DELL Technologies

White paper

Make Artificial Intelligence Real

Deliver real impact from edge to core to cloud

Advancing human/machine partnerships

There's nothing artificial about making the world a better place

Over the last several decades, technology has slowly shaped our world into one our grandparents wouldn't recognize. Some of that change has been about the gadgets in our homes and in our pockets. Much else has been driven by researchers and scientists using powerful high performance computing (HPC) supercomputers to answer life-changing questions and make groundbreaking discoveries in life sciences, earth sciences, and physics, chemistry and astronomy.

But the pace of change is about to accelerate. As the price/performance ratio of HPC continues to decrease and the field of artificial intelligence (AI) is hitting its stride, the possibilities are becoming nearly limitless. Now, many in the business world have begun exploring the possibilities of AI to help them fulfill their business goals better and faster. And that's perhaps more relevant than ever before.

AI lets companies use what used to be overwhelming amounts of data to create intelligent insights about how to better serve the people who rely on them, including:

- Fighting disease by advancing drug development and precision medicine
- Making the supply chain more flexible and responsive so products get where they need to be, when they need to be there
- Reaching the right customer with the right offer at the right time
- Developing innovative products and services faster and more cost-effectively

And that's just the beginning. Because when real people work with AI, it extends our capabilities as humans — to save our loved ones; to increase efficiency and reduce waste; to compete — and win — in an uncertain business climate.

There's nothing artificial about that.

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> "Data has limited value without the right technology that empowers organizations to extract valuable, accurate and timely insights."
>
> *—IDC*[6]

The prerequisites for AI success

Remove the barriers to innovation

The global datasphere is growing exponentially, and predicted to reach 175ZB by 2025[1]. AI has the power to help organizations make meaningful, value-added predictions and respond quickly to changing market conditions and customer demands.

Perhaps because of this, according to IDC, over 90% of new enterprise applications will embed AI by 2025.[2] But at the same time, "only 14.6% of firms report that they have deployed AI capabilities into widespread production."[3] This indicates a wide gap between companies' ability to move from proof of concept into full production.

Companies now — more than ever — need technology that empowers them to extract valuable, accurate and timely insights from their data.

However, as with any new technology, there is a lag between what's possible and what's practical. Many early adopters started experimenting with AI using a cloud model. Cloud offers a number of advantages, in particular the ability to get started quickly with AI without having to build complicated and costly on-premises systems that require advanced skillsets.

But as AI use cases progress from proof-of-concept to production, many of these early adopters of AI are experiencing latency and portability challenges across hybrid clouds. Latency can become problematic when bursting AI workloads to the public cloud, when transferring data between the cloud and on-premises, and when processing data in the cloud. In fact, industry insiders report that "hybrid latency prevents companies from running AI workloads in the cloud with data on-prem."[4]

Bringing at least some AI workloads on-premises would seem to be the answer. However, the initial challenge remains: lack of skilled in-house resources to design, deploy and manage HPC systems capable of running AI in production and across on-premises data centers and multiple public and private clouds.

In light of this, it's not surprising that, "Gartner's 2019 AI in Organizations survey revealed that organizations are experiencing multiple external and internal barriers to AI implementation. Security or privacy concerns and complexity of AI solution(s) integration with existing infrastructure were cited as the top barriers."[5]

The reality is, that for enterprises to excel with AI they need to enhance application portability across hybrid cloud environments while simultaneously reducing IT complexity so that AI can be managed by existing staff resources with minimal additional training.

Dell Technologies is addressing these challenges, paving the way for AI to truly revolutionize the world — and your business.

[1] IDC white paper, sponsored by Seagate, "Data Age 2025: The Digitization of the World: From Edge to Core," November 2018.

[2] IDC, "IDC FutureScape: Worldwide IT Industry 2020 Predictions," October 2019. Doc #US45599219.

[3] Forbes, "AI Stats News: Only 14.6% Of Firms Have Deployed AI Capabilities In Production," January 2020.

[4] Disruptor Daily, "What Are The Challenges To AI Adoption In Cloud Computing? 9 Experts Share Their Insights," September 2019.

[5] Gartner, "Cool Vendors in AI Core Technologies," April 2020.

[6] IDC, "Worldwide Artificial Intelligence Forecast, 2019–2023," July 2019. Doc #US45332319.

The Dell Technologies point of view

Every day, more and more engineers, researchers and designers are using the power of AI to meaningfully change our world. Organizations of all sizes and from many industries are leveraging AI to help them answer bigger questions and make more amazing discoveries, faster.

Dell Technologies is dedicated to bringing the power of AI to anyone who wants to use it. Our portfolio of products and solutions is designed to get AI into the hands of businesses and institutions of all sizes so that more people can harness the power of data to make the world a better place.

That's why Dell Technologies is expanding our AI offerings to make hybrid cloud AI a reality. Our latest offerings are designed to complement our already expansive AI portfolio, giving you the multi-cloud portability, compute power and scalability you need to be successful with multi-cloud AI.

With Dell Technologies you can get the benefits of:

- **AI anywhere:** Rapidly mobilize AI applications across hybrid clouds with VMware-enabled portability.
- **Continuous insights:** Keep insights flowing with innovative remediation and intuitive management across clouds.
- **AI at real scale:** Expand AI solutions from laptops to supercomputers with the end-to-end Dell Technologies portfolio.

> "Our partnership with Dell EMC and VMware enables us to make AI a reality while bringing cutting edge technology to our customers. As a medium sized business, we are proud to demonstrate that any size business can run AI workloads if they have the right technology partner."
>
> *—P.J. Camm, IT Director, OTTO Motors*

"There are going to be more apps provisioned in the next five years than there were in the past 40. ... There's going to be many more of them … more data-centric, using all sorts of new capabilities such as AI. The nature of the app is fundamentally changing."

—Kit Colbert, VP and CTO, Cloud Platform BU at VMware

Make AI real with Dell Technologies

AI anywhere

Dell Technologies gives you the power to mobilize AI applications across hybrid clouds with portability enabled by VMware® vSphere®.

VMware Cloud Foundation with VMware vSphere 7.0

As part of the Dell Technologies family, VMware is an integral part of our AI portfolio. VMware vSphere 7.0, part of VMware Cloud Foundation™, offers groundbreaking innovations for AI on Dell Technologies infrastructure:

- **Kubernetes® container control plane:** Consolidate containerized, virtualized and traditional application environments into a single platform that existing vSphere admins can support with minimal additional training.
- **Bitfusion accelerator virtualization:** Virtualize on-premises and cloud accelerators from multiple vendors to give developers self-service access to elastic pools of accelerators, managed as VMware vCenter® clusters.
- **VMware Cloud Foundation:** Bundles vSphere, VMware vSAN™, VMware NSX®, and the VMware vRealize® Suite into a single platform so you can operate your hybrid environment with the same tools, teams, skills, policies and standards already used in your data center.

Dell EMC Ready Solutions for AI: GPU as a service (GPUaaS)

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

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

- **More accelerator power:** AI workload performance may depend on the power of accelerators. However, GPUs and other accelerators are typically stuck in silos and grossly underutilized, often bound to workstations that are dedicated to individual users. VMware vSphere 7.0 incorporates Bitfusion technology that enables virtualizing accelerators located on-premises or in the cloud. Giving developers self-service access to acceleration enables innovation and increases utilization and efficiency for valuable accelerator resources.
- **Portability across hybrid cloud:** AI applications need to perform consistently and reliably across public and private cloud with little to no modifications. VMware vSphere includes native support for Kubernetes, providing a portable and consistent containerized environment for porting AI applications across clouds.
- **Simplified management:** Innovations included in VMware Cloud Foundation enable IT teams to run AI and other applications together in familiar VMware environments running on proven Dell EMC PowerEdge servers, networking and storage.

The Data Accelerator implementation at the University of Cambridge was so successful that it reached #1 in the June 2019 IO500 world HPC storage ranking, making it the fastest HPC storage solution in the world, with almost twice the performance of the second-placed entry on the list.[7]

Dell EMC Ready Solutions for vHPC

HPC workloads, like 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. These include:

- **Increased flexibility and agility:** Rapid provisioning of infrastructure on-demand enables speedy iteration and scale-out so you can spend more time attaining insights and less time on setup and retooling.
- **Reduced complexity:** You can run AI and HPC on a familiar virtualization platform with a broad ecosystem of technology partners offering value-added services such as backup, security analysis, firewall and operations management.
- **Enhanced operational efficiency:** Minimize setup and configuration time with centralized management capabilities. Simplify operations such as ongoing provisioning and maintenance. Avoid planned downtime through live migration.
- **Data governance and control of sensitive information:** Security isolation prevents VMs from seeing data in the same cluster. Each VM can only access the virtual disk files that have been designated for it.
- **Cost-effective licensing:** VMware vSphere Scale-Out offers the industry-leading virtualization platform at a cost-effective price point for AI, HPC and big data workloads.

Dell EMC Ready Solutions for HPC Storage, Data Accelerator

As HPC and AI converge, and researchers seek to run these workloads side-by-side on the same systems, growing data sets, coupled with bandwidth- and latency-sensitive workloads are placing high demands on central parallel file systems. This creates storage I/O bottlenecks that increase wait times and can even render file systems inoperable.

To help solve this storage challenge, Dell Technologies, Intel® and the University of Cambridge have collaborated to enable the next generation of data-intensive HPC and AI workflows. An NVMe-based storage solution, referred to as the Data Accelerator, makes optimal use of Dell EMC PowerEdge R740xd Servers with advanced SSD and fabric technologies to mitigate I/O-related performance issues. The Data Accelerator enables organizations to:

- **Alleviate performance bottlenecks** for data-intensive applications on central networked file systems.
- **Provide breakthrough I/O performance** via deterministic, high-performance, schedulable I/O resources.
- **Integrate with traditional HPC storage** without redesign to interact with commonly-used scheduling tools.
- **Create an open-source software solution**, utilizing infrastructure-as-code and cloud-native technologies built on readily available server and networking technology.

Read the white paper.

[7] Virtual Institute for I/O, "IO500," June 2019.

Continuous insights

Modern IT infrastructures are powerful and flexible, yet often complex and challenging to manage. Dell Technologies can round out your AI solution with powerful infrastructure management that keeps insights flowing across hybrid clouds.

Dell EMC OpenManage

The Dell EMC OpenManage systems management portfolio helps you tame the complexity of your IT infrastructure with intuitive tools that work together to deliver automated, repeatable processes based on your unique policies, enabling effortless management. Plus you can respond quickly to unexpected events or changes in business priorities with immediate notifications, remote management and augmented reality–enabled remediation.

- **OpenManage Mobile:** Dell EMC OpenManage Mobile, a unique Android/iOS app, helps IT administrators track data center issues and respond rapidly to unexpected events — anytime, anywhere. The app also leverages machine learning to identify a Dell EMC PowerEdge MX7000 chassis and then adds an overlay of health status for each component using augmented reality (AR). With the latest release, IT administrators can view power and thermal policies, perform emergency power reduction and monitor internal storage. It also includes an updated AR interface.
- **OpenManage Integration for VMware vCenter:** Dell Technologies is one of only two vendors that support vSphere Lifecycle Manager. The integration plugs into your workflow so you can see both the physical and virtual host information from a single pane of glass, and use the vCenter user interface to coordinate software, driver and firmware updates in one scheduler. The single scheduler helps unify a complete, end-to-end update of your VMware infrastructure. Furthermore, a pre-check helps warn you if there are clusters not ready for update.
- **OpenManage Enterprise:** Accelerate server onboarding and scale server lifecycle management with confidence. On a single interface, unify the system management experience and manage at scale across MX chassis and standard Dell EMC PowerEdge infrastructure, with new features such as pool-based profile management and automated modular component discovery.

Dell Technologies is one of only two vendors that support vSphere Lifecycle Manager.

"OpenManage Enterprise can deploy a server in 88% less time and 14 fewer steps for a single server compared to manual deployment. ... Server-initiated discovery with OpenManage requires only 5 basic steps and 15 seconds of IT administrator time for a single server, with no network scans necessary."[8]

[8] Principled Technologies, "Boost data center staff productivity with OpenManage Enterprise," March 2020.

AI at real scale

Dell Technologies is already helping our customers explore and reap the benefits of this exciting new frontier, with scalable, flexible solutions designed to help solve complex problems faster than ever. In fact, we're one of the only companies in the world with a portfolio for AI, HPC and data analytics that spans workstations, servers, networking, storage, rack systems and services. In addition, Dell Technologies AI experts are active innovators and collaborators in the worldwide technical community dedicated to advancing AI and HPC.

Our existing AI portfolio includes:

- **Dell EMC Ready Solutions for AI** help make AI simpler with designs enabling you to get faster, deeper insights delivered with proven AI expertise.
- **Dell EMC Reference Architectures and Validated Designs for AI** provide engineering-tested guidance to build and operate workload- or application-optimized systems.
- **Dell Precision workstations** deliver the power to deploy and manage AI with a cost-effective solution that puts advanced technology within reach.
- **Dell EMC PowerEdge servers** — such as the R740, R740xd, R7525 and C4140 — are built for scale out workloads like AI, with the latest processors, accelerators, memory and NVMe storage in a wide range of configuration and connectivity options.

"In order to provide our customers personalized marketing content, we needed a flexible, reliable, and scalable infrastructure to run AI workloads. The partnership with Dell EMC and VMware enables us to make artificial intelligence real."

—Robert Walden, CIO, Epsilon

The Dell Technologies difference

At Dell Technologies, our goal is to enable more organizations like yours to leverage AI to do what you do best — change the world.

Dell Technologies Customer Solution Centers

Our global network of dedicated Dell Technologies 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 and help you become more successful and competitive. Customer Solution Centers help reduce the risks associated with new technology investments and can help improve speed and ease of implementation.

AI Experience Zones

Curious about AI? You can run demos, try proofs of concept and pilot software in Singapore, Seoul, Sydney and Bangalore. Dell Technologies experts are available to collaborate and share best practices as you explore the latest technology and get the information and hands on experience needed for advanced computing workloads.

Dell Technologies HPC & AI Innovation Lab

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

"By 2025, at least 90% of new enterprise apps will embed artificial intelligence. Most of these will be AI-enabled apps, delivering incremental improvements to make applications 'smarter' and more dynamic."

—IDC[9]

Dell Technologies HPC & AI Centers of Excellence

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

Services

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

- Consulting provides AI and data analytics services from strategy through to implementation and ongoing optimization, and helps bridge the people, processes and technology needed to achieve desired business outcomes at speed and scale. This includes implementing and operationalizing AI technologies and helping you accelerate your data engineering capabilities.
- For those just getting started with AI and HPC, ProConsult Advisory Services assess and plan transformations that will achieve measurable outcomes aligned to your vision and strategy. These services are available at multiple levels and rely on a replicable methodology.
- Education Services offers courses and certifications in data science and advanced analytics. Through self-paced online labs and instructor-led workshops, the Deep Learning Institute provides training on the latest techniques for designing, training and deploying neural networks across a variety of application domains.
- ProDeploy leverages a global team of dedicated AI and HPC specialists with the experience, expertise and best practices to enhance your success with Dell EMC Ready Solutions. Our deployment model provides you with comprehensive, proven system implementation along with design validation, benchmarking and product orientation.
- ProSupport can provide comprehensive hardware and collaborative software support 24x7 for optimal system performance and minimized downtime. The ProSupport Add-on for HPC provides solution-aware support with specific entitlements for Dell EMC Ready Solutions for AI, HPC and Data Analytics, including access to dedicated HPC solution experts to help manage the complexities of supporting multi-vendor systems.
- PowerEdge Configuration Services help you deploy your new servers quickly to enable scale in your AI environment by configuring them before shipping. From system settings, custom asset tagging, to customer supplied system image, and card placement — we deliver your new PowerEdge servers with precision, to your specifications, ready to deploy.
- With Remote Cluster Management service, highly skilled experts will proactively manage and maintain your HPC system and applications so that you can focus on your core business.
- Dell Technologies multi-cloud AI offerings span a variety of public, private and hybrid cloud resources, including Dell Technologies Cloud and R Systems®, Verne Global® and DXC® cloud service providers.

[9] IDC, "IDC FutureScape: Worldwide IT Industry 2020 Predictions," October 2019. Doc #US45599219.

Resources

- Dell EMC PowerEdge Reference Architectures
- Dell EMC OpenManage Systems Management Solutions
- Dell Technologies Customer Solution Centers
- Dell Technologies HPC & AI Innovation Lab
- Dell Technologies HPC & AI Centers of Excellence

Learn more

delltechnologies.com/ai

Flexible payment and consumption solutions

Dell Technologies gives you more choice, flexibility and predictability in how you consume IT infrastructure. Flexible payment and consumption solutions are designed to enable immediate IT acquisition with the ability to pay over time. Additionally, these solutions allow organizations to manage cash flow and plan for future upgrades while staying on budget. Dell offers a wide range of payment solutions to make it easier than ever to meet your needs.

- Dell Technologies payment solutions are available across the Dell Technologies portfolio of products and services.
- Pay as you go solutions align predictable payments with business goals, deployment schedules and growth forecasts.
- APEX Custom consumption solutions allow you pay as you use without the burden and cost of over-provisioning and paying for technology that is not being utilized.
- Software financing solutions accommodate software acquisition, including deferred and annual payments, and can also be used to purchase license agreements.

DELL Technologies