and implicit finite element and multiphysics application used to analyze the nonlinear response of structures. Any LS-DYNA features can be combined for a given simulation to model a wide range of physical events. Its potential applications are numerous and can be tailored to many fields.

Configuration options					
Dell PowerEdge servers			Networking	Operational Storage	Software
Infrastructure servers	Compute building blocks	Basic building blocks			
R640	R640 or C6420	R840	<ul style="list-style-type: none"> Dell PowerSwitch S3048-ON NVIDIA SB7890 36-port EDR InfiniBand (recommended) 	<ul style="list-style-type: none"> PowerEdge R740xd 	<ul style="list-style-type: none"> LS-DYNA Bright Cluster Manager

Siemens Simcenter STAR-CCM+

Speed product design and simulation workloads.

Siemens® Simcenter™ STAR-CCM+®, is CFD and multiphysics software for the simulation of products and designs operating under real-world conditions. It’s capable of capturing the physics that will influence product performance, enabling engineers to predict performance changes in response to multiple parametric design changes. It provides engineers with automated design exploration and optimization, allowing them to efficiently explore the entire design space instead of focusing on single-point design scenarios. With decades of experience, Dell Technologies is helping digital manufacturers transform performance for Simcenter STAR-CCM+ workloads.

Configuration options				
Dell PowerEdge servers		Networking	Storage options	Software
Infrastructure servers	Compute building blocks			
R650 or R6515	R650, R750, C6520, R6525 or C6525	<ul style="list-style-type: none"> Dell PowerSwitch S3048-ON NVIDIA QM8790 HDR InfiniBand 	<ul style="list-style-type: none"> R740xd, R7515 PowerScale A200 or Validated Design for HPC PixStor Storage 	<ul style="list-style-type: none"> STAR-CCM+ Bright Cluster Manager

SIMULIA Abaqus

Speed FEA workloads.

Leveraging robust simulation software powered by HPC vastly reduces physical testing requirements for manufacturers, helping reduce product costs and enhance quality while speeding time to market. Because best-in-class manufacturers are taking advantage of Dassault Systèmes® SIMULIA® Abaqus® software to consolidate processes and tools and reduce costs and inefficiencies, Dell Technologies offers

a Validated Design for the Abaqus Unified FEA software suite. The combination offers powerful solutions for both routine and sophisticated engineering problems, covering a vast spectrum of industrial applications.

Configuration options				
Dell PowerEdge servers		Networking	Storage options	Software
Infrastructure servers	Compute building blocks			
R650 or R6515	R650, R6525, R750, R7525, C6520 or C6525	<ul style="list-style-type: none"> Dell PowerSwitch N3248TE-ON NVIDIA QM8790 HDR InfiniBand 	<ul style="list-style-type: none"> R740xd operational PowerScale A300, F600 Validated Design for HPC BeeGFS Storage High Performance configuration, or PixStor Storage 	<ul style="list-style-type: none"> SIMULIA Abaqus Bright Cluster Manager



HPC Life Sciences

Make breakthroughs faster.

Amazing work is being done today in healthcare and the life sciences. For some projects, every hour closer to discovery and results can mean the difference between life and death. But organizations face many factors that may hinder discovery and cause inefficiencies. Dell Validated Designs for HPC Life Sciences can accelerate time to insight for a range of applications, including drug design, cancer research, agriculture, forensics, genomics and bioinformatics.

- **Faster time to production** — Enables efficient planning, design and implementation.
- **Better performance** — Recommended configurations facilitate achieving performance and reliability goals.
- **Easier scalability** — Building-block design makes it easy to manage and extend storage and networking on-premises so the solution can grow over time.

Configuration options				
Dell PowerEdge servers		Networking	Storage	Software
Compute nodes	Accelerators			
Intel Xeon Scalable: R650, R750, R750xa, R950, C6520	NVIDIA A100, A40	Dell PowerSwitch S, N and Z series Ethernet and NVIDIA QM8700 series HDR	<ul style="list-style-type: none"> Validated Designs for HPC NFS, BeeGFS, or PixStor Storage PowerScale scale-out NAS 	Choice of: Bright Cluster Manager or OpenHPC
AMD EPYC: R6525, C6525, XE8545				Red Hat Enterprise Linux

Genomics with BioBuilds

Sequence and assemble more genomes, faster.

Advanced computing technologies have rapidly transformed genomics, giving researchers the power to work with vast amounts of data. However, as the science advances, the amount of data increases as well. This necessitates continuing innovation to fuel the breakthroughs that help build our understanding of the human genome. The building blocks for Genomics with BioBuilds™ are optimized, tested and tuned for a variety of key genomics use cases, such as next-generation sequencing (NGS) and de novo assembly.

Configuration options				
PowerEdge servers		Networking	Storage	Software
Infrastructure nodes	Compute nodes			
R440 Login nodes: R640	DNA sequencing: C6400 enclosure with 4x C6420 De novo assembly: R740xd	<ul style="list-style-type: none"> Dell PowerSwitch S3048-ON NVIDIA InfiniBand QM8790 (HDR) or SB7890 (EDR) 	<ul style="list-style-type: none"> Validated Design for HPC BeeGFS Storage PowerScale scale-out NAS 	<ul style="list-style-type: none"> Bright Cluster Manager (recommended) BioBuilds (tested and recommended) Red Hat Enterprise Linux or CentOS®

Genomics with NVIDIA Clara Parabricks

Accelerate secondary analysis for NGS.

Keeping up with the pace of genetics research requires the ability to handle large — and growing — data sets. The secondary analysis phase of NGS can take minutes or days depending on the available software, computing and storage resources. When you're talking about the difference between life and death, a few days can be too long to wait. Having the secondary analysis resources to keep pace with the rate of raw NGS data generation is critical for preventing analysis backlogs.

Configuration options				
Dell				Software
Infrastructure compute	GPU compute	Networking	Storage options	
PowerEdge R650	<ul style="list-style-type: none"> PowerEdge XE8545 with 4x NVIDIA A100 GPUs SXM4 with NVLink™ R7525 servers with 2x NVIDIA A100 GPUs 	<ul style="list-style-type: none"> NVIDIA QM8790 InfiniBand 	<ul style="list-style-type: none"> Validated Design for HPC BeeGFS Storage 	<ul style="list-style-type: none"> NVIDIA Clara™ Parabricks Bright Cluster Manager (recommended)



Radiology Kubeflow implementation with One Convergence DKube

Quickly build deep-learning platforms for detecting disease in X-rays with GPU clusters on-premises.

Radiology is a particularly good fit for deep learning (DL), since it combines visual data with complicated, hard-to-define outcomes. Dell Technologies and One Convergence have joined forces to provide integrated, scalable and cost-effective DL systems that combine the leadership family of Dell PowerEdge servers with the One Convergence® DKube™ cloud-native machine learning operations (MLOps) solution. By joining forces, Dell Technologies and One Convergence simplify on-premises deployment of GPU clusters for detecting disease in X-rays. The extensive Dell PowerEdge server portfolio can be paired with DKube to build a DL solution that meets your specific requirements and has been engineering-validated in the HPC Validated Design for AI and Data Analytics.

Configuration options		
Dell servers	Max server GPUs	Target workloads
PowerEdge T640	4x NVIDIA V100	VDI, ML/DL training and inferencing, database/analytics
PowerEdge R740 / R7425	3x NVIDIA V100 6x NVIDIA T4	VDI, ML/DL training and inferencing, database/analytics
PowerEdge R940XA	4x NVIDIA V100	ML/DL training, database/analytics
DSS 8440	10x NVIDIA V100	ML/DL training and inferencing
PowerEdge C4140	4x NVIDIA V100	ML/DL training, HPC

HPC on demand

Get on-demand access to HPC/AI resources and technical expertise

The use of HPC and AI is mainstreaming at a rapid pace. Every day, new types of organizations and users seek to use the power of HPC and AI to fuel innovation. However, many of these organizations lack the skills and budget to buy and build HPC clusters and manage them in house. Dell Technologies, VMware and R Systems® are helping you get the resources you need with scalable, flexible AI- and HPC-as-a-Service with white-glove managed services. The option to pay per use for these resources in the cloud makes advanced computing more accessible for more types of organizations.

- **Lower costs** — No upfront hardware costs or egress fees and predictable billing.
- **Get to value faster** — Design consultation shortens deployment and optimizes results.
- **Enhance performance** — Purpose-built environments are designed by experts using the latest generation of servers, storage, accelerators and interconnects.
- **Simplify operations** — VMware Cloud Foundation enables admins to operate the hybrid environment with minimal additional training.
- **Leave the management to someone else** — White glove managed services from R Systems remove guesswork, complexity and risks.

Configuration options			
Dell			Software
PowerEdge servers	PowerSwitch networking	PowerScale storage	
Choice of versatile configurations	Choice of open networking options	Choice of scalable, available HPC storage	VMware Cloud Foundation



16 of the TOP500 supercomputers

are powered by Dell infrastructure.⁸

HPC Research

Match the unique needs of research workloads, more quickly and cost-effectively.

Many research organizations are in a race to address complex research challenges, such as handling massive amounts of simulation and machine-generated data from sensor systems and scientific instruments; dealing with complex algorithms for modeling, rendering and analysis; and managing the time-criticality of research projects. This makes HPC an important source of competitive advantage.

The Dell Validated Design for HPC Research enables quick development of HPC solutions that match the needs of complex research applications. It delivers the performance and throughput, large shared memories, and ultrafast interconnect fabrics required to keep up with demanding research workloads.

- **Optimize investments** — Tailored for specific workloads to speed deployment, reduce software and hardware issues and optimize performance.
- **Customize a solution** — A flexible building-block approach helps you efficiently design, implement and scale HPC solutions.
- **Test and tune** — [Dell Technologies HPC & AI Innovation Lab](#) engineers work closely with customers and partners to optimize and test these solutions.

Configuration options		Networking	Dell storage	Software
Dell PowerEdge servers				
Compute nodes	Accelerators			
Choice of: AMD EPYC: R6515, R6525, R7515, R7525, C6525, XE8545 or Intel Xeon Scalable: R650, R750, R750xa, C6520	Choice of: NVIDIA A100, A40, or AMD Instinct Mi100	NVIDIA Quantum QM8700 series HDR and Dell PowerSwitch S, N and Z series Ethernet	<ul style="list-style-type: none"> • Validated Designs for HPC NFS, BeeGFS, or PixStor Storage • PowerScale scale-out NAS 	Choice of: Bright Cluster Manager or OpenHPC Red Hat Enterprise Linux



HPC Storage

Unlock the value of your data with storage optimized for HPC.

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. Dell Validated Designs for HPC Storage are delivered with hardware, software and support from Dell Technologies. HPC & AI Innovation Lab engineers develop and tune each solution based on performance characterizations and best practices to simplify installation and provide faster time to results.

- **Simplicity** — Simplify monitoring and management without specialized training or expertise required.
- **Reliability** — Take the guesswork out of configuration, reducing interoperability issues and improving quality with storage that’s highly available, with no single point of failure.
- **Efficiency** — Lower the cost of planning and deploying HPC storage with tested and tuned solutions and manage your data center hardware from anywhere, at any time with the power of Dell OpenManage.

BeeGFS Storage

High performance and ease of use for I/O-intensive workloads

BeeGFS® storage was designed specifically to manage I/O-intensive workloads in performance-critical environments. Hundreds of leading enterprises, universities and researchers worldwide choose BeeGFS for its ease of installation, massive scalability, robustness and exceptional flexibility, including converged systems where servers are used for storage and compute. The Dell Validated Design for HPC BeeGFS Storage is preconfigured, tested and validated to enable deploying storage systems more easily and scaling as needed.

- **Simple** — Tested and tuned HPC storage systems with simplified installation, configuration and management features simplify infrastructure and streamline technology.
- **Scalable** — Deploy large-capacity storage systems that scale seamlessly from small clusters up to enterprise-class systems with thousands of nodes — on-premises or in the cloud.
- **Performant** — Designed specifically to manage I/O-intensive workloads in performance-critical environments.

High-performance and high-capacity storage configuration options are available

Dell PowerEdge servers			Software
Management	Networking	Storage	
R650	<ul style="list-style-type: none"> • Dell PowerSwitch S3048-ON (management) • NVIDIA InfiniBand QM8790 HDR 	<ul style="list-style-type: none"> • Metadata servers (MDS) and storage servers (SS): R750 • PowerVault ME4024 • PowerVault ME4084 	<ul style="list-style-type: none"> • BeeGFS • Red Hat Enterprise Linux

NFS Storage

Enhance availability of storage services with Red Hat Enterprise Linux NFS.

Storage solutions based on the NFS protocol are widely used for HPC clusters because NFS is simple and time-tested and is a standard package in virtually every Linux distribution. The Dell Validated Design for HPC NFS Storage is preconfigured, tested and validated to allow deployment of large-capacity storage solutions more easily and with less risk, while preserving resources and budget for higher-value activities. It also provides the power to quickly and easily scale storage capacity as computing needs grow.

- **Low cost** — Compute, storage, networking and software are integrated to provide excellent performance and scalability for the money.
- **Performant** — A robust storage file system with good performance as primary storage for small to medium systems or for larger clusters with lower I/O needs.
- **Scalable** — Meets future needs more easily with the ability to scale easily up to 64 nodes and 480TB raw capacity in a supported single namespace.

Configuration options			
Dell			Software
Servers	Networking	Storage	
PowerEdge R750	<ul style="list-style-type: none"> • PowerSwitch S3048-ON • NVIDIA Quantum QM8700 	PowerVault ME4024	<ul style="list-style-type: none"> • Red Hat Enterprise Linux with Network File System (NFS) and Red Hat High-Availability Add-On

PixStor Storage

High-performance, scalable parallel file system with data tiering and simplified management

Delivering data-driven insights requires storage that can handle massive data growth with security, reliability and performance. Accelerating data growth makes the economics of processing, accessing and storing data on some Fibre Channel and scale-out network-attached storage (NAS) unsustainable. PixStor™ is high-performance, highly scalable, enterprise-class software-defined storage that empowers you to search, manage, securely isolate and protect data, collaborate and share across distances, and run in the cloud. The Dell Validated Design for PixStor Storage delivers high performance with limitless scale at lower cost than traditional legacy solutions.

- **Unified** — Data moves seamlessly through many storage tiers — from fast flash and disk tiers to cost-effective, high-capacity object storage, all the way to the cloud — to put data at your fingertips.
- **Scalable** — Quickly and easily scale storage capacity as computing needs grow.
- **Easy to adopt** — Tested and tuned systems speed adoption of high performance, scalable HPC storage systems with simplified installation, configuration and management features.

Configuration options			
Dell			Software
PowerEdge servers	Networking	Storage	
<ul style="list-style-type: none"> • Management: R650 • Gateway: R750 or R7525 • High-demand metadata (optional): R750 or R7525 	<ul style="list-style-type: none"> • Dell PowerSwitch S3048-ON (management) • 2x NVIDIA InfiniBand SB7800 EDR or QM8700 HDR 	<ul style="list-style-type: none"> • High-demand metadata storage (optional): Up to 4x PowerVault ME4024 • Object storage: 1, 2, or 4x PowerVault ME4084 	<ul style="list-style-type: none"> • PixStor • Red Hat Enterprise Linux



Virtualized HPC

Get the flexibility and agility, simplicity and efficiency of virtualization for HPC.

Virtualization is a time-tested technology that creates measurable IT value. And while virtualization has been widely embraced in enterprise data centers for traditional workloads, HPC workloads, such as AI, have typically been run on bare-metal, unvirtualized systems that require specialized skills to deploy and manage. However, with the introduction of the latest version of VMware vSphere, more organizations can experience the benefits of virtualized HPC.

To take advantage of virtualized HPC, Dell Technologies brings these technologies together to deliver an elastic, centrally managed, self-service and secure virtual HPC environment that's ready for the enterprise.

- **Flexibility and agility** — Rapid provisioning of infrastructure on-demand enables speedy iteration and scale-out and less time spent on setup and retooling.
- **Simplicity** — Run AI and HPC on a familiar virtualization platform with a broad ecosystem of technology partners.
- **Efficiency** — Minimize setup and configuration time with centralized management. Simplify operations such as ongoing provisioning and maintenance. Avoid planned downtime through live migration.

Configuration options

Dell PowerEdge servers		Networking	Storage	Software
Compute nodes	Accelerator nodes			
Choice of: R640, R840, C6420, R6525, R7525, C6520	Choice of: C4140, R740, R7525	Dell PowerSwitch 25 or 100GbE or NVIDIA HDR100 InfiniBand	<ul style="list-style-type: none"> • Validated Design for HPC NFS Storage • PowerScale F800 	<ul style="list-style-type: none"> • VMware vSphere • VMware NSX, vRealize®, Horizon® (optional) • NVIDIA CUDA®

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 Precision workstations, together with accelerators, deliver breakthrough performance for parallel computing applications.

PowerEdge servers: Dell PowerEdge servers are engineered to deliver unmatched performance and versatile configurations to meet the demands of HPC workloads. Flash storage, the latest processors, greater memory bandwidth and flexible local storage make Dell PowerEdge servers a foundational choice for HPC.

PowerSwitch networking: Today's HPC workloads call for new thinking about network architecture. Based on open standards, Dell PowerSwitch networking frees the data center from outdated, proprietary approaches. Our future-ready networking technology helps you improve network performance, lower networking costs and remain flexible to adopt new innovations. Take control of your network's future and learn how the Dell Technologies strategy for open networking can dramatically transform your business.

PowerScale NAS: HPC environments require large, scalable, reliable and efficient storage. With support for multiple workloads and enterprise-grade data and file management capabilities out of the box, Dell PowerScale scale-out NAS is the leading storage for HPC. You can take advantage of the high capacity of PowerScale to reduce the acquisition and ownership cost for managing and monetizing data using advanced or predictive analytics and ML.

Omnia software: Omnia is an open-source, Ansible-based software stack designed to automate the deployment of mixed-workload clusters, giving IT the agility to run AI, HPC and analytics workloads in the same environment, with a single pane of glass for cluster provisioning, deployment and management, with easy-to-use point-and-click templates for building complete environments.



“Over a number of years, I’ve had the opportunity to work with many people at [Dell Technologies] who are really passionate about what they do, and believe in the mission. I think Michael Dell puts it best when he says it’s not just about building technology for technology’s sake. It’s about building technology to solve problems, to work in the real world and to make a difference. That philosophy aligns very closely with what we are trying to do here at TGen. Having a partner who is truly invested in trying to change things for the better is absolutely critical. That’s something we value immensely.”

— James Lowey, Chief Information Officer, TGen¹¹

Services and financing

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

- [Consulting Services](#) help you create a competitive advantage for your business. Our expert consultants work with companies at all stages to help you plan, implement and optimize solutions that enable you to unlock your data capital and support advanced techniques, such as HPC.
- [Deployment Services](#) help you streamline complexity and bring new IT investments online as quickly as possible. Leverage our 30+ years of experience for efficient and reliable solution deployment to accelerate adoption and ROI while freeing IT staff for more strategic work.
- [Support Services](#) driven by AI and DL 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 just 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.
- [APEX Custom Solutions](#) offer 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.

“We have ASU engineers on my team working directly with the Dell engineers on the Omnia team. We’re working on code and providing feedback and direction on what we should look at next. It’s been a very rewarding effort.”

— Douglas Jennewein,
Senior Director of ASU
Research Computing¹²

Why choose Dell Technologies for HPC

We’re committed to advancing HPC, AI and analytics.

- 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 one of the only companies 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 Technologies Customer Solution Centers reduce the risks associated with new technology investments and can help improve speed of implementation.

AI Experience Zones

Are you 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 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 servers, three 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 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.

¹² Dell Technologies case study, [Accelerating scientific research with high performance computing](#), June 2021.

Resources

delltechnologies.com/hpc

delltechnologies.com/innovationlab

Community: dellhpc.org

Engineering: Dell [InfoHub](#)

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 information technology needs from Dell Technologies.

- #1 in servers¹³
- #1 in converged and hyperconverged infrastructure (HCI)¹⁴
- #1 in storage¹⁵

See [Dell Technologies Key Facts](#).

Take the next step, today.

Don't wait to harness the benefits of HPC on optimized solutions designed from the ground up to accelerate and simplify HPC so you can achieve success at any scale. Contact your Dell Technologies representative to find out more today.

¹³ IDC, WW Quarterly x86 Server Tracker, Vendor Revenue & Shipments, March 2022.

¹⁴ IDC, WW Quarterly Converged Systems Tracker, March 2022.

¹⁵ IDC, WW Quarterly Enterprise Storage Systems Tracker, March 2022.

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