



FlexPod for VMware Solutions Guide

In Collaboration with Cisco and VMware

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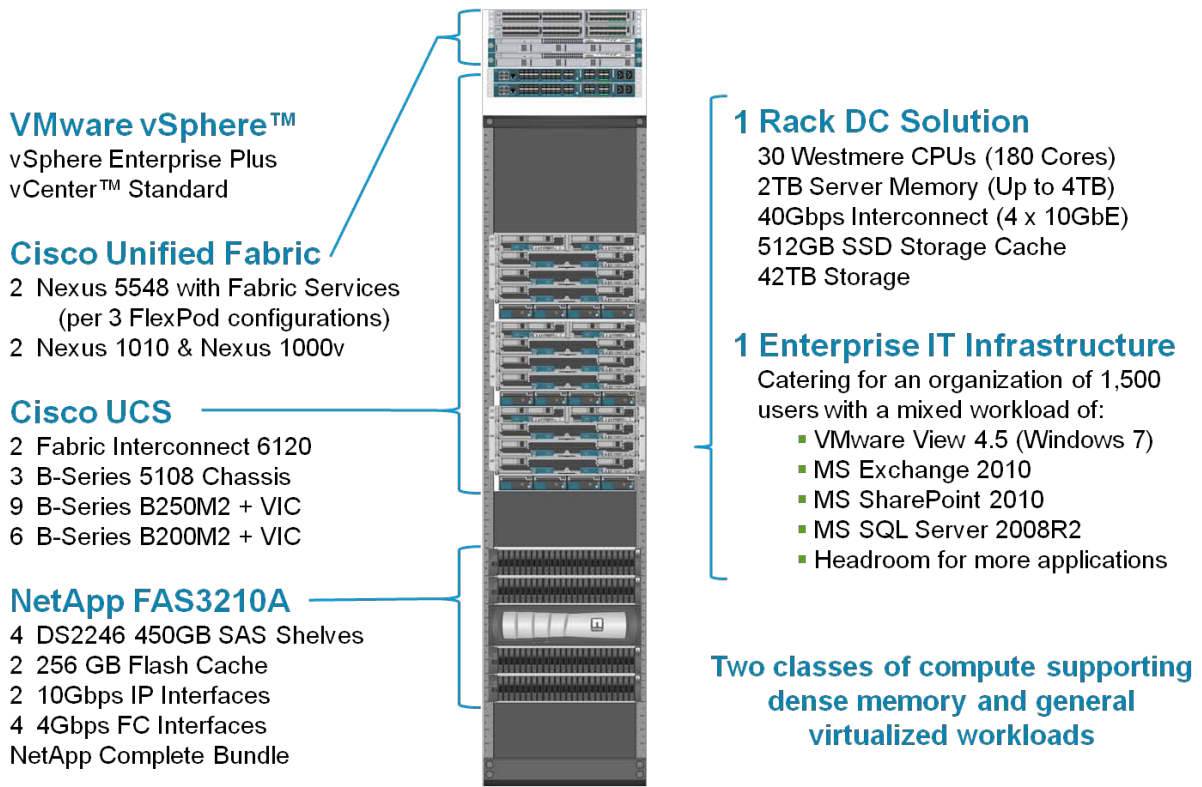
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1 INTRODUCTION

Industry trends indicate a vast data center transformation toward shared infrastructures. Enterprise customers are moving away from silos of information and moving toward common infrastructures, virtualized environments, and cloud computing to increase agility and reduce costs. This transformation appears daunting and complex because companies must address both organizational and technical resistance to this new IT model. Cisco, NetApp, and VMware have developed FlexPod™ for VMware to address these virtualization needs and to simplify the evolution to shared and cloud infrastructures.

FlexPod is a defined set of hardware and software that serves as an integrated infrastructure stack for all virtualization solutions. FlexPod for VMware includes NetApp® storage, Cisco® networking, the Cisco Unified Computing System™, and VMware® virtualization software in a single package in which the computing and storage components fit in one data center rack and the networking components reside in a separate rack. The networking components can accommodate up to three FlexPod for VMware configurations. Figure 1 shows the FlexPod for VMware components.

Figure 1) FlexPod for VMware components.



The solution can be scaled, while still maintaining its integrity, either by adding more FlexPod for VMware configurations or by adding to the solution components. A number of solutions can be built on top of one or more FlexPod for VMware configurations. This document describes how to build several different solutions on top of FlexPod for VMware.

1.1 TARGET AUDIENCE

The target audience for this document includes sales engineers, field consultants, professional services, IT managers, partner engineering, and customers who want to deploy solutions on top of a FlexPod for VMware architecture.

2 SIZING FLEXPOD FOR VMWARE APPLICATIONS

2.1 FLEXPOD FOR VMWARE SIZING GUIDE

The “FlexPod for VMware Sizing Guide” provides a starting point for building and sizing shared infrastructure solutions.

The “FlexPod for VMware Sizing Guide” focuses on the FlexPod for VMware architecture, using the FAS3210A and FAS3240A NetApp unified storage controllers and the Cisco UCS B200 M2 Blade Server and B250 M2 Extended Memory Blade Server. This platform is designed to concurrently support various counts of VMware virtual desktops, Microsoft® Exchange 2010 users, and Microsoft SharePoint® 2010 users, as well as a Microsoft SQL Server® (MS-SQL) 2008 Release 2 (R2) online transaction processing (OLTP) environment. Secure multi-tenancy (SMT) capabilities such as load isolation, security zones, and array based backup and DR can be built on top of the FlexPod for VMware for use in private or public cloud environments. In addition, application workloads can be layered on top of the SMT features.

The NetApp FAS3210A has been selected as the base storage system, with additional support for the NetApp FAS3240A. With the capability to scale with external drives, the NetApp FAS3210A is offered with four external NetApp DS2246 disk shelves, and it is partnered with nine Cisco UCS B250 M2 and six Cisco UCS B200 M2 blade servers mounted within three Cisco UCS 5108 Blade Server Chassis.

Note: The sizing data covers typical enterprise workloads; however, individual customers may have lighter or heavier workloads related to the greater headroom required for growth or during system failure. Take these factors into consideration when sizing for individual customers.

2.2 RECOMMENDED SUPPORT DOCUMENTS

Refer to the following document for more information about this solution:

- “FlexPod for VMware Sizing Guide” (available only to NetApp, Cisco, and authorized SI partners)

3 DEVELOPMENT AND TEST ENVIRONMENTS ON FLEXPOD FOR VMWARE

3.1 SOLUTION DESCRIPTION

For businesses of all sizes, the demand for database application development continues to grow at a dramatic rate. Full or partial production database copies are required for many activities, including application development and testing. Often, many copies of the production database are required to support multiple code streams as part of a modular development process. NetApp solutions can dramatically reduce the time, resources, and effort required for rapid and cost-effective database cloning and deployment. NetApp FlexClone® clones require less storage than traditional clones, and they can be created without the need for storage administrator support. In addition, the capability to use NetApp storage efficiency technologies from the VMware vSphere™ layer itself (through the invocation of storage layer services by the VMware vCenter™ server) has enabled rapid and efficient provisioning of server and storage resources for the development and testing environment.

Server virtualization technologies provided by VMware vSphere enable the creation of a base virtual machine that runs a database application that is properly installed and tested. This base virtual machine, which can actually simulate a real production database system, is stored as a set of files in the shared NetApp storage system. It is self-contained and includes a guest operating system, a database application, and all the data and log partitions. Cloning of the virtual machine using NetApp storage-efficient thin cloning technologies, provided by the NetApp Virtual Storage Console (VSC), provides everything needed for a functional development and testing environment.

Another approach to this solution is to first create cloned development and testing virtual machines containing just the guest operating system and the database binaries and then to mount the database clones created from the production database instance using NetApp thin cloning technologies on the cloned virtual machines.

Database and VMware administrators can use automated and powerful tools from NetApp such as NetApp SnapManager[®] and VSC provisioning to easily and quickly create database and virtual machine clones, using negligible additional storage and without requiring extensive storage skills or storage administrator support.

3.2 DEVELOPMENT AND TESTING ON FLEXPOD FOR VMWARE

The development and testing solution fits very well on top of FlexPod for VMware. FlexPod for VMware has the required storage system features licensed, such as NetApp FlexClone, Internet Small Computer System Interface (iSCSI), and Network File System (NFS). The NetApp VSC provisioning module is also included in FlexPod for VMware and can be used to create space-efficient development and testing clones of production virtual machines.

Note: NetApp SnapDrive[®] and SnapManager for the database application need to be purchased separately.

When NetApp SnapDrive and SnapManager are used, logical unit numbers (LUNs) for the development and testing database clones can either be mapped directly to the virtual machine by using iSCSI or mapped as VMware iSCSI raw device mapping (RDM) LUNs. With FlexPod for VMware, space-efficient development and testing clones of production environments can be set up quickly with use of very little additional storage, accelerating the application development and testing cycle.

Also, the server blades in the Cisco Unified Computing System can be grouped. Pools of blades can be defined in the development and testing and the production organizations. These organizations physically isolate the development and testing blade resources from the production blade resources, and therefore, the development and testing environment from the production environment. In this setup, the development and testing blades and production blades are in two separate VMware ESXi clusters, further separating the two environments. Another way to accomplish development and testing separation is to put all blades into a single organization and single VMware ESXi cluster and to use resource pools to control resource use within the cluster, providing virtual isolation of development and testing.

3.3 RECOMMENDED SUPPORT DOCUMENTS

Refer to the following documents for more information about this solution:

- [RA-0005: Accelerating Development of Microsoft SQL Applications in Heterogeneous Environments](#)
- [TR-3681: Oracle Dev/Test on VMware vSphere and NetApp Storage Solutions Overview](#)
- [TR-3742: Using FlexClone to Clone Files and LUNs](#)

4 DISASTER RECOVERY ON FLEXPOD FOR VMWARE

4.1 SOLUTION DESCRIPTION

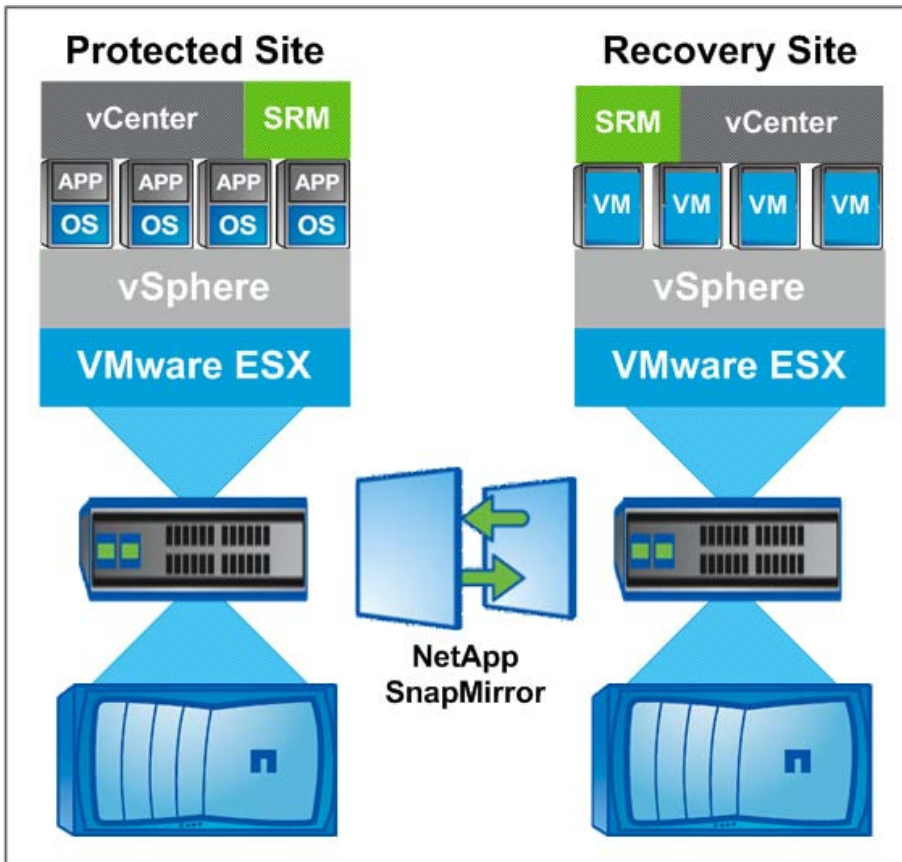
Setting up a disaster recovery (DR) environment involves setting up a secondary or recovery data center site with hardware (compute, network, and storage) that closely mirrors the hardware in the primary or protected data center. In the event of failure of the protected data center, the virtual machines that were running in the protected data center can be brought up and into production on the hardware at the recovery data center. Virtual machines and virtual machine application data are periodically replicated from the protected data center storage to the recovery data center storage. In addition, a test environment can be brought up at the recovery data center to test the disaster recovery plan. Finally, one recovery data center can serve as the DR site for multiple protected data centers.

4.2 DISASTER RECOVERY ON FLEXPOD FOR VMWARE

A FlexPod for VMware configuration can function as a recovery DR site. An ideal situation is to have one or more FlexPod for VMware configurations at the protected site with one or more FlexPod for VMware configurations at the recovery DR site. The configuration for this solution is simplified because the sites can both be set up as mirror images of each other. To implement DR on FlexPod for VMware, VMware

Site Recovery Manager (SRM) must be purchased and the NetApp adapter for VMware SRM must be added to the environment to automatically manage the DR plan and to implement offline tests of this plan at the recovery site. Additionally, the backup portion of NetApp VSC (previously NetApp SnapManager for Virtual Infrastructure) must be purchased as well as NetApp SnapMirror®, SnapDrive, and the appropriate SnapManager products to back up and replicate virtual machines and virtual machine data to the DR site. The recovery site networking and VMware environment must be manually set up similar to the protected site setup. Figure 2 shows a logical representation of a DR setup. FlexPod for VMware configurations can be used for both the protected site and the recovery site with the purchase of the previously mentioned software.

Figure 2) VMware SRM with NetApp storage.



4.3 RECOMMENDED SUPPORT DOCUMENTS

Refer to the following documents for more information about this solution:

- [TR-3671: VMware vCenter Site Recovery Manager in a NetApp Environment](#)
- [TR-3822: Disaster Recovery of Microsoft Exchange, SQL Server, and SharePoint Server Using VMware vCenter Site Recovery Manager, NetApp SnapManager and SnapMirror, and Cisco Nexus Unified Fabric](#)

5 MICROSOFT MIXED WORKLOAD APPLICATIONS ON FLEXPOD FOR VMWARE

5.1 SOLUTION DESCRIPTION

As customers move toward their goal of 100% virtualized data centers, they increasingly look for ways to bring the benefits of VMware virtualization to their mission-critical Microsoft applications. Customers have an ideal opportunity to transition to a VMware vSphere virtual infrastructure built on NetApp unified storage. Setting up a mixed workload of Microsoft applications (Microsoft Exchange, MS-SQL, and SharePoint) in a virtual environment provides the following benefits:

- Reduced costs with VMware virtualization
- Advanced NetApp unified and efficient storage solutions
- High availability
- Advanced backup and recovery solutions

5.2 MICROSOFT MIXED WORKLOAD APPLICATIONS ON FLEXPOD FOR VMWARE

The FlexPod for VMware architecture is an ideal location for running a mixed workload of Microsoft applications. FlexPod for VMware includes storage efficiency features such as deduplication, thin provisioning, and NetApp Snapshot[®] technology that provide a space-efficient design. As previously mentioned, the VMware portion of FlexPod for VMware provides the reduced costs of virtualization and high availability. The Cisco Nexus[®] platform's unified switching fabric allows connections between virtual machines and storage by using Fibre Channel (FC), Fibre Channel over Ethernet (FCoE), iSCSI, NFS, or Common Internet File System (CIFS) over a single network fabric. With the additional purchase of NetApp SnapDrive for Windows[®]; NetApp SnapManager for Microsoft Exchange (SME); SnapManager for SQL Server (SMSQL); and SnapManager for Microsoft Office SharePoint Server (SMOSS); the backup portion of NetApp VSC, and NetApp SnapMirror; the previously mentioned advanced backup and recovery solutions can be set up. Finally, a DR environment, as described in [section 4](#) of this document, can be set up with a Microsoft mixed application workload.

The "FlexPod for VMware Sizing Guide," described in [section 2](#) of this document, specifically addresses sizing of the Microsoft mixed workload applications with FlexPod for VMware. Customer workload requirements can be used to customize the compute and storage provided in FlexPod for VMware to meet those requirements.

5.3 RECOMMENDED SUPPORT DOCUMENTS

Refer to the following documents for more information about this solution:

- [CVD: Microsoft Exchange 2010 with VMware vSphere on Cisco Unified Computing System with NetApp Storage](#)
- [TR-3785: Microsoft Exchange Server, SQL Server, and SharePoint Server Mixed Workload on VMware vSphere 4, NetApp Unified Storage \(FC, iSCSI, and NFS\), and Cisco Nexus Unified Fabric](#)

6 ENHANCED SECURE MULTI-TENANCY ON FLEXPOD FOR VMWARE

6.1 SOLUTION DESCRIPTION

Today, IT infrastructure too often suffers from oversegmentation of server, networking, and storage resources. Each organization or customer purchases and uses its own equipment, which leads to low utilization, inefficiency, and the inability to scale properly and respond quickly to changing business needs. Although virtualization of server and network environments has been effective in increasing utilization of storage and network resources, adoption of cloud computing to deliver IT as a service (ITaaS) in data centers promises to complete the vision of a fully virtualized environment.

The biggest obstacle to the adoption of ITaaS has been a lack of confidence that data and applications are securely isolated in a cloud-based infrastructure in which servers, networks, and storage are all shared resources. To address this need, Cisco, NetApp, and VMware have joined together to develop enhanced secure multi-tenancy (ESMT) in a virtualized data center, which is a carefully designed and lab-validated solution for the next-generation data center.

To develop a robust design, organizations must clearly define the requirements and apply proven methodology and design principles. The following four requirements are defined as the critical elements, or pillars, for the ESMT architecture:

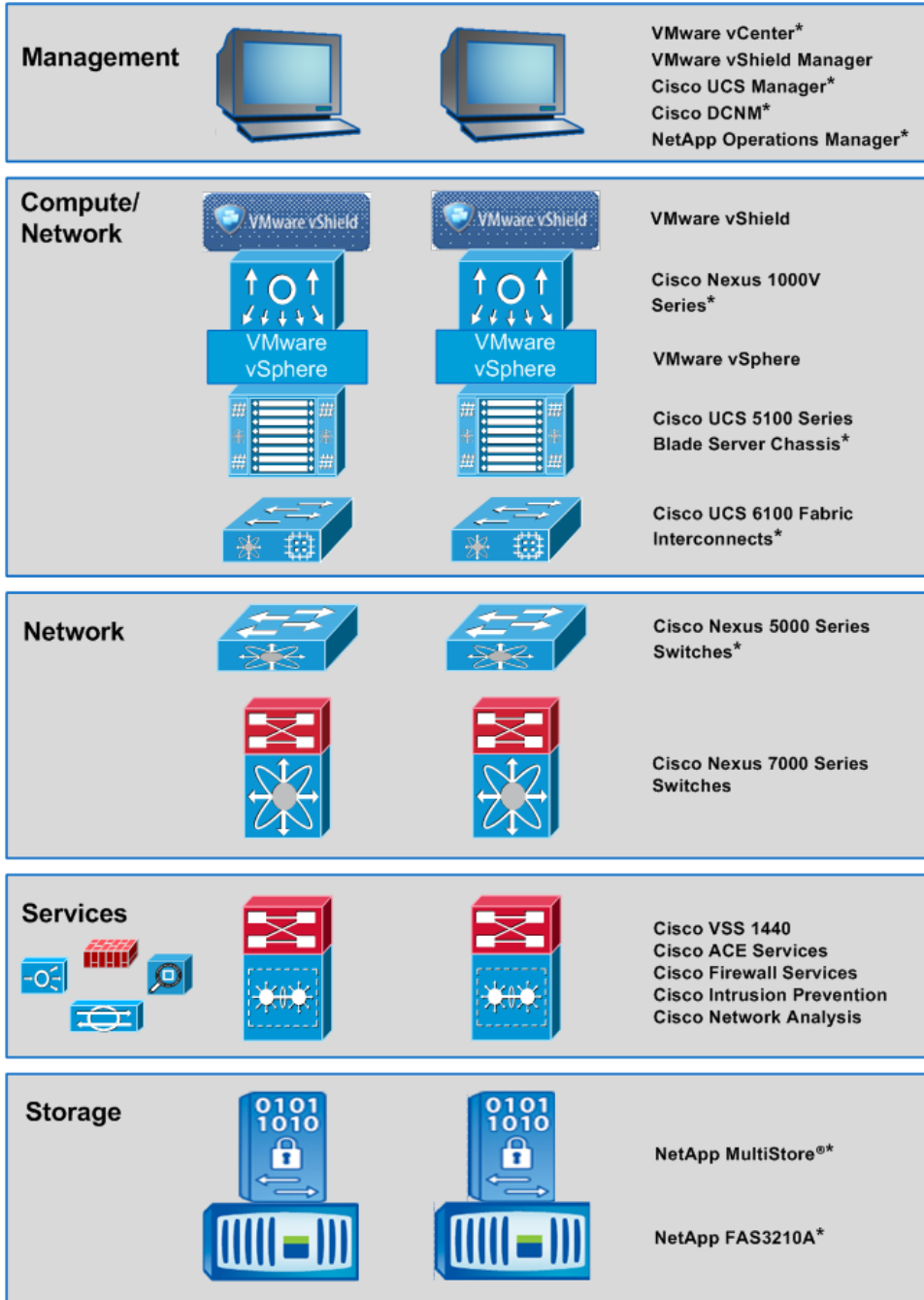
- **Availability.** This pillar allows the infrastructure to meet the expectation that compute, network, and storage resources will always be available even in the event of failure. Each layer has its own method for providing a high-availability configuration that works cohesively with adjacent layers, similar to the approach used by the secure separation pillar. Security and availability are best deployed in a layered approach.
- **Secure separation.** This pillar makes sure one tenant does not have access to another tenant's resources, such as virtual machines, network bandwidth, and storage. Each tenant must be securely separated using techniques such as access control, virtual local area network (VLAN) segmentation, and virtual storage controllers. Also, each layer has its own means of enforcing policies that help reinforce the policies of the adjacent layers.
- **Service assurance.** This pillar provides isolated compute, network, and storage performance during both steady-state and non-steady-state operation. For example, the network can provide each tenant with a certain bandwidth guarantee using quality of service (QoS). Resource pools within VMware help balance and guarantee CPU and memory resources, and NetApp FlexShare[®] can balance resource contention across storage volumes.
- **Management.** This pillar is required to rapidly provision and manage resources and view resource availability. Domain and element management provides comprehensive administration of the shared resources that compose the secure cloud architecture. The demarcation point for managing this design is defined by the interactive and programmable interfaces delivered by NetApp, VMware, and Cisco. The administrative interfaces and APIs in this portfolio address infrastructure components such as VMware vCenter and vCloud Director, Cisco UCS Manager and Data Center Network Manager (DCNM), and the NetApp Manageability Suite. These element managers and their associated open APIs provide the foundation for delivery of cohesive service lifecycle orchestration with solution partners.

6.2 ESMT ON FLEXPOD FOR VMWARE

Figure 3 shows the architectural components of ESMT.

Note: The components included in FlexPod for VMware are marked with an asterisk in Figure 3.

Figure 3) ESMT architectural components.



FlexPod for VMware can serve as the base layer of this architecture. The FlexPod for VMware configuration can be set up, and the additional ESMT components can be layered on top of the FlexPod for VMware configuration. The additional components are as follows:

- Cisco Nexus 7000 Series Switches

- VMware vShield App and Edge virtual firewalls
- VMware Site Recovery Manager (required when implementing DR with ESMT)
- NetApp SnapDrive and SnapManager products
- Cisco Services layer

The [Enhanced Secure Multi-Tenancy Design Guide](#) specifies the setup of Microsoft applications such as Microsoft Exchange, MS-SQL Server, and SharePoint as securely separated tenants. The [Enhanced Secure Multi-Tenancy Design Guide](#) also specifies the setup of a DR site for recovery of the ESMT infrastructure and tenants. To use the DR site equipment during normal operations, follow the design guide specification to set up a development and testing environment running VMware vCloud at the secondary DR site. During DR failover, the development and testing environment is preempted by the production environment.

The “FlexPod for VMware Sizing Guide,” described in [section 2](#) of this document, specifically addresses sizing of ESMT applications with FlexPod for VMware. Customer workload requirements can be used to customize the compute and storage provided in the FlexPod for VMware configuration to meet those requirements.

6.3 RECOMMENDED SUPPORT DOCUMENTS

Refer to the following documents and Web site for more information on this solution:

- [CVD: Enhanced Secure Multi-Tenancy Design Guide](#)
- [Imagine Virtually Anything with Cisco, NetApp, and VMware](#)
- [WP-7083: Delivering IT as a Service for Virtualized Data Centers](#)
- [WP-7113: An Overview of the Enhanced Secure Multi-Tenancy Architecture](#)

7 SAP ON SECURE MULTI-TENANCY ON FLEXPOD FOR VMWARE

7.1 SOLUTION DESCRIPTION

The combination of application, server, network, and storage virtualization provides many advantages in managing existing SAP® environments or provisioning new ones. Secure multi-tenancy (SMT) offers separation of environments on all layers of the solution stack. It also makes it possible to simplify and fully automate SAP application lifecycle management tasks, such as backup and the creation of SAP system copies. The system uses NetApp SnapManager products and efficient storage-based technologies integrated with SAP to automate backup and recovery tasks and to clone SAP systems and landscapes.

7.2 SAP ON SMT ON FLEXPOD FOR VMWARE

As described in [section 6](#) of this document, an SMT environment can be layered on top of a FlexPod for VMware configuration. With the addition of NetApp SnapManager for SAP, a SAP implementation can then be built on top of SMT.

7.3 RECOMMENDED SUPPORT DOCUMENTS

Refer to the following document for more information about this solution:

- [WP-7102: Secure Multi-Tenancy for SAP](#)

8 VIRTUAL DESKTOP INFRASTRUCTURE ON FLEXPOD FOR VMWARE

8.1 SOLUTION DESCRIPTION

Corporate IT departments are facing a new class of desktop management challenges as they strive to provide end users with the flexibility to access corporate IT resources using any device from any network.

IT is also being asked to provide access to corporate resources for an increasingly dispersed and growing audience that includes workers in off-site facilities, contractors, partners, and outsourcing providers as well as employees traveling or working from home. All these groups demand access to sensitive corporate resources, but IT must strictly adhere to corporate security requirements and new regulatory standards.

VMware View 4, based on the proven VMware vSphere virtualization platform, delivers unique desktop control and manageability, while providing end users with a familiar desktop experience without any modifications to the desktop environment or applications.

NetApp solutions enable companies to optimize their virtual infrastructures by providing advanced storage and data management capabilities. NetApp provides industry-leading storage solutions that:

- Simplify virtual machine provisioning
- Enable mass virtual machine cloning and redeployment
- Handle typical I/O bursts: for example, boot storms and antivirus storms
- Provide efficient OS, application, and user data management
- Provide individual virtual machine backup and restore operations
- Deliver simple and flexible business continuance
- Help reduce virtual desktop storage needs

8.2 VIRTUAL DESKTOP INFRASTRUCTURE ON FLEXPOD FOR VMWARE

The FlexPod for VMware environment, with NetApp storage, Cisco Nexus networking, and VMware vSphere, provides an excellent base for building a virtual desktop infrastructure (VDI) environment. With the addition of VMware View and the NetApp Backup and Recovery plug-in for NetApp VSC, a scalable and resilient VDI environment can be built on top of a FlexPod for VMware configuration. Additionally, a VDI DR environment can be set up with an additional FlexPod for VMware configuration, VMware SRM, and NetApp SnapMirror and SRM Adapter.

The “FlexPod for VMware Sizing Guide,” described in [section 2](#) of this document, specifically addresses sizing of VDI environments with FlexPod for VMware. Customer workload requirements can be used to customize the compute and storage components provided in the FlexPod for VMware configuration to meet those requirements.

8.3 RECOMMENDED SUPPORT DOCUMENTS

Refer to the following document for more information about this solution:

- [TR-3705: NetApp and VMware View Solution Guide](#)

9 SUMMARY

NetApp, Cisco, and VMware combined their respective technologies to develop FlexPod for VMware, which is a new solution for virtual computing. FlexPod is a defined set of hardware and software that serves as an integrated infrastructure stack for all virtualization solutions. This document describes how to build the following solutions on top of one or more FlexPod for VMware configurations:

- Development and testing environments
- Disaster recovery
- Microsoft mixed workload applications
- Enhanced SMT
- SAP on SMT
- VDI

10 REFERENCES

The following Cisco documents are referenced in this solutions guide:

- [CVD: Enhanced Secure Multi-Tenancy Design Guide](#)
- [CVD: Microsoft Exchange 2010 with VMware vSphere on Cisco Unified Computing System with NetApp Storage](#)

The following NetApp documents are referenced in this solutions guide:

- [RA-0005: Accelerating Development of Microsoft SQL Applications in Heterogeneous Environments](#)
- [TR-3671: VMware vCenter Site Recovery Manager in a NetApp Environment](#)
- [TR-3681: Oracle Dev/Test on VMware vSphere and NetApp Storage Solutions Overview](#)
- [TR-3705: NetApp and VMware View Solution Guide](#)
- [TR-3742: Using FlexClone to Clone Files and LUNs](#)
- [TR-3785: Microsoft Exchange Server, SQL Server, and SharePoint Server Mixed Workload on VMware vSphere 4, NetApp Unified Storage \(FC, iSCSI, and NFS\), and Cisco Nexus Unified Fabric](#)
- [TR-3822: Disaster Recovery of Microsoft Exchange, SQL Server, and SharePoint Server Using VMware vCenter Site Recovery Manager, NetApp SnapManager and SnapMirror, and Cisco Nexus Unified Fabric](#)
- [WP-7083: Delivering IT as a Service for Virtualized Data Centers](#)
- [WP-7102: Secure Multi-Tenancy for SAP](#)
- [WP-7113: An Overview of the Enhanced Secure Multi-Tenancy Architecture](#)

The following Web site is referenced in this solutions guide:

- [Imagine Virtually Anything with Cisco, NetApp, and VMware](#)

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