DELL EMC

Dell EMC Ready Solutions for AI

From AI-possible to AI-ready

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69.2% of CFOs

surveyed say artificial intelligence and machine learning are "critically important" or "very important" to the business[1]

75%

of enterprise and independent software vendor (ISV) development will include AI or machine learning in at least one application[2]

The future of artificial intelligence is now

Artificial intelligence (AI) and its supporting computing models — machine and deep learning — are decades-old technologies that are just now beginning to take off. Why is AI so hot right now? The reason is likely a convergence of multiple forces. First, the industry is making incredible breakthroughs in AI, especially in deep learning. Second, the mainstreaming of high-performance computing (HPC) is making advanced computing power available and affordable for a much wider range of companies. And third, there is a lot more data available to fuel AI — with more being produced every second.

This perfect storm is creating an opportunity for you to quickly identify trends and patterns that otherwise would be difficult and time-consuming to detect. Whatever your industry vertical, AI, machine and deep learning can change everything. Whether you're just getting started, or whether you've been doing AI, machine learning or deep learning for some time, Dell EMC can help you capitalize on the latest technological advances, saving you time and money while reducing risk.

Pushing the boundaries of AI, machine and deep learning

Dell EMC is at the forefront of AI, providing the technology that makes tomorrow possible, today. Dell EMC uniquely provides an extensive portfolio of technologies — spanning workstations, servers, networking, storage, software and services — to create the HPC and data analytics solutions that underpin successful AI, machine and deep learning implementations. What's more, Dell EMC has invested to create a portfolio of Ready Solutions, simplifying the IT infrastructure to provide faster, deeper insights. You can rely on the Dell EMC team of experts to help you adapt as AI, machine and deep learning evolve over time.

AI simplified

Dell EMC Ready Solutions for AI are validated, hardware and software stacks optimized to accelerate AI initiatives, shortening the time to architect a new solution by 6-12 months[1]. They increase data scientist productivity by offering self-service workspaces, allowing each data scientist to configure their environment from a library of AI models and frameworks in just five clicks. Customers report that Dell EMC Ready Solutions for AI, machine learning with Hadoop® solutions can help boost data scientist productivity by as much as 30%.[1] IT operations are also simplified through a single console for monitoring the health and configuration of the cluster.

Faster, deeper AI insights

Dell EMC Ready Solutions for AI, deep learning with NVIDIA delivers unprecedented performance for deep learning at scale with leading Dell EMC PowerEdge servers with NVIDIA® GPUs, high-speed networking and Dell EMC Isilon all-flash scale-out NAS storage. Designed for accelerated performance while eliminating I/O bottlenecks, Dell EMC Ready Solutions for AI deliver fast access to larger data sets to help improve model accuracy, while inferencing at scale can drive actionable responses in real-time.

Proven AI expertise

To enhance customer success, Dell EMC includes award-winning services with Ready Solutions for AI. Dell EMC consulting services provide expert guidance to bridge the gap between IT, data scientists and the lines of business. In addition to a world-class engineering team, the HPC and AI Innovation Lab has one of the world's fastest supercomputers and extensive industry partnerships, bringing together a community of the brightest minds focused on AI, machine and deep learning.

[1] CNBC.com, "One quarter of CFO Council members say A.I. is 'critical' to their companies," June 2017.

[2] IDC FutureScape, "Worldwide Analytics, Cognitive/AI and Big Data 2017 Predictions," December 2016.

"One of the things that's really exciting about deep learning is that it's taking a lot of problems that used to be very specialized and ... transferring [them] into an engineering problem, so that people even without a lot of domain expertise are able to solve hard problems in many different domains. And, because of this ... deep learning is going to be applied very widely in a lot of surprising places."

— Bryan Catanzaro, Ph.D., Vice President, Applied Deep Learning Research at NVIDIA

See more.

Do any of these challenges sound familiar?

"AI is too complex."

Customers report that it can take 12–18 months to architect a new solution with software, hardware, PoC and vendor selection.[3] Because each vendor focuses on its own piece, with little integration between hardware and software, you must know servers, GPUs, networks and storage. From there, you must choose an operating system that is compatible with the machine and deep learning libraries and frameworks their data scientists use. Once it's all assembled, improper integration and tuning can lead to failed jobs, software version incompatibilities or unbalanced configurations resulting in under-utilized resources. And, each data scientist may have a unique combination of frameworks and libraries that they need for their work, making ongoing maintenance of the environment a complex and time-consuming task.

"We haven't been able to take full advantage of our data, and results are too slow."

Data is growing at an astronomical rate, and it's impossible to take full advantage of it manually to get insights. The speed of automated image and pattern detection can help provide faster insights. And with historical data sets, you can get deeper insights into, for example, buying behavior. While most know that automation can provide faster, better and deeper data insights, some don't know how to effectively leverage and scale existing resources while maximizing utilization for AI workloads.

"We don't have the in-house expertise."

AI and related computing paradigms are emerging quickly and many organizations have not had the time to develop the skills required to design, deploy and manage advanced AI, machine and deep learning architectures. This is especially evident as customers evolve from AI projects to production-level environments.

AI, machine learning and deep learning

These three concepts are closely intertwined. AI is an umbrella term, while machine and deep learning are the techniques that make AI possible.

Machine learning refers to the process of "training" the machine, feeding large amounts of data into algorithms that give it the ability to learn how to perform the task. Deep learning is a machine learning technique that uses neural networks as the underlying architecture for training models.

Training deep learning models is compute intensive, and results are only as fast as the slowest component of any solution. Fast compute and storage with a lot of memory and high-bandwidth networking will allow models to train faster.

Read more about the difference between AI, machine and deep learning.

"'Buoyed by Moore's Law and fed by a deluge of data, AI is at the heart of much of today's technical innovation.' With use cases and solutions led by artificial intelligence spanning across agriculture, sports, financial institutions, autonomous cars, healthcare, education and more, the race to tap the burgeoning market is set to become more competitive. With its focus on AI, Intel is preparing to stay ahead of its competitors with technological innovation."[4]

Typical AI, machine and deep learning use cases

Healthcare and life sciences	Financial services	Government security and defense	Media and entertainment
• Drug interaction • Cancer detection • Chronic illness prediction • Drug discovery • Gene mutation • Sanitation	• Fraud prevention • Risk management • Investment predictions • Customer service • Digital assistants • Network security	• Facial recognition • Video surveillance • Cyber security • Satellite imagery • Event prediction • Emergency services	• Video captioning • Content-based search • Real-time translation • Language processing • Content suggestions based on selections over time

Manufacturing	Energy	Transportation	Retail
• Smart manufacturing systems • Factory and demand analytics and optimization • Preventative maintenance • Relationship intelligence • Product and service quality	• Wind power generation • Solar forecasts • Oil production optimization • Weather prediction • Prediction of consumption demand	• Autonomous vehicles • Pedestrian and object detection • Lane tracking and traffic patterns • Preventative maintenance • Risk assessment	• Supply and demand planning • Predicting buying behavior • Loss prevention • Upsell, cross-sell opportunities • Customer and product movement tracking

Customer successes

- Reduced by 2–10X the time taken to do analysis at the MIT Lincoln Laboratory Supercomputing Center (LLSC).
- University of Pisa is using deep learning technologies from Dell EMC for DNA sequencing, encoding DNA as an image.
- Dell EMC is collaborating with the Chinese Academy of Sciences on a joint AI and advanced computing laboratory.
- Mastercard® is using AI to protect their customers from fraud.
- AeroFarms is using AI to automate image recognition and classification to adjust plant nutrients, light, and other factors to improve yield, taste and texture.
- Ziff.ai does image, voice and video recognition and selection using AI-enabled algorithms.
- At Simon Fraser University, scientists are tracking viruses by their DNA to contain and treat outbreaks faster.
- Otto Motors is using autonomous vehicles/robots in supply chain fulfillment/inventory management.
- Epsilon uses AI for marketing services and real-time content.
- Caterpillar is leveraging autonomous mining vehicles for safety.

For more customer success stories, visit the Dell EMC Customer Stories portal.

Dell EMC Ready Solutions for AI

Dell EMC Ready Solutions for AI are based on a scalable building-block approach, so they can grow to meet your needs in the future.

Dell EMC Ready Solutions for AI, including Deep Learning with Intel, Deep Learning with NVIDIA and Machine Learning with Hadoop, include software, servers, networking, storage and services optimized for AI workloads.

Automated multi-user, multi-node deployment tool sets

Scale-out, near-bare-metal performance

Lower TCO vs. cloud and GPU-accelerated AI environments

Deep Learning with Intel

Deep Learning with Intel enables near-bare-metal performance from a Kubernetes/Docker based platform for deep learning workloads powered by Second Generation Intel® Xeon® Scalable Processors and the optimized Nauta open-source platform. With a lower price point and less complexity versus accelerated solutions, Deep Learning with Intel simplifies AI, enabling IT to set up multi-user environments using Kubernetes and containers for high resiliency. You can scale compute independent of storage and achieve optimal cost-capacity-performance balance with documented and supported Isilon storage integration.

Deep Learning with Intel technical specifications

Head node	
Compute	PowerEdge R740xd
Processor	2x Intel Xeon Gold 6230
Memory	384GB 2933MHz DDR4 RAM
Drives	12x 12TB 3.5" HDD
Network card	Intel x710 10Gpbs SFP Ethernet
Worker nodes	
Compute	16x PowerEdge C6420
Processor	2x Xeon Gold 6230
Memory	192 GB 2933MHz DDR4 RAM
Drives	250GB M.2 BOSS
Network card	Intel x710 10Gbps SFP Mezzanine
Networking	
External (top of rack) switch	Dell EMC Networking S3048-ON
Internal (data) switch	Dell EMC Networking S4128F-ON
Storage	
External storage	Isilon H600 (optional)
Customization for specific workload needs	
Software	• Nauta 1.0 • Kubernetes 1.10.1
Frameworks/libraries	MLK, MLK-DNN, TensorFlow, Horovod
Services	
Consulting	Advisory and Portal Configuration (2 weeks) Optional Data Engineering Accelerator (4+ weeks)
Deployment	ProDeploy
Support	ProSupport ProSupport Plus recommended and optional
Financing	Flexible consumption models, options vary based on country

Delivers up to 2.9x the performance of competitor offerings.[5]

Saves up to 12 months vs. implementing on their own[6]

More than 30k full-time Services experts available to help along journey to AI[7]

[Bright Cluster Manager for Data Science](#) lets you deploy, monitor and manage big data clusters with ease to accelerate data science projects.

[Dell EMC Data Science Provisioning Portal](#) provides a single, intuitive, point-and-click GUI for Bright Cluster Manager that radically simplifies cluster deployment, delivering ready-to-run environments in just five clicks.

Deep Learning with NVIDIA

Dell EMC Deep Learning with NVIDIA provides a GPU-optimized solution stack that can shave valuable time from deep learning projects. Dell EMC engineers can help you configure, test and tune GPU-enabled hardware and software, with included services to help data scientists discover insight from data more quickly.

Deep Learning with NVIDIA is built around NVIDIA Tesla® V100 GPUs. With 640 tensor cores, this powerful accelerator was the first to break the 100 teraflops barrier for deep learning performance.[9] NVIDIA NVLink™ connects multiple V100 GPUs at up to 300GB/s to deliver 30X higher inference performance than CPU-based servers. This level of throughput makes scaling out machine and deep learning services cost-effective and efficient.

Deep Learning with NVIDIA technical specifications

Head node	
Compute	1x PowerEdge R740xd
Processor	2x Intel Xeon Gold 6148 Scalable
Memory	384GB (24x 16GB) DIMMS
Drives	12x 10TB NL SAS
Network card	Mellanox® ConnectX®-5 single port EDR VPI QSFP28 PCIe adapter
Accelerators	4x NVIDIA Tesla V100-SXM2 GPUs
Worker nodes	
Compute	4x PowerEdge C4140
Processor	2x Intel Xeon 6148 Gold Scalable
Memory	384GB (24x 16GB) DIMMS
Drives	2x 240GB M.2 BOSS for boot
Network card	Mellanox ConnectX-5 EN single/dual-port
Accelerators	4x NVIDIA Tesla V100 SXM2 GPUs
Networking	
Switches	Mellanox SB7800 Switch-IB™-2 InfiniBand EDR 100Gb/s Mellanox SX6036 InfiniBand/VPI gateway Dell EMC Networking S3048-ON 1GbE top-of-rack
Storage	
External storage	Isilon F800 All-Flash Scale-out NAS
Customization for specific workload needs	
Software	Bright Cluster Manager for Data Science, Dell EMC Data Science Provisioning Portal
Frameworks/ libraries	Caffe 2, MXNET, TensorFlow, NVIDIA CUDA® Deep Neural, Network Library (cuDNN), NVIDIA CUDA basic linear algebra subroutines (cuBLAS)
Services	
Consulting	Advisory and Portal Configuration (2 weeks) Optional Data Engineering Accelerator (4+ weeks)
Deployment	Custom deployment available
Support	ProSupport ProSupport Plus recommended and optional
Financing	Flexible consumption models, options vary based on country

[5] [ESG Technical Review: Accelerating the Artificial Intelligence Journey with Dell EMC Ready Solutions for AI](#), August 2018

[6] [The Total Economic Impact of Dell EMC Ready Solutions for AI, Machine Learning with Hadoop](#), commissioned by Dell EMC | Intel, August 2018

[7] [Dell Technologies Key Facts](#), February 2018

Optimized solution stack

Data science and framework optimization

Machine learning and deep learning on a single platform

Cloudera Enterprise Data Hub is one software package with many applications that range from data science and engineering, to powering an operational database, to running large-scale analytics.

Cloudera Data Science Workbench enables fast, easy and secure self-service data science for the enterprise.

Dell EMC Data Science Provisioning Engine jumpstarts and simplifies Hadoop environments with configured engines built on Cloudera Data Science Containers.

Apache Spark is an open-source cluster computing framework, a fast and general engine for large-scale data processing.

Machine Learning with Hadoop

Dell EMC Machine Learning with Hadoop builds on the power of tested and proven Dell EMC Ready Solutions for Hadoop created in partnership with Cloudera®. Dell EMC provides an optimized solution stack along with data science and framework optimization, so you can get up and running quickly. Customers wanting to move to Apache® Spark® can take advantage of the BigDL distributed deep learning library for Apache Spark, enabling both machine learning and deep learning on a single platform where data is stored. This platform also includes the Cloudera Data Science Workbench — a collaborative multiuser platform for data scientists to develop machine and deep learning models.

Machine Learning with Hadoop technical specifications

Head node	
Compute	1x PowerEdge R640
Processor	Intel Xeon Gold 6154 Scalable
Memory	1.92GB (12x 16GB RDIMM) @ 2666MT/s, dual rank
Data disk	960GB SSD SATA mixed use 6Gbps 512e 2.5" hot-plug drive, S4600, 3 DWPD, 5256 TBW 1x 92TB SSD SATA mixed use 6Gbps 512e 2.5" hot-plug drive, S4600, 3 DWPD, 10512 TBW
O/S disk	480GB SSD SATA mixed use 6Gbps 512e 2.5" hot-plug drive, S4600, 3 DWPD, 2628 TBW
Network card	Mellanox ConnectX-4 Lx EN dual port 25GbE SFP28 rNDC
Worker nodes	
Compute	2x PowerEdge R640
Processor	Intel Xeon Gold 6154 Scalable
Memory	192GB (12x 16GB) RDIMM @ 2666MT/s, dual rank
Data disk	960GB SSD SATA mixed use 6Gbps 512e 2.5" hot-plug drive, S4600, 3 DWPD, 5256 TBW
O/S disk	480GB SSD SATA mixed use 6Gbps 512e 2.5" hot-plug drive, S4600, 3 DWPD, 2628 TBW
Network card	Mellanox ConnectX-4 Lx EN dual port 25GbE SFP28 rNDC
Hadoop nodes	
Infrastructure	3x PowerEdge R740xd
Worker	7x PowerEdge R740xd
Networking	
Switches	Leverage networking from your existing Hadoop cluster, or Dell EMC Networking Z9100-ON 25Gbe Dell EMC Networking S3048-ON
Customization for specific workload needs	
Software	Cloudera Enterprise Data Hub, Spark, Cloudera Data Science Workbench, Dell EMC Data Science Provisioning Engine
Frameworks/libraries	BigDL
Services	
Consulting	Advisory and Workbench Installation (2 weeks) Optional Data Engineering Accelerator (4+ weeks)
Deployment	Custom deployment available
Support	ProSupport ProSupport Plus recommended and optional
Financing	Flexible consumption models, options vary based on country

Services and financing

Dell Technologies understands that customer success with AI, machine and deep learning initiatives depends on each hardware and software component being configured correctly and integrated seamlessly into the environment. Equally important is having skilled resources and processes in place to effectively use the technology and achieve the desired business outcomes. That's why organizations of all sizes turn to Dell Technologies to provide the services needed to succeed and accelerate the time to value.

Dell Technologies Services

Dell Technologies offers a full portfolio of Services to help you drive the rapid adoption and optimization of your AI environment.

Dell Technologies Consulting provides data analytics and AI services, from strategy through to implementation and ongoing optimization, and helps bridge the people, process and technology needed to achieve desired business outcomes at speed and scale. This includes implementing and operationalizing AI technologies and helping customers accelerate their data engineering capabilities.

For those just getting started with AI, Dell Technologies Consulting offers ProConsult Advisory Services to help assess and plan transformations that will achieve measurable outcomes aligned to the organization's vision and strategy, in six weeks or less, using our proven AS-IS / TO-BE methodology.

Dell Technologies Education Services offers courses and certifications in Data Science and Advanced Analytics. Through self paced online labs and instructor led workshops, Dell Technologies. in partnership with the NVIDIA Deep Learning Institute. provides training on the latest techniques for designing, training and deploying neural networks across a variety of application domains.

Dell Technologies Deployment experts have the experience, expertise and best practices to enhance success as you plan, design and implement Dell Technologies AI, machine and deep learning solutions. With a proven track record of success in thousands of engagements worldwide, customers can rely on Dell Technologies as their partner.

Dell Technologies Support experts can provide comprehensive hardware and collaborative software support 24x7 to help ensure optimal system performance and minimize 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.

Dell Financial Services

The wealth of leasing and financing options from Dell Financial Services can help you find opportunities when 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 your needs.

- Leasing and financing solutions are available throughout the U.S., Canada and Europe.
- Dell Financial Services can help finance your technology purchase.
- Electronic quoting and online contracts offer an efficient customer experience.

Dell EMC Support experts can provide comprehensive hardware and collaborative software support 24x7 to help ensure optimal system performance and minimize 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 provides a single point-of-contact for your support needs.

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Learn more about Dell Financial Services.

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

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

- Come in for an executive briefing and collaborate on ways to reach your business goals.
- Dell EMC Customer Solution Centers are staffed with computer scientists, engineers and PhDs 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 Alienware® to supercomputers, including workstations, servers, networking, storage, software and services.
- Because Dell EMC offers such a wide selection of solutions, we can act as a 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.

Dell EMC Centers of Excellence

As data analytics, HPC and AI converge and the technology evolves, Dell EMC's worldwide centers for innovation 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 Centers of Excellence provide a network of resources based on the wide-ranging know-how and experience in the community.

Dell EMC HPC and AI Innovation Lab

The Dell EMC HPC and AI Innovation Lab in Austin, Texas, is our flagship innovation center. Housed in a 13,000 square foot data center, it gives you access to thousands of Dell EMC servers, two powerful HPC clusters, and sophisticated storage and network systems. It's staffed by a dedicated group of computer scientists, engineers and 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.

"The HPC and AI Innovation Lab gives our customers access to cutting-edge technology, like the latest-generation Dell EMC products, Scalable System Framework from Intel®, InfiniBand® from Mellanox®, NVIDIA GPUs, Bright Computing® software and more. Customers can bring us their workloads, and we can help them tune a solution before the technology is readily available."

— Garima Kochhar, Systems Sr. Principal Engineer

Learn more about the Dell EMC HPC and AI Innovation Lab.

"There are a lot of advantages to working with Dell EMC. We laid out our requirements and the people at Dell EMC took those requirements and developed exactly what we needed. Our engineers were very pleased with that, because, obviously, we are all very busy doing other things. It was very nice to be able to hand this off to people who are experts in the field, who understood what our requirements were, and who could give us a product that actually met those requirements."

— Thomas McCauley, engineering manager, autonomous mining, Caterpillar

Read the case study.

[10] IDC WW Quarterly Server Tracker, Vendor Revenue, March 2019.

[11] IDC WW Quarterly Converged Systems Tracker, Vendor Revenue, September 2018.

[12] IDC WW Quarterly Enterprise Storage Systems Tracker, Vendor Revenue, March 2019.

[13] IDC WW Quarterly Cloud IT Infrastructure Tracker, Vendor Revenue, January 2019.

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.

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 explore the latest technology and get the information and hands-on experience you need for your advanced computing workloads.

Proven results

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

- #1 in servers[10]
- #1 in converged and hyper converged infrastructure (HCI)[11]
- #1 in storage[12]
- #1 cloud IT infrastructure[13]

See Dell Technologies Key Facts.

Take the next step, today

Learn more about how you can quickly deploy a solution ready to power AI, machine and deep learning initiatives. Contact your Dell EMC or authorized partner sales representative, join the HPC Community at dellhpc.org, learn about Intel AI Builders, or visit dellemc.com/readyforai to learn more.

Contact us

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

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