



VMware EVO SDDC Overview

WHITE PAPER

Introduction

Fueled by trends such as business analytics and mobility, the public cloud continues to expand year after year. Lines of business enjoy the agility and scalability required for next generation applications by accessing the public cloud. For stability, security compliance, and service level agreement enforcement, CIOs continue to choose private clouds. However, CIOs struggle to provide a public cloud experience because they are stymied by technology and process challenges.

The VMware Software-Defined Data Center (SDDC) addresses these challenges. VMware's vision is a software-defined data center where the concepts of virtualization are extended across all data center resources and services (compute, storage, and networking) to deliver a fully automated, zero-downtime infrastructure that can transparently include different hardware over time. SDDC provides abstraction, pooling, and automation of the compute/storage/networking infrastructure services. Under SDDC, policy-driven automation will enable provisioning and ongoing management of both physical and logical compute, storage, and network services. Ideally, in this environment, physical infrastructure disappears with flexibility to transparently support business needs today and tomorrow.

To achieve this vision requires delivering an integrated hardware and software stack that just works. Unfortunately, delivering this remains a non-trivial challenge as that requires disparate pieces of virtualization software, management, and automation tools to be tightly integrated while dealing with variations in hardware configurations and resources. With multi-vendor environments, CIOs struggle to realize the SDDC value proposition and efficiently apply resources needed to procure, install, manage, and patch an SDDC private cloud.

SDDC Challenges

There are three phases in the development of the private cloud. Each has its own challenges. First, customers must select the right set of server, storage, and networking hardware capabilities and ensure that the hardware is compatible with the SDDC software stack. Once the hardware is selected, ordered and received, customers must install and configure the hardware and software stacks. Second, IT must patch and upgrade existing pools of resources as well as add new pools of private cloud resources to keep the cloud highly available and conforming to performance requirements. Existing silos within IT make it especially challenging to quickly deploy resources and ensure they meet performance specifications while ensuring that the infrastructure is secure. Additionally, even after the time is spent, best practices on new technology are not always understood. Therefore, configurations may not be optimal in terms of performance and availability for customer workloads. Finally, when operational issues do arise, a single point of contact to reduce the mean time to innocence is required. Given these issues, enterprises struggle to achieve the agility, economy of scale, and efficiency of hyper-scale clouds.

The VMware EVO™ SDDC™ simplifies the build, deployment and management of a data center infrastructure and the resulting SDDC-based private cloud. EVO SDDC consists of the VMware components and third-party software needed to instantiate and manage a complete SDDC on a Hypervisor-Converged Infrastructure (HCI) with compute, storage, and network virtualization. The EVO SDDC is tested to run only on a pre-qualified EVO hardware and software Bill of Materials (BoM) including servers and switches sold by VMware EVO partners. Partners use the EVO SDDC to pre-integrate and deliver differentiated integrated systems to efficiently deploy and operate an SDDC private cloud.

Thus, the EVO SDDC delivers a self-contained private cloud instance that can be easily deployed in a corporate network. Based on a scale-out architecture, an EVO SDDC BoM starts as small as one-third of a rack (8 nodes) and scales to multiple racks – in as little as one server node at-a-time. In addition, the EVO SDDC provides a cloud admin user interface that is a single point of entry for managing the SDDC private cloud and to orchestrate the lifecycle management of the entire hardware and software stack.

EVO SDDC Cloud Services

By moving infrastructure to a service-based model, organizations can focus their time and resources where they belong - on developing innovations in applications and solutions. The EVO SDDC automates construction, operations and patching of Infrastructure as a Service (IaaS) and Virtual Desktop Infrastructure (VDI) within the private cloud.

Infrastructure as a Service

The EVO SDDC automatically provisions infrastructure for on-demand virtual machines. Cloud administrators have the ability to expand and contract the underlying infrastructure to meet their changing business needs. With a foundation that is based on the market leading virtualization platform, lines of business have the flexibility to deploy a wide variety of OS and application stacks within the tenant VMs. Virtual infrastructure admins can integrate with and monitor the underlying infrastructure using a unified EVO SDDC monitoring toolset that aggregates and correlates across physical and virtual infrastructure. In addition, customers have flexibility to integrate their VMware vSphere® compatible tools directly with VMware vCenter™.

Virtual Desktop as a Service

VDI infrastructure deployment is a non-trivial task requiring sizing and configuration of connections servers, authentication servers, databases, networking, and security. The EVO SDDC makes virtual desktop deployment faster and more secure. Private cloud admins focus on specifying the policies and needs of the VDI infrastructure instead of dealing with details of deploying the VDI infrastructure. The EVO SDDC takes as input the logical capacity, SLA, and policy needs of target virtual desktops and automates provisioning of fully installed and configured VMware Horizon® VDI. Customers experience a highly simplified integration of Active Directory (AD) and associated databases. The EVO SDDC also automates the configuration and installation of VMware NSX™-based networking and micro-segmentation security for virtual desktops.

VMware EVO™ Software Defined Data Center

The EVO SDDC integrates logical and physical compute, storage, and networking into a unified solution. For illustration purposes, Figure 1 describes a dual rack configuration. Each rack contains x86-based servers with Direct Attached Storage (DAS), top of rack (ToR) switches, a management switch and Power Distribution Units (PDU). The first rack contains spine switches to interconnect racks in a highly resilient, scale-out, leaf-spine architecture. The VMware EVO SDDC, which includes VMware vSphere, NSX, and Virtual SAN™, is installed to pool network, compute, and storage capacity in a single virtual rack. To carve out logical capacity from the virtual rack, customers utilize the EVO SDDC Manager, the physical and logical infrastructure management plane that complements the existing suite of VMware management software (vCenter, vRealize™ Operations™, vRealize Log Insight™, etc.). Figure 2 describes the key components of an EVO SDDC instance.

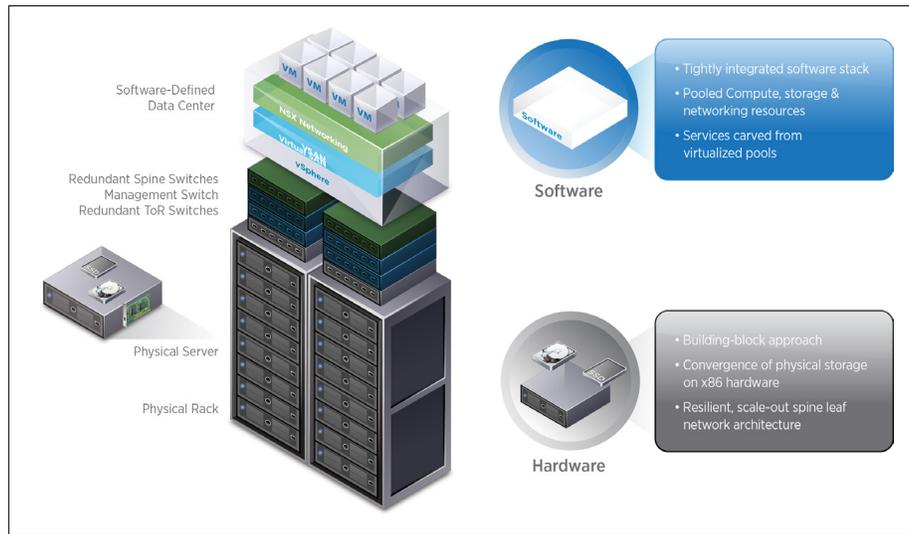


Figure 1: VMware EVO SDDC elastic and resilient hardware and software architecture

VMware EVO SDDC Manager

For the logical infrastructure, the EVO SDDC includes the familiar, VMware virtualization and management components augmented by a new component, the VMware EVO SDDC Manager™. The VMware EVO SDDC Manager serves as the single interface for managing the logical and physical infrastructure of the private cloud. From this console, the cloud administrator can provision new private cloud resources, monitor changes to the physical and logical infrastructure, manage lifecycle and other operational activities. Private cloud customers can now expect to consume their resources in a manner consistent with the public cloud. EVO SDDC Manager provides REST-based API's to integrate with the existing data center management and monitoring tools.

To configure and manage the underlying hardware, the VMware EVO SDDC Manager relies upon the EVO Hardware Management Services (HMS). The HMS is a hardware abstraction layer that interfaces with the hardware components such as servers, switches, PDUs, and other physical devices. It is responsible for discovery, inventory, monitoring, configuration, and lifecycle management of individual servers or switches. For example, HMS automatically discovers new servers, bootstraps or resets them, and processes hardware events (e.g., alarms, sensor data threshold triggers) and state changes. EVO Hardware Monitoring Services then exposes events and state changes to the rest of the EVO SDDC in a hardware-independent manner. HMS also supports rack-level boot-up sequencing of hardware components and provides services such as secure, remote, hard reset of these components. HMS is part of a dedicated management infrastructure running in each physical rack.

Server

An EVO SDDC server is an Intel x86 based server. Each server typically contains redundant, multi-gigabit network interfaces, power supplies, a combination of hard drives and solid state drives. To provide a reliable power source to the servers, every rack is equipped with redundant power distribution units.

The market-leading VMware vSphere Enterprise Plus software serves as the virtualization layer enabling VMware vMotion®, Distributed Resource Scheduler®, High Availability and Network IO Controller and many more features. While EVO SDDC Manager constructs and manages the virtualization environment, cloud administrators continue to have full administrative access to the market leading, ESXi™ hypervisor and vCenter.

Storage

Virtual SAN, an example of hypervisor converged infrastructure, is a distributed layer of software that runs natively as a part of the ESXi hypervisor. Virtual SAN aggregates local or direct-attached capacity devices of a host cluster and creates a single storage pool shared across all hosts in the Virtual SAN cluster. While supporting VMware features that require shared storage, such as HA, vMotion, and DRS, Virtual SAN simplifies storage configuration and virtual machine provisioning activities when compared to external storage options.

Based upon simplified availability and performance policy, the EVO SDDC Manager provisions and configures VMware Virtual SAN. For additional flexibility, the EVO integrated system provides interfaces to external IP-based storage in addition to Virtual SAN.

Networking

The EVO SDDC deploys, configures, and manages two layers of networking: the physical network and the virtual network overlay.

Physical Networking

The software defined compute and storage infrastructures change the predominant network traffic patterns from north-south to east-west. The EVO SDDC deploys an integrated spine-leaf network topology that creates a self-contained cloud instance in which all the inter-rack traffic is carried across the leaf-spine network. This network architecture offers a number of benefits in the modern data center including

1. Scale out networking design
2. Lower latency between hosts
3. Reduction in congestion points compared to three tier architectures
4. Isolation from the existing corporate network so that there is a well-defined single point of attachment to the existing corporate network to carry North-bound traffic and enforce security and access control policies

The EVO SDDC networking hardware includes

1. Redundant spine switches for connectivity among racks
2. Redundant top of rack Switches (ToR) in each rack for aggregated/redundant connectivity to the servers
3. Management switch for out-of-band connectivity to the management consoles on the servers, top of rack, and spine switches
4. Highly-available network design with multiple paths between any two servers

Redundant ToR switches provide intra-rack connectivity and multi-chassis link aggregation to each host. To scale out, the top of rack switches are connected to redundant spine switches as new racks are brought online. To integrate with customer's existing data center network, EVO SDDC Manager configures the top of rack switches to connect to the corporate network using highly available Layer 2 or Layer 3 protocols.

Virtual Networking

VMware NSX is a software networking and security virtualization platform that delivers the operational model of a virtual machine for the network. Virtual networks reproduce the Layer2 - Layer7 network model in software, allowing complex multi-tier network topologies to be created and provisioned programmatically in seconds. NSX also provides a new model for network security. Security profiles are distributed to and enforced by virtual ports and move with virtual machines.

NSX includes a library of logical networking services - logical switches, logical routers, logical firewalls, logical load balancers, logical VPN, and distributed security.

EVO SDDC Manager deploys and configures these logical networking services. For example, in VDI deployments, EVO SDDC Manager enables micro-segmentation to secure each virtual desktop from unauthorized access or the spreading of network based worms. Virtual networks are programmatically provisioned and managed independent of networking hardware. This decoupling from hardware introduces agility, speed, and operational efficiency that can transform datacenter operations.

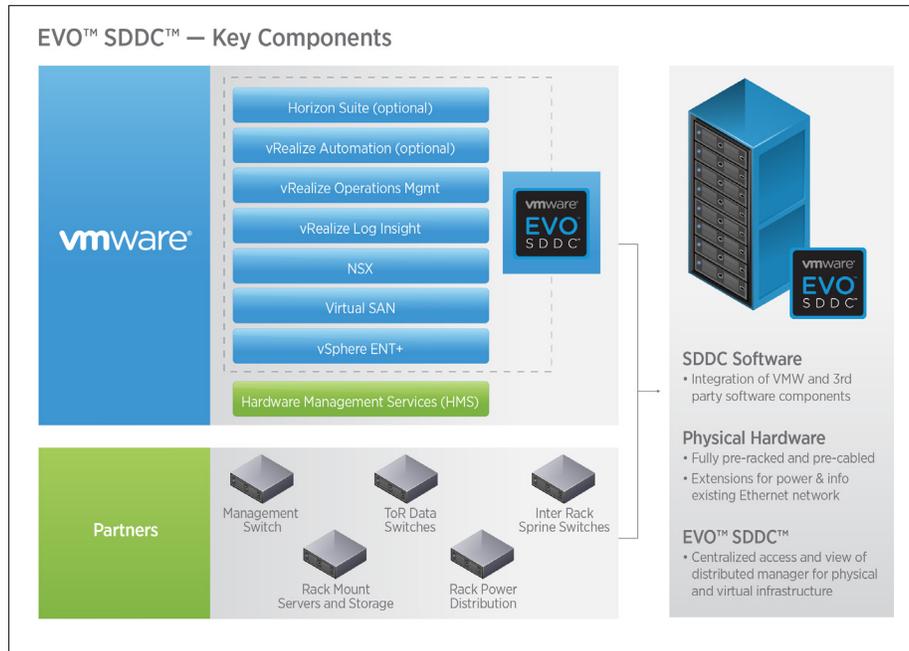


Figure II: The EVO SDDC Physical and Logical Components

Day 0 Experience

A key EVO SDDC value proposition is the simplification and speed with which a customer may procure, build, deploy, manage, and operate a SDDC instance. Towards that end, EVO SDDC vastly simplifies the “Day 0” experience including procurement and installation.

Procurement

Customers start their private cloud deployment process by sizing an EVO SDDC instance. The sizing process translates into an EVO SDDC bill of materials (BoM) consisting of both hardware and software components. Based upon the BoM and resultant purchase order, EVO SDDC partners integrate and ship an integrated system consisting of rack of servers, server sub-components, power distribution units, switching infrastructure and EVO SDDC software.

Within this hardware BoM, customers have the flexibility to choose variations in

1. Hardware vendors across racks (footnote: servers must be homogenous within a rack)
2. Initial rack size starting at 8 servers (1/3 rack) and growing to 8 racks (for the 1.0 version of the product but future versions will scale to 10s of racks)
3. Server model
4. CPU and memory (amount of RAM, no of cores, CPU version, etc)
5. Storage drive sizes and combinations (SSD and HDD)

Software Defined Data Center Installation

The EVO SDDC simplifies private cloud deployment and instantiation on the first day of use, installation day. Figure III illustrates the process of translating a customer request into the Day 0 deployment of an SDDC-ready private cloud after the customer sizes its needs and places an order. Each EVO SDDC integrated system is pre-cabled and pre-imaged at the manufacturer before the rack is shipped to the end user. Once the power and networking is provided to the rack, the EVO software components leverage their knowledge of the hardware bill of materials and user provided environmental information (e.g. DNS, IP address pool, etc.) to initialize the rack. The whole initialization process takes approximately two hours. When the process completes, the customer has an SDDC-ready virtual infrastructure to start deploying vSphere clusters and provisioning workloads.

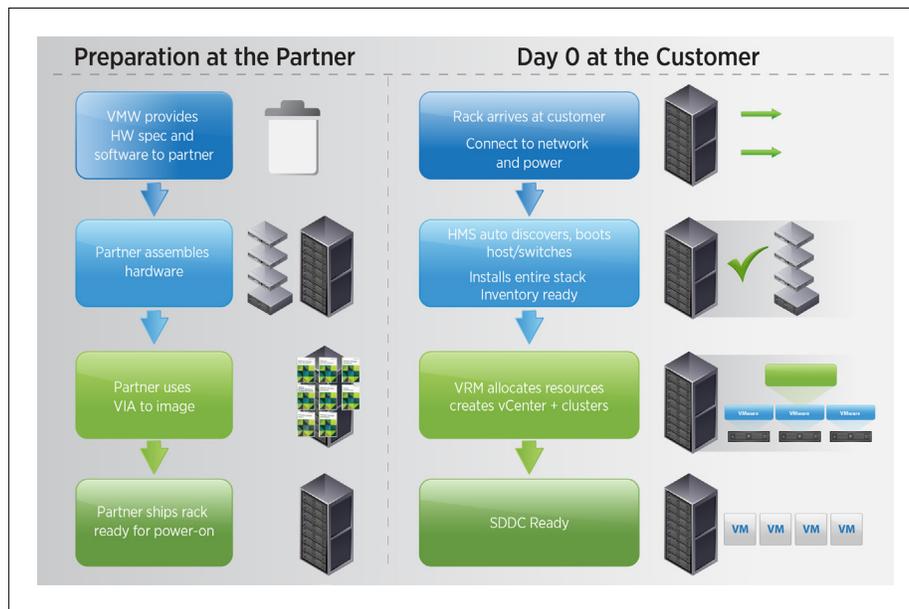


Figure III: Customer experience with ordering and bring-up of the SDDC infrastructure

Automated Private Clouds with Workload Domains

Extensive coordination is required across networking, server and storage silos to construct private clouds that are highly available and meet performance requirements. With the EVO SDDC integrated systems, a cloud administrator will need only to create and manage pools of resources targeted at each workload.

For this purpose, the EVO SDDC introduces a new abstraction, Workload Domains, for creating resource pools across compute, storage, and networking. Workload domains are a policy-driven approach for capacity deployment where each workload domain provides the needed capacity with specified policies for performance, availability, and security. For instance, a cloud admin would create a separate workload domain for a dev/test workload that has different performance (balanced) and availability (low) requirements than a separate workload domain for a production workload requiring high availability and high performance.

EVO Cloud manager provides and automatically implements a deployment workflow to translate the workload domain specifications into the underlying pool of resources. For example, based upon availability policy, EVO SDDC Manager would choose hosts from one or more fault domains. A cloud administrator need only focus on specifying policies and capacity needs and treat each workload domain as a separate, atomic entity for the purpose of operational management. Workload Domains relieve a cloud administrator from having to research and implement best practices needed to achieve the operational goals.

Lifecycle Management

Automated Patch Management

Data Center patch management is typically a manual, repetitive task that introduces configuration errors or slows the roll out of new features or security and bug fixes. The EVO SDDC Manager automates patch management for both the logical and physical infrastructure freeing resources to focus on business critical initiatives while improving reliability and consistency. Components eligible for patching include the VMware EVO SDDC software, physical switching, and server firmware.

Patches are provided in two different cadences. First, regular, pre-scheduled releases include feature, bug, and non-critical security. Second, asynchronous releases deliver critical security when required.

The EVO SDDC lifecycle management is designed to be non-disruptive to tenant virtual machines within a specific workload domain. By intelligently utilizing live VM migration, EVO SDDC Manager can intelligently patch servers, switches and the SDDC stack to improve infrastructure security and reliability while maintaining tenant uptime.

End to End Integration Testing

Validation testing of the software and hardware firmware stack requires extensive quality assurance testing in proof of concept environments. Strapped for time, IT must sometimes make the difficult decision to deploy new patches before they are fully vetted or defer new patches. Both situations increase risk for the private cloud. Due to the hardware BOM, VMware can test all components of the EVO managed private cloud together before shipping new patches to the customer. In this way, the EVO SDDC integrated systems are more stable, consistent, and secure than existing private cloud installations.

Operations

Monitoring

Private cloud service disruptions or degradations may require significant time to root cause and repair because tools and processes span multiple silos. EVO Cloud Manager understands the physical and logical topology of the software defined data center, their relation to each other, and efficiently monitors the infrastructure to detect potential risks, degradations and failures. It provides stateful alert management to prevent notification spam on problem detection. Each notification includes clear description of the problem and provides remediation actions needed to restore service quickly. Degradations / failures are aggregated and correlated to workload domains to enable a clear view of the impact of any issue to the business services being deployed within a domain. Therefore, the EVO SDDC Manager can greatly reduce the mean time to resolution across organizational and technology silos.

The EVO SDDC integrates vRealize Operations to provide advanced monitoring and analytics across physical and virtual infrastructure including NSX. It also integrates vRealize Log Insight to enable easier problem diagnosis and repair from unstructured data. The EVO SDDC Cloud Manager provides REST API's for integration with third party monitoring tools.

Backup

To address both planned and unplanned downtime scenarios, customers require the ability to backup and restore VM's located in the management cluster and other workload domains. The EVO SDDC solution provides customers the ability to install vADP compliant plug-ins on all vCenters. Backups can be placed on VMware EVO SDDC controlled hosts or external IP-based storage arrays. This architecture provides backup administrators with a set of choices along with the efficiency that comes from using a common set of tools across their data center.

Additionally, the EVO SDDC lifecycle management feature considers data protection before any patching scenario, performing a snapshot beforehand. The lifecycle management capability will reverse changes in case of a patch failure or merge snapshots if patches are successful.

Conclusion

VMware's Software-Defined Data Center vision extends virtualization across all data center resources (compute, storage, and networking) to offer a fully automated, policy-driven resource provisioning, management, and operation of a private cloud. EVO SDDC integrated systems deliver on this promise. EVO SDDC Manager, the central orchestrator of the solution, provides:

- Automated, simplified, rapid setup of the entire SDDC-based private cloud
- Integrated management of servers/switches and virtualized resources from a single pane
- Operational simplicity and automation for health monitoring of both physical and virtual infrastructure
- Workload Domain abstraction for ease of carving up aggregated resource pools into private cloud capacity with different availability, performance, and security attributes.
- Simplified IaaS and VDI services deployment and operations similar to a public cloud
- Automated lifecycle management of the entire stack including hardware and software components

As a result, the VMware EVO SDDC solution significantly improves agility while reducing risk. CIOs and IT Cloud administrators now have a simpler and easier way to deliver a private cloud.



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