The Software-Defined Data Center: A paradigm shift in data center deployment

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Executive summary
This white paper provides an overview of the challenges and advantages of adopting a software-defined data center — showcasing how Dell Services can help enterprises transform their traditional data centers into software-defined data centers.

Figure 1: Traditional data center versus software-defined data center.
Enterprise expectations for next-generation IT
As the pressure increases for IT to provide on-demand services that are agile, elastic and secure, traditional methodologies that require significant time to design, procure and provision are rapidly becoming a thing of the past.

Enterprises expect IT to adopt technologies that allow them to pool resources (such as computing, storage and network) and optimize costs through enhanced infrastructure, agility and change management processes.

According to Gartner, private cloud has moved from an aspiration to a reality for nearly half of large enterprises in the past few years.1 And hybrid cloud computing isn’t far behind. One of the major reasons for the advance in private cloud technology is the availability of virtualized security components — such as firewall and intrusion detection systems — to complement existing security appliances.

Enterprises want IT to be agile while designing and operating their own data centers and delivering private cloud services similar to the leading public cloud service providers (like Google and Amazon). Simply put, business wants more for less.

While enterprises crave the resiliency, predictability, data integrity, resource pooling, virtualization, elasticity and cost transparency of private cloud, they also want the flexibility to connect with public clouds. According to a recent survey, 82 percent of enterprises have a hybrid cloud strategy — up from 74 percent in 2014.2

Challenges of a traditional data center
Data center architecture has evolved from a three-tier structure similar to campus network architecture to a more robust and efficient spine-and-leaf architecture that utilizes equal-cost multi-path (ECMP) routing, reducing latency and improving data center reliability.

However, a few challenges still exist:
• Data center architecture is often dominated by vendor-specific hardware and software dependencies, which often leads to the use of proprietary technologies instead of open industry standards
• The refresh cycle for data center network equipment is predominately dictated by the equipment vendors and typically spans between three to five years, which slows down the speed of data center innovation
• Workload mobility is confined by the number of subnets in a data center, which is dependent on the maximum number of virtual segments or LAN segments
• The majority of data center network equipment requires manual configuration, with limited support from the vendor through software configuration, which increases data center provisioning and deployment cycles

Bandwidth needs continue to grow
Evolving workloads create east-west traffic jams
More devices means more risk

Multiple vendors’ chipsets now exceed proprietary designs
Networking functionality is increasing in Linux
Organizations are planning for software-defined networks

Figure 2: Current challenges for a traditional data center.
Network chokepoints increase latency, resulting in slower response times for users.

Data center trends: Traditional to software-defined data center

Server virtualization technologies create an abstraction layer (server hypervisor) that makes it possible to reproduce the attributes of an x86 physical environment (such as CPU, a network interface card and RAM) in software. This capability has created a massive shift in data center deployments as it enables IT to pool resources, optimizing data center costs and increasing agility.

Virtualization also allows IT to create, delete and move workloads from within and across data centers using automated software tools and processes that require minimal downtime. Data center networks, however, continue to use standard, vendor-specific hardware and software technologies that are complex and need manual provisioning. To create a true software-defined data center, enterprises need to virtualize both servers and networks.

In a software-defined data center, software abstraction virtualizes the majority of data center components (such as computing, storage and networking), while policy-driven software controls infrastructure management tasks. By separating service management from the physical infrastructure, data centers become more agile than ever before.

Software-defined data centers are a radical paradigm shift in data center deployment. They enable critical network functions (such as routing, switching, firewall and load balancer) using software instead of hardware — transforming traditional data center methods that focus on infrastructure into an application- or service-based environment.

Our vision of the software-defined data center

At Dell Services, we believe the future of IT is software defined, extending data center services across computing, storage and networking environments to provide comprehensive IT-as-a-service capabilities. Software-defined data centers can automate IT, increasing agility and simplifying operations and service delivery.

Software-defined data centers also help enterprises deploy, operate, manage and update applications while ensuring business continuity — using cost-effective and secure business processes that ensure agility.

Figure 3: Server virtualization.

Figure 4: Network virtualization.

Figure 5: Data center evolution — from traditional to a software-defined data center.
We take a hybrid approach to creating a software-defined data center, allowing customers to choose the specific technology (or combination of technologies) that best meets their needs using programmable, controller-based and overlay solutions.

Banking, financial services & insurance
Secure and fast transactions are critical for banking, financial services and insurance companies. A software-defined data center provides enhanced security, efficient data recovery and mobility solutions for any geographic region.

Network virtualization overlay (NVO) solutions offer a scalable, straightforward and cost-effective path to delivering the benefits of software-defined networking for virtualized and private cloud solutions. As a leading strategic partner of Microsoft and VMware, Dell helps develop unique infrastructure technologies that optimize each NVO offering. Our comprehensive strategy utilizes open standards, open protocols and open source development to ensure deep integration and strategic alignment with leading Microsoft and VMware integrated network virtualization frameworks.

While anyone can transition from a traditional data center environment, there are unique challenges and advantages of deploying a software-defined data center for each business. A few industry-specific instances are highlighted below.

Advantages of software-defined data centers
• Facilitates high-frequency trading and banking transactions by decreasing network latency
• Helps organizations comply with strict regulatory requirements with increased data center adaptability and flexibility
• Makes it easier to replicate and deploy new data centers or disaster recovery data centers across the globe
• Enhances transaction security, including:
  − Security policies can be automatically attached to and migrated with application workloads at the time of virtual machine creation
  − Potential security blind spots are avoided using virtual firewalls, as well as traditional firewalls

Challenges of software-defined data centers
• Virtualized network services — such as firewalls and load balancers — have to continuously evolve as the data center bandwidth grows from 10GB to 40GB and 100GB
• Software abstraction may increase data center complexity unless designed carefully using established industry best practices

Ecommerce and retail
A minute delay on an ecommerce website can lead to low customer conversion rates, fewer page views and a decrease in customer satisfaction. Retail websites also need to be equipped to handle a range of customer demands, including increased customer activity during the holiday season and flash sales. Software-defined data centers can help improve security, resiliency and agility, while reducing latency and increasing provisioning.

Advantages of software-defined data centers
• Improves the customer shopping experience with reduced latency

Figure 6: The future of IT is flexibility, scalability and automation.

Figure 7: Hybrid approach to software-defined data centers.
• Increases security by allowing security policies to be applied at a more granular, workload level
• Helps ecommerce sites seamlessly adapt to fluctuations in demand with increased agility
• Simplifies data center provisioning time, reduces provisioning errors and lowers data center operational costs using best practices-driven design and automation
• Empowers customers to focus on quality and cost optimization by commoditizing the underlying hardware (computing, storage and network)

Challenges of software-defined data centers
- Requires a new set of data center provisioning and monitoring tools
- Calls for entirely new processes — from hardware procurement and design to management tools and troubleshooting skills
- Needs in-depth training for data center operations team to operate in the new software-defined environment

Enterprises undergoing digital transformation
The success of online retail has forced traditional brick-and-mortar businesses (such as car rental companies and supermarkets) to reinvent themselves. As enterprises undergo digital transformation, they integrate their existing business model to include online presence, mobility and social media. Software-defined data centers can help provide a consistent and secure user experience across applications running on different devices and enable businesses with the ability to scale their online presence while maintaining low capital expenditures and operating costs.

Advantages of software-defined data centers
- Speeds IT service delivery by significantly reducing the time it takes to bring new, revenue-generating applications and services to the market
- Increases flexibility with centralized management and infrastructure orchestration that allows enterprises to seamlessly and cost-effectively scale their online presence
- Enables the ability to deploy and update applications more rapidly

Challenges of software-defined data centers
- Requires robust re-engineering of IT processes to create cost savings, while increasing productivity and business agility
- Requires a change in culture, processes, organizational structure and technology

How Dell can help
As each enterprise has a unique set of data center requirements spanning across computing, storage, network and security, Dell provides end-to-end consulting services that integrate business objectives, IT strategy and customer priorities.

We help enterprises simplify IT and accelerate innovation using open standards combined with Dell intellectual property, global support, industry best practices and comprehensive change management processes. Increase productivity, collaboration and efficiency with software-defined data center solutions from Dell.

Further reading
- Moving toward a software-defined data center with Open Networking
- VMworld 2014 highlights: software-defined data center
- Dell and the Software Defined Network
- Dell’s open networking solutions continue to revolutionize the software defined data center

For more information, visit our IT Consulting Services page or contact a Dell representative.

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