EMC DESKTOP-AS-A-SERVICE

EMC VNX, EMC SYMMETRIX VMAX, VMWARE VCLOUD DIRECTOR, VMWARE VSPHERE 5.0, AND VMWARE VIEW 5

- Deploy virtual desktop services in cloud environments
- Support virtual desktops in multi-tenant environments
- Simplify management and decrease TCO

EMC Solutions Group

April 2012
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Reference architecture overview

**Document purpose**
This document describes the reference architecture of the EMC® Desktop-as-a-Service (DTaaS) solution based on EMC VNX™, EMC Symmetrix® VMAX™, VMware® vCloud™ Director, VMware vSphere™ 5.0, and VMware View™ 5.

**Solution purpose**
The purpose of this reference architecture is to demonstrate the functionality, performance, and scalability of a cloud computing services platform that provides virtualized desktops as a service for multiple types of customers in public, private, or hybrid cloud environments including:

- Enterprise desktops
- Multi-department enterprise desktops
- Hosted virtual desktops
- Multi-tenant hosted virtual desktops

This reference architecture validates the solution’s performance and provides guidelines to build similar solutions. This document is not a comprehensive guide to every aspect of this solution. For more detailed information, consult the EMC Desktop-as-a-Service Proven Solution Guide (March, 2012).

**Desktop-as-a-Service use cases**
Service providers can deliver virtualized desktop services through a multitude of public or private cloud infrastructure business models, depending on the market opportunity that they want to address. The most common use cases include:

- Enterprise desktop service is the simplest virtualized desktop business model. In this case, the IT department is the service provider and the consumers are the employees within the company.

- Multi-departmental enterprise desktop services provide desktop services to multiple cost-centers within the enterprise. In this use case, the service provider is the enterprise’s IT department but the services are billed to individual cost centers within the organization.

- Hosted virtual desktop infrastructure services are similar to enterprise services except the infrastructure is owned, installed, and maintained by a third-party service provider. The service provider and the enterprise negotiate a per-desktop or usage-based compensation structure.

- Multi-tenant hosted virtual desktop infrastructure is a complex use case where a single service provider delivers desktop services to multiple enterprise customers. This model requires a high level of security to ensure that each customer’s desktop infrastructure is isolated and protected from access by other tenants or outside parties.

**The business challenge**
With today’s widely-distributed workforce, IT organizations can find it difficult to deliver a consistent end-user desktop experience while maintaining security, providing business continuity, and keeping costs down. With DTaaS, customers can extend the useful life of their current assets, accommodate growth, and lower the cost of managing their desktop environment.
Service providers can offer Desktop-as-a-Service as an alternative to building and provisioning dedicated, stand-alone VDI environments for each customer deployment. EMC DTaaS leverages VMware vCloud Director to provide trusted multitenancy, enabling service providers to better leverage their data center assets while lowering their cost to serve.

EMC DTaaS also allows service providers to support different types of end-user devices such as tablets, smart-phones, and other mobile devices; and eases the transition to new OS releases and upgrades.

The combination of leading technologies from EMC and VMware allows companies to:

- Maximize their investment
- Support service level agreements
- Easily maintain virtual desktop infrastructure and security across organizations and locations
- Improve end-user productivity with a consistent experience around the globe

Service providers who already offer Compute-as-a-Service, Storage-as-a-Service, and Backup-as-a-Service are ideally positioned to provide DTaaS for customers to round out their other service offerings.

This EMC DTaaS solution enables service providers to provide an enterprise-class, scalable, multi-tenant platform for offering desktop services to their customers. EMC DTaaS supports flexible deployment on public, private, and hybrid clouds with full benefits, including:

- Data security
- Business continuity
- Lower total cost of ownership (TCO)
- Consistent, available user experience

This solution incorporates the following components:

- EMC VNX and EMC Symmetrix VMAX storage
- VMware technology including vCloud Director, vSphere 5.0, View 5, vCenter Operations, and VMware ThinApp™
- 5000 Microsoft Windows 7 virtual desktops, including a mix of standard and premium desktops
- Storage tiering (EFD SAS and NL-SAS)
- EMC FAST Cache
- EMC FAST VP
This document describes a validated EMC DTaaS solution. We built a 5000-desktop environment in which the desktops were distributed among multiple tenant organizations. The virtual desktops included a mix of premium and standard desktop configurations.

Figure 1 depicts the overall physical architecture of the solution.

As detailed in Figure 1, this solution presents a multi-instance VMware View Desktop-as-a-Service deployment in a multi-tenant infrastructure. Using VMware vCloud Director for secure separation of tenants, View is deployed as a vApp to each tenant organization. Each organization has Active Directory and View Connection broker services, as well as independent desktop replica images to support the required number of desktops. An overarching service provider infrastructure, including a self-service portal and orchestration, allows for the efficient deployment and management of the multiple tenant resources.
Figure 2 shows the logical architecture of the solution.

Figure 2. Logical solution architecture
Table 1 lists the hardware used in this solution.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Quantity</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC Symmetrix VMAX</td>
<td>2</td>
<td>195 × 450 GB FC, 30 × 1 TB SATA, 15 × 200 GB SSD</td>
</tr>
<tr>
<td>EMC VNX</td>
<td>2</td>
<td>440 × 600 GB SAS, 90 × 2 TB NL-SAS, 60 × 200 GB SSD</td>
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<tr>
<td>Cisco B200 Servers</td>
<td>26</td>
<td>Dual six-core Xeon X5680: 3.33 GHz, 96 GB RAM</td>
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<tr>
<td></td>
<td>18</td>
<td>Dual quad-core Xeon E5540: 2.53 GHz, 48 GB RAM</td>
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<td></td>
<td>6</td>
<td>Dual quad core Xeon E5540: 2.53 GHz, 96 GB RAM</td>
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<tr>
<td>Cisco B440 Servers</td>
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<td>Quad ten-core, E7-4860: 2.27 GHz, 256 GB RAM</td>
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<tr>
<td>MDS switches</td>
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<td>MDS9509</td>
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<tr>
<td>Nexus switches</td>
<td></td>
<td>Nexus 5K, 7K</td>
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</table>

Table 2 lists the software used in this solution.

<table>
<thead>
<tr>
<th>Software</th>
<th>Version</th>
<th>Description</th>
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<tbody>
<tr>
<td>EMC VNX5700</td>
<td>Release 31</td>
<td>Operating environment for block storage</td>
</tr>
<tr>
<td>EMC VNX5700</td>
<td>Release 7.0</td>
<td>Operating environment for file storage</td>
</tr>
<tr>
<td>EMC Symmetrix VMAX</td>
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<td></td>
</tr>
<tr>
<td>VMware View</td>
<td>5.0</td>
<td>Software hosting virtual desktops</td>
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<td>VMware vCloud Director</td>
<td>1.5</td>
<td></td>
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<td>VMware vSphere 5</td>
<td>5.0.0 build 504890</td>
<td>Server hypervisor</td>
</tr>
<tr>
<td>VMware vShield Manager</td>
<td></td>
<td></td>
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<td>EMC PowerPath®</td>
<td>5.7/VE</td>
<td>Multipathing and load balancing for block access</td>
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<tr>
<td>EMC Unisphere™</td>
<td></td>
<td>Management tool for EMC VNX series</td>
</tr>
<tr>
<td>EMC Symmetrix Management Console</td>
<td>7</td>
<td></td>
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<tr>
<td>Cisco Intelligent Automation for Cloud</td>
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<td></td>
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<tr>
<td>Cisco Fabric Manager</td>
<td>4.1</td>
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<tr>
<td>Cisco UCS Manager</td>
<td>1.4.3(q)</td>
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<tr>
<td>VMware View Planner</td>
<td>2.1</td>
<td></td>
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</table>
Key components

Introduction

This section briefly describes the key components used in this solution, including:

- EMC VNX platform
- EMC Symmetrix VMAX platform
- VMware vCloud Director
- VMware vSphere 5.0
- VMware View 5

EMC VNX platform

The EMC VNX family delivers industry-leading innovation and enterprise capabilities for file, block, and object storage in a scalable, easy-to-use solution. This next-generation storage platform combines powerful and flexible hardware with advanced efficiency, management, and protection software to meet the demanding needs of today's enterprises.

The VNX series is designed to meet the high-performance, high-scalability requirements of midsize and large enterprises, delivering leadership performance, efficiency, and simplicity for demanding virtual application environments.

EMC Symmetrix VMAX platform

Built on the strategy of simple, intelligent, modular storage, EMC Symmetrix VMAX incorporates a highly scalable Virtual Matrix Architecture™ that enables Symmetrix VMAX arrays to grow seamlessly and cost-effectively from an entry-level configuration into the world's largest storage system. Symmetrix VMAX supports EFDs, FC drives, and SATA drives within a single array, as well as an extensive range of RAID types.

VMware vCloud Director

VMware vCloud Director (vCD) is a cloud computing management platform for private and hybrid cloud-computing infrastructures. vCD manages a cloud infrastructure using the virtual resources provided by VMware vSphere. It helps you manage as-a-service offerings by monitoring and controlling cloud components such as security, virtual machine provisioning, billing, and self-service portal access.

VMware vSphere 5.0

VMware vSphere 5.0 is a virtualization platform that can transform or virtualize computer hardware resources including CPU, RAM, hard disk, and network controller, to create a fully-functional virtual machine that runs its own operating systems and applications just like a physical computer.

VMware View 5

VMware View 5 is the leading desktop virtualization solution that enables desktops to deliver cloud computing services to users. VMware View integrates effectively with VMware vSphere to provide performance optimization, tiered storage support, and thin provisioning support.
# Desktop management infrastructure overview

## Introduction

This solution leverages a cloud management infrastructure to deliver flexible, on-demand desktop resources to customers who do not want to purchase, configure, or maintain desktop infrastructure themselves.

Much like an electric power utility, in which end-users consume and pay for power without needing to understand or maintain the component devices and infrastructure required to provide the service, customers can draw upon the elastic resources that cloud computing delivers and pay only for the desktops that they need.

A DTaaS environment typically consists of:

- Self-service portal
- Orchestration tool
- Secure multi-tenant enabled shared infrastructure

## Self-service portal and service catalog

The self-service portal and service catalog play a key role in a service-oriented architecture. It allows users to select desktops and desktop services from a published service catalog, providing an experience similar to Internet shopping.

There are various portal and service catalog options available that perform all or some of the portal and catalog functions. For this solution we focused on VMware vCenter Orchestrator.

## Orchestration tool

An orchestration tool allows you to define the workflows and operations needed to deploy the desktops and deliver them on demand. For example, it provisions the server using Cisco UCS Manager plug-ins, deploys the storage using automated processes, configures the network, updates CMDB, provisions the provider vDC and organization vDC, and so on.

There are various orchestration tools available that perform all or some of the orchestration functions. For this solution we focused on vCenter Orchestrator, which uses an open and flexible plug-in architecture to automate provisioning and operational tasks across both VMware and third-party applications.

## Secure multi-tenant enabled shared environment

VMware vCloud Director provides a cloud infrastructure using the virtual resources provided by VMware vSphere. It addresses the following key requirements:

- Secure separation
- Service assurance
- Service provider in control
- Tenant in control
- Security and compliance
- Availability and data protection
EMC technology overview

Introduction
This section identifies and briefly describes the major EMC VNX and EMC Symmetrix VMAX features used in this solution environment, including:

- EMC VNX
- EMC Symmetrix VMAX
- EMC FAST Cache
- EMC FAST VP

EMC VNX
The EMC VNX platform brings flexibility to virtual desktop and DTaaS environments. With EMC unified storage, you can design your storage solution architecture to leverage the storage protocols best suited to your environment (NAS, iSCSI, and Fibre Channel SAN). EMC unified storage uses advanced technologies like EMC FAST VP and EMC FAST Cache to optimize desktop performance while maintaining a competitive cost structure. EMC unified storage supports vStorage APIs for Array Integration (VAAI) and the Virtual Storage Integrator (VSI) plug-in, which enable tight integration between your VMware environment and the VNX platform.

EMC Symmetrix VMAX storage array
The tiered storage configuration used in the test environment is based on the following Symmetrix VMAX features:

- FAST VP
- VLUN 3 or Virtual LUN VP Mobility
- Support for VAAI

The EMC Enginuity™ operating environment controls all components in the Symmetrix VMAX array. Enginuity 5875 for Symmetrix VMAX offers:

- More efficiency: New zero-downtime technology for migrations (technology refreshes) and lower costs with automated tiering
- More scalability: Up to two times more performance, with the ability to manage up to 10 times more capacity per storage administrator
- More security: Built-in encryption, RSA®-integrated key management, increased value for virtual server and mainframe environments, replication enhancements, and a new e-licensing model
EMC FAST Cache

VNX FAST Cache, a part of the VNX FAST suite, enables Flash drives to be used as an expanded cache layer for the array. FAST Cache eliminates the impact of slow storage by accelerating the read/write response time of active data. In a DTaaS environment, frequently accessed data such as VMware View replicas and linked clones migrate to Flash drives. This enables rapid response to boot storms, anti-virus scans, and any I/O intensive workloads such as operating system patches and application updates.

FAST Cache has array-wide features available for both file and block storage. FAST Cache works by examining 64-KB chunks of data in FAST Cache enabled objects on the array. Frequently accessed data is copied to the FAST Cache and subsequent accesses to that data chunk are serviced by FAST Cache. This allows immediate promotion of very active data to the Flash drives, which dramatically improves the response time for very active data and reduces the data hot spots that can occur within the LUN.

EMC FAST VP

EMC FAST VP provides tiering automation and sub-LUN tiering with both file and block support. FAST VP works at the storage pool level, below the LUN abstraction, to analyze data patterns at a granular level. For example, rather than move an 800 GB LUN to enterprise Flash drives, FAST VP monitors the entire storage pool in 1-GB chunks. If data becomes active, FAST VP automatically moves only these “hot” chunks to a higher tier like Flash. As data cools, FAST VP also correctly identifies which chunks to migrate to lower tiers and proactively moves them. Such granular tiering reduces storage acquisition, improves performance and lowers response time. And because FAST VP is fully automated and policy-driven, there is no manual intervention required to make this happen, so you save on operating costs as well.
VMware technology overview

Introduction

VMware View delivers rich and personalized virtual desktops as a managed service from a virtualization platform built to deliver the entire desktop, including the operating system, applications, and user data. VMware View 5.0 supports the delivery of Windows desktops as a cloud service, enabling end-user freedom and IT management and control. VMware View 5.0 integrates with vSphere 5.0 to provide:

- Optimization controls to deliver protocol efficiency and enable IT administrators to configure bandwidth settings by use case, user needs, or network requirements.
- Continuity services to deliver a seamless end-user experience regardless of network reliability.
- Extension services that allow Windows Management Instrumentation (WMI) tools to collect more than 20 end-user session statistics.
- View persona management that dynamically associates a user persona with stateless floating desktops. IT administrators can deploy stateless floating desktops while enabling user personalization to persist between sessions.

VMware View components

To provide a virtual desktop experience, VMware View uses various components, each with its own purpose. Figure 3 shows the VMware components described in the following sections.

Figure 3. VMware components
**Hypervisor**
Hypervisor is used to host the virtual desktops. To get most of the features, we recommend that you use VMware vSphere 5. The vSphere 5 features such as vSphere API for Array Integration (VAAI), Memory Compression, and Ballooning help to host more virtual desktops on a host.

**VMware View Connection server**
The VMware View Connection server hosts the LDAP directory and keeps the configuration information of the VMware View Desktop Pools, its associated virtual desktops, and VMware View. This data information can be replicated to other View Connection Replica servers. The Connection server also acts as a connection broker that maintains the desktop assignment. It supports an SSL connection to the desktop using RDP or PCoIP. It also supports RSA SecurID® two-factor authentication and smart card authentication.

**VMware vSphere vCenter/View Composer**
The VMware vSphere vCenter server helps you manage your virtual machines and vSphere ESX hosts, and provides high availability (HA) and Distributed Resource Scheduling (DRS) clusters. VMware vCenter server permits cloned virtual machines to join the Active Directory (AD) domain. The View Composer service is installed on the vCenter server that provides storage savings by using linked clone technology to share the hard disk of a parent virtual machine.

**VMware View Agent**
VMware View Agent is installed on the virtual desktop template and is deployed to all the virtual desktops. It provides communication to the View Connection server and enables options for USB redirection, virtual printing, PCoIP server, and Smartcard over PCoIP.

**VMware View client**
VMware View Client software is used to connect to the virtual desktops using the connection broker. View Client allows users to print locally from their virtual desktop, and with the proper configuration, users can access USB devices locally.

**VMware View Admin Console**
VMware View Admin Console is a browser-based administration tool for VMware View and is hosted on the View Connection server.

**VMware ThinApp**
VMware ThinApp is an application virtualization product for enterprise desktop administrators and application owners. It enables rapid deployment of applications to physical and virtual desktops. ThinApp links the application, the ThinApp runtime, the virtual file system, and the virtual registry into a single package. Administrators can use the EMC VNX CIFS share as a repository and to deploy the ThinApp to the virtual desktops.
Conclusion

Summary

This EMC DTaaS solution enables service providers to offer their customers enterprise-class, scalable, desktop services leveraging a trusted multi-tenant architecture. EMC Desktop-as-a-Service allows service providers to guarantee a quality desktop experience leveraging EMC technology such as FAST VP and FAST Cache. Service providers can then support their customers’ key business requirements including data security, business continuity, and a consistent and available user experience. DTaaS also helps customers to lower their TCO, and helps service providers to leverage their existing cloud platform infrastructures.

A virtual desktop environment increases security and simplifies management for customers who face the challenges of a widely distributed workforce. With DTaaS customers can extend the useful life of their current assets, accommodate growth, and lower the TCO for their desktop environment.

Key findings

While testing this solution, we found that the EMC DTaaS solution:

- Supported 5000 virtual desktops, including a mix of premium and standard desktop configurations.
- Maintained secure separation between multiple customers using the same cloud infrastructure.
- Integrated VDI deployment with an existing IaaS infrastructure for both the service provider and the customer to manage their resources.

About EMC Proven™ Solutions

EMC Proven Solutions help customers identify and overcome business challenges by reducing risk and time-to-value of their information infrastructure. EMC leverages its expertise and proven technologies with its strategic relationships with Cisco, Microsoft, Oracle, SAP, and VMware to deliver solutions that support our customers' business and technical requirements. All solutions are rigorously tested and documented with reference architectures and best practices designed to reduce the total cost of ownership of the infrastructure and increase IT Efficiency.

Take the next step

EMC offers a portfolio of consulting and professional services for service providers and their customers to assist in balancing workloads across service delivery models – ranging from legacy physical architectures and virtualized infrastructures through on- and off-premise cloud architectures. The EMC Cloud Advisory Service with Cloud Optimizer helps customers develop a strategy for optimizing the placement of application workloads. By assessing three factors – economics, trust and functionality – organizations can maximize their cost savings and business agility gained through the use of private and public cloud resources.
References

**EMC documentation**

The following documents, located on the EMC online support website, provide additional and relevant information. Access to these documents depends on your login credentials. If you do not have access to a document, contact your EMC representative:

- *EMC Compute-as-a-Service — EMC Symmetrix VMAX, EMC VNX Series, VMware vSphere, vCloud Director*
- *ENC Infrastructure for Virtual Desktops Enabled by EMC VNX Series (NFS), VMware vSphere 5.0, VMware View 5.0 and VMware View Composer 2.7*

**VMware documentation**

The following VMware documents, located on the VMware website, also provide useful information:

- *Introduction to VMware View Manager*
- *VMware View Architecture Planning Guide*
- *VMware View Reference Architecture*