Dell EMC Ready Solution for HPC Digital Manufacturing

Simplify and speed design with a building-block approach to HPC

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Many small and medium manufacturers (SMMs) understand the value of using HPC to run structural analysis, computational fluid dynamics, and other prototype tests faster and with fewer errors. However, building a high performance computing (HPC) solution from scratch can be complex and time-consuming.

The Dell EMC Ready Solution for HPC Digital Manufacturing helps you easily deploy the resources required for the computer-aided engineering (CAE) tools that drive your success. It is designed, tuned, tested and validated specifically for digital manufacturing workloads. And each solution is built on standardized building blocks to simplify design, configuration and ordering — so you can leverage the advantages of HPC sooner and with less risk.

Faster performance

The Dell EMC Ready Solution for HPC Digital Manufacturing features industry-specific designs that are tuned by Dell EMC engineers and industry experts for specific manufacturing workloads. The Dell EMC HPC and AI Innovation Lab works to optimize, integrate and test these solutions. Then the Dell EMC engineering team spends hours to rigorously tune the solution for your specific applications and workloads, with a focus on efficiency, performance and reliability.

Easier scaling

Dell EMC Ready Solutions for HPC leverage a flexible building-block approach that helps you efficiently design, implement and scale HPC solutions. Dell EMC's extensive track record with the HPC computing environment — compute, storage, networking and services — enables us to implement holistic solutions that work from day one, with an eye toward the future.

Reduced risk

Purpose-built HPC building blocks are integrated and tailored for your specific workloads to speed deployment as well as help eliminate potential software and hardware issues. Dell EMC also provides comprehensive professional services and support capabilities to help you maximize system productivity and efficiency without compromising on performance. Dell EMC is a leader in creating HPC solutions that deliver fast setup with a wide range of optional services for maximizing HPC investments. With proven success in thousands of implementations worldwide, you can be confident with Dell EMC as your partner.

Do any of these challenges sound familiar?

"Workstations don't provide sufficient performance for digital manufacturing workloads."

Many struggle with insufficient scalability/performance of installed workstations to get the job done. These platforms are often running at maximum capacity and don't have the ability to handle today's peak computational workloads. A properly balanced and integrated HPC system can deliver the throughput and capacity needed to manage rapid data growth and increased workload demands. Dell EMC makes it easy to customize an HPC solution to meet performance requirements with a range of available options.

"We need to be able to build out digital manufacturing infrastructure more easily, with a shorter learning curve."

Advancements in digital manufacturing software capabilities continue to push the limits of existing systems. To keep up, you need the power to scale quickly and easily. The modular, building-block design of the Dell EMC Ready Solution for HPC Digital Manufacturing makes it easy to manage and extend compute power, storage and networking on-premises so you can grow as needed to keep pace with the competition.

"It's important for us to reduce risks for HPC investments."

HPC is an important source of competitive advantage for many SMMs. But deploying HPC systems for specific or multiple workloads requires significant investments of time and resources — and increases the chance for errors. Tested and validated Dell EMC Ready Solutions for HPC reduce deployment risks, increase system reliability and provide a single point of contact for services and support.

Customer success stories

Mikuni®: automobile engine components

20% improvement in software performance

~40% more capacity than previous workstations

Several minutes → seconds for boot up

Read the case study: Designing automobiles of the future.

Nissan® Motor Company

73% reduction in backup times

20X more capacity with 40TB available storage

30 hours → 8 hours to back up data

Read the case study: Gearing up for data driven automobile manufacturing.

Nakashima Propeller: maritime components

70–80X more parallel calculations through better server performance

2 weeks → 2 days for analysis

Read the case study: Helping make maritime shipping faster and greener.

Dell EMC Ready Solution for HPC Digital Manufacturing

The base configuration shown in the following table serves as a starting point for your solution. Dell EMC engineers will assist you with designing an HPC solution for your specific needs.

Dell EMC Ready Solution for HPC Digital Manufacturing technical specifications — Bright Cluster Manager

Servers/ processors	Head/ master nodes	**Choice of:** PowerEdge R640 PowerEdge R740	PowerEdge R740xd
	Compute nodes	**Choice of:** PowerEdge C6420 PowerEdge R640	PowerEdge R740 PowerEdge R740xd
	Processors	Intel® Xeon® 8100, 6100, 5100, 4100, and 3100 series	Intel Xeon SKL-F (only on C6420) Intel Xeon E7-4800 v3, E7-8800 v4
Operating systems	Head nodes	Red Hat® Enterprise Linux® (RHEL) 7.4 (2- or 4-socket)	
	Compute nodes	RHEL 7.4 for HPC Compute Node (2- or 4-socket)	
Software		Bright Cluster Manager® 8.0 Mellanox® OFED 3.4.x and 4.0 NVIDIA® CUDA® 9	Intel XPPSL 1.5.3 IFS 10.6
Networking **Omni-Path (OPA)**	OPA Host Fabric Interface (HFI)	Intel Omni-Path Host Fabric Interface Adapter 100 Series 1 Port PCIe x16	
	OPA switches	Dell EMC Networking H1000 Edge series: H1048 and H1024 Dell EMC Networking H9100 series	
	OPA IFS driver stack	10.6	
InfiniBand® (IB)	IB host channel adapters	**Rack:** Mellanox ConnectX®-4 EDR single port or Mellanox ConnectX-3 FDR dual port	**Blade:** Mellanox ConnectX-3 small form factor (SFF): FDR or FDR10 mezzanine cards
	IB switches: FDR and EDR	**Rack:** Mellanox SwitchX® 6xxx series Mellanox SB 77xx and 78xx series Mellanox MSB 78xx series	**Blade:** Mellanox M4100F (supported on M630 blades) Mellanox M4100T (supported on M830 blades)
	Drivers	Mellanox OFED 3.4.x and 4.0	
Ethernet	NICs	1, 10, 40GbE (full and low profile)	
	Dell EMC Networking switches	Z and S series, 1, 10, 40GbE	
Storage	NFS	Dell EMC Ready Solution for HPC NFS Storage	
	Lustre®	Dell EMC Ready Solution for HPC Lustre Storage	
	Isilon	Dell EMC Isilon Scale-out NAS Storage	
	SAS RAID Controller	PERC 9/10 (for 14G servers)	
Systems management		Dell EMC Deployment Toolkit (DTK) Dell EMC OpenManage (OM)	

Dell EMC Ready Solution for HPC Digital Manufacturing technical specifications — Open source option

Servers/ processors	Head/ master nodes	**Choice of:** PowerEdge R440 PowerEdge R640 PowerEdge R740	 PowerEdge R740xd PowerEdge M640, M1000e
	Compute nodes	**Choice of:** PowerEdge R440 PowerEdge R640 PowerEdge R740 PowerEdge R740xd	 PowerEdge R940 PowerEdge M640, M1000e PowerEdge M830 PowerEdge C6420
	Processors	Intel Xeon 8100, 6100, 5100, 4100, and 3100 series Intel Xeon E5-2600 v4 series	Intel Xeon E5-4600 v4 series Intel Xeon E5-2600 v4 series Intel Xeon E7-4800 v3, E7-8800 v4
Operating systems	Head nodes	RHEL 7.4 (2- or 4-socket)	
	Compute nodes	RHEL 7.4 for HPC Compute Node (2- or 4-socket)	
Software		OpenHPC v1.3.3 Mellanox OFED 3.4.x and 4. 0	IFS 10.6
Networking **OPA**	OPA HFI	Intel Omni-Path Host Fabric Interface Adapter 100 Series 1 Port PCIe x16	
	OPA switches	Dell EMC Networking H1000 Edge series: H1048 and H1024 Dell EMC Networking H9100 series	
	OPA IFS driver stack	10.6	
IB	IB host channel adapters	**Rack:** Mellanox ConnectX-4 EDR single port or Mellanox ConnectX-3 FDR	**Blade:** Mellanox ConnectX-3 SFF: FDR dual port or FDR10 mezzanine cards
	IB switches: FDR and EDR	**Rack:** Mellanox SwitchX 6xxx series Mellanox MSB 78xx series	**Blade:** Mellanox M4100F (supported on Mellanox SB 77xx and 78xx series M630 blades) Mellanox M4100T (supported on M830 blades)
	Drivers	Mellanox OFED 3.4 x and 4.0	
Ethernet	NICs	1, 10, 40GbE (full and low profile)	
	Dell EMC Networking switches	Z and S series, 1, 10, 40GbE	
Storage	NFS	Dell EMC Ready Solution for HPC NFS Storage	
	Lustre	Dell EMC Ready Solution for HPC Lustre Storage	
	SAS RAID Controller	PERC 9/10 (for 14G servers)	
Systems management		Dell EMC DTK Dell EMC OM	

Digital manufacturing reference design for those moving up from a workstation

Basic building blocks	Typical simulation types	Crash Stamping Safety Impact analysis Fluid flow	Pump design Combustion Aerodynamics Acoustics
	Typical run environment	SMP parallel jobs on a single node and MPI parallel jobs run across two-node 10GE switchless “couplet”	
	Server	PowerEdge R640 Intel Xeon Gold 6142 (32 cores per server / 64 cores per couplet)	192GB 2667MHz DDR4 memory 2x 480GB mixed-use SATA SSDs

General digital manufacturing reference design

Explicit solver building blocks	Typical ISV applications	CFD: Fluent®, CFX®, STAR-CD®, STAR-CCM+®, OpenFOAM®, PowerFLOW® Explicit Structures: Abaqus®-Explicit, LS-DYNA®, PAM-CRASH®, Altair-RADIOSS™	
	Typical simulation types	Crash Stamping Safety Impact analysis Fluid flow	Pump design Combustion Aerodynamics Acoustics
	Typical run environment	MPI parallel jobs run across 4–12 nodes	
	Server	PowerEdge C6420 Intel Xeon Gold 6142 (32 cores per server)	192GB 2667MHz DDR4 memory 2x 480GB mixed-use SATA SSDs
Implicit solver building blocks	Typical use	ANSYS Mechanical®, Abaqus®-Standard, MSC® Nastran®, NX® Nastran, Altair OptiStruct®	
	Typical simulation types	Noise vibration harshness (NVH) assembly	Structural integrity (linear and nonlinear)
	Typical run environment	Most jobs run on a single node and tend to require large memory to improve overall performance	
	Server	PowerEdge R640 Intel Xeon Gold 6136 (24 cores per server)	384GB 2667MHz DDR4 memory 4x 480GB mixed-use SATA SSDs
Management building blocks	Management software	Bright Cluster Manager (optional) IPMI based cluster management tools	
	Management server building blocks	Cluster management: 1 for modest clusters; 2 for larger clusters Login: 1 for each 30–100 users	
	Server	PowerEdge R640 Intel Xeon Bronze 3106 (16 cores per server)	192GB 2667MHz DDR4 memory 2x 480GB mixed-use SATA SSDs

Winner of the coveted HPCwire Editors' Choice Award for Best Use of High Performance Data Analytics.[10]

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

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

Dell EMC Ready Solution for HPC Lustre Storage allows you to tap into the power and scalability of Lustre with simplified installation, configuration and management features.

Dell EMC Isilon Scale-out NAS Storage is flexible storage that provides large capacity and high performance. Powered by Intel Xeon processors, Isilon solutions are ideal for demanding enterprise file workloads.

Bright Cluster Manager for HPC lets you deploy clusters over bare metal with a management view that spans the hardware, operating system, software and users.

Why Dell EMC?

The combination of Dell and EMC brings together two industry-leading companies with strong reputations for value and innovation. Dell EMC holds leadership positions in some of the biggest and largest growth categories in the IT infrastructure business, and that means you can confidently source your IT needs from one provider — Dell EMC.

- #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 hyper-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]

World-class Dell EMC HPC Innovation Centers

Leverage these invaluable assets

You can work directly with Dell EMC HPC experts to test and tune solutions prior to purchase at worldwide Dell EMC HPC Innovation Centers:

- Dell EMC HPC and AI Innovation Lab
- Cambridge Solution Centre
- University of Pisa
- San Diego Supercomputer Center
- Texas Advanced Computing Center
- Centre for High Performance Computing in South Africa

[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 Wrangler. TACC Stampede is the largest system in XSEDE. See "XSEDE Resources."

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

[3] IDC WW Quarterly Converged Systems Tracker, June 2018, Vendor Revenue — Q1 2018.

[4] IDC WW Quarterly Enterprise Storage Systems Tracker, June 2018, Vendor Revenue — Q1 2018.

[5] Dell EMC Annual Report, 2015.

[6] IDC WW Quarterly Cloud IT Infrastructure Tracker, June 2018, Vendor Revenue — Q1 2018.

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

[8] Gartner, "Magic Quadrantfor Data Center Backup and RecoverySolutions," July 2017.

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

[10] HPCwire, "HPCwire Reveals Winners of the 2016 Readers' and Editors' Choice Awards at SC16 Conference in Salt Lake City," November 2016.

Services and financing

Dell EMC understands that HPC success depends on each server, interconnect and storage component being set up, configured and tuned 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 includes fast setup with services for maximizing HPC investments. Dell EMC Services and Dell EMC partners can provide the services you need to succeed with HPC.

Dell EMC HPC Services

From design and implementation to support and systems management, Dell EMC offers a comprehensive services portfolio for HPC clusters, including on-premises and managed systems, as well as those in the cloud.

Learn more about Dell EMC Services for High Performance Computing.

Dell EMC Professional Services

Customers can select Dell EMC ProDeploy to help them reduce 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, your customers can be confident with Dell EMC as their 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 Suite and the ProSupport Add-on for HPC provide a single point of accountability and HPC solution experts ready to assist with advanced cluster-level support services, 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 Financial Services

Let the wealth of leasing and financing options from Dell Financial Services help your customers find opportunities when they're facing decisions regarding capital expenditures, operating expenditures and cash flow. Dell offers a wide range of payment options to make it easier than ever to meet their needs.

Learn more about Dell Financial Services.

Dell EMC Customer Solution Centers

Our global network of 21 dedicated Dell EMC Customer Solution Centers are trusted environments where world-class IT experts collaborate with customers and prospects to share best practices; facilitate in-depth discussions of effective business strategies using briefings, workshops, or proofs-of-concept (PoCs); and help businesses become more successful and competitive. Dell EMC Customer Solution Centers reduce the risks associated with new technology investments and can help improve speed of implementation.

Take the next step, today

Don't wait to find out how Dell EMC can simplify design, configuration and ordering — so you can leverage the advantages of HPC sooner and with less risk. Contact your Dell EMC or authorized channel partner representative for more details right away.

Contact us

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