

# Dell EMC Ready Solutions for HPC Life Sciences

Make medical breakthroughs faster with the power of high performance computing

## Table of Contents

<b>Get life-changing answers, faster</b> . . . . .	<b>2</b>
Dell EMC has what you need . . . . .	2
Do any of these challenges sound familiar? . . . . .	3
<b>Dell EMC Ready Solutions for HPC Life Sciences</b> . . . . .	<b>3</b>
Faster time to production . . . . .	3
Better performance . . . . .	4
Easier scalability . . . . .	4
Customer success stories . . . . .	4
<b>Dell EMC Ready Solutions for HPC Life Sciences Specifications</b> . . . . .	<b>5</b>
Ready Solutions for HPC Life Sciences technical specifications — Bright Cluster Manager . . . . .	5
Ready Solutions for HPC Life Sciences technical specifications — Open source option . . . . .	6
<b>Services and financing</b> . . . . .	<b>7</b>
<b>Why choose Dell EMC for data analytics, HPC and AI</b> . . . . .	<b>8</b>
Dell Customer Solution Centers . . . . .	8
Dell EMC HPC and AI Centers of Excellence . . . . .	8
Dell EMC AI Experience Zones . . . . .	9
Dell EMC HPC and AI Innovation Lab . . . . .	9
Proven results . . . . .	9
<b>Take the next step, today</b> . . . . .	<b>9</b>

81%

of healthcare leaders expect humans and machines to work as teams<sup>1</sup>

79%

of healthcare leaders have invested or will invest in AI<sup>1</sup>

“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.”<sup>2</sup>

—James Lowey, CIO,  
TGen

## Get life-changing answers, faster

Advanced computing technologies, such as data analytics, artificial intelligence (AI) and high performance computing (HPC), are the key to using medical data to save lives and protect health — better, faster and with lower costs. While they have existed as separate technologies for many years, the three are converging as the industry comes to understand that the powerful, scalable compute, networking and storage provided by HPC is required for data analytics and AI to excel.

This convergence will enable human/machine partnerships, reshaping the ability of the life sciences to prevent, detect and treat disease. Advanced computing is already having a profound impact on the industry; faster processing speeds and AI algorithms that are more sensitive than the human eye are already enabling earlier diagnoses, reducing treatment times, accelerating genetic analysis and speeding development of personalized healthcare while reducing costs and timelines.

### Dell EMC has what you need

#### Expertise and guidance

The technology around data analytics, HPC and AI is emerging quickly, so your team may not have had time to develop the skills required to design, deploy and manage solution stacks optimized for new workloads. While AI might seem like the latest IT trend, Dell EMC has been a leader in the advanced computing space for over a decade, with proven products, solutions and expertise. Dell EMC has a team of data analytics, HPC and AI experts dedicated to staying on the cutting edge, testing new technologies and tuning solutions to your applications to help you keep pace with this constantly evolving landscape.

#### Dell EMC Ready Solutions for HPC

The advantage in today's marketplace goes to the data driven enterprise. For many organizations, high performance computing is —or is becoming —an important source of competitive advantage. An optimized HPC solution delivers the compute, throughput and capacity needed to manage the rapid data growth and increased workload demands presented by advanced data analytics and other enterprise workloads. Dell EMC Ready Solutions for HPC simplify design, speed configuration and ordering of clusters with standardized building blocks tested for life sciences applications.

#### Solutions customized for your environment

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

<sup>1</sup> Dell EMC Infographic, “[Preparing for Human - Machine Partnerships in Healthcare](#),” May 2018.

<sup>2</sup> Dell EMC ebook, “[Making digital transformation in healthcare a reality](#),” February 2018.

### Do any of these challenges sound familiar?

“Designing, deploying and tuning infrastructure with little IT expertise or support is complex and time-consuming.”

HPC for life sciences has traditionally been custom-built. In addition, each aspect of an HPC solution is interconnected and impacts the overall performance of the solution: performance, reliability, access protocols, scalability, ease-of-management, price, power and more. Building a solution from scratch that addresses each one of these requirements can be complex and time-consuming. Dell EMC Ready Solutions for HPC Life Sciences can reduce deployment time and speed time to production.

Dell EMC is a leader in creating HPC solutions — regardless of size or complexity — 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.

“Providing the performance required for life sciences workloads is challenging.”

Software-licensing costs and application-specific performance are greatly affected by solution design, and finding the right mix for both can be difficult. Code optimization can take advantage of the latest technologies. Dell EMC Ready Solutions for HPC Life Sciences feature industry-specific designs tuned by Dell EMC engineers and industry experts for life sciences workloads.

“We need scalability to handle rapidly growing data sets.”

The growth of life sciences data is pushing data repositories to incredible sizes. Life sciences researchers can generate and consume data at such speed that multiple petabytes to exabytes are starting to become commonplace. And the data requirements around performance and capacity keep increasing rapidly. The design of Dell EMC Ready Solutions for HPC Life Sciences can make it easy to manage and extend storage and networking on-premises for growth over time.

## Dell EMC Ready Solutions for HPC Life Sciences

Dell EMC has invested to create a portfolio of Ready Solutions designed to simplify the configuration, deployment and management of HPC solutions. They provide trusted designs that have been optimized, tuned and tested for a variety of key use cases. They include the servers, storage, networking, software and services that have been proven in our labs and in customer deployments to meet workload requirements and customer outcomes. The modular building blocks provide a customized yet validated approach, for customers deploying new clusters or upgrading their existing environments.

Ready Solutions for HPC Life Sciences have been designed to speed time to production, improve performance with purpose-built solutions, and scale easier with modular building blocks for capacity and performance.

### Faster time to production

The faster you can get your system up and running, the faster you can find the answers. Dell EMC Ready Solutions are engineered hardware and software stacks designed to shorten the time to architect a new solution by 6–12 months<sup>3</sup>. Dell EMC Services ranging from consulting and education to integration and support are available as needed, so you can spend more time focusing on the science that can make a real impact.

**Faster time to production**

**Better performance**

**Easier scalability**

<sup>3</sup> Forrester Research commission by Dell EMC, “[The Total Economic Impact of Dell EMC Ready Solutions for AI, Machine Learning with Hadoop](#),” August 2018.



“The HPC clusters from Dell EMC are critical to our research missions that highly depend on the analysis of big data generated from highly automated cryo-electron microscopes.”<sup>4</sup>

—Dr. Youdong “Jack” Mao, Assistant Professor of Biophysics, Peking University

### Better performance

Dell EMC is committed to helping more people make more innovations and discoveries than any other HPC solutions vendor in the world. To that end, Dell EMC engineers and industry experts have worked in collaboration with Dell EMC customers and partners to design these solutions specifically for life sciences workloads. The Dell EMC HPC and AI Innovation Lab works closely with customers and partners to integrate, test and optimize these solutions for your applications and workloads, with a focus on efficiency, performance and reliability.

### Easier scalability

Dell EMC Ready Solutions for HPC help customers get the optimal IT infrastructure for today — and tomorrow. That means creating solutions with scalable building blocks to meet evolving needs over time. Dell EMC Ready Solutions for HPC are built on modular building blocks that can be configured and ordered in a simplified process that enables you to scale easily to meet new capacity and performance demands. Dell EMC’s extensive track record with servers, storage, networking and services enables us to implement holistic solutions that work from day one, with an eye toward the future.

### Customer success stories

#### Beijing Genomics Institute

<b>288.5TFLOPS</b> peak performance	<b>20%</b> TCO reduction compared to previous solution	<b>70GB</b> I/O speed
--	---	-----------------------

Read the case study: [Using a modular architecture to understand the mysteries of life.](#)

#### Tsinghua University’s Protein Technology Center

<b>4X</b> increase in compute power	<b>50%</b> reduction in IT complexity	<b>75–80%</b> reduction in compute time
--	--	--

Read the case study: [Science computing supports near-atomic structural studies.](#)

#### Dana-Farber Cancer Institute, Harvard Medical School and Peking University

<b>~2PB</b> of storage	<b>1,000X</b> faster averaging compared to previous solution
------------------------	--

Read the case study: [Leveraging HPC Hardware to Run Next-generation Molecular Imaging Analysis.](#)

- [TGen](#) uses advanced computing to fight rare diseases.
- [Partners Healthcare](#) uses advanced analytics to transform patient health.
- [Peking University](#) uses Cryo-EM supported by 2PB of storage to open new frontiers in biochemistry.
- [Bumrungrad International Hospital](#) uses advanced computing to support personalized care models.
- [CSIRO](#) uses HPC to double the computational power available for AI-enabled bionic vision.
- [Tsinghua University Protein Technology Center](#) uses HPC to reduce biological research complexity by 50%.

<sup>4</sup> HPCwire, “[A catalyst for scientific breakthroughs: Cryo-EM and HPC.](#)” December 2018.

## Dell EMC Ready Solutions for HPC Life Sciences Specifications

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

### Ready Solutions for HPC Life Sciences technical specifications — Bright Cluster Manager

<b>Servers / processors</b>	<b>Head / master nodes</b>	<b>Choice of:</b> PowerEdge R440 PowerEdge R640
	<b>Compute nodes</b>	<b>Choice of:</b> PowerEdge R640 PowerEdge R740 PowerEdge R740xd PowerEdge R940  PowerEdge C4140 PowerEdge C6420 PowerEdge FC430
	<b>Processors</b>	Intel® Xeon® 8200, 8100, 6200, 6100 series Intel Xeon SKL-F only on C6420
	<b>Accelerator nodes</b>	<b>Choice of:</b> PowerEdge C4140 (with up to 4 GPUs) PowerEdge R740 (with up to 3 GPUs)  <b>Choice of accelerators:</b> NVIDIA® Tesla® V100 16GB and 32GB (SMX2 and PCIe), P100 (SMX2 and PCIe), P40, P4
<b>Operating systems</b>	<b>Head nodes</b>	Red Hat® Enterprise Linux® (RHEL) (2- or 4-socket)
	<b>Compute nodes</b>	RHEL for HPC Compute Node (2- or 4-socket)
<b>Software</b>		Bright Cluster Manager® Mellanox® OFED NVIDIA CUDA®  Intel XPPSL IFS
<b>Networking</b>		
<b>Omni-Path (OPA)</b>	<b>OPA Host Fabric Interface (HFI)</b>	Intel Omni-Path Host Fabric Interface Adapter 100 Series 1 Port PCIe x16
	<b>OPA switches</b>	Dell EMC Networking H1000 Edge series: H1048 and H1024 Dell EMC Networking H9100 series
	<b>OPA IFS driver</b>	10.9
<b>InfiniBand® (IB)</b>	<b>IB host channel adapters</b>	<b>Rack:</b> Mellanox ConnectX®-5 EDR single port or Mellanox ConnectX-3 FDR dual port  <b>Blade:</b> Mellanox ConnectX-3 small form factor (SFF): FDR or FDR10 mezzanine cards
	<b>IB switches: FDR and EDR</b>	<b>Rack:</b> Mellanox SwitchX® 6xxx series Mellanox SB 77xx and 78xx series Mellanox MSB 78xx series  <b>Blade:</b> Mellanox M4001F with M640
	<b>Drivers</b>	Mellanox OFED 4.5
	<b>Ethernet</b>	<b>NICs</b>
	<b>Dell EMC Networking</b>	Z and S series, 1, 10, 40GbE

## Ready Solutions for HPC Life Sciences technical specifications — Bright Cluster Manager

<b>Storage</b>	NFS	Dell EMC Ready Solutions for HPC NFS Storage
	Lustre®	Dell EMC Ready Solutions for HPC Lustre Storage
	Isilon	Dell EMC Isilon Scale-out NAS Storage
	SAS RAID Controller	PERC 10
<b>Systems management</b>		Dell EMC Deployment Toolkit (DTK) Dell EMC OpenManage (OM)

## Ready Solutions for HPC Life Sciences technical specifications — OpenHPC

<b>Servers / processors</b>	Head / master nodes	<b>Choice of:</b> PowerEdge R440 PowerEdge R640
	Compute nodes	<b>Choice of:</b> PowerEdge R640 PowerEdge R740 PowerEdge R740xd PowerEdge R940 PowerEdge C6420
	Processors	Intel Xeon 8200, 8100, 6200, 6100, 5200, 5100, 4200, 4100, 3200, 3100 series Intel Xeon E5-4600 v4 series Intel Xeon E5-2600 v4 series Intel Xeon E7-4800 v3, E7-8800 v4
<b>Operating systems</b>	Head nodes	Red Hat Enterprise Linux (RHEL) (2- or 4-socket)
	Compute nodes	RHEL for HPC Compute Node (2- or 4-socket)
<b>Software</b>		OpenHPC Mellanox OFED IFS
<b>Networking</b>		
<b>Omni-Path</b>	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	10.9
<b>InfiniBand</b>	IB host channel adapters	<b>Rack:</b> Mellanox ConnectX-5 EDR single port or Mellanox ConnectX-3 FDR <b>Blade:</b> Mellanox ConnectX-3 SFF: FDR dual port or FDR10 mezzanine cards
	IB switches: FDR and EDR	<b>Rack:</b> Mellanox SwitchX 6xxx series Mellanox MSB 78xx series <b>Blade:</b> Mellanox M4100F with M640
	Drivers	Mellanox OFED 4.5
<b>Ethernet</b>	NICs	1, 10, 40GbE (full and low profile)
	Dell EMC Networking switches	Z and S series, 1, 10, 40GbE

Ready Solutions for HPC Life Sciences technical specifications — OpenHPC		
Storage	NFS	Dell EMC Ready Solutions for HPC NFS Storage
	Lustre	Dell EMC Ready Solutions for HPC Lustre Storage
	SAS RAID Controller	PERC 10
Systems management		Dell EMC Deployment Toolkit (DTK) Dell EMC OpenManage (OM)

#### Solution highlights

- [Dell EMC PowerEdge Servers](#) enhance performance across the widest range of applications with highly scalable architectures and flexible internal storage.
- [Dell EMC Ready Solutions for HPC NFS Storage](#) are reliable, easy to administer and have very good performance within certain boundaries.
- [Dell EMC Ready Solutions for HPC Lustre Storage](#) allow customers to tap into the power and scalability of Lustre with simplified installation, configuration and management features.
- [Bright Cluster Manager for HPC](#) enables the deployment of clusters over bare metal with a management view that spans the hardware, operating system, software and users.

## Services and financing

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

- [Dell EMC Big Data Vision Workshop](#) focuses on big data for business leaders. We have a unique methodology to identify and prioritize a single use case with a combination of implementation feasibility and business value. It's a three week engagement that applies research, interviews and data science expertise and techniques to the organization — culminating in a one day workshop for your team to identify and agree on a use case and path forward. This approach sets Dell EMC apart from the “bring in a bunch of technology and see what it can do” approach that's pushed by many vendors.
- [Dell EMC Consulting Services](#) are delivered by certified experts to help you get the business value of advanced computing. The services include an assessment, workshop, testing, proofs of concept and production implementation. These experts help determine where advanced computing is a good fit for your organization. They also help you build your own internal team of experts through knowledge transfer at each step.
- [Dell EMC Education Services](#) offers courses and certifications in data science and advanced analytics through self-paced online labs and instructor-led workshops.
- [Dell EMC Deployment](#) experts have the experience, expertise and best practices to enhance your success with data analytics, HPC and AI solutions. With a proven track record of success in thousands of engagements worldwide, you can rely on Dell EMC as your partner.
- [Dell EMC Support](#) experts can provide comprehensive hardware and collaborative software support 24x7 for optimal system performance and minimized downtime. ProSupport includes next-business-day on-site service with four- and eight-hour parts-and-labor response options, and escalation management with customer-defined severity levels. You can also opt for ProSupport Plus to get a technology service manager, who serves as a single point of contact for your support needs.

- Once the HPC cluster is deployed, [Dell EMC Remote HPC Cluster Management](#) services help keep it running smoothly with proactive monitoring and management of the entire HPC solution.
- [Dell Financial Services](#) offers a wealth of leasing and financing options to help you find opportunities when your organization faces decisions regarding capital expenditures, operating expenditures and cash flow.

## Why choose Dell EMC for data analytics, HPC and AI

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

- Come in for an [executive briefing](#) and collaborate on ways to reach your business goals.
- Dell [Customer Solution Centers](#) are staffed with computer scientists, engineers and Ph.D.s who are subject matter experts in a variety of disciplines.
- We are committed to [providing you with choice](#). We want you to get what you need and have a great experience working with us. If we don't have what you need, we'll tell you who does. We believe in being open, and we publish our performance results.
- Dell EMC is the only company in the world with a portfolio that spans from workstations to supercomputers, including servers, networking, storage, software and services.
- Because Dell EMC offers such a wide selection of solutions, we can act as your trusted advisor without trying to sell you a one-size-fits-all approach to your problem. That range of solutions has also given us the expertise to understand a broad spectrum of challenges and how to address them.
- To protect, detect and recover from cyberattacks, [security is built into the Dell EMC PowerEdge server design](#), not bolted on after the fact.

“Realizing the vision of Big Science that is delivered from our extensive research and clinical development efforts, from basic research to cancer genomics, requires new technology collaboration.”<sup>5</sup>

—Shawn N. Murphy, MD, PhD, Corporate Director of Research Information Systems and Computing, Partners HealthCare

### Dell Customer Solution Centers

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

### Dell EMC HPC and AI Centers of Excellence

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

<sup>5</sup> Dell EMC ebook, “[Making digital transformation in healthcare a reality](#),” February 2018.



Winner of the coveted HPCwire Editors' Choice Award for Best Use of High Performance Data Analytics.<sup>6</sup>

### Dell EMC AI Experience Zones

Curious about AI and what it can do for your business? Run demos, try proofs of concept and pilot software in Singapore, Seoul, Sydney, and Bangalore. Dell EMC experts are available to collaborate and share best practices as you can explore the latest technology, get the information and hands-on experience you need for your advanced computing workloads.

### Dell EMC HPC and AI Innovation Lab

The [Dell EMC HPC and AI Innovation Lab](#) in Austin, Texas, is the flagship innovation center. Housed in a 13,000-square-foot data center, it gives you access to thousands of Dell EMC servers, two powerful HPC clusters, and sophisticated storage and network systems. It's staffed by a dedicated group of computer scientists, engineers and Ph.D. subject matter experts who actively partner and collaborate with customers and other members of the HPC community. The team engineers HPC and AI solutions, tests new and emerging technologies, and shares expertise including performance results and best practices.

### Proven results

Dell EMC holds leadership positions in some of the biggest and largest-growth categories in the IT infrastructure business, and that means you can confidently source your IT needs from Dell EMC.

- #1 in servers<sup>7</sup>
- #1 in converged and hyper converged infrastructure (HCI)<sup>8</sup>
- #1 in storage<sup>9</sup>
- #1 cloud IT infrastructure<sup>10</sup>

See [Dell Technologies Key Facts](#).

### Take the next step, today

Don't wait to find out how Dell EMC can simplify and speed life sciences applications and workloads. Contact your Dell EMC or authorized channel partner representative for more details right away.

<sup>6</sup> HPCwire, "2018 HPCwire Awards – Readers' & Editors' Choice," November 2018.

<sup>7</sup> IDC [WW Quarterly Server Tracker](#), Vendor Revenue, March 2019.

<sup>8</sup> IDC [WW Quarterly Converged Systems Tracker](#), Vendor Revenue, September 2018.

<sup>9</sup> IDC [WW Quarterly Enterprise Storage Systems Tracker](#), Vendor Revenue, March 2019.

<sup>10</sup> IDC [WW Quarterly Cloud IT Infrastructure Tracker](#), Vendor Revenue, January 2019.

## Contact us

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

