NetApp Verified Architecture

FlexPod Data Center Solution

VMWARE VSPHERE BUILT ON FLEXPOD

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1 NETAPP VERIFIED ARCHITECTURE

A NetApp® Verified Architecture (NVA) is a new program that provides a seal of assurance for NetApp solutions. This seal of assurance represents the NetApp promise to provide customers with a thoroughly tested and prescriptive architecture of a NetApp solution that minimizes customers' deployment risk and accelerates their time to results.

The NetApp Verified Architecture program is governed by a group of NetApp technical experts who verify that each NVA:

- Consists of a pretested, preintegrated verified architecture that meets specific customer needs
- Is backed up by prescriptive deployment, testing, and operational procedures
- Has a proven design that is based on prescriptive best practices
- Reduces the complexity of architecting and implementing NetApp technologies

2 FLEXPOD DATA CENTER SOLUTION OVERVIEW

Industry trends indicate a vast data center transformation toward shared infrastructure and cloud computing. Enterprise customers are moving away from silos of IT operation toward more cost-effective virtualized environments, leading eventually to cloud computing to increase agility and reduce costs. This transformation appears daunting and complex because companies must address resistance to change in both their organizational and technical IT models. To accelerate this process and simplify the evolution to shared cloud infrastructure, Cisco and NetApp have developed the FlexPod™ data center solution.

FlexPod is a predesigned, best practice data center architecture that is built on the Cisco Unified Computing System™ (Cisco UCS™), Cisco Nexus® switches, and NetApp fabric-attached storage (FAS) systems. FlexPod is an ideal platform for running a variety of enterprise workloads. FlexPod can scale up for greater performance and capacity (adding compute, network, or storage resources individually as needed), or it can scale out for environments that need multiple consistent deployments (rolling out additional FlexPod stacks). FlexPod delivers a baseline configuration, but also the flexibility to be sized and optimized to accommodate many different use cases.

This document presents the base FlexPod architecture, including both hardware and best practice configurations. Further, to demonstrate the value of FlexPod in a real-world use case, the configuration is extended to include a fault-tolerant VMware® vSphere® deployment.

This FlexPod data center solution is also described in the following Cisco Validated Designs (CVDs):

- FlexPod Deployment Guide
- VMware Built on FlexPod Deployment Guide

2.1 PROBLEM STATEMENT

Customers face several questions as they transition toward shared infrastructure, or cloud computing, such as:

- What will be my return on investment?
- How do I build a future-proof infrastructure?
- How do I transition from my current infrastructure cost-effectively?
- Will my applications run properly in a shared infrastructure?

The FlexPod architecture is designed to help customers answer these questions with proven guidance and measurable value. FlexPod helps customers mitigate the risk and uncertainty involved with planning, designing, and implementing a new data center infrastructure.

HOW DOES FLEXPOD ADD VALUE?

Cisco and NetApp have thoroughly tested and verified the FlexPod solution architecture and its many use cases while creating a portfolio of detailed documentation, information, and references to assist customers in transforming their data centers to this shared infrastructure model. This portfolio includes but is not limited to:

- Best practice architectural design
- Workload sizing and scaling guidance
- Implementation and deployment instructions
- Bills of materials and technical specifications
- Frequently asked questions (FAQs)

Cisco and NetApp have built a robust and experienced support team focused on FlexPod solutions, from customer account and technical sales representatives to professional services and technical support engineers. This foundation is further strengthened by a rich ecosystem of FlexPod delivery and solution partners.

The unprecedented experience, technology, and value delivered by Cisco and NetApp and the FlexPod ecosystem converge to help customers minimize risk and maximize their IT potential, shifting the focus from IT concerns back to the core business.

2.2 TARGET AUDIENCE

The target audience for this NVA includes the following groups:

- **CxO-level executives.** FlexPod serves as a flexible, scalable, and future-ready platform that lowers costs through efficiency and consolidation. This NVA highlights the business benefits of FlexPod and shows how such benefits can be achieved by leveraging the right components from industry-trusted vendors.
- **Technical and nontechnical decision makers.** FlexPod provides both technical and business value in the data center. This NVA highlights the value enabled by leveraging FlexPod in the data center to help decision makers choose the appropriate infrastructure solution to fulfill their specific requirements.
- **Cisco and NetApp partners.** FlexPod is designed to leverage the strength of its partner ecosystem; therefore, it is important for Cisco and NetApp partners to understand the FlexPod portfolio of architecture and solutions, leveraging it to meet and exceed customer requirements and expectations.

This NVA provides an overview of the FlexPod data center solution and links to more detailed supporting documentation.

2.3 TECHNOLOGY SOLUTION

FlexPod is a predesigned and validated base configuration that includes:

- Cisco UCS and Cisco UCS Manager
- Cisco Nexus data center switches
- NetApp FAS systems

FlexPod can scale up for greater performance and capacity (adding resources individually as needed), or it can scale out for environments that need multiple consistent deployments.

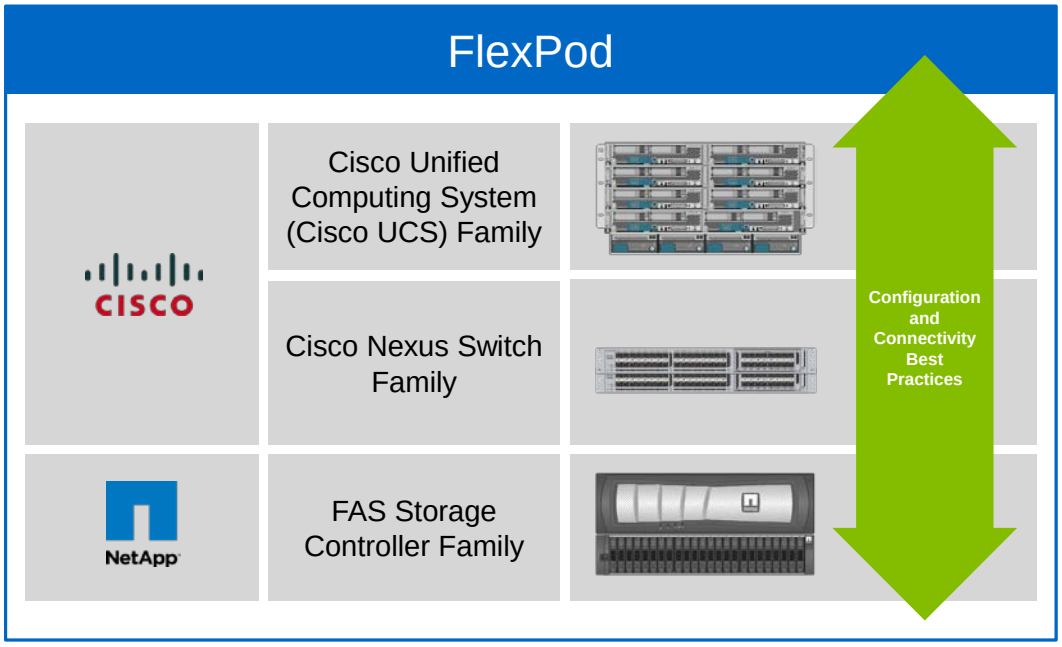
FlexPod includes all of the infrastructure elements that serve as the foundation for layering a broad range of workload solutions. Many customers require the ability to support a variety of operating systems. To satisfy this demand, FlexPod can be deployed as a virtualized, physical platform, or hybrid environment.

For example, the VMware vSphere built on FlexPod solution illustrates a fully virtualized environment, the Red Hat Enterprise Linux® built on FlexPod solution exemplifies a physical platform environment, and the SAP® applications built on FlexPod solution demonstrates a hybrid approach.

FlexPod has the flexibility to be sized and optimized to accommodate many different use cases or any combination of cases. For example, a customer who needs a FlexPod configuration to satisfy virtual desktop infrastructure (VDI) requirements might require higher capacity server and optimized NetApp Flash Cache technologies. For a development and test environment, a customer might require more compute resources but less storage because of the extreme efficiencies of NetApp storage. In contrast, for a data-protection and backup environment, a customer might require less computing and more storage capacity.

The flexibility of the FlexPod shared infrastructure makes it a great foundation for many different use cases. Customers can begin with a small, simple FlexPod configuration and scale up or out, responding as the needs of the business grow. Figure 1 illustrates the hardware families that define a FlexPod configuration.

Figure 1) FlexPod infrastructure.



2.4 USE CASE SUMMARY

FlexPod is designed to accommodate a variety of use cases. It can be leveraged as a nonvirtualized, fully virtualized, or hybrid infrastructure by simply layering on the hypervisor(s) or bare metal operating system(s) of choice. The flexibility and scalability of the architecture provide an ideal shared infrastructure for satisfying a combination of use cases, workload solutions, or application environments. Some examples include:

- VMware vSphere built on FlexPod (described in this document)
- Secure multi-tenancy
- Red Hat Enterprise Linux built on FlexPod
- SAP built on FlexPod
- Microsoft® solutions built on FlexPod
- VMware View™ 4.5 built on FlexPod

- Citrix XenDesktop built on FlexPod (choice of hypervisors)

As workloads and application requirements change, FlexPod provides the flexibility to adapt and scale accordingly. For more information, refer to NetApp Technical Report 3384, “FlexPod Solutions Guide” (to be published November 2011).

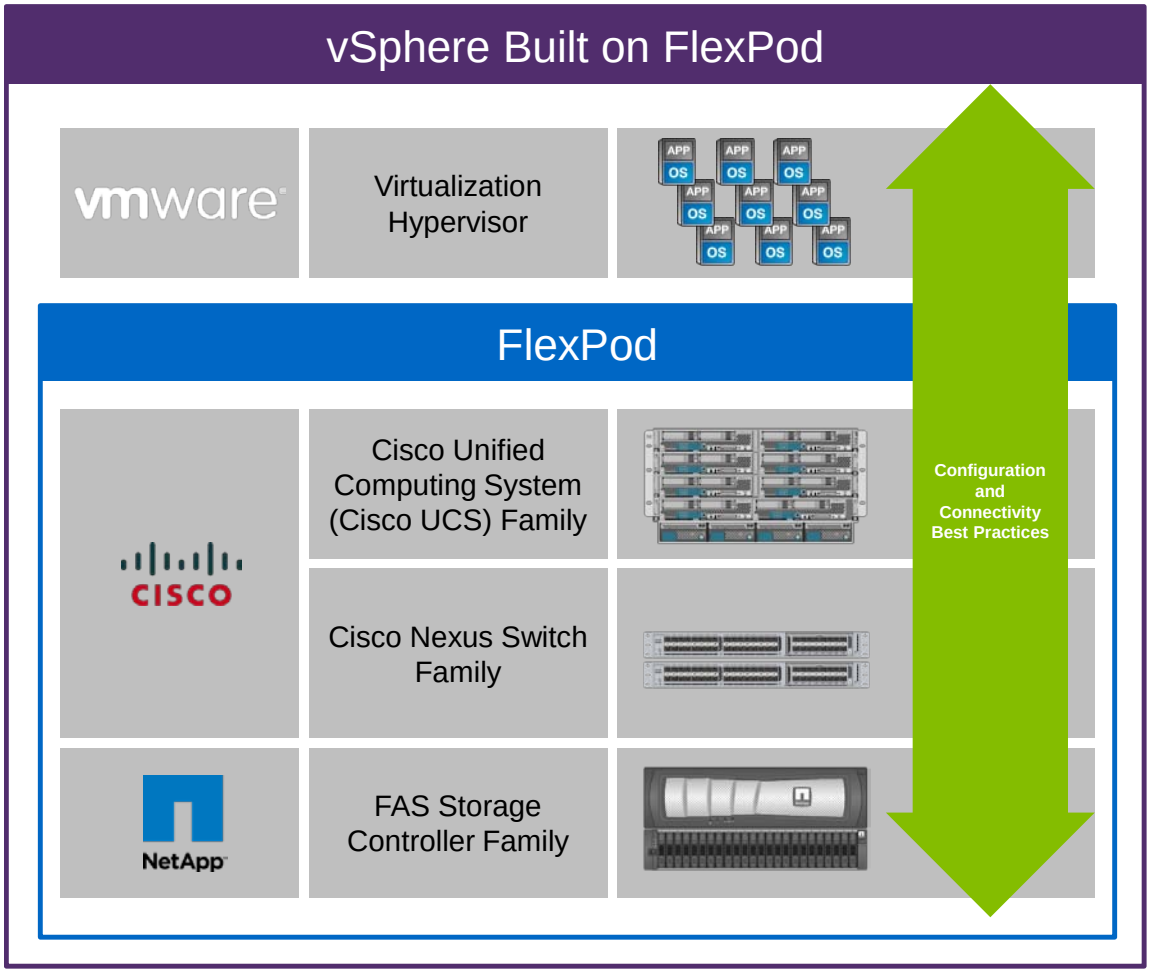
3 ARCHITECTURE USE CASE

FlexPod delivers a shared infrastructure platform from which to deploy a variety of workload solutions and applications. In real-world use cases, the extended configuration also includes the solutions that are built on the FlexPod platform. This section focuses on one such common use case: VMware vSphere built on FlexPod.

3.1 SOLUTION ARCHITECTURE

Deploying VMware vSphere on the FlexPod shared infrastructure, as shown in Figure 2, leverages the full capabilities of the market leader in virtualization technology. The combination of FlexPod and VMware vSphere enables administrators to easily virtualize all FlexPod infrastructure resources (storage, network, and server) to deliver logical environments for applications and workloads. In the vSphere built on FlexPod solution, the configuration and connectivity best practices delivered for the FlexPod infrastructure are also extended to the VMware vSphere environment.

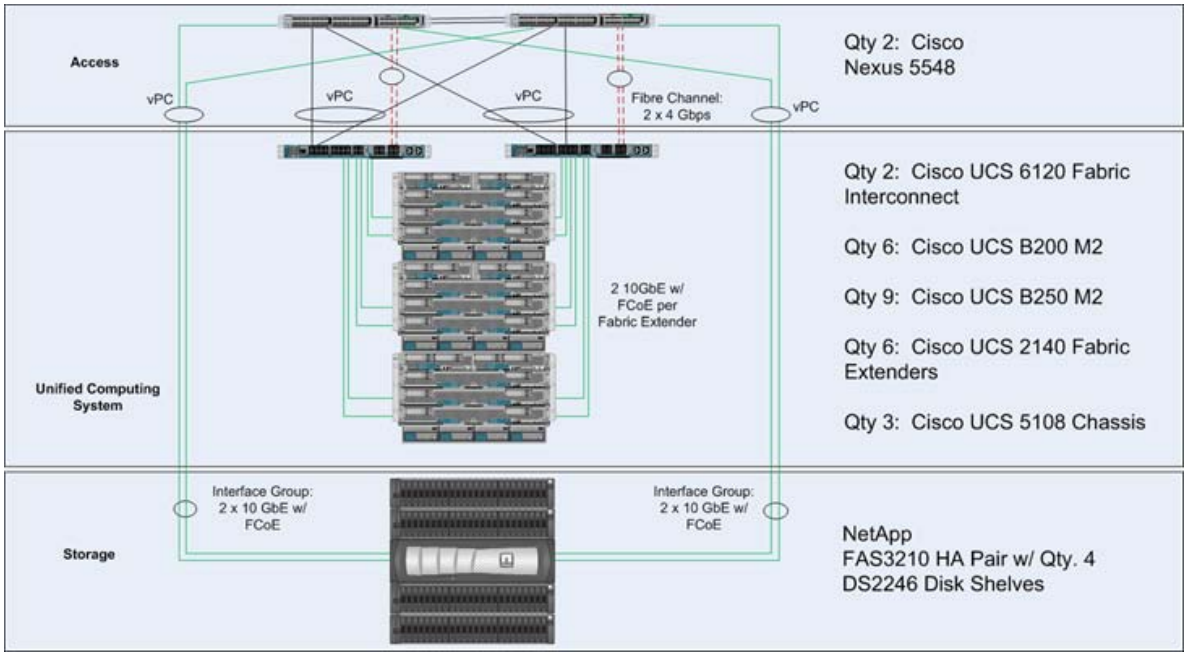
Figure 2) VMware vSphere built on FlexPod.



The use of VMware vSphere extends the benefits of FlexPod. The VMware vSphere hypervisor enables the consolidation of multiple workloads or applications on fewer servers, increasing efficiency and utilization. This leads to a smaller footprint and lower costs associated with running the data center. As requirements change, workloads or applications can be migrated to another vSphere host or even to another data center quickly and easily, with mobility further enhanced and simplified by the FlexPod shared infrastructure. NetApp also delivers the Virtual Storage Console (VSC), which is a VMware vCenter™ Server plug-in and service that provides storage visibility and enhanced virtual machine (VM) provisioning from within the VMware vCenter management interface and is automated through API control.

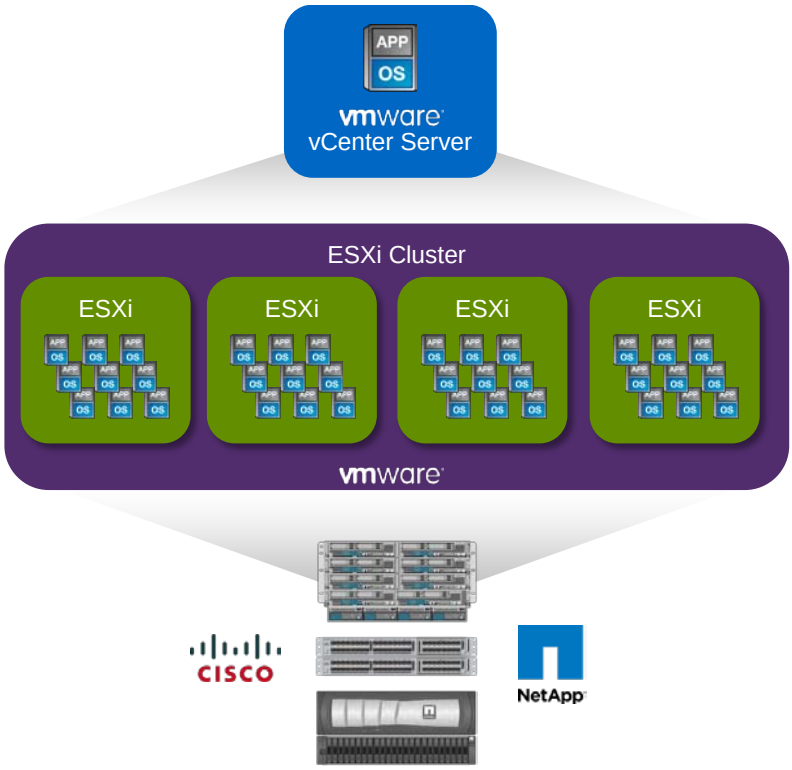
Figure 3 illustrates one example of a VMware vSphere interface built on FlexPod connectivity topology. Because of the inherent flexibility in supported configurations, FlexPod component details and connectivity can vary; however, in all cases, architectural best practices still apply.

Figure 3) FlexPod physical topology (example).



VMware vSphere built on FlexPod leverages several software components from the VMware vSphere suite, most notably the VMware ESXi™ hypervisor and the VMware vCenter Server. VMware ESXi is installed on two or more physical servers, providing the capability to deploy multiple VMs in the environment. VMware vCenter Server provides the management for the vSphere environment using a single centralized interface. Figure 4 illustrates the VMware components deployed within a VMware vSphere built on FlexPod solution.

Figure 4) VMware vSphere built on FlexPod, VMware components.



The Cisco Nexus 1000v Virtual Switch is used to provide a consistent Cisco Nexus switching environment between the physical and virtual networking layers. The Cisco Nexus 1000v provides the network administrator with a seamless Cisco® methodology across the physical and virtual networking environment, whereas traditional VMware vSwitches require a different operational approach.

3.2 SOLUTION SIZING AND PERFORMANCE CONSIDERATIONS

Flexibility and scalability are some of the biggest key benefits of the FlexPod architecture. Whether the main business driver is to lower costs or to provide a specific private or public service, these goals can be achieved because of the adaptable and agile design of FlexPod.

The “vSphere Built on FlexPod Sizing Guide” (available only to NetApp, Cisco, and authorized system integrator partners) provides information for building and sizing shared infrastructure solutions based on customer requirements. The sizing guide is based on a design principle of supporting concurrent workloads on a right-sized platform. The vSphere built on FlexPod reference configuration is designed to support concurrent user workloads of VMware virtual desktops running Microsoft Windows® 7, Microsoft Exchange 2010, Microsoft SharePoint® 2010, and a Microsoft SQL Server® (MS-SQL) 2008 Release 2 (R2) online transaction processing (OLTP) environment.

Depending on their application requirements, customers can choose the appropriate hardware for their deployment. This allows the customer to avoid purchasing an infrastructure stack that is underutilized.

For more information about sizing vSphere solutions on FlexPod, refer to the “vSphere Built on FlexPod Sizing Guide” on the NetApp Field Portal or consult with your Cisco and NetApp sales representatives.

3.3 PHYSICAL INFRASTRUCTURE

CISCO NEXUS 5000 SERIES SWITCH FAMILY

The networking foundation for any FlexPod deployment is the Cisco Nexus 5000 series family of switches. The Nexus 5000 series switch enables any transport over Ethernet, including Layer 2 and Layer 3 traffic and storage traffic, on one common data center–class platform. Cisco Nexus 5000 series switches help transform data centers with a standards-based, multipurpose, multiprotocol, Ethernet-based fabric.

Cisco Nexus 5000 series switches are ideal for enterprise-class data center server access layer and smaller scale, midmarket data center aggregation layer deployments. These multipurpose, multilayer switches can be deployed across a diverse set of traditional, virtualized, unified, and high-performance computing (HPC) environments.

CISCO UCS FABRIC INTERCONNECTS

The Cisco UCS Fabric Interconnects are a core part of the Cisco UCS platform, providing both network connectivity and management capabilities for the system. The Cisco UCS Fabric Interconnects offer line-rate, low-latency, lossless 10GbE and Fibre Channel over Ethernet (FCoE) functions.

The Cisco UCS Fabric Interconnects provide the management and communication backbone for the Cisco UCS B-Series Blades and C-Series rackmount servers. All Cisco UCS blade and rackmount servers attached to the Cisco UCS Fabric Interconnects become part of a single highly available management domain. In addition, by supporting unified fabric, the Cisco UCS Fabric Interconnects provide both the LAN and the storage area network (SAN) connectivity for all blades within their domain. The VMware vSphere deployment described in this document is based on B-series blade servers.

CISCO UCS B-SERIES BLADES AND BLADE SERVER CHASSIS

The Cisco UCS 5100 Series Blade Server Chassis is a crucial building block of the Cisco UCS, delivering a scalable and flexible blade server chassis for today's and tomorrow's data center while helping reduce total cost of ownership (TCO).

Cisco's first blade server chassis offering, the Cisco UCS 5108 Blade Server Chassis, is six rack units (6RU) high and can mount in an industry-standard 19-inch rack. A chassis can house up to eight half-width Cisco UCS B-Series Blade Servers and can accommodate both half- and full-width blade form factors.

NETAPP FABRIC-ATTACHED CONTROLLERS

The NetApp Unified Storage Architecture provides customers with an agile and scalable storage platform. All NetApp FAS storage systems use the NetApp Data ONTAP® operating system to provide SAN (FCoE, FC, iSCSI), NAS (CIFS, Network File System [NFS]), and primary and secondary storage within a single unified platform so that all data resources can be hosted within the same storage array. A unified storage platform for activities such as installation, provisioning, mirroring, backup, and upgrading is used throughout the entire NetApp FAS product line, from the entry level to enterprise-class controllers. NetApp unified storage delivers unprecedented simplicity and efficiency to even the most complex enterprise data management challenges, enabling customers to achieve measurable business value, such as:

- Reducing the complexity of data ownership
- Enabling companies to adapt to their changing business needs without interruption
- Reducing TCO

3.4 NETWORKING

10 GIGABIT ETHERNET

Today's data center environments demand higher network bandwidth and performance as endpoints such as desktops, servers, and storage grow increasingly more powerful and virtualization and workloads are increasingly consolidated through virtualization technologies. The 10 Gigabit Ethernet (10GbE) standard was introduced to accommodate these demands as well as provide a foundation for features such as FCoE and lossless Ethernet.

FIBRE CHANNEL OVER ETHERNET

FCoE is a standard that calls for the encapsulation of Fibre Channel frames over a 10GbE network. With the addition of FCoE, Data Center Bridging (DCB) was introduced to address the unique characteristics of the Fibre Channel protocol running on Ethernet. The features provided by DCB include priority flow control and lossless Ethernet. FCoE requires the use of special FCoE-capable adapters, commonly referred to as converged network adapters (CNAs). CNAs enable end devices to receive and transmit both Fibre Channel and Ethernet frames simultaneously over the same 10GbE network medium.

LINK AGGREGATION CONTROL PROTOCOL

The Link Aggregation Control Protocol (LACP) is an enhanced feature that greatly simplifies link aggregation procedures. Link aggregation is the bundling of multiple physical links into a single logical link for greater bandwidth and higher availability. LACP works by enabling all ports on both ends of the aggregated link to send and receive LACP data unit (LACPDU) frames. All participating devices use LACPDU frames to communicate and negotiate which ports will be allowed to perform as part of the aggregated link. This technology greatly simplifies the link aggregation procedure and minimizes the risk of misconfiguration.

CISCO VIRTUAL PORT CHANNEL

A port channel is the Cisco switch implementation of a link aggregation. To achieve higher levels of availability, port channels are ideally configured using physical links that span two network devices capable of link aggregation, achieving link redundancy across multiple switches as well as switchports. With the introduction of Cisco virtual PortChannel (vPC), a logical aggregation can be created across two physically separated Cisco vPC-capable switches (or peers) over standard cabling. vPC technology simplifies the network architecture to achieve the ideal combination of aggregated bandwidth and link high availability (HA).

3.5 STORAGE

STORAGE EFFICIENCY

One of the key business challenges to shared infrastructure adoption is the increased cost incurred from using storage to obtain a highly available, enterprise-quality solution. Virtual desktop and other enterprise application use cases can create a high level of data redundancy, especially in highly consolidated, virtualized environments. For example, in a virtualized environment using traditional storage, the total capacity required equals the sum of the storage required by each VM. If each VM were 20GB in size, and the solution contained 1,000 VMs, at least 20TB of usable data capacity would be required from the shared storage.

NetApp delivers industry-leading technologies such as thin provisioning, data deduplication, and FlexClone® technology to multiple levels of storage efficiency across all forms of data. By leveraging the NetApp unified portfolio of storage technologies, customers have been proven to cut storage costs by up to 50% to 90%.

NETAPP UNIFIED STORAGE

NetApp unified storage platforms deliver the ability to support multiple storage network protocols from a single storage controller. Data ONTAP enables users on client workstations (or hosts) to create, delete, modify, and access files or blocks stored on the storage system. Storage systems can be deployed in NAS or SAN environments for accessing a full range of enterprise data on a variety of platforms supporting NFS, CIFS, HTTP, HTTPS, FCP, iSCSI, and FCoE protocols. Files written using one protocol are accessible to clients of any protocol. For example, an NFS client can access a file created by a CIFS client, and a CIFS client can access a file created by an NFS client.

NETAPP MULTISTORE

NetApp MultiStore® technology enables shared storage environments to quickly and easily create separate and completely private logical partitions, called vFiler® units, on a single NetApp storage system as discrete administrative domains. vFiler units enable a single physical storage system to appear to serve as many logical systems. Each vFiler unit can be individually managed with different sets of performance and policy characteristics, authentication domains, and access controls. Providers can leverage MultiStore to enable multiple customers to share the same storage resources with secure storage separation. Administrative control of the virtual storage container can even be delegated directly to the customer. Up to 130 vFiler units can be created on most NetApp HA configurations using MultiStore technology.

3.6 VIRTUAL INFRASTRUCTURE

VMWARE ESXI

VMware ESXi is a lightweight hypervisor that is installed directly onto the physical servers, enabling the abstraction and distribution of compute resources such as memory, CPU, network attachment, and storage allocations into logical constructs called virtual machines (VMs). ESXi hosts can be aggregated with shared infrastructure resources to create host “clusters,” which simplify the management of virtualized resources and enable enhanced features such as VMware vMotion®, VMware HA, and VMware Distributed Resource Scheduler (DRS). The VMware vSphere Client may be used to manage each ESXi host individually or to use VMware vCenter Server to centrally manage multiple ESXi hosts.

NFS DATASTORES

VMware vSphere allows customers to make use of enterprise-class NFS shared storage to provide datastores with concurrent access by all of the nodes in a vSphere cluster. NetApp NFS delivers industry-leading storage performance, availability, efficiency, and advanced data management capabilities.

By leveraging NetApp storage for VMware vSphere datastores using NFS, customers can realize the powerful potential of NetApp efficiencies and integrations with VMware virtualization technologies achieved with WAFL® (Write Anywhere File Layout), the NetApp advanced data management and storage virtualization engine. These integrations provide:

- NetApp storage resource monitoring correlated to VMware datastores
- Seamless access to VM storage operations enhanced by NetApp, such as:
  - Primary data deduplication
  - Automated storage attachment path optimization
  - Automated datastore provisioning and vSphere host attachment across clusters
  - Immediate, zero-cost VM and datastore clones
  - Array-based thin provisioning
  - Automated policy-based datastore resizing
- Direct access to array-based NetApp Snapshot™ copies

NetApp also provides integrated tools such as the NetApp Adapter for Site Recovery Manager and the Virtual Storage Console (VSC).

NETAPP VIRTUAL STORAGE CONSOLE

The VSC software delivers storage configuration and monitoring, datastore provisioning, VM cloning, and backup and recovery of VMs and datastores. VSC also includes an API for automated control.

VSC delivers a single VMware plug-in that provides end-to-end VM lifecycle management for VMware environments leveraging NetApp storage.

VSC is delivered as a vCenter Server plug-in. It is available to all vSphere Clients that connect to the vCenter Server. This is different from a client-side plug-in that must be installed on every vSphere Client. The VSC software can be installed either on the vCenter Server or on a separate Microsoft Windows server or VM.

CISCO NEXUS 1000V VIRTUAL SWITCH

The Cisco Nexus 1000v virtual switch is an optional software virtual switch that can be used in place of the VMware vSwitch or Distributed Virtual Switch (DVS). The Cisco Nexus 1000v provides enterprise-class Cisco Nexus switching capabilities to the virtual access layer of the VMware vSphere environment. VM network ports are individually connected through software to the Cisco Nexus 1000v, enabling per-port granularity for configuration and security control.

Two main components make up the Cisco Nexus 1000v virtual switch:

- The Virtual Supervisor Module (VSM)
- The Virtual Ethernet Module (VEM)

The VSM serves as a single management interface for the entire distributed virtual switch, similar to a supervisor module in a physical Cisco enterprise-class switch chassis. The VEM modules are installed on each host and serve as the software access layer within the virtual network. VM virtual network ports and physical uplink ports both link to the VEM modules on their respective virtual hosts. The VSM and VEMs all operate in concert to provide a complete virtual distributed Cisco Nexus switch within VMware vSphere.

3.7 ELEMENT MANAGEMENT

CISCO UCS MANAGER

Cisco UCS Manager (UCSM) is robust device-management software that is embedded in every Cisco UCS deployment. Cisco UCSM runs on the Cisco UCS Fabric Interconnects and provides highly available management of the entire Cisco UCS environment. Cisco UCSM provides flexible role- and policy-based management of resources through the use of service profiles and templates. The use of service profiles and templates abstracts those elements that typically denote server personality (such as mandatory access control [MAC] address, worldwide port name [WWPN], system universally unique identifier [UUID], and firmware revisions) from the role the compute resource serves in the data center. Through this methodology, configuration attributes such as firmware, boot order, network interface card (NIC) and host bus adapter (HBA) settings, and boot targets are no longer tied to a given server. This approach enables IT compute resources to be deployed in minutes rather than days and allows organizations to focus on strategy rather than trivial operational tasks.

NETAPP ONCOMMAND

NetApp OnCommand™ management software improves storage and service efficiency through functions that help control, automate, and analyze shared storage infrastructures.

Only NetApp OnCommand unified manager delivers a unified experience to manage physical and virtual storage environments using integrated workflows and policy-driven automation. From a single interface, OnCommand enables the consolidation and simplification of shared IT storage management, delivering significant flexibility and efficiency.

OnCommand manages shared storage resources using policy-based automation for provisioning and data protection, resulting in up to 50% savings in storage costs. OnCommand integrates with third-party management suites, providing a unified storage management approach while still allowing flexibility in the data center.

VMWARE VCENTER SERVER

VMware vCenter Server provides a scalable and unified approach to managing a VMware vSphere environment. VMware vCenter Server provides a common interface for monitoring and configuring vSphere hosts and VMs as well as their underlying resources such as memory, CPU, network attachments, and storage resources. Other advanced features can also be enabled by unifying the management of an entire vSphere environment under VMware vCenter Server, including:

- VMware DRS
- VMware HA
- VMware Fault Tolerance
- VMware vMotion and Storage vMotion

3.8 END-TO-END MANAGEMENT

Although the element managers discussed in the previous sections provide thorough control of their respective components, there is a need for comprehensive end-to-end management to handle the daily operation of the environment. To provide customers with a variety of choices for this role, NetApp and Cisco have joined with known and trusted partners to form the FlexPod Management Solution Program. This program includes two classes of solutions to help manage FlexPod:

- **FlexPod management solutions.** These solutions, provided by partners, address specific management needs on each of the FlexPod components: Cisco Nexus, Cisco UCS, and NetApp storage controllers. These partner solutions might provide a variety of services, including configuration management, health and performance monitoring, VM lifecycle management, and more.
- **FlexPod management validated solutions.** These partner solutions have been verified by NetApp and Cisco to deliver rich operational control and fulfill a rigorous set of use case requirements and are proven to provide unified manageability of the FlexPod environment. Validated solutions must meet a high bar of integration with all of the FlexPod components, in addition to usability and feature requirements, including:
  - A unified organizational model for resource assignment
  - A unified service catalog across FlexPod resources
  - Easily adaptable automation
  - Unified resource metering
  - The ability to integrate into an existing management environment

  All validated solutions share this same core set of capabilities, but our partners also go beyond this prescribed baseline to innovate and differentiate their solutions. This enables customers to compare with confidence and find the validated solution that best fits the needs of their business.

This program allows customers to easily identify FlexPod management solutions from qualified developers, and the validated solutions provide the additional assurance of FlexPod unified management and verification by Cisco and NetApp. For more information on the FlexPod management software ecosystem, refer to the FlexPod Landing Page.

4 DESIGN VALIDATION

4.1 SUCCESS STORIES

FlexPod is a valuable solution architecture that has been widely implemented and proven to be a huge success for many Cisco and NetApp customers in a number of varied geographies and industries. Whether they want to run business-critical applications or specific use case workloads or build public and private clouds, FlexPod continues to help customers succeed and achieve their data center and IT objectives.

Current FlexPod customers include Lockheed Martin, Trusted Cloud, World Wide Technology, and NightHawk Radiology.

LOCKHEED MARTIN

In June of 2011, Lockheed Martin announced the unveiling of its "BlackCloud" solution, which is a secure private cloud offering for government agencies built leveraging FlexPod and its secure multi-tenancy use case. For more information, refer to the article Lockheed Martin Announces BlackCloud™ Solution Based on Trusted Infrastructure Technologies from Cyber Security Alliance Partners.

TRUSTED CLOUD

In August of 2011, Trusted Cloud in Australia chose FlexPod as the platform on which to build its public cloud solution, offering virtual desktops as a service to its enterprise customers. For more information, refer to the article Australian First as Trusted Cloud Chooses NetApp and FlexPod To Deliver Secure ITaaS.

WORLD WIDE TECHNOLOGY AND NIGHTHAWK RADIOLOGY

World Wide Technology, a solution provider and partner to both Cisco and NetApp, assisted NightHawk Radiology in building a scalable infrastructure for transferring, storing, and studying radiological images from radiology providers and hospitals around the country. For more information, refer to the article Cisco UCS Implementation in 30 Days? VAR Makes It Happen.

5 CONCLUSION

FlexPod is the optimal shared infrastructure foundation on which to deploy a variety of IT workloads. Cisco and NetApp have created a platform that is both flexible and scalable for multiple use cases and applications. One common use case is to deploy VMware vSphere as the virtualization solution, as described in this NVA. From VDI to SAP, FlexPod can efficiently and effectively support business-critical applications running simultaneously from the same shared infrastructure. The flexibility and scalability of FlexPod also enable customers to start out with a right-sized infrastructure that can ultimately grow with and adapt to their evolving business requirements.

6 APPENDIX

6.1 SUPPORTING DOCUMENTS

- FlexPod Landing Page
  www.netapp.com/us/technology/flexpod
- FlexPod Solutions Guide
  http://media.netapp.com/documents/tr-3884.pdf
- VMware vSphere Built on FlexPod Landing Page
  www.netapp.com/us/technology/flexpod/vmware

- VMware vSphere Built on FlexPod Solution Brief
  http://media.netapp.com/documents/ds-3105-flexpod.pdf
- VMware vSphere Built on FlexPod Technical Specifications
  www.bdtcorp.com/pdfs/netapp/white_papers/flexpod-technical-specifications-final.pdf
- IDC White Paper on FlexPod
  http://media.netapp.com/documents/ar-accelerating-converged-infrastructure.pdf

6.2 RECOMMENDED DOCUMENTS

- Cisco Unified Computing System
  www.cisco.com/en/US/products/ps10281/index.html
  www.cisco.com/en/US/products/ps10280/index.html
- Cisco Nexus 5000 Series Switches
  www.cisco.com/en/US/products/ps9670/index.html
- Cisco Nexus 1000v Virtual Switch
  www.cisco.com/en/US/products/ps9902/index.html
- FlexPod Deployment Guide CVD
  www.cisco.com/en/US/docs/solutions/Enterprise/Data_Center/Virtualization/flexpod_deploy.html
- NetApp Virtual Storage Console
  www.netapp.com/us/products/management-software/vsc/virtual-storage-console.html
- NetApp OnCommand
  www.netapp.com/us/products/management-software/oncommand
- NetApp Storage Systems
  www.netapp.com/us/products/storage-systems
- VMware Built on FlexPod Deployment Guide CVD
  www.cisco.com/en/US/docs/solutions/Enterprise/Data_Center/Virtualization/flexpod_vsphere.html
- VMware ESX(i) Hypervisor
  www.vmware.com/products/vsphere/esxi-and-esx/overview.html
- VMware vCenter Server
  www.vmware.com/products/vcenter-server/overview.html

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