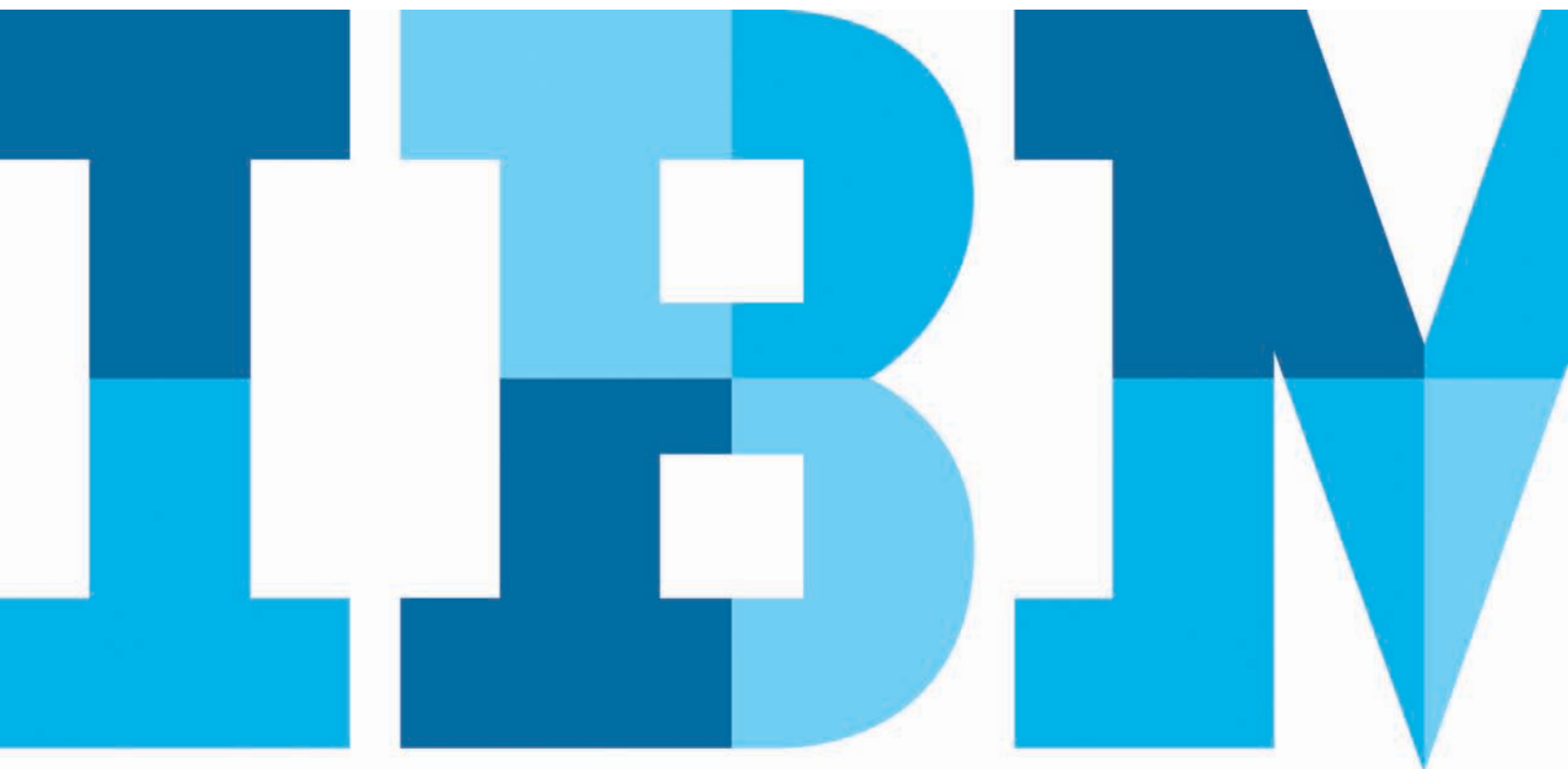


# IBM Software Defined Network for Virtual Environments

*Network virtualization for the network you have*



## The promise of SDN, the performance of IBM

Into a world populated by position papers, statements of direction and technology roadmaps, IBM introduces its latest solution that supports the next major advance in enterprise communications, which is Software Defined Networking (SDN). Hailed as “the most exciting and disruptive data center networking technology in decades,”<sup>1</sup> SDN is a new network paradigm that separates network control logic from the underlying network hardware.

With SDN, instead of having to directly configure each connected device that makes up a network, administrators can dynamically establish multiple networks. They can also allocate bandwidth and route data flows for optimized performance using high-level control programs. By overlaying virtual networks onto physical networks, administrators can make existing infrastructure more adaptable to different workloads. The result is an agile, optimized, scalable network that is responsive to the needs of the business.

This is the promise of SDN. IBM is putting it to work with IBM Software Defined Network for Virtual Environments (SDN VE), a network overlay solution that supplies a complete implementation framework for network virtualization. In short, SDN VE software supplies a core component of SDN architecture, which is fully deployable for data center expansion.

The purpose of this white paper is to provide an overview of the functions and benefits of SDN VE, and outline the steps to implementation.

## A short history of IBM SDN VE

SDN VE began as a breakthrough innovation developed at the IBM Research Laboratories in Haifa, Israel. The research was published in a 2011 paper describing Distributed Overlay Virtual Ethernet (DOVE).<sup>2</sup> SDN VE is founded on this host-based overlay technology, which achieves advanced network abstraction that enables application-level network services in large-scale multitenant environments. The technological breakthrough that

SDN VE represents demonstrates that IBM is committed not to just accommodating major shifts in technology, but leading them by pioneering new technology models. SDN VE is a direct outcome of this initiative.

## The ultimate app for agile data center connectivity

SDN VE is a multi-hypervisor, server-centric solution comprising multiple components that overlay virtual networks onto any physical network that provides IP connectivity. The software is designed to support multivendor data center environments. IBM SDN VE VMware Edition is the first release of this solution.

Although implementing the software does not require changes to physical infrastructure, the hypervisor must be updated. Specifically, implementing SDN VE VMware Edition requires an SDN VE Virtual Switch (an upgrade to the IBM Distributed Virtual Switch 5000V) to be resident in VMware. SDN VE VMware Edition is packaged for easy installation using VMware install and update tools.

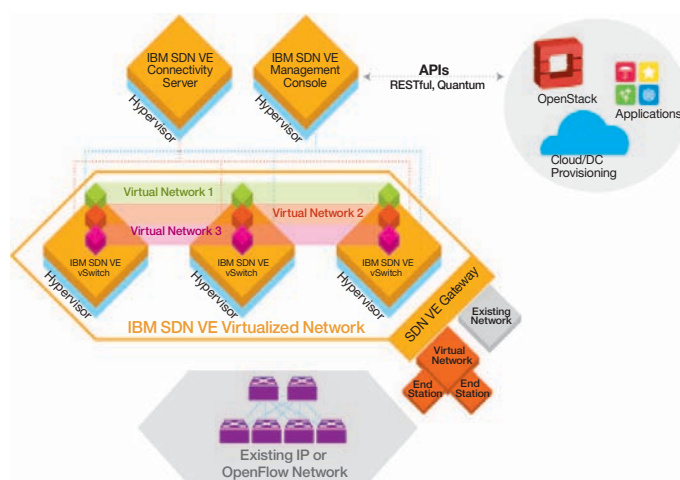


Figure 1. IBM SDN VE is a multi-hypervisor virtual network overlay that uses existing IP infrastructure

## Components of the IBM SDN VE solution

The SDN VE solution is made up of four software components that work in combination to provide effective host-based network virtualization.

- An SDN VE Virtual Switch is software that resides in the hypervisor. It serves as the start and end point of each virtual network. The SDN VE Virtual Switch provides Layer 2 and Layer 3 network virtualization over a UDP overlay, and implements the data path of the virtual network. The virtual switch also performs control plane functions to support virtual machine (VM) address auto discovery, VM migration and network policy configuration.
- A connectivity service disseminates VM addresses to the virtual switches participating in an SDN VE virtual network. The connectivity service software is deployed as a cluster of virtual appliances.
- A management console is the centralized point of control for configuring IBM SDN VE. It configures each virtual network, controls policies and disseminates policies to the virtual switches. It also helps administrators manage individual virtual networks. The software resides on a server as a virtual appliance.
- VLAN- and IP-based gateways enable SDN VE to establish interoperability with networks and servers that are external to the SDN VE environment. For Layer 2 networks, SDN VE provides VLAN-based gateways. For Layer 3 networks, the software provides IP-based gateways.

## Benefits of the IBM SDN VE solution

The SDN VE solution offers data center managers many ways to expand services and control costs. Benefits of the software include:

- Virtualizes existing IP networks with no change to the underlying physical network infrastructure
- Automates network provisioning and simplifies administration, which can help reduce operating expenses

- Expedites data center consolidation by allowing existing network addresses to be retained
- Enables large-scale multitenancy with independent management and optimization of multiple virtual networks
- Improves server resource utilization and return on investment (ROI) by removing the network as a bottleneck to increased VM density
- Provides API-based programmatic access to virtual networks, which allows data center provisioning platforms and network services to use virtual networks as a service or as an infrastructure

## No disruption to existing IP networks—what a disruptive idea

No CIO wants to replace a data center network. In most large-scale data centers, network administrators strive to wire the network one time then operate and maintain it without change. The fact is, changing the underlying physical infrastructure to support new business application requirements is hard to do and typically takes days to weeks to complete. This is a central problem data center managers must resolve. When compute and storage resources can be provisioned rapidly but network connectivity cannot, it can negatively impact business agility.

SDN VE can help data center managers increase business agility by enabling rapid provisioning of virtual network services without disrupting existing physical assets. The software does not require any changes to existing networks to operate, a valuable attribute that simplifies adoption.

The only requirement to implement SDN VE is a simple one. The physical network infrastructure on which the software is overlaid must be capable of providing IP address-based connectivity. Every enterprise data center network supports this capability.

SDN VE efficiently overlays virtual networks onto existing networks, thus decoupling application connectivity from the physical network infrastructure. This enables a “wire once” physical network that can support multiple SDN VE virtual networks which can be flexibly managed and controlled through highly available clusters of IBM SDN Connectivity servers and the IBM SDN Management Console. This architecture separates the control plane from the data plane, a central tenet of SDN.

SDN VE operates by adding a distinct header to packets sent by VMs. Each SDN VE data transfer is just an ordinary IP packet sent to the existing switches in the data center network and the switches can use existing IP forwarding routes and tables. Devices continue to operate at line rates. The SDN VE solution builds on the network that is already in place, and provides the flexibility to create and manage virtual networks on demand.

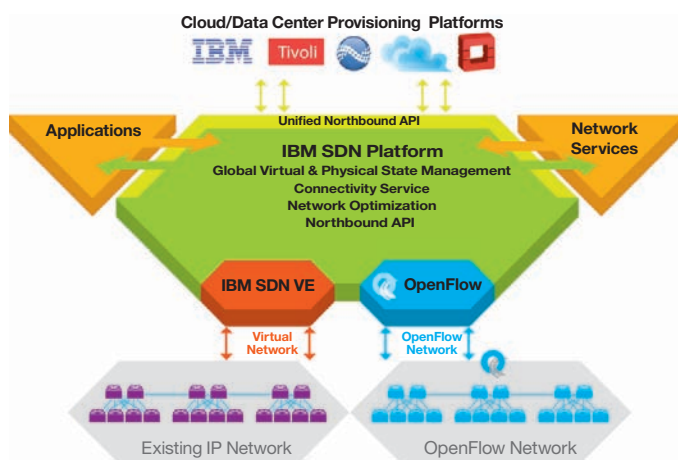


Figure 2. IBM SDN VE is a core component of the IBM platform for Software Defined Networking. It abstracts the underlying network and presents it to applications as either a service or as an infrastructure.

## IBM SDN VE does for networks what virtualization does for compute

SDN VE is a logical extension of the virtualization trend that has become the dominant feature in the data center. The software extends the efficiency and productivity advantages achieved with server virtualization to the process of network provisioning and management. These advantages allow data centers to be more:

- Efficient, because SDN VE improves resource use. It allows secure, dedicated virtual networks to be created quickly and easily, without requiring changes to the underlying physical infrastructure.
- Agile, because SDN VE cuts network provisioning time from days to minutes. With SDN VE, you can establish secure virtual networks as easily as starting up VMs.
- Scalable, because SDN VE offers data center managers the scalability needed for current and future growth. Up to 16 million networks can be specified in the architecture. The first release supports 16,000 virtual networks.

## High availability, the ultimate data center imperative

Enterprise data centers maintain uncompromising standards for high availability, which reflects the value that data center operations contribute to the enterprise. In many cases, the data center is one of the most valuable components in the business because the enterprise cannot function if the data center is down. SDN VE supports enterprise needs for high availability with customizable, redundant component design.

Two or more active SDN VE Connectivity Servers control each virtual network. The number of SDN VE Connectivity Servers that can be assigned to individual virtual networks is user-configurable. This ensures that the user can select the level of high availability needed for a given virtual network. This redundant design allows the state of each SDN VE Connectivity Server to be replicated in at least one other instance of the SDN VE Connectivity Server at all times. The SDN VE

Management Console provides high availability in Active and Standby modes. One instance operates in Active mode, and the other functions in Standby mode. If an Active SDN VE Management Console experiences a failure or outage, automatic failover to the Standby SDN VE Management Console occurs. SDN VE Gateways also support redundancy, allowing failover in the event of an outage. In these ways, SDN VE is a high-performance, high availability solution.

### Secure, scalable multitenancy for cloud providers

What can be gained by adopting SDN VE if you are already using VLANs? With SDN VE you can create secure, scalable multitenant networks with individual network control. Each virtual network created with SDN VE can be managed individually using the application programming interface (API) the software provides. In addition, you get greater scalability with SDN VE: A traditional network is physically limited to 4,096 VLANs, and requires configuration of end-to-end VLANs on some or all physical devices in the network. With SDN VE, the maximum number of VLANs that can be supported increases from a physical limit of 4,096 networks to an architectural limit of 16,000,000. The first release of SDN VE—SDN VE VMware Edition—supports 16,000 virtual networks. Cloud providers need to support multiple customers with dedicated, reliable, secure and scalable networks, and SDN VE can help supply these services with increased cost effectiveness and efficiency.

### Data center consolidation

Data center consolidation is a common practice among large enterprises today because of the increased economy and efficiency that can be gained. Consolidation can also be necessitated by mergers and acquisitions because the acquiring company wants to ensure that all customers receive the same service experience. The difficulty centers on combining IP addresses. Redesigning complete network schemas is an exceptionally complex and time-consuming challenge. SDN VE resolves this problem by reusing existing IP addresses. In fact, the network address of each VM in an SDN VE virtual network is not

exposed to the physical network. SDN VE only exposes one network address per NIC. This greatly simplifies the process of creating and deploying virtual networks on demand.

### Maximizing server ROI

VMs require real network connections. However, since it is much easier to create VMs than it is to network them, your network resources can be exhausted before you can use your servers to the fullest extent. Maximizing server use is a principal reason to implement SDN VE. With the software in place, VM density can be increased to the limits of memory, and processor cycles and server virtualization can continue without concern for VM network bottlenecks. With SDN VE, you can establish a “wire-once” data center network environment with expansion capacity for future growth and increased virtualization.

### Optimizing network provisioning with programmable APIs

The SDN VE solution provides programmatic access to virtual network functions using RESTful APIs, which can provide web services to any client program able to transmit messages using the HTTP protocol. SDN VE also supports the OpenStack Quantum API, which is a network abstraction that allows OpenStack to use the underlying network as the infrastructure without requiring it to have knowledge of the underlying resources.

### Conclusion: Helping you build a software-defined environment

In the era of Smarter Computing, entire data center infrastructures will become as programmable as individual systems are today. Compute, storage, network and middleware components will be tuned to the workload, endlessly scalable and adaptable to dynamic workload demands. The data center, in short, will be efficient, flexible, purpose-built and aligned with the needs of the business. With SDN VE software, secure multitenant network virtualization and abstraction of physical assets are not merely capabilities your network will have in the future. They are benefits you can achieve with the network you have today.

## For more information

To learn more about the IBM Software Defined Network for Virtual Environments, visit: [ibm.com/systems/networking](http://ibm.com/systems/networking) or contact your IBM representative or IBM Business Partner.

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<sup>1</sup> For more information read: IBM delivers smarter virtual networks with new OpenFlow controller Vikram Mehta, VP System Networking at: [https://www-304.ibm.com/connections/blogs/VMstg/?lang=en\\_us](https://www-304.ibm.com/connections/blogs/VMstg/?lang=en_us)

<sup>2</sup> For more information read: Designing Modular Overlay Solutions for Network Virtualization at: [http://domino.research.ibm.com/library/cyberdig.nsf/papers/F59140F39B4A09E285257A750043F4A6/\\$File/h-0316.pdf](http://domino.research.ibm.com/library/cyberdig.nsf/papers/F59140F39B4A09E285257A750043F4A6/$File/h-0316.pdf)



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