FlexPod Express with Cisco UCS C-Series and NetApp AFF C190 Series Design Guide

FlexPod

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NVA-1139-DESIGN: FlexPod Express with Cisco UCS C-Series and NetApp AFF C190 Series

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In partnership with:

Industry trends indicate a vast data center transformation toward shared infrastructure and cloud computing. In addition, organizations seek a simple and effective solution for remote and branch offices that uses the technology that they are familiar with in their data center.

FlexPod Express is a predesigned, best practice data center architecture that is built on the Cisco Unified Computing System (Cisco UCS), the Cisco Nexus family of switches, and NetApp AFF systems. The components of FlexPod Express are like their FlexPod Datacenter counterparts, enabling management synergies across the complete IT infrastructure environment on a smaller scale. FlexPod Datacenter and FlexPod Express are optimal platforms for virtualization and for bare-metal operating systems and enterprise workloads.

Next: Program summary.

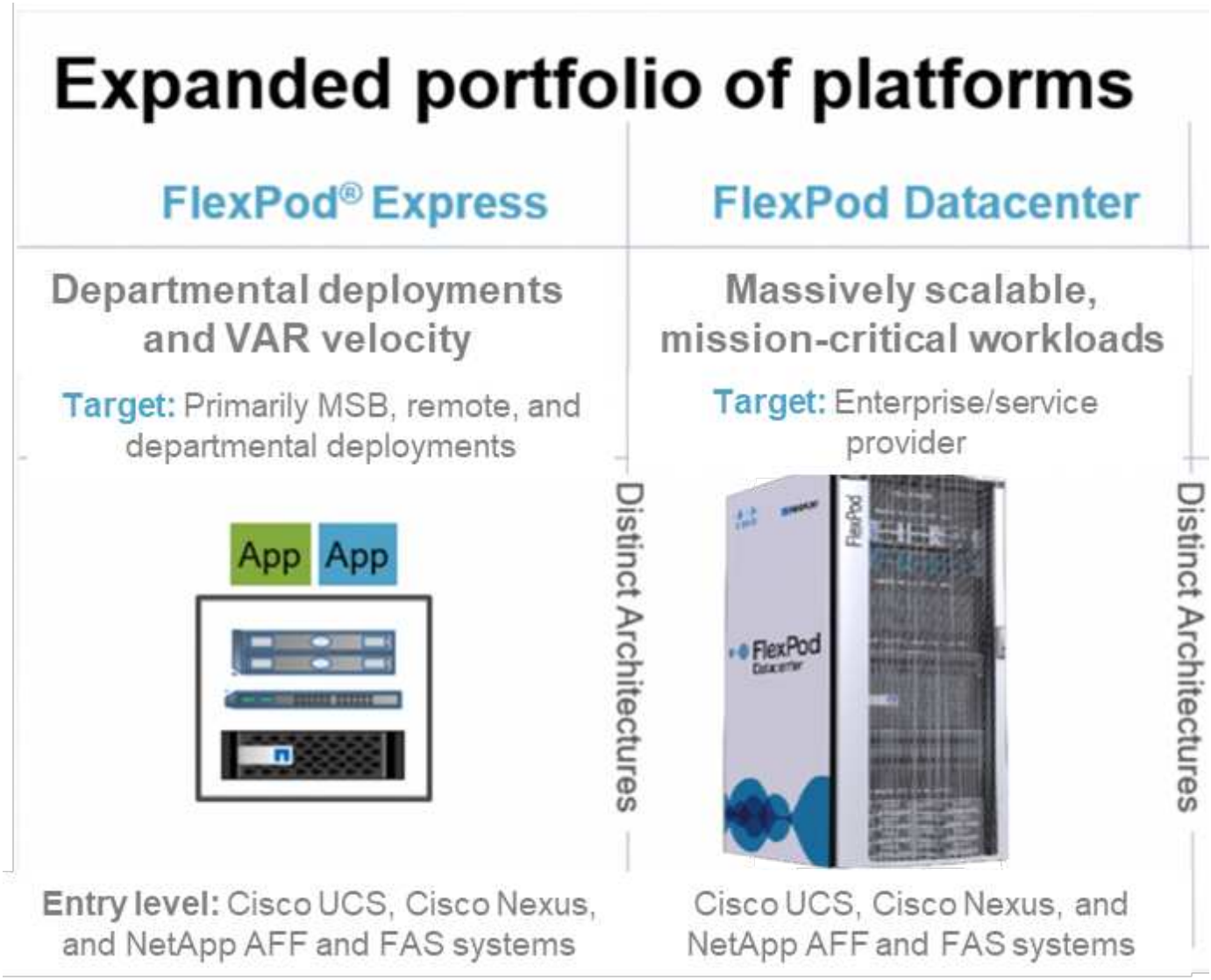
Program summary

FlexPod Converged Infrastructure Portfolio

FlexPod reference architectures are delivered as Cisco Validated Designs (CVDs) or as NetApp Verified Architectures (NVAs). Deviations that are based on customer requirements from a given CVD or NVA are permitted if those variations do not result in the deployment of unsupported configurations.

As illustrated in the following figure, the FlexPod portfolio includes the following solutions: FlexPod Express and FlexPod Datacenter.

- **FlexPod Express** is an entry-level solution with technologies from Cisco and NetApp.
- **FlexPod Datacenter** delivers an optimal multipurpose foundation for various workloads and applications.



NetApp Verified Architecture program

The NetApp Verified Architecture program offers customers a verified architecture for NetApp solutions. An NVA solution has the following qualities:

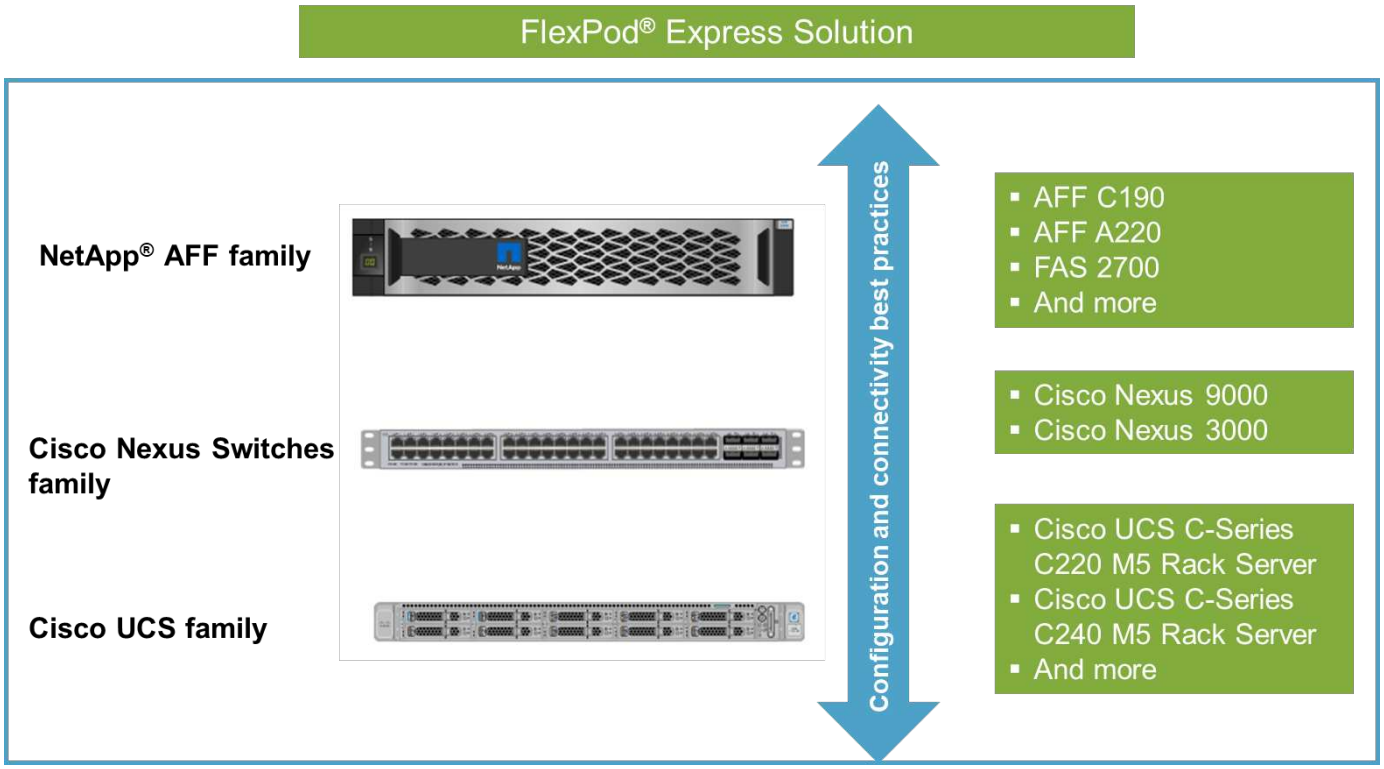
- Is thoroughly tested
- Is prescriptive in nature
- Minimizes deployment risks
- Accelerates time to market This guide details the design of FlexPod Express with VMware vSphere.

In addition, this design leverages the all-new AFF C190 system, which runs NetApp ONTAP 9.6 software, Cisco Nexus 31108 switches, and Cisco UCS C220 M5 servers as hypervisor nodes.

Solution overview

FlexPod Express is designed to run mixed virtualization workloads. It is targeted for remote and branch offices and for small to midsize businesses. It is also optimal for larger businesses that want to implement a dedicated solution for a specific purpose. This new solution for FlexPod Express adds new technologies such as NetApp ONTAP 9.6, NetApp AFF C190 system, and VMware vSphere 6.7U2.

The following figure shows the hardware components that are included in the FlexPod Express solution.

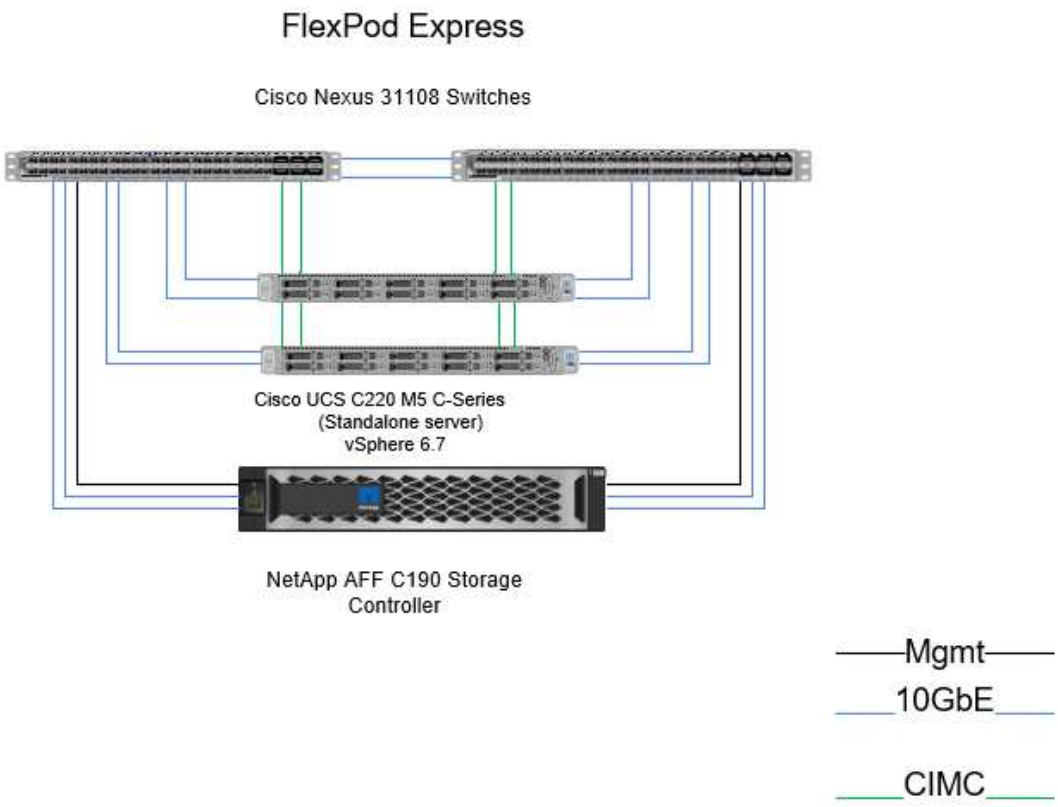


Target audience

This document is intended for people who want to take advantage of an infrastructure that is built to deliver IT efficiency and to enable IT innovation. The audience for this document includes, but is not limited to, sales engineers, field consultants, professional services personnel, IT managers, partner engineers, and customers.

Solution technology

This solution leverages the latest technologies from NetApp, Cisco, and VMware. It features the new NetApp AFF C190 system, which runs ONTAP 9.6 software, dual Cisco Nexus 31108 switches, and Cisco UCS C220 M5 rack servers that run VMware vSphere 6.7U2. This validated solution, illustrated in the following figure, uses 10 Gigabit Ethernet (10GbE) technology. Guidance is also provided on how to scale by adding two hypervisor nodes at a time so that the FlexPod Express architecture can adapt to an organization's evolving business needs.



Next: Technology requirements.

Technology requirements

FlexPod Express requires a combination of hardware and software components that depends on the selected hypervisor and network speed. In addition, FlexPod Express lays out the hardware components that are required to add hypervisor nodes to the system in units of two.

Hardware requirements

Regardless of the hypervisor chosen, all FlexPod Express configurations use the same hardware. Therefore, even if business requirements change, you can use a different hypervisor on the same FlexPod Express hardware.

The following table lists the hardware components that are required for this FlexPod Express configuration and to implement this solution. The hardware components that are used in any implementation of the solution can vary based on customer requirements.

Hardware	Quantity
AFF C190 2-node cluster	1
Cisco UCS C220 M5 Server	2

Hardware	Quantity
Cisco Nexus 31108 Switch	2
Cisco UCS Virtual Interface Card (VIC) 1457 for Cisco UCS C220 M5 rack server	2

Software requirements

The following table lists the software components that are required to implement the architectures of the FlexPod Express solution.

Software	Version	Details
Cisco Integrated Management Controller (CIMC)	4.0.4	For C220 M5 rack servers
Cisco NX-OS	7.0(3)I7(6)	For Cisco Nexus 31108 switches
NetApp ONTAP	9.6	For NetApp AFF C190 controllers

The following table lists the software that is required for all VMware vSphere implementations on FlexPod Express.

Software	Version
VMware vCenter Server Appliance	6.7U2
VMware vSphere ESXi	6.7U2
NetApp VAAI Plug-In for ESXi	1.1.2
NetApp Virtual Storage Console	9.6

Next: Design choices.

Design choices

The technologies listed in this section were chosen during the architectural design phase. Each technology serves a specific purpose in the FlexPod Express infrastructure solution.

NetApp AFF C190 Series with ONTAP 9.6

This solution leverages two of the newest NetApp products: NetApp AFF C190 system and ONTAP 9.6 software.

AFF C190 system

The target group is customers who want to modernize their IT infrastructure with all- flash technology at an affordable price. The AFF C190 system comes with the new ONTAP 9.6 and flash bundle licensing, which means that the following functions are on board:

- CIFS, NFS, iSCSI, and FCP
- NetApp SnapMirror data replication software, NetApp SnapVault backup software, NetApp SnapRestore data recovery software, NetApp SnapManager storage management software product suite, and NetApp

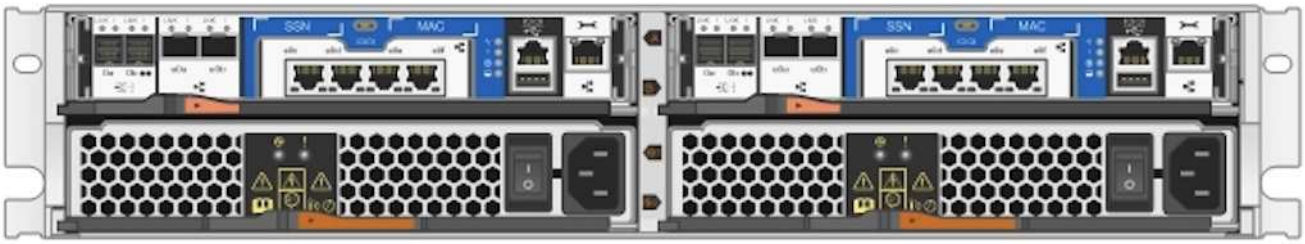
SnapCenter software

- FlexVol technology
- Deduplication, compression, and compaction
- Thin provisioning
- Storage QoS
- NetApp RAID DP technology
- NetApp Snapshot technology
- FabricPool

The following figures show the two options for host connectivity.

The following figure illustrates UTA 2 ports where SFP+ module can be inserted.

The following figure illustrates 10GBASE-T ports for connection through conventional RJ-45 Ethernet cables.



For the 10GBASE-T port option, you must have a 10GBASE-T based uplink switch.

The AFF C190 system is offered exclusively with 960GB SSDs. There are four stages of expansions from which you can choose:

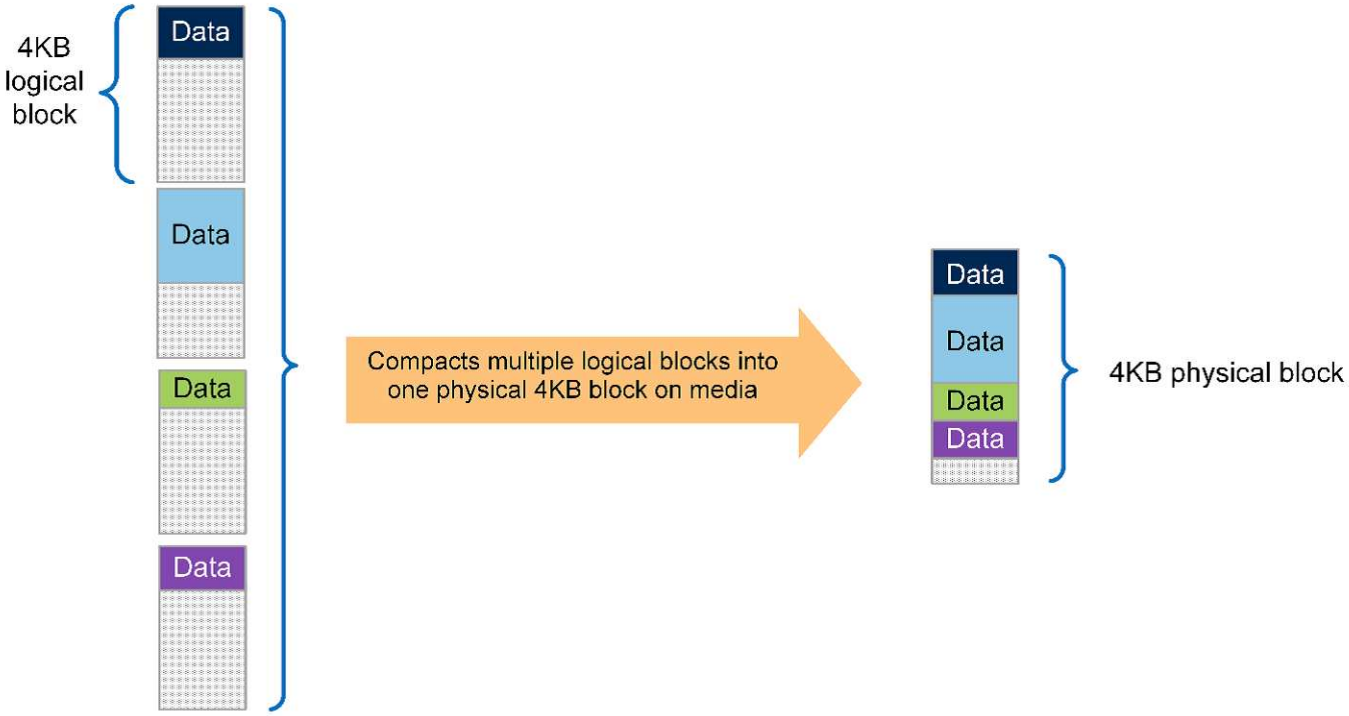
- 8x 960GB
- 12x 960GB
- 18x 960GB
- 24x 960GB

For full information about the AFF C190 hardware system, see the NetApp AFF C190 All-Flash Array page.

ONTAP 9.6 software

NetApp AFF C190 systems use the new ONTAP 9.6 data management software. ONTAP 9.6 is the industry's leading enterprise data management software. It combines new levels of simplicity and flexibility with powerful data management capabilities, storage efficiencies, and leading cloud integration.

ONTAP 9.6 has several features that are well suited for the FlexPod Express solution. Foremost is NetApp's commitment to storage efficiencies, which can be one of the most important features for small deployments. The hallmark NetApp storage efficiency features such as deduplication, compression, compaction, and thin provisioning are available in ONTAP 9.6. The NetApp WAFL system always writes 4KB blocks; therefore, compaction combines multiple blocks into a 4KB block when the blocks are not using their allocated space of 4KB. The following figure illustrates this process.



ONTAP 9.6 now supports an optional 512- byte block size for NVMe volumes. This capability works well with the VMware Virtual Machine File System (VMFS), which natively uses a 512-byte block. You can stay with the default 4K size or optionally set the 512-byte block size.

Other feature enhancements in ONTAP 9.6 include:

- **NetApp Aggregate Encryption (NAE).** NAE assigns keys at the aggregate level, thereby encrypting all volumes in the aggregate. This feature allows volumes to be encrypted and deduplicated at the aggregate level.
- **NetApp ONTAP FlexGroup volume enhancement**. In ONTAP 9.6, you can easily rename a FlexGroup volume. There's no need to create a new volume to migrate the data to. The volume size can also be reduced by using ONTAP System Manager or CLI.
- **FabricPool enhancement.** ONTAP 9.6 added additional support for object stores as cloud tiers. Support for Google Cloud and Alibaba Cloud Object Storage Service (OSS) was also added to the list. FabricPool supports multiple object stores, including AWS S3, Azure Blob, IBM Cloud object storage, and NetApp StorageGRID object-based storage software.
- **SnapMirror enhancement.** In ONTAP 9.6, a new volume replication relationship is encrypted by default before leaving the source array and is decrypted at the SnapMirror destination.

Cisco Nexus 3000 Series

The Cisco Nexus 31108PC-V is a 10Gbps SFP+ based top-of-rack (ToR) switch with 48 SFP+ ports and 6 QSFP28 ports. Each SFP+ port can operate in 100Mbps, 10Gbps, and each QSFP28 port can operate in native 100Gbps or 40Gbps mode or 4x 10Gbps mode, offering flexible migration options. This switch is a true PHY-less switch that is optimized for low latency and low power consumption.

The Cisco Nexus 31108PC-V specification includes the following components:

- 2.16Tbps switching capacity and forwarding rate of up to 1.2Tbps for 31108PC-V
- 48 SFP ports support 1 and 10 Gigabit Ethernet (10GbE); 6x QSFP28 ports support 4x 10GbE or 40GbE each or 100GbE

The following figure illustrates the Cisco Nexus 31108PC-V switch.

For more information about Cisco Nexus 31108PC-V switches, see Cisco Nexus 3172PQ, 3172TQ, 3172TQ-32T, 3172PQ-XL, and 3172TQ-XL Switches Data Sheet.

Cisco UCS C-Series

The Cisco UCS C-Series rack server was chosen for FlexPod Express because its many configuration options allow it to be tailored for specific requirements in a FlexPod Express deployment.

Cisco UCS C-Series rack servers deliver unified computing in an industry-standard form factor to reduce TCO and to increase agility.

Cisco UCS C-Series rack servers offer the following benefits:

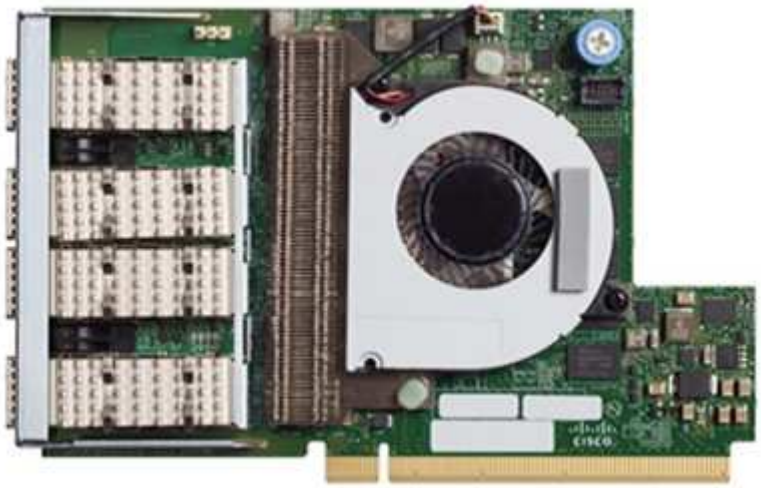
- A form-factor-agnostic entry point into Cisco UCS
- Simplified and fast deployment of applications
- Extension of unified computing innovations and benefits to rack servers
- Increased customer choice with unique benefits in a familiar rack package

The Cisco UCS C220 M5 rack server, shown in the above figure, is among the most versatile general-purpose enterprise infrastructure and application servers in the industry. It is a high-density two-socket rack server that delivers industry-leading performance and efficiency for a wide range of workloads, including virtualization, collaboration, and bare-metal applications. Cisco UCS C-Series rack servers can be deployed as standalone servers or as part of Cisco UCS to take advantage of Cisco's standards-based unified computing innovations that help reduce customers' TCO and increase their business agility.

For more information about C220 M5 servers, see Cisco UCS C220 M5 Rack Server Data Sheet.

Cisco UCS VIC 1457 connectivity for C220 M5 rack servers

The Cisco UCS VIC 1457 adapter shown in the following figure is a quad-port small form-factor pluggable (SFP28) modular LAN on motherboard (mLOM) card designed for the M5 generation of Cisco UCS C-Series Servers. The card supports 10/25Gbps Ethernet or FCoE. The card can present PCIe standards-compliant interfaces to the host, and these can be dynamically configured as either NICs or HBAs.



For full information about the Cisco UCS VIC 1457 adapter, see Cisco UCS Virtual Interface Card 1400 Series Data Sheet.

VMware vSphere 6.7U2

VMware vSphere 6.7U2 is one of the hypervisor options for use with FlexPod Express. VMware vSphere allows organizations to reduce their power and cooling footprint while confirming that the purchased compute capacity is used to its fullest. In addition, VMware vSphere allows hardware failure protection (VMware High Availability, or VMware HA) and compute resource load balancing across a cluster of vSphere hosts (VMware Distributed Resource Scheduler in maintenance mode, or VMware DRS-MM).

Because it restarts only the kernel, VMware vSphere 6.7U2 allows customers to quick boot, loading vSphere ESXi without restarting the hardware. The vSphere 6.7U2 vSphere client (HTML5-based client) has some new enhancements like Developer Center with Code Capture and API Explore. With Code Capture, you can record your actions in the vSphere client to deliver simple, usable code output. vSphere 6.7U2 also contains new features like DRS in maintenance mode (DRS-MM).

VMware vSphere 6.7U2 offers the following features:

- VMware is deprecating the external VMware Platform Services Controller (PSC) deployment model.

> Starting with the next major vSphere release, external PSC will not be an available option.

- New protocol support for backing up and restoring a vCenter server appliance. Introducing NFS and SMB as supported protocol choices, up to 7 total (HTTP, HTTPS, FTP, FTPS, SCP, NFS, and SMB) when configuring a vCenter Server for file-based backup or restore operations.
- New functionally when using the content library. Syncing a native VM template between content libraries is now available when the vCenter Server is configured for enhanced linked mode.

- Update to the Client Plug-Ins page.
- VMware vSphere Update Manager also adds enhancements to the vSphere client. You can perform attach-check compliance and remediate actions all from one screen.

For more information about VMware vSphere 6.7 U2, see the VMware vSphere Blog page.

For more information about the VMware vCenter Server 6.7 U2 updates, see the Release Notes.

> Although this solution was validated with vSphere 6.7U2, it supports any vSphere version qualified with the other components by the NetApp Interoperability Matrix Tool (IMT). NetApp recommends that you deploy the next released version of vSphere for its fixes and enhanced features.

Boot architecture

The supported options for the FlexPod Express boot architecture include:

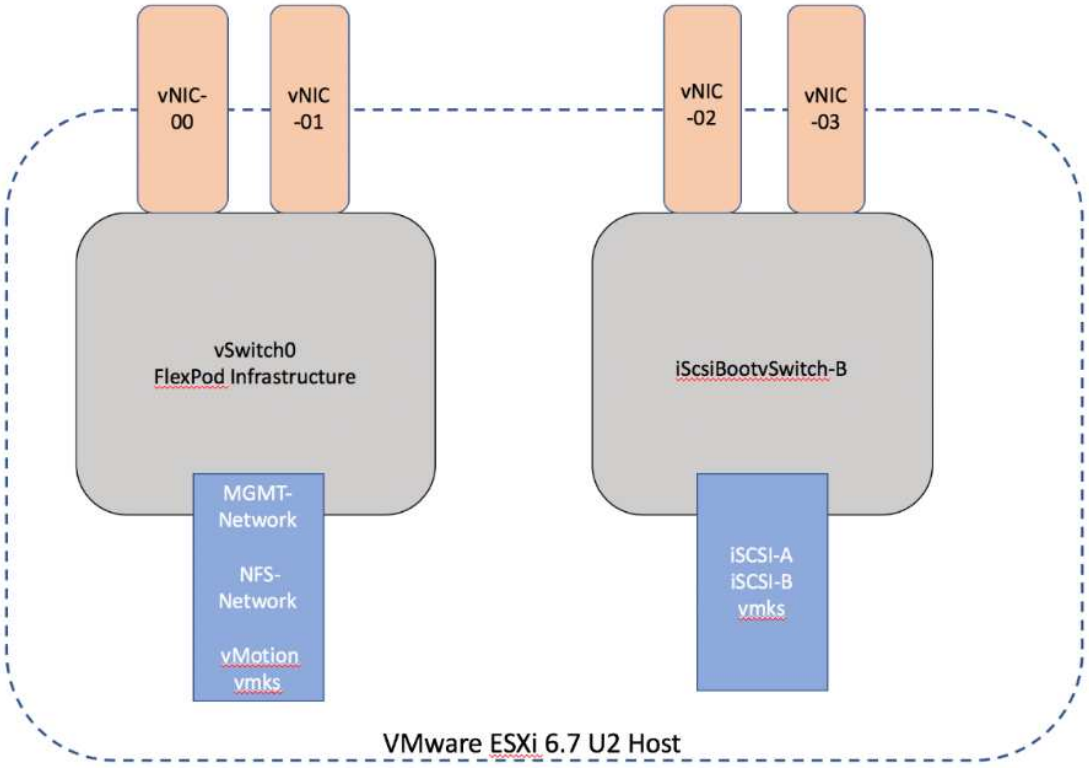
- iSCSI SAN LUN
- Cisco FlexFlash SD card
- Local disk

FlexPod Datacenter is booted from iSCSI LUNs; therefore, solution manageability is enhanced by using iSCSI boot for FlexPod Express as well.

ESXi Host Virtual Network Interface Card layout

Cisco UCS VIC 1457 has four physical ports. This solution validation includes these four physical ports in using the ESXi host. If you have a smaller or larger number of NICs, you might have different VMNIC numbers.

In an iSCSI boot implementation, iSCSI boot requires separate virtual network interface cards (vNICs) for iSCSI boot. These vNICs use the appropriate fabric's iSCSI VLAN as the native VLAN and are attached to the iSCSI boot vSwitches, as shown in the following figure.



Next: Conclusion.

Conclusion

The FlexPod Express validated design is a simple and effective solution that uses industry-leading components. By scaling and providing options for the hypervisor platform, FlexPod Express can be tailored for specific business needs. FlexPod Express was designed for small to midsize businesses, remote and branch offices, and other businesses that require dedicated solutions.

Next: Where to find additional information.

Where to find additional information

To learn more about the information described in this document, see the following documents and websites:

- AFF and FAS System Documentation Center

  https://docs.netapp.com/platstor/index.jsp

- AFF Documentation Resources page

  https://www.netapp.com/us/documentation/all-flash-fas.aspx

- FlexPod Express with VMware vSphere 6.7 and NetApp AFF C190 Deployment Guide (in progress)

- NetApp documentation

  https://docs.netapp.com

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