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Harnessing the Power of Network Virtualization



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Every decade or so, a technology comes along that dramatically changes the efficiency and capabilities of the data center. Virtualization was one such technology. By virtualizing physical servers into pools of compute resources, enterprises sought to significantly reduce capital expenses (CapEx), enable faster provisioning, avoid hardware vendor lock-in and, amid a plethora of other benefits, begin the move to the cloud.

It wasn't long before storage virtualization joined server virtualization in the data center IT team's toolkit. Like server virtualization, storage virtualization decoupled storage capacity from the physical device. In most cases, enterprises gathered the storage capabilities of multiple network storage devices into what appears to be a single pool of storage capacity.

Several years later, VMware introduced the broader vision of the Software-Defined Data Center (SDDC). The SDDC takes virtualization technologies and uses them to transform the data center—particularly, its cost structure and its business agility. With the SDDC, businesses can leverage their existing investments in virtualization to realize significant economic, operational, and strategic advantages.

Enterprise data centers had already started enjoying the benefits of server and [storage virtualization solutions](#); among other advantages, they were able to consolidate and repurpose hardware, reduce operational complexity and dynamically align application infrastructure with business priorities—at least, to a point because the data center network was not yet part of the SDDC.



Finally, IT turned its attention to the network, which was, comparatively speaking, proprietary, complex, and utterly rigid. The network was a significant barrier to businesses that wished to pursue the SDDC vision.

Enter network virtualization.

Network virtualization is the essential third pillar of the SDDC architecture. In essence, it does for networking what earlier forms of virtualization did for compute and storage assets. For example, server virtualization allows businesses to create, snapshot, delete, and restore virtual machines (VMs) as needed—without touching the underlying physical servers. Likewise, network virtualization allows businesses to create, save, delete, and restore virtual networks, also without having to worry about the underlying physical network.

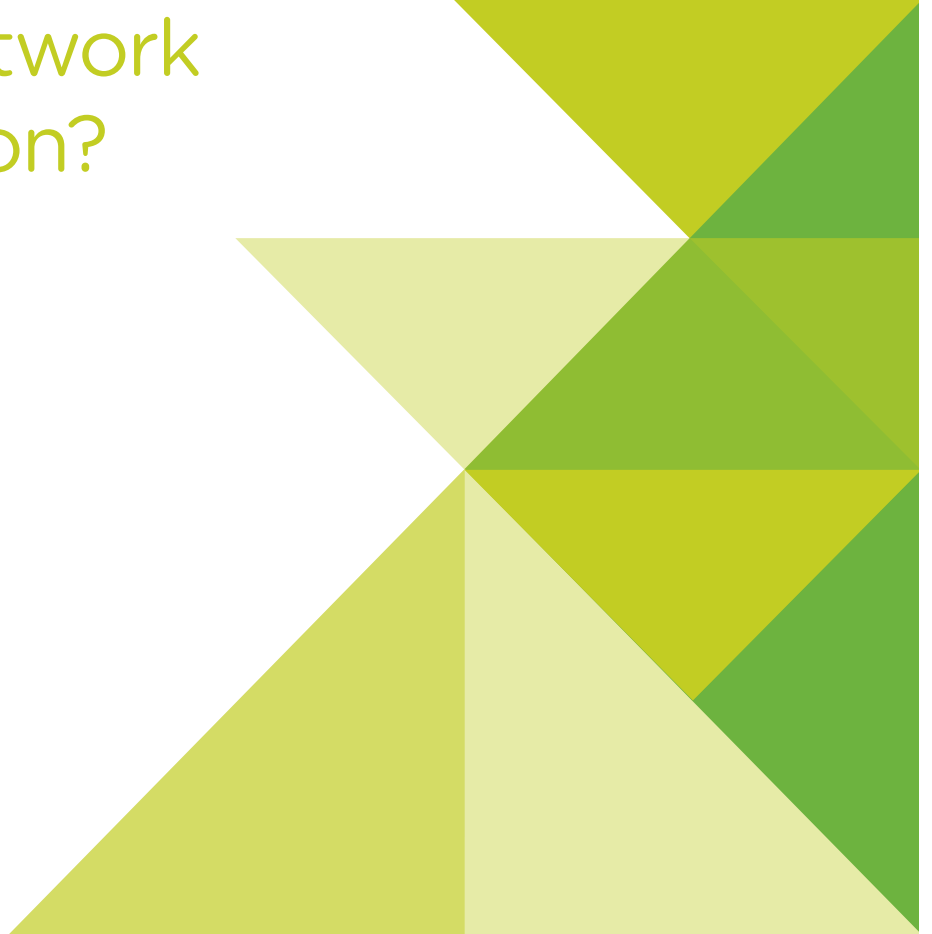
For the SDDC to function at full steam, management functionality is a necessity. Automation is required, otherwise enterprises won't achieve the full operating expense (OpEx) savings made possible by the SDDC; there would still be too much manual intervention required in provisioning, managing, and maintaining the servers, storage, and the network. Operational insight is also required, to monitor the health, performance and capacity of the network, and providing guidance on when it's necessary to take remedial action. Finally, business insight is required, allowing IT to analyze demand and usage so it can track costs.

Only with these management tools can IT reap the full benefits of network virtualization and the SDDC.



Chapter 1

What can you do with network virtualization?





For starters, network virtualization doesn't require a rip-and-replace of your existing network infrastructure. The technology—at least leading network virtualization products—can be implemented on any IP network, whether current designs or next-generation fabric architectures. It is vendor agnostic—it doesn't matter which vendor supplied your physical networking equipment. If you have a working network, you have the physical network infrastructure you need to deploy SDDC architecture.

Virtual networks enable what are known as overlay technology where each virtual network is fully isolated from other virtual networks and from the underlying physical network. Because the virtual network technology runs on top of the existing network and data center equipment, businesses preserve their infrastructure investments, while allowing additional architectural flexibility.

Here's just a partial list of the benefits you reap from network virtualization:

- **Cut provisioning time**—The VM operating model can be leveraged for the network. It can be used to programmatically create virtual networks on demand and provision network services for applications and other workloads in just minutes. Provisioning network resources in lockstep with server and storage resources enables revenue-generating applications to be deployed faster than before. This means that having a virtualized network leads to faster time-to-value.
- **Reduce costs and complexity**—Workloads can move freely independent of the network topology and availability of physical network resources. Everything a VM needs is provided



by NSX regardless of physical location. This means that you no longer have to over-provision server capacity within each application/network pod. You can access capacity wherever it is available—this means better resource utilization and consolidation and reduced need for new network infrastructure and forklift upgrades

- **Simplify Provisioning**—Automated network provisioning and a single interface for configuring and monitoring network services [simplifies network operations](#) and eliminates manually generated errors. Making changes to provision or de-provision network services is much easier since you do not need to touch the physical network. As a result you can increase your operational efficiency without the need for highly paid IT personnel
- **Eliminates the rigidity and complexity**

of current network topologies—Quite possibly, the network topology you have today is limited, complex, and plagued with issues. Layer 2 (L2) domains have the Spanning Tree problem. Network virtualization solutions that deploy overlays and work on L3 or on a combination of L2 and L3 eliminate these kinds of issues. And the fact that virtual networks work on L3 means you get a 24-bit virtual network interface that provide up to 16 million networks as opposed to the much-deployed 4,096 that VLANs allow

- **Secures the SDDC with micro-segmentation**—By moving from security that merely guards the perimeter to security policies that travel with workloads, network virtualization allows for much more robust security. Micro-segmentation has three key functions: isolation,



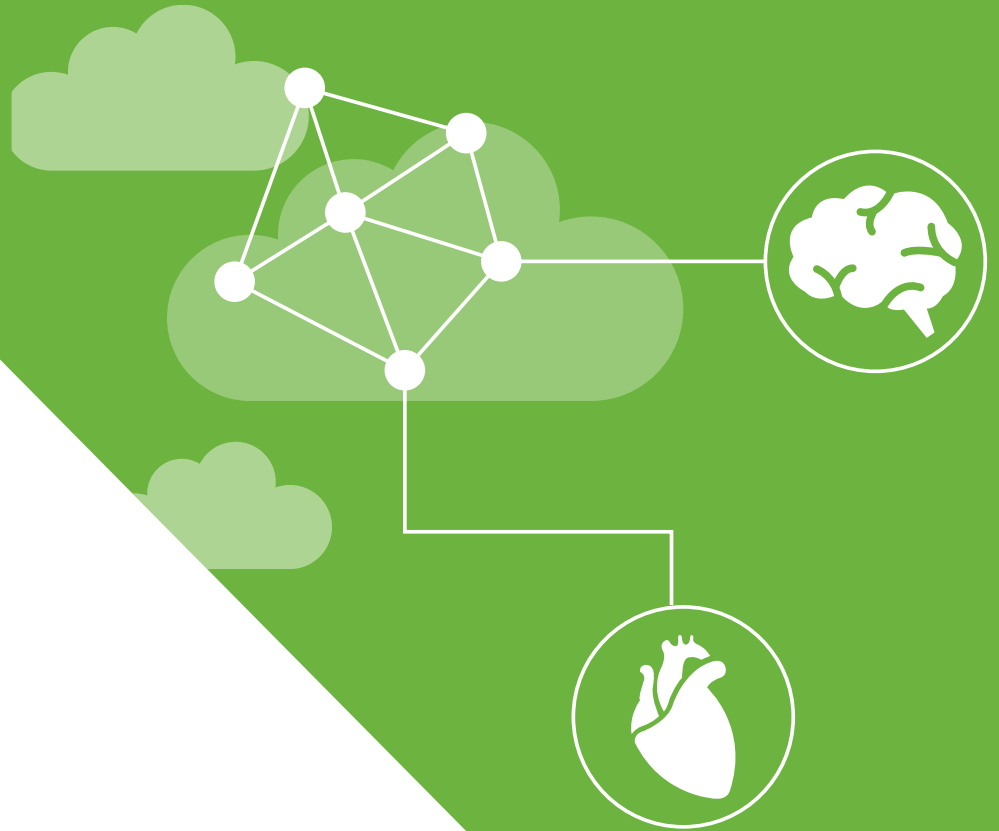
segmentation, and segmentation with advanced services. Isolation is the ability to separate each virtual network from other virtual networks and from the underlying physical network. Segmentation implies that virtual networks can be partitioned in a way that secures communication within the virtual network with flexible security policies that mirror business logic and workflows. Beyond using IP addresses, virtual networking technology policies incorporate virtual machine name, virtual network, OS,

and more—streamlining configuration and reducing errors. Finally, among the features implied by advanced services segmentation is dynamic security tags, which aid the sharing security information to adapt to changing security conditions

- **Minimize downtime**—Network virtualization helps an enterprise to reduce the downtime of its business-critical applications, which in turn improves user productivity and helps increase business revenue

Chapter 2

Anatomy of network virtualization





It's not uncommon for virtual machines (VMs) to need network connectivity to other VMs as well as to the outside world—the latter via WANs and the Internet. A software virtual switch on the hypervisor is the first network device these VMs are attached to. The “network” that is virtualized includes all the L2-L7 services viewed by the VMs in addition to the network configurations required to implement the application's network architecture. The network used by the VMs is frequently called the “virtual network.”

This name could be confusing, because of its similarity to virtual servers, which have been decoupled from the underlying physical hardware using server virtualization technology. But this isn't the case with a virtual network. In fact, provisioning an application's virtual network must be carefully engineered across multiple switches—both physical and virtual—as well as L4-L7 service appliances. Thus despite all this

virtualization technology, the application is still tied to the hardware.

Network virtualization changes that. It takes all of the network functionality necessary to provision the application's virtual network—everything from VLANs to load balancer pools, to multi-tenancy—decouples it from the physical network, and places it into a virtualization software-only layer.

With the virtual network fully decoupled, the physical network configuration is simplified to provide packet-forwarding service from one hypervisor to the next. And the two networks—the virtual and physical—can evolve independently of one another. This is a good thing, because virtual network capabilities evolve much faster than physical ones.

Network virtualization solves one particularly thorny problem with physical



networks: that of the manual deployment of network policy, features, and services that are viewed by the VMs.

The way network virtualization solves that is this: it reproduces the L2-L7 network services required to implement the application's virtual network at the same software virtualization layer that hosts the applications VMs. That's the hypervisor kernel and its programmable virtual switch.

This simplifies everything. You can now provision the application's virtual network at the software virtual switch layer using modern tools and APIs. No configuration is required in the physical network. The programmable software virtual switch layer gives you the whole virtual network functionality for each application—not omitting isolation and

multi-tenancy. Thus you've got the virtual network provisioned completely in software and by software. Because you use APIs, you've got the same quick provisioning as you do with server virtualization. The very identical software tools that you're using to provision an application's VMs can provision both compute and network at the same time.

Each application's network can finally keep up with its compute. And that's the beauty of network virtualization.

Policy-Based Management And Automation Is The Catalyst That Empowers The SDDC

- Cloud Automation accelerates the end-to-end delivery of infrastructure, applications, and custom IT services through the dynamic configuring of the virtualized infrastructure



- Cloud Operations monitors the health, performance and capacity providing the guidance to take corrective action
- Cloud Business Management provides visibility into cost and quality of service



Chapter 3

Cloud management and network virtualization: A catalyst at work



Today, the business world revolves around applications. Creating, delivering, and managing those applications is a formidable challenge for both IT development and infrastructure teams. But by virtualizing all aspects of the data center—specifically, the compute, storage, and networking—you’re finally getting close to building a true SDDC architecture that will make managing the application lifecycle much easier.

Of course, virtualizing your infrastructure won’t by itself provide the desired efficiency improvements if your infrastructure and applications are still being delivered by siloed manual processes, ones that take weeks to implement services the business needed yesterday.

So what is needed to address these fundamental challenges?

Cloud management—specifically, automation—is the catalyst to delivering IT services more efficiently. That’s because applications need much more than appropriately sized VMs. They also need networks configured with appropriate connectivity, security, availability, scale, and performance.

Think back to when server virtualization was new a decade ago and it was just starting to catch on. The primary driver for most companies was the CapEx savings generated by hardware consolidation and resource pooling. A side benefit was that virtual machines could be delivered much quicker than physical machines, helping accelerate service delivery times from many weeks or even months down to a few weeks or even days.

A combination of developments, most



notably, cloud automation and management will drive the next round of IT efficiency improvements. Automation will help accelerate IT service delivery from days and sometimes weeks to hours and even minutes. Policy-based governance and controls will assure that business users receive the appropriate level of resources for the tasks they need to perform their jobs. Performance and health monitoring will make sure that applications continue

to operate at peak efficiencies and make the appropriate adjustments to make sure that happens. Financial management capabilities will allow IT to compare costs of internal and external delivery models. Intelligent placement algorithms will help deliver the appropriate service level based on both cost as well as operational policies that control where specific applications and data need to be located.

Where the savings come in

Virtualization:

- Accelerate service delivery (weeks to days)
- Resource pooling for increased utilization of server resources
- Operational simplicity with operating model of VM

Automated Cloud Management:

- Accelerate service delivery (days to min)
- Improve operational efficiency
- Optimize resource utilization



If network administrators can't configure all of the network services dynamically in the context of deploying an application, then it will take them additional manual steps to complete a partially automated application deployment. A cloud management solution can dynamically

provision network logical services customized to the specific needs of each application. The combined capabilities of these products empower IT to fully automate the delivery of secure, scalable, and high performing multi-tier applications.

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Chapter 4

How VMware brings it all together



VMware vRealize Suite is a comprehensive management solution for harnessing the SDDC architecture. This portfolio of four solutions delivers a wide range of

functionality that supports the network capabilities of VMware NSX, VMware's network virtualization and security virtualization solution.

Product 	Function 	Benefit 
vRealize™ Automation	Automate the delivery of infrastructure and application services	Business agility; right-size app/resources; reclaim inactive resources
vRealize™ Operations	Automate operations management, including performance, capacity and configuration management	Holistic view of infrastructure; proactively avoid performance issues; enable optimal resource usage
vRealize™ Operations Insight™	Real-time log management across physical, virtual and cloud environments	Proactively identify and resolve problems faster with intelligent operations across all machine generated data
vRealize™ Business™	Get transparency and control over the costs/quality of IT services	Control/optimize IT budget; align IT with business priorities



Taken altogether, vRealize Suite delivers:

Automation—IT can automate a wide selection of self-service networking infrastructure and application services through a web-based portal and catalog. This allows IT to model networks and applications once, and deploy them in any cloud—private, public, or hybrid. IT also gets zero-touch provisioning, where the right levels of resources are automatically allocated based on business rules and service-level requirements. Administrators can also dynamically orchestrate and balance workloads to meet changes in business demand.

Intelligent Operations—IT also obtains insight into performance, capacity and configuration management with an operations platform that allows administrators to proactively identify and remediate issues with predictive analytics and smart

alerts. Customizable dashboards give administrators app-to-storage visibility, and can even extend the power of analytics to unstructured data with integrated log management for faster root-cause analysis. Because of all this, administrators will never again have over- or under-provisioned VMs or networks, and IT can leverage capacity modeling to anticipate and optimize future needs.

Business Insight—IT also needs insight into the business aspect of the data center. vRealize Suite allows administrators to view and compare the costs of complex initiatives and investments, including private and public clouds. This allows IT to perform equitable chargeback with visibility and transparency into the types, cost and quality of IT services consumed by various business units.

Unified Management—vRealize Suite



provides a single, extensible platform to provision and manage applications and infrastructure on-site and in the cloud, and for both traditional and cloud-native application architectures. Two of the solutions in the vRealize Suite, vRealize Automation, and vRealize Log Insight, are proving especially popular with businesses that have deployed VMware NSX. vRealize Automation works with VMware NSX to provide outstanding connectivity, security, and availability, whereas vRealize Operations Insight provides radically improved visibility into your network with extensions

specifically for NSX.

By deploying network virtualization in conjunction with a leading cloud management platform such as vRealize, IT can finally obtain significant business gains ranging from reduced CapEx and OpEx spending to much faster business processes and IT agility. These final components—NSX and vRealize—often cap the completion of a software-defined data center, an approach that transforms IT into a valuable business partner and an agile, internal service provider.

[Click here to find out more about VMware's NSX network virtualization platform.](#)

From there you'll be able to try out NSX for free via VMware's Hands On Labs, as well as contact a VMware specialist who can get you started on your journey to network virtualization.