NetApp Verified Architecture

FlexPod Express with VMware vSphere 6.7U1 and NetApp AFF A220 with Direct-Attached IP-Based Storage

NVA Design

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Reviewed by

CISCO

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1 Executive Summary

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, leveraging the technology that they are familiar with in their data center.

FlexPod® Express is a predesigned, best practice architecture that is built on the Cisco Unified Computing System (Cisco UCS), the Cisco Nexus family of switches, and NetApp® AFF. The components in 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.

FlexPod Datacenter and FlexPod Express deliver a baseline configuration and have the versatility to be sized and optimized to accommodate many different use cases and requirements. Existing FlexPod Datacenter customers can manage their FlexPod Express by using the tools that they are accustomed to, and new FlexPod Express customers can easily adapt to managing a FlexPod Datacenter as their environment grows.

FlexPod Express is an optimal infrastructure foundation for remote offices or branch offices (ROBOs) and for small to midsize businesses. It is also an optimal solution for customers who want to provide infrastructure for a dedicated workload.

FlexPod Express provides an easy-to-manage infrastructure that is suitable for almost any workload.

2 Program Summary

This FlexPod Express solution is part of the FlexPod converged infrastructure program.

2.1 FlexPod Converged Infrastructure Program

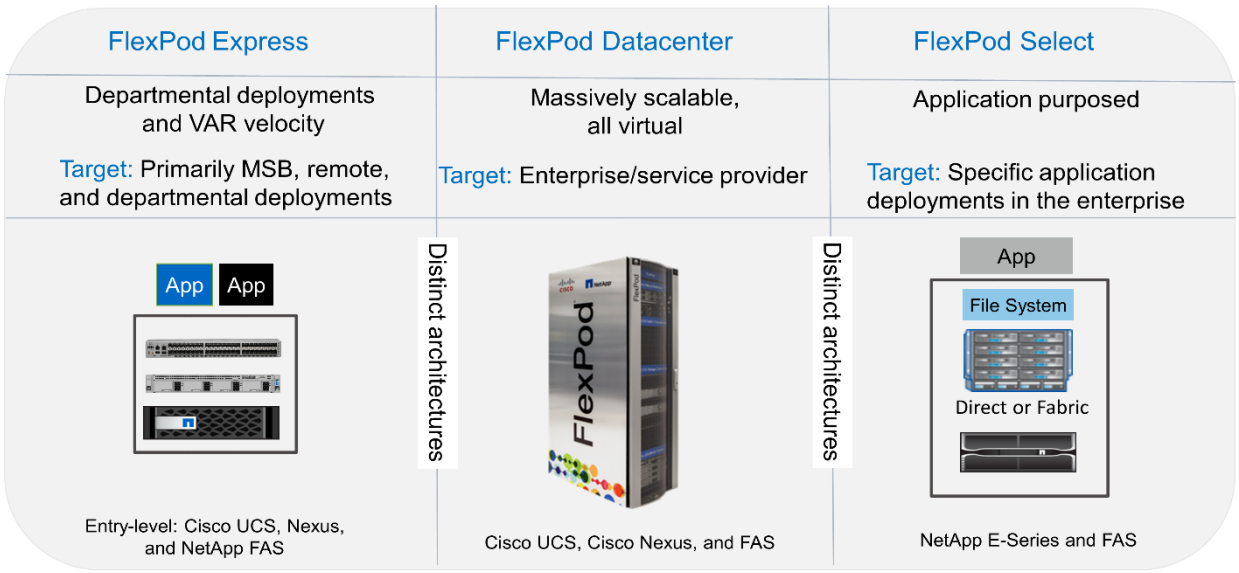
FlexPod reference architectures are delivered as Cisco Validated Designs (CVDs) or NetApp Verified Architectures (NVAs). Deviations based on customer requirements from a given CVD or NVA are permitted if these variations do not create an unsupported configuration.

As depicted in Figure 1, the FlexPod program includes three solutions: FlexPod Express, FlexPod Datacenter, and FlexPod Select:

- **FlexPod Express** offers customers an entry-level solution with technologies from Cisco and NetApp.
- **FlexPod Datacenter** delivers an optimal multipurpose foundation for various workloads and applications.
- **FlexPod Select** incorporates the best aspects of FlexPod Datacenter and tailors the infrastructure to a given application.

Figure 1 shows the technical components of the solution.

Figure 1) FlexPod portfolio.



2.2 NetApp Verified Architecture Program

The NVA program offers customers a verified architecture for NetApp solutions. An NVA provides a NetApp solution architecture with 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 direct-attached NetApp storage. The following sections list the components used in this solution design.

Hardware Components

- NetApp AFF A220 or FAS 2750/2720
- Cisco UCS Mini
- Cisco UCS B200 M5
- Cisco UCS VIC 1440/1480
- Cisco Nexus 3000 Series Switches

Software Components

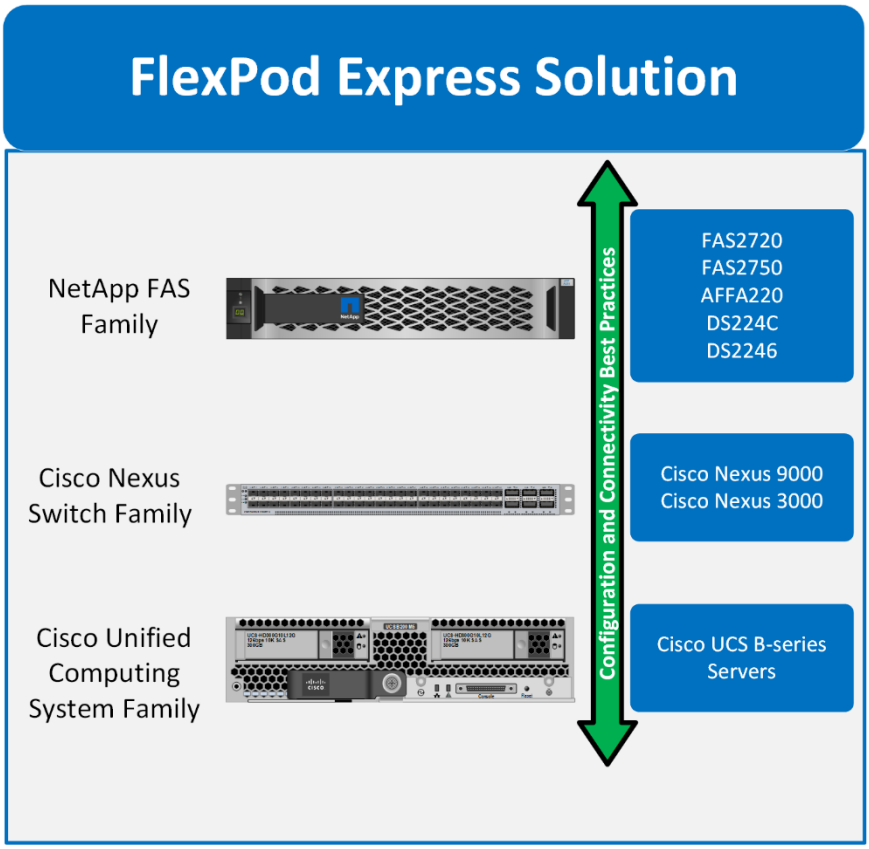
- NetApp ONTAP® 9.5
- VMware vSphere 6.7U1
- Cisco UCS Manager 4.0 (1b)
- Cisco NXOS firmware 7.0(3)I6(1)

3 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 purpose. The primary driver of the new FlexPod Express solution is to add new technologies such as ONTAP 9.5, FAS27xx/AFF220, VMware vSphere 6.7U1 to FlexPod Express.

Figure 2 shows the hardware components that are included in the FlexPod Express solution.

Figure 2) Hardware components of the FlexPod Express solution.



3.1 Target Audience

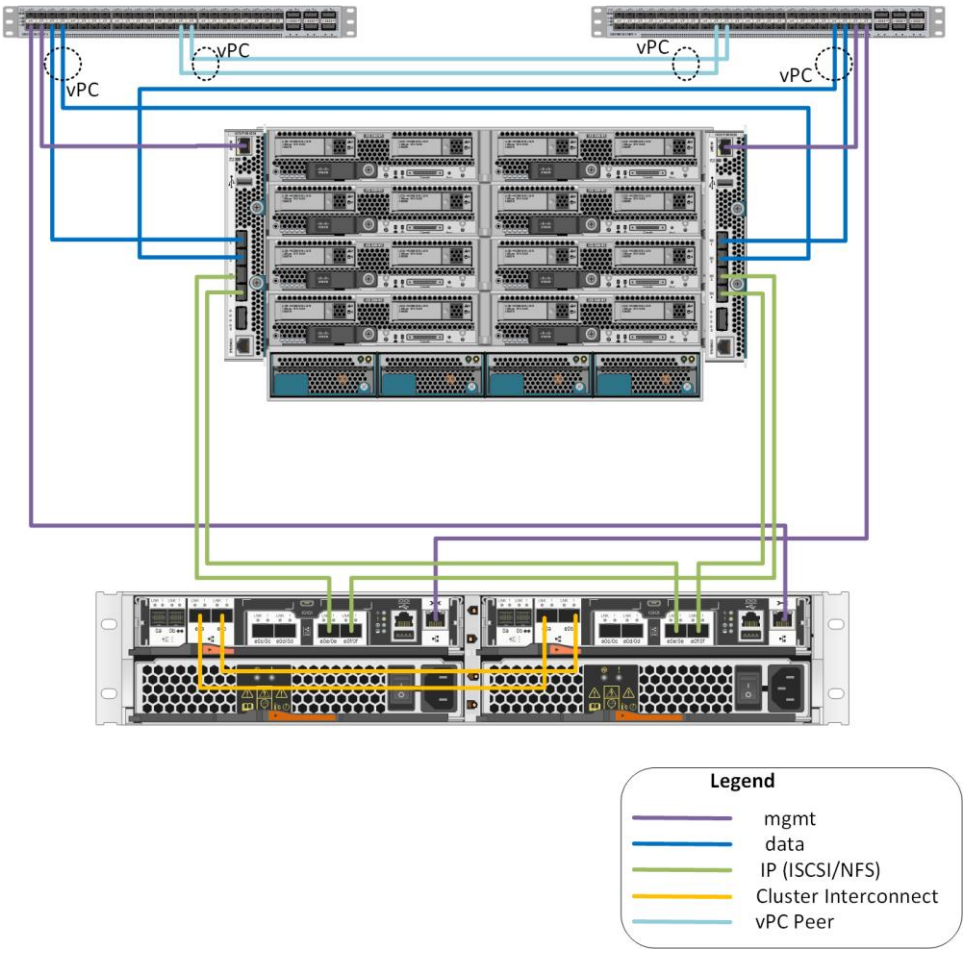
This document is intended for people who want to take advantage of an infrastructure that is built to deliver IT efficiency and enable IT innovation. The audience for this document includes, but is not limited to, sales engineers, field consultants, professional services personnel, IT managers, partner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

3.2 Solution Technology

This solution uses the latest technologies from NetApp, Cisco, and VMware. It features NetApp AFF A220 running ONTAP 9.5, dual Cisco Nexus 31108PCV switches, and Cisco UCS B200 M5 servers that run VMware vSphere 6.7U1. This validated solution uses Direct Connect IP storage over 10GbE technology.

Figure 3 FlexPod Express with VMware vSphere 6.7U1 IP-Based Direct Connect architecture.

Figure 3) FlexPod Express with VMware vSphere 6.7U1 IP-Based Direct Connect architecture.



3.3 Use Case Summary

The FlexPod Express solution can be applied to several use cases, including the following:

- ROBOs
- Small and midsize businesses
- Environments that require a dedicated and cost-effective solution

FlexPod Express is best suited for virtualized and mixed workloads.

4 Technology Requirements

A FlexPod Express system requires a combination of hardware and software components. FlexPod Express also describes the hardware components that are required to add hypervisor nodes to the system in units of two.

4.1 Hardware Requirements

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

Table 1 lists the hardware components that are required for all FlexPod Express configurations.

Table 1) Hardware requirements for the base configuration.

Hardware	Quantity
AFF A220 HA pair	1
Cisco UCS B200 M5 server	2
Cisco Nexus 31108PCV switch	2
Cisco UCS Virtual Interface Card (VIC) 1440 for the B200 M5 server	2
Cisco UCS Mini with two integrated UCS-FI-M-6324 fabric interconnects	1

4.2 Software Requirements

Table 2 lists the software components that are required to implement the architectures of the FlexPod Express solutions.

Table 2) Software requirements for the base FlexPod Express implementation.

Software	Version	Details
Cisco UCS Manager	4.0(1b)	For Cisco UCS fabric interconnect FI-6324UP
Cisco Blade software	4.0(1b)	For Cisco UCS B200 M5 servers
Cisco nenic driver	1.0.25.0	For Cisco VIC 1440 interface cards
Cisco NX-OS	7.0(3)I6(1)	For Cisco Nexus 31108PCV switches
NetApp ONTAP	9.5	For AFF A220 controllers

Table 3 lists the software that is required for all VMware vSphere implementations on FlexPod Express.

Table 3) Software requirements for a VMware vSphere implementation.

Software	Version
VMware vCenter Server Appliance	6.7U1
VMware vSphere ESXi hypervisor	6.7U1

5 Design Choices

The following technologies were chosen during the process of architecting this design. Each technology serves a specific purpose in the FlexPod Express infrastructure solution.

5.1 NetApp AFF A220 or FAS27xx Series with ONTAP 9.5

The solution uses two of the newest NetApp products, NetApp FAS 2750 or FAS 2720 and AFF A220 systems with ONTAP 9.5.

FAS2750/FAS2720 System

The NetApp FAS2700 series is designed to support more of your IT needs, the NetApp FAS2700 hybrid storage arrays offer more value than other systems in their class. The FAS2700 running NetApp ONTAP storage software simplifies the task of managing growth and complexity by delivering high performance, providing leading integration with the cloud, supporting a broader range of workloads, and seamlessly scaling performance and capacity.

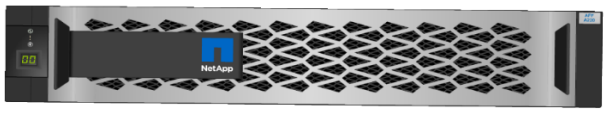
For more information about the FAS2700 hardware system, see the FAS2700 Hybrid Storage System product page.

AFF A220 System

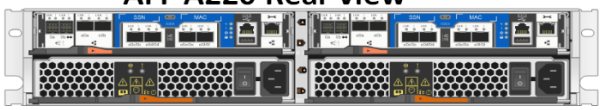
The newly refreshed AFF A220 platform for small and medium enterprise environments delivers 30% more performance than its predecessor to continue NetApp's leadership in this segment.

NetApp AFF systems help you meet your enterprise storage requirements with industry's highest performance, superior flexibility, and best-in-class data management and cloud integration. Combined with the industry's first end-to-end NVMe technologies and NetApp ONTAP data management software, AFF systems accelerate, manage, and protect your business-critical data. With an AFF system, you can make an easy and risk-free transition to flash for your digital transformation.

AFF A220 Front view



AFF A220 Rear view



For more information about the AFF A220 hardware system, see the NetApp AFF Datasheet.

5.2 ONTAP 9.5

NetApp's new ONTAP 9.5 software features several significant enhancements aimed at making the management of data from the data center to the cloud seamless.

ONTAP 9.5 allows a hybrid cloud to be the foundation of a Data Fabric that spans from on the premises to the cloud and back again.

ONTAP 9.5 has several features that are 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 9.5 with a new addition, of NetApp Memory Accelerated Data, NVMe support. Because the NetApp WAFL® system always writes 4KB blocks, compaction combines multiple blocks into a 4KB block when the blocks are not using their allocated space of 4KB.

These are just a few key features that complement the FlexPod Express solution. For details about the additional features and functionality of ONTAP 9.5, see the ONTAP 9 Data Management Software datasheet.

For more information about ONTAP 9.5, see the NetApp ONTAP 9 Documentation Center, which has been updated to include ONTAP 9.5.

5.3 Cisco Nexus 3000 Series

The Cisco Nexus 31108PC-V is a robust, cost effective switch offering 1/10/40/100Gbps switching. It offers 48 1/1-Gbps ports, and 40/100-Gbps uplinks that enable flexibility.

Because all the various Cisco Nexus series models run the same underlying operating system, NX-OS, multiple Cisco Nexus models are supported in the FlexPod Express and FlexPod Datacenter solutions.

Figure 6) Cisco Nexus 31108.

The Cisco Nexus 31108 provides a comprehensive layer 2 feature set that includes virtual LANs (VLANs), IEEE 802.1Q trunking, and the Link Aggregation Control Protocol (LACP). Additional layer 3 functionality is available by adding licenses to the system.

For more information about the Cisco Nexus 3000 series, see the Cisco Nexus 31108PC-V Switch product information.

5.4 Cisco UCS B-Series

The Cisco UCS 5108 Blade Server Chassis revolutionizes the use and deployment of blade-based systems. By incorporating unified fabric and fabric-extender technology, the Cisco Unified Computing System enables the chassis to:

- Have fewer physical components
- Require no independent management
- Be more energy efficient than traditional blade-server chassis

This simplicity eliminates the need for dedicated chassis management and blade switches, reduces cabling, and allowing scalability to 20 chassis without adding complexity. The Cisco UCS 5108 Blade Server Chassis is a critical component in delivering the simplicity and IT responsiveness for the data center as part of the Cisco Unified Computing System.

The Cisco UCS B-Series B200M5 server was chosen for the FlexPod Express because its many configuration options, which allows it to be tailored for specific requirements in FlexPod Express deployment.

Figure 3) Cisco B200M5 blade server.

The enterprise-class Cisco UCS B200 M5 blade server extends the capabilities of Cisco UCS portfolio in a half-width blade form factor. The Cisco UCS B200 M5 blade server harnesses the power of the latest Intel Xeon processor scalable family CPUs with up to 3072 GB of RAM (using 128 GB DIMMs), two solid-state drives (SSDs) or HDDs and up to 80 Gbps throughput connectivity.

For more information about Cisco UCS B200 M5 blade server, see Cisco UCS B200 M5 Blade Server Spec Sheet.

5.5 Cisco UCS Virtual Interface Card 1440/1480

The Cisco UCS VIC 1440 is a dual-port 40Gbps or dual 4x 10Gbps Ethernet/FCoE capable modular LAN On Motherboard (mLOM) designed exclusively for the M5 generation of Cisco UCS B-Series Blade Servers. When used with an optional port expander, the Cisco UCS VIC 1440 capabilities are enabled for two ports of 40Gbps Ethernet. The Cisco UCS VIC 1440 enables a policy-based, stateless, agile server

infrastructure that can present to the host PCIe standards-compliant interfaces that can be dynamically configured as either NICs or HBAs.

The Cisco UCS VIC 1480 (Figure 4) is similar to the VIC 1440 except that it is mezzanine card.

Figure 4) Cisco UCS VIC 1480.

For more information about Cisco VIC 1440/1480, see Cisco UCS Virtual Interface Card 1400 Series Data Sheet.

5.6 VMware vSphere 6.7U1

VMware vSphere 6.7U1 is one hypervisor option 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, or VMware DRS).

VMware vSphere 6.7U1 features the latest VMware innovations. The VMware vCenter Server Appliance (VCSA) that is used in this design adds a host of new features and functionality, such as VMware vSphere Update Manager integration. The VCSA also provides native vCenter High Availability for the first time. To add clustering capability to hosts and to use features such as VMware HA and VMware DRS, VMware vCenter Server is required.

VMware vSphere 6.7U1 also has several enhanced core features. VMware HA introduces an orchestrated restart for the first time, so virtual machines restart in the proper order in case of an HA event. In addition, the DRS algorithm has now been enhanced, and more configuration options have been introduced for more granular control of compute resources inside vSphere.

The vSphere Web Client is the management tool of choice for VMware vSphere environments. Several user enhancements have been made to the vSphere Web Client, such as reorganization of the home screen and the inventory tree's now being the default view upon login.

Note: For more information about VMware vSphere, see vSphere: The Efficient and Secure Platform for Your Hybrid Cloud.

Note: For more information about the new features of VMware vSphere 6.7U1, see What's New in VMware vSphere 6.7.

Note: For ONTAP 9.5 with VMware HCL support, see VMware Compatibility Guide.

VMware vSphere and NetApp Integration

There are two main integration points for VMware vSphere and NetApp. The first is the NetApp Virtual Storage Console (VSC). The Virtual Storage Console is a plug-in for VMware vCenter. This plug-in enables virtualization administrators to manage their storage from the familiar vCenter management interface. VMware datastores can be deployed to multiple hosts with just a few clicks. This tightly coupled integration is key for branch offices and smaller organizations, where administrative time is at a premium.

The second integration is the NetApp NFS Plug-in for VMware VAAI. Although VAAI is supported natively by block protocols, all storage arrays require a VAAI plug-in to provide the VAAI integration for NFS. Some NFS VAAI integrations include space reservation and copy offload. The VAAI plug-in can be installed by using VSC.

For more information about the NetApp VSC for VMware vSphere, see NetApp Virtual Infrastructure Management product page.

6 Solution Verification

Cisco and NetApp designed and built FlexPod Express to serve as a premier infrastructure platform for their customers. Because it was designed by using industry-leading components, customers can trust FlexPod Express as their infrastructure foundation. In keeping with the fundamental principles of the FlexPod program, the FlexPod Express architecture was thoroughly tested by Cisco and NetApp data center architects and engineers. From redundancy and availability to each individual feature, the entire FlexPod Express architecture is validated to instill confidence in our customers and to build trust in the design process.

VMware vSphere 6.7U1 hypervisor was verified on the FlexPod Express infrastructure components. This validation includes iSCSI Direct Connect SAN Boot connection and NFS Direct Connect datastores using 10GbE connectivity option.

7 Conclusion

FlexPod Express provides a simple and effective solution by providing a validated design that uses industry-leading components. By scaling and by providing options for the hypervisor platform, FlexPod Express can be tailored for specific business needs. FlexPod Express was designed keeping in mind the small to midsize businesses, ROBOs, and other businesses that require dedicated solutions.

Where to Find Additional Information

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

- NVA-1131-DEPLOY: FlexPod Express with VMware vSphere 6.7UI and NetApp AFF A220 with Direct Attached IP-Based Storage NVA Deploy
  https://www.netapp.com/us/media/nva-1131-deploy.pdf
- AFF and FAS Systems Documentation Center
  http://docs.netapp.com/platstor/index.jsp
- ONTAP 9 Documentation Center
  http://docs.netapp.com/ontap-9/index.jsp
- NetApp Product Documentation
  https://docs.netapp.com

Version History

Version	Date	Document Version History
Version 1.0	January 2019	Initial release.

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