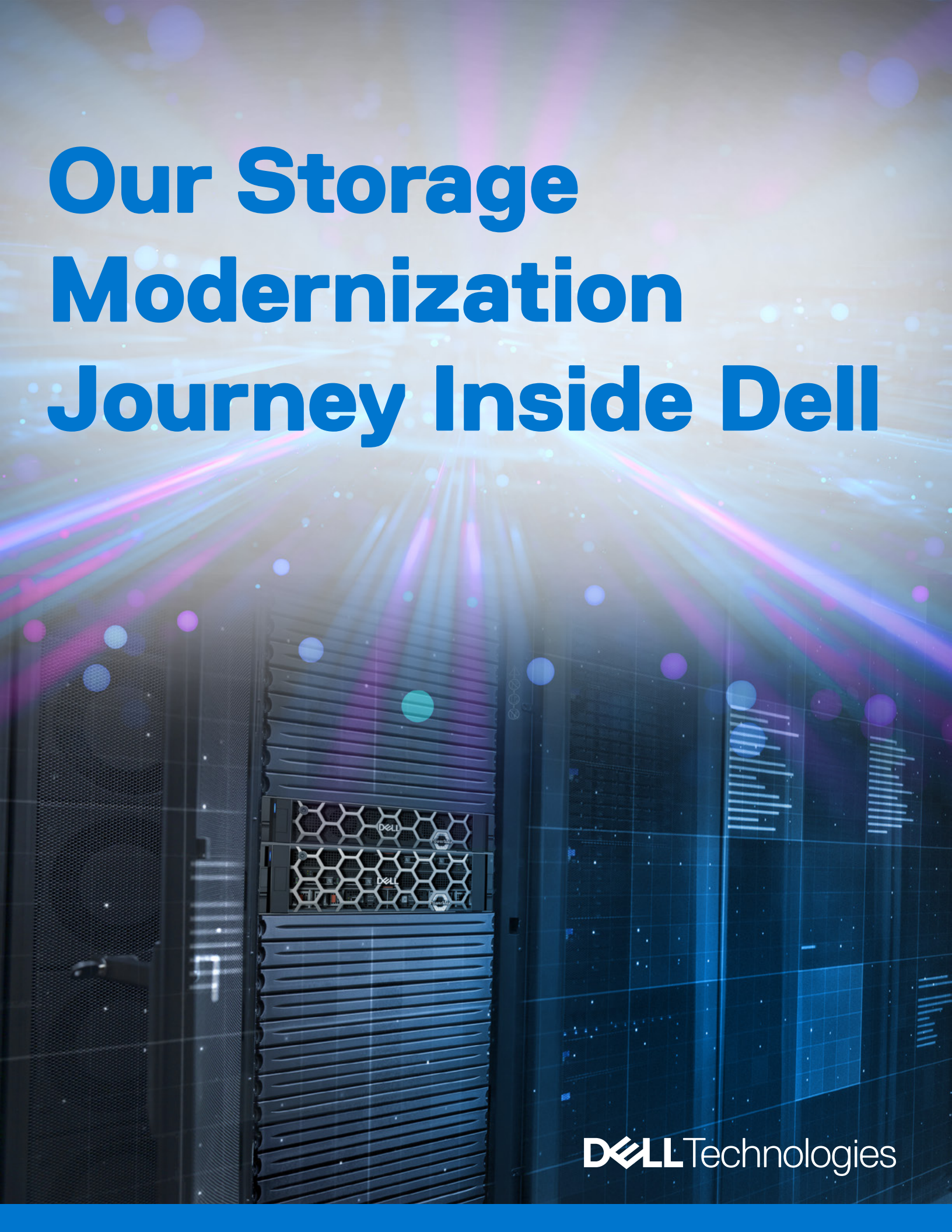
Our Storage Modernization Journey Inside Dell



DELL Technologies

Over the past several years, Dell Digital, Dell Technologies' IT organization, has been on a journey to modernize our data center, at the heart of which is our storage ecosystem. The task has been to understand our business requirements for growth and workloads and create a simple, standardized platform wrapped in software that will allow us to provide consistent infrastructure and operations from the private cloud to the public cloud to the edge.

The task is also to build a scalable foundation to manage the explosion of data and maximize its potential value for Dell.

These pages offer insights on how Dell Digital is continuously driving a modern storage experience using our software-defined innovations.

Architecture: Software-Defined Infrastructure

Dell Digital's storage ecosystem is built to maximize flexibility, optimize costs and be prepared for whatever comes next in a digitally transforming world.

Central to our strategy is a simplified and scalable infrastructure foundation built on a standardized set of software-defined building blocks using Dell PowerEdge, Dell PowerFlex and Dell PowerMax.

The majority of our workloads run on Dell PowerFlex, a software-defined infrastructure platform that accommodates a variety of workloads and database solutions encompassing legacy and modern database architecture. It provides a common framework that allows us to consolidate and modernize databases that were previously spread across the company and were using a variety of Dell products.

In our drive to simplify our storage strategy, we found that converging around a common PowerFlex model not only reduces complexity for applications and databases but also improves storage performance.

We use the PowerFlex Appliance, which provides preconfigured and validated components that simplify our deployment and management of storage infrastructure. Underneath it all, we rely on Dell PowerEdge servers, with a technology that has been a staple of our environment for 20+ years.

Dell PowerFlex hosts approximately 75% of our block storage as the common platform for high-performance, high-capacity workloads. Dell PowerEdge vSAN ReadyNodes accommodates another 10% of our storage, providing a turnkey, low touch solution that is easy to roll out and serves workloads with a smaller storage footprint. For the remaining 15%, Dell PowerMax is our high-end storage solution with advanced data services for core applications and databases with large CPU, memory and storage requirements.

To meet the needs of solutions with more extensive data demands, we also use Dell PowerScale, Dell PowerStore and Dell ECS (Elastic Cloud Storage). PowerScale is a scale-out file solution that handles analytics, data science workloads and edge applications. We use PowerStore for enterprise file storage that feeds mission-critical data shares to our private cloud. And ECS is our object store solution for data we access less frequently but nonetheless still need to retain.

And we protect it all using PowerProtect Data Domain, which leverages our segmented storage network to copy data to a third location and have it vaulted in a secure manner so that we can protect ourselves from ransomware.

Moving to a simple, repeatable, one-size-fits-most building block infrastructure enables our Dell IT teams to quickly optimize application and workload environments for the business. Unlike the complexities of a silo-type infrastructure that is project-oriented, we can use our standardized building block strategy to easily forecast and build added capacity and make it available to our cloud consumers in a just-in-time process.

In our initial transformation, we converted some 65 petabytes of legacy databases to our new software-defined architecture hosted on 1,300 nodes of PowerFlex in our data center. And in the past three years, we have more than quadrupled that capacity.

The Journey: Forging Our Building Block Design

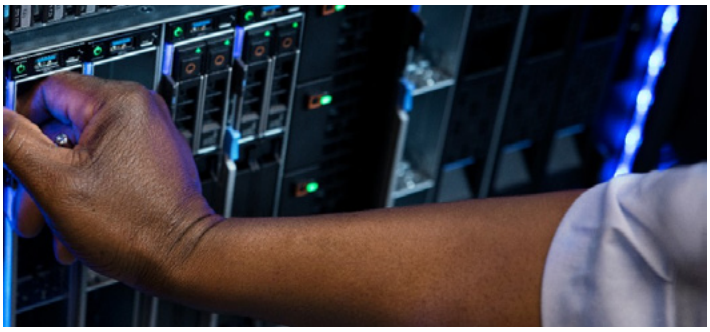
Dell Digital began using a building block infrastructure design as it tackled the merger of Dell and EMC Corp. in 2016. The challenge was to converge two very large and very different data center infrastructures into a brand-new set of infrastructure platform services to support our business in the wake of one of the biggest mergers in high-tech history.

When we started, we had two large storage area networks that tied together multiple technologies, database workloads, purpose-built storage arrays, and solutions with varying unique ways of operating. At the same time, we were seeing the rise of direct-attached-storage (DAS)-based solutions, with distributed NoSQL databases or analytic type database systems needed to abstract information from big data environments. The preferred architecture for those solutions was to buy a server, fill it up with a bunch of drives and put it on your network.

We had to find a solution that allows us to maintain a storage ecosystem at scale and meet the demands of modern applications but accommodate our legacy workloads.

On a broader front, Dell Digital wanted to create a modern, cloud-based data center that would meet the needs of a changing IT landscape and drive our ongoing digital transformation. We needed a data center strategy that would meet changing business demands for faster, more flexible IT delivery with standard processes, more efficient architecture and a multi-cloud strategy that allows for seamless access to multiple cloud environments.

Rather than building our virtualized platform the way we did in the past by assembling independent servers, storage, networking, Dell Digital chose to adopt a hyper-converged infrastructure (HCI.) standard. HCI provided ready-configured compute, networking and storage as building blocks for our private cloud.



The IT team used a mix of Dell PowerEdge vSAN ReadyNodes technology to leverage servers preconfigured with storage, networking and compute as well as Dell PowerFlex. Adopting a software-defined platform also allowed us to move from a specialized fiber channel network for storage transport to a more cost-effective, ethernet-based network, which reduced the costs of our storage transport.

While a modern data center is essential to digital transformation, software-defined storage is one of the largest components of that data center.

Dell Digital initially had a dual storage strategy, running less capacity intensive workloads on vSAN and higher capacity databases on PowerFlex. However, more and more we found that we could improve the performance that many vSAN applications needed by migrating them to PowerFlex.

Eventually, we converged on a common PowerFlex model for most of our workloads to remove added complexity from our build and deployment model. PowerFlex supports everything from bare metal to virtualized and containerized infrastructure with one common footprint.

What began as an effort to incorporate software-defined storage into our data center has expanded to become the common compute and storage platform for the majority of our workloads to improve the compute as well as storage experience for our user across our environment. For more detail, check out **Supercharging our Software-defined Strategy with PowerFlex**.

Outcomes, Benefits Realized

Among the key benefits of our storage strategy is that our common, easily buildable, highly resilient, software-defined infrastructure platform enables the compute and networking needed to drive our digital transformation. It lets us deliver compute, network and storage capacity simultaneously for just-in-time delivery of capacity when and where we need it.

Standardizing on infrastructure building blocks helps our Dell IT teams to quickly optimize application and workload environments for the business. It has freed the storage team from lengthy back and forth with the business about storage sizing and product requirements and sped up deployment and provisioning tasks.

It also makes the process of security patching and life cycling management easier. Since our standardized building blocks are repeatable, we can programmatically address the infrastructure and we know how it's going to react. This helps us keep the system up to date, patched and running smoothly. In a legacy model with specialized solutions deployed for each environment, we had to do a lot more tracking of the various components to maintain each part of the infrastructure.

Our software-defined platform is also the foundation of our cloud operating model that allows us to offer as-a-service infrastructure to our developers, stakeholders and business partners via a service catalog and a self-service portal.

Our portal runs on PowerEdge and PowerFlex at the heart of our modern data center. Users can provision services—virtual machines (VMs), containers, data services, databases and more—in less than an hour compared with waiting weeks via a typical IT provisioning process. For more details, go to **Increasing Development Velocity with Self-Service IT**.

And finally, our software-defined strategy lets us run any workload without having to spend a lot of time developing a custom solution or moving back to bare metal solutions that are resource-intensive. We can take the most demanding workload and confidently run it on our infrastructure.

We recently put our software-defined strategy to the test when we faced an urgent need for added data center capacity. We were able to build two new data centers on opposite sides of the United States in just 90 days. For more details, go to **Spinning Up Two Data Centers in 90 Days**.

A Portfolio for the Future Growth

While PowerFlex is our primary software-defined platform for our cloud environment, Dell Digital relies on an array of options across our storage portfolio to meet the various types of storage challenges we face every day. We have important use cases for all of our storage products and will continue to grow them as evolving workloads require.

PowerScale continues to be a very important platform for the type of services that need to leverage a scale-out, high performance file solution. We're expanding our use of PowerScale rapidly to meet our growing analytics and data services needs as well as edge storage capabilities in our factories.

We're also in the process of migrating legacy workloads to PowerStore and growing its footprint as our enterprise file platform. PowerStore also serves applications that need a shared file resource that spans across multiple data centers.

And we continue to have a very important set of capabilities and infrastructure where PowerMax is suited to run high compute, high memory intensive applications that require a large storage footprint. PowerMax handles our largest, most important workloads, including our enterprise resource planning (ERP) and Symmetrix Remote Data Facility (SRDF) databases.

Overall, Dell Digital's evolving storage strategy unlocks our ability to create solutions within our data center that provide the most efficient use of storage at scale and provide services to all the new and emerging types of applications and workloads that we face going forward.

Keep up with our Dell Digital strategies and more at ***Dell Technologies: Our Digital Transformation****.*