NetApp

FlexPod Definition

FlexPod

NetApp
November 04, 2025

Table of Contents

FlexPod Definition

FlexPod Express Technical Specifications

TR-4293: FlexPod Express Technical Specifications

Karthick Radhakrishnan, Arvind Ramakrishnan, Lindsey Street, Savita Kumari, NetApp

FlexPod Express is a predesigned, best practice architecture that is built on the Cisco Unified Computing System (Cisco UCS) and the Cisco Nexus family of switches, and the storage layer is built by using the NetApp FAS or the NetApp E-Series storage. FlexPod Express is a suitable platform for running various virtualization hypervisors and bare metal operating systems (OSs) and enterprise workloads.

FlexPod Express delivers not only a baseline configuration, but also the flexibility to be sized and optimized to accommodate many different use cases and requirements. This document categorizes the FlexPod Express configurations based on the storage system used, FlexPod Express with NetApp FAS and FlexPod Express with E-Series.

FlexPod platforms

There are three FlexPod platforms:

- **FlexPod Datacenter.** This platform is a massively scalable virtual data center infrastructure suited for workload enterprise applications, virtualization, VDI, and public and private cloud. FlexPod Datacenter has its own specifications, which are documented in TR-4036: FlexPod Datacenter Technical Specifications.
- **FlexPod Express.** This platform is a compact converged infrastructure that is targeted for remote office and edge use cases.

This document provides the technical specifications for the FlexPod Express platform.

FlexPod Rules

The FlexPod design allows a flexible infrastructure that encompasses many different components and software versions.

Use the rule sets as a guide for building or assembling a valid FlexPod configuration. The numbers and rules listed in this document are the minimum requirements for FlexPod; they can be expanded in the included product families as required for different environments and use cases.

Supported versus validated FlexPod configurations

The FlexPod architecture is defined by the set of rules described in this document. The hardware components and software configurations must be supported by the Cisco Hardware Compatibility List (HCL) and the NetApp Interoperability Matrix Tool (IMT).

Each Cisco Validated Design (CVD) or NetApp Verified Architecture (NVA) is a possible FlexPod configuration. Cisco and NetApp document these configuration combinations and validate them with extensive end-to-end testing. The FlexPod deployments that deviate from these configurations are fully supported if they follow the

guidelines in this document and all the components are listed as compatible in the Cisco HCL and NetApp IMT.

For example, adding additional storage controllers or Cisco UCS servers and upgrading software to newer versions is fully supported if the software, hardware, and configurations meet the guidelines defined in this document.

Storage Software

FlexPod Express supports storage systems that run NetApp ONTAP or SANtricity operating systems.

NetApp ONTAP

The NetApp ONTAP software is the operating system that runs on AFF and FAS storage systems. ONTAP provides a highly scalable storage architecture that enables nondisruptive operations, nondisruptive upgrades, and an agile data infrastructure.

For more information about ONTAP, see the ONTAP product page.

E-Series SANtricity software

E-Series SANtricity software is the operating system that runs on E-Series storage systems. SANtricity provides a highly flexible system that meets varying application needs and offers built-in high availability and a wide variety of data protection features.

For more information, see the SANtricity product page.

Minimum hardware requirements

This section describes the minimum hardware requirements for the different versions of FlexPod Express.

FlexPod Express with NetApp FAS

The hardware requirements for FlexPod Express solutions that use NetApp FAS controllers for underlying storage include the configurations describe in this section.

CIMC-based configuration (standalone rack servers)

The Cisco Integrated Management Controller (CIMC) configuration includes the following hardware components:

- Two 10Gbps standard Ethernet switches in a redundant configuration (Cisco Nexus 31108 is recommended, with Cisco Nexus 3000 and 9000 models supported)
- Cisco UCS C-Series standalone rack servers
- Two AFF C190, AFF A250, FAS2600, or FAS 2700 series controllers in a high-availability (HA) pair configuration deployed as a two-node cluster

Cisco UCS-managed configuration

The Cisco UCS-managed confirmation includes the following hardware components:

- Two 10Gbps standard Ethernet switches in a redundant configuration (Cisco Nexus 3524 is recommended)
- One Cisco UCS 5108 alternating current (AC) blade server chassis
- Two Cisco UCS 6324 fabric interconnects
- Cisco UCS B-Series servers (at least four Cisco UCS B200 M5 blade servers)
- Two AFF C190, AFF A250, FAS2750, or FAS2720 controllers in an HA pair configuration (requires two available unified target adapter 2 [UTA2] ports per controller)

FlexPod Express with E-Series

The hardware requirements for the FlexPod Express with E-Series starter configuration include:

- Two Cisco UCS 6324 fabric interconnects
- One Cisco UCS Mini chassis 5108 AC2 or DC2 (the Cisco UCS 6324 fabric interconnects are only supported in the AC2 and DC2 chassis)
- Cisco UCS B-Series servers (at least two Cisco UCS B200 M4 blade servers)
- One HA pair configuration of an E-Series E2824 storage system loaded with minimum 12 disk drives
- Two 10Gbps standard Ethernet switches in a redundant configuration (existing switches in the data center can be used)

These hardware components are required to build a starter configuration of the solution; additional blade servers and disk drives can be added as needed. The E-Series E2824 storage system can be replaced with a higher platform and can also be run as an all-flash system.

Minimum Software Requirements

This section describes the minimum software requirements for the different versions of FlexPod Express.

Software requirements for FlexPod Express with NetApp AFF or FAS

The software requirements for the FlexPod Express with NetApp FAS include:

- ONTAP 9.1 or later
- Cisco NX-OS version 7.0(3)I6(1) or later
- In the Cisco UCS- managed configuration, Cisco UCS Manager UCS 4.0(1b)

All software must be listed and supported in the NetApp IMT. Certain software features might require more recent versions of code than the minimums listed in previous architectures.

Software requirements for FlexPod Express with E-Series

The software requirements for the FlexPod Express with E-Series include:

- E-Series SANtricity software 11.30 or higher
- Cisco UCS Manager 4.0(1b).

All software must be listed and supported in the NetApp IMT.

Connectivity requirements

This section describes the connectivity requirements for the different versions of FlexPod Express.

Connectivity requirements for FlexPod Express with NetApp FAS

The connectivity requirements for FlexPod Express with NetApp FAS include:

* NetApp FAS storage controllers must be directly connected to the Cisco Nexus switches, except in the Cisco UCS-managed configuration, where storage controllers are connected to the fabric interconnects.
* No additional equipment can be placed inline between the core FlexPod components.
* Virtual port channels (vPCs) are required to connect the Cisco Nexus 3000/9000 series switches to the NetApp storage controllers.
* Although it is not required, enabling jumbo frame support is recommended throughout the environment.

Connectivity requirements for FlexPod Express with NetApp E-Series

The connectivity requirements for FlexPod Express with E-Series include:

* The E-Series storage controllers must be directly connected to the fabric interconnects.
* No additional equipment should be placed inline between the core FlexPod components.
* vPCs are required between the fabric interconnects and the Ethernet switches.

Connectivity requirements for FlexPod Express with NetApp AFF

The connectivity requirements for FlexPod Express with NetApp AFF include:

* NetApp AFF storage controllers must be directly connected to the Cisco Nexus switches, except in the Cisco UCS–managed configuration, where storage controllers are connected to the fabric. interconnects.
* No additional equipment can be placed inline between the core FlexPod components.
* Virtual port channels (vPCs) are required to connect the Cisco Nexus 3000/9000 series switches to the NetApp storage controllers.
* Although it is not required, enabling jumbo frame support is recommended throughout the environment.

Other requirements

Additional requirements for FlexPod Express include the following:

* Valid support contracts are required for all equipment, including:
  * SMARTnet support for Cisco equipment
  * SupportEdge Advisor or SupportEdge Premium support for NetApp equipment
* All software components must be listed and supported in the NetApp IMT.
* All NetApp hardware components must be listed and supported on NetApp Hardware Universe.
* All Cisco hardware components must be listed and supported on Cisco HCL.

Legacy equipment

The following table lists the NetApp legacy storage controller options.

Storage controller	FAS part number	Technical specifications
FAS2520	Based on individual options chosen	http://www.netapp.com/us/products/storage-systems/fas2500/fas2500-tech-specs.aspx
FAS2552	Based on individual options chosen	http://www.netapp.com/us/products/storage-systems/fas2500/fas2500-tech-specs.aspx
FAS2554	Based on individual options chosen	http://www.netapp.com/us/products/storage-systems/fas2500/fas2500-tech-specs.aspx
FAS8020	Based on individual options chosen	http://www.netapp.com/us/products/storage-systems/fas8000/fas8000-tech-specs.aspx

The following table lists the NetApp legacy disk shelf options for NetApp FAS.

Disk shelf	Part number	Technical specifications
DE1600	E-X5682A-DM-0E-R6-C	Disk Shelves Technical Specifications Supported Drives on NetApp Hardware Universe
DE5600	E-X4041A-12-R6	Disk Shelves Technical Specifications Supported Drives on NetApp Hardware Universe
DE6600	X-48564-00-R6	Disk Shelves Technical Specifications Supported Drives on NetApp Hardware Universe

NetApp legacy FAS controllers

The following table lists the legacy NetApp FAS controller options.

Current component	FAS2554	FAS2552	FAS2520
Configuration	2 controllers in a 4U chassis	2 controllers in a 2U chassis	2 controllers in a 2U chassis
Maximum raw capacity	576TB	509TB	336TB
Internal drives	24	24	12
Maximum number of drives (internal plus external)	144	144	84
Maximum volume size	60TB		
Maximum aggregate size	120TB		

Current component	FAS2554	FAS2552	FAS2520
Maximum number of LUNs	2,048 per controller		
Storage networking supported	iSCSI, FC, FCoE, NFS, and CIFS		iSCSI, NFS, and CIFS
Maximum number of NetApp FlexVol volumes	1,000 per controller		
Maximum number of NetApp Snapshot copies	255,000 per controller		

ⓘ   For more NetApp FAS models, see the FAS models section in the Hardware Universe.

Additional Information

To learn more about the information that is 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

- FAS Storage Systems Documentation Resources page

    https://www.netapp.com/us/documentation/fas-storage-systems.aspx

- FlexPod

    https://flexpod.com/

- NetApp documentation

    https://docs.netapp.com

FlexPod Datacenter Technical Specifications

TR-4036: FlexPod Datacenter Technical Specifications

Arvind Ramakrishnan, and Jyh-shing Chen, NetApp

The FlexPod platform 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 storage controllers (AFF, ASA, or FAS systems).

FlexPod is a suitable platform for running a variety of virtualization hypervisors as well as bare-metal operating systems and enterprise workloads. FlexPod delivers not only a baseline configuration, but also the flexibility to

be sized and optimized to accommodate many different use cases and requirements.

> ⓘ Before you order a complete FlexPod configuration, see the FlexPod Converged Infrastructure page on netapp.com for the latest version of these technical specifications.

FlexPod platforms

There are two FlexPod platforms:

- **FlexPod Datacenter.** This platform is a massively scalable virtual data center infrastructure that is suited for workload enterprise applications; virtualization; virtual desktop infrastructure (VDI); and public, private, and hybrid cloud workloads.
- **FlexPod Express.** This platform is a compact converged infrastructure that is targeted to remote office and edge use cases. FlexPod Express has its own specifications that are documented in the FlexPod Express Technical Specifications.

This document provides the technical specifications for the FlexPod Datacenter platform.

FlexPod rules

The FlexPod design enables a flexible infrastructure that encompasses many different components and software versions.

Use the rule sets as a guide for building or assembling a valid FlexPod configuration. The numbers and rules that are listed in this document are the minimum requirements for a FlexPod configuration. They can be expanded in the included product families as required for different environments and use cases.

NetApp ONTAP

NetApp ONTAP software is installed on all NetApp FAS, AFF, and AFF All SAN Array (ASA) systems. FlexPod is validated with ONTAP software, providing a highly scalable storage architecture that enables nondisruptive operations, nondisruptive upgrades, and an agile data infrastructure.

For more information about ONTAP, see the ONTAP Data Management Software product page.

Cisco Nexus switching modes of operation

A variety of Cisco Nexus products can be used as the switching component of a given FlexPod deployment. Most of these options leverage the traditional Cisco Nexus OS or NX-OS software. The Cisco Nexus family of switches offers varying capabilities within its product lines. These capabilities are detailed later in this document.

Cisco's offering in the software-defined networking space is called Application Centric Infrastructure (ACI). The Cisco Nexus product line that supports the ACI mode, also called fabric mode, is the Cisco Nexus 9300 series. These switches can also be deployed in NX-OS or standalone mode.

Cisco ACI is targeted at data center deployments that focus on the requirements of a specific application.

Applications are instantiated through a series of profiles and contracts that allow connectivity from the host or virtual machine (VM) all the way through the network to the storage.

FlexPod is validated with both modes of operation of the Cisco Nexus switches. For more information about the ACI and the NX-OS modes, see the following Cisco pages:

- Cisco Application Centric Infrastructure
- Cisco NX-OS Software

Minimum hardware requirements

A FlexPod Datacenter configuration has minimum hardware requirements, including, but not limited to, switches, fabric interconnects, servers, and NetApp storage controllers.

You must use Cisco UCS Servers. Both C-Series and B-Series Servers have been used in the validated designs. Cisco Nexus Fabric Extenders (FEXs) are optional with C-Series Servers.

A FlexPod configuration has the following minimum hardware requirements:

- Two Cisco Nexus switches in a redundant configuration. This configuration can consist of two redundant switches from the Cisco Nexus 5000, 7000, or 9000 Series. The two switches should be of the same model and should be configured in the same mode of operation.

  If you are deploying an ACI architecture, you must observe the following additional requirements:

  - Deploy the Cisco Nexus 9000 Series Switches in a leaf-spine topology.
  - Use three Cisco Application Policy Infrastructure Controllers (APICs).
- Two Cisco UCS 6200, 6300, or 6400 Series Fabric Interconnects in a redundant configuration.
- Cisco UCS Servers:
  - If the solution uses B-Series Servers, one Cisco UCS 5108 B-Series Blade Server Chassis plus two Cisco UCS B-Series Blade Servers plus two 2104, 2204/8, 2408, or 2304 I/O modules (IOMs).
  - If the solution uses C-Series Servers, two Cisco UCS C-Series Rack Servers.

    For larger deployments of Cisco UCS C-Series Rack Servers, you can choose a pair of 2232PP FEX modules. However, the 2232PP is not a hardware requirement.
- Two NetApp storage controllers in a high-availability (HA) pair configuration:

  This configuration can consist of any supported NetApp FAS, AFF, or ASA-series storage controllers. See the NetApp Hardware Universe application for a current list of supported FAS, AFF, and ASA controller models.

  - The HA configuration requires two redundant interfaces per controller for data access; the interfaces can be FCoE, FC, or 10/25/100Gb Ethernet (GbE).
  - If the solution uses NetApp ONTAP, a cluster interconnect topology that is approved by NetApp is required. For more information, see the Switches tab of the NetApp Hardware Universe.
  - If the solution uses ONTAP, at least two additional 10/25/100GbE ports per controller are required for data access.
  - For ONTAP clusters with two nodes, you can configure a two-node switchless cluster.
  - For ONTAP clusters with more than two nodes, a pair of cluster interconnect switches are required.

- One NetApp disk shelf with any supported disk type. See the Shelves tab of the NetApp Hardware Universe for a current list of supported disk shelf models.

Minimum software requirements

A FlexPod configuration has the following minimum software requirements:

- NetApp ONTAP:
  - ONTAP software version requires ONTAP 9.1 or later
- Cisco UCS Manager releases:
  - Cisco UCS 6200 Series Fabric Interconnect—2.2(8a)
  - Cisco UCS 6300 Series Fabric Interconnect—3.1(1e)
  - Cisco UCS 6400 Series Fabric Interconnect—4.0(1)
- Cisco Intersight Managed Mode:
  - Cisco UCS 6400 Series Fabric Interconnect – 4.1(2)
- For Cisco Nexus 5000 Series Switches, Cisco NX-OS software release 5.0(3)N1(1c) or later, including NX-OS 5.1.x
- For Cisco Nexus 7000 Series Switches:
  - The 4-slot chassis requires Cisco NX-OS software release 6.1(2) or later
  - The 9-slot chassis requires Cisco NX-OS software release 5.2 or later
  - The 10-slot chassis requires Cisco NX-OS software release 4.0 or later
  - The 18-slot chassis requires Cisco NX-OS software release 4.1 or later
- For Cisco Nexus 9000 Series Switches, Cisco NX-OS software release 6.1(2) or later

ⓘ The software that is used in a FlexPod configuration must be listed and supported in the NetApp IMT. Some features might require more recent releases of the software than the ones that are listed.

Connectivity requirements

A FlexPod configuration has the following connectivity requirements:

- A separate 100Mbps Ethernet/1Gb Ethernet out-of-band management network is required for all components.
- NetApp recommends that you enable jumbo frame support throughout the environment, but it is not required.
- The Cisco UCS Fabric Interconnect appliance ports are recommended only for iSCSI and NAS connections.
- No additional equipment can be placed in line between the core FlexPod components.

Uplink connections:

- The ports on the NetApp storage controllers must be connected to the Cisco Nexus 5000, 7000, or 9000 Series Switches to enable support for virtual port channels (vPCs).
- vPCs are required from the Cisco Nexus 5000, 7000, or 9000 Series Switches to the NetApp storage

controllers.

- vPCs are required from the Cisco Nexus 5000, 7000, or 9000 Series Switches to the fabric interconnects.
- A minimum two connections are required for a vPC. The number of connections within a vPC can be increased based on the application load and performance requirements.

Direct connections:

- NetApp storage controller ports that are directly connected to the fabric interconnects can be grouped to enable a port channel. vPC is not supported for this configuration.
- FCoE port channels are recommended for end-to-end FCoE designs.

SAN boot:

- FlexPod solutions are designed around a SAN-boot architecture using iSCSI, FC, or FCoE protocols. Using boot-from-SAN technologies provides the most flexible configuration for the data center infrastructure and enables the rich features available within each infrastructure component. Although booting from SAN is the most efficient configuration, booting from local server storage is a valid and supported configuration.
- SAN boot over FC-NVME is not supported.

Other requirements

A FlexPod architecture has the following additional interoperability and support-related requirements:

- All hardware and software components must be listed and supported on the NetApp IMT, the Cisco UCS Hardware and Software Compatibility List, and the Cisco UCS Hardware and Software Interoperability Matrix Tool.
- Valid support contracts are required for all equipment, including:
  - Smart Net Total Care (SmartNet) support for Cisco equipment
  - SupportEdge Advisor or SupportEdge Premium support for NetApp equipment
- Relevant sales attributes on the sales order to support:
  - FlexPod entitlements
  - FlexPod solution support entitlements
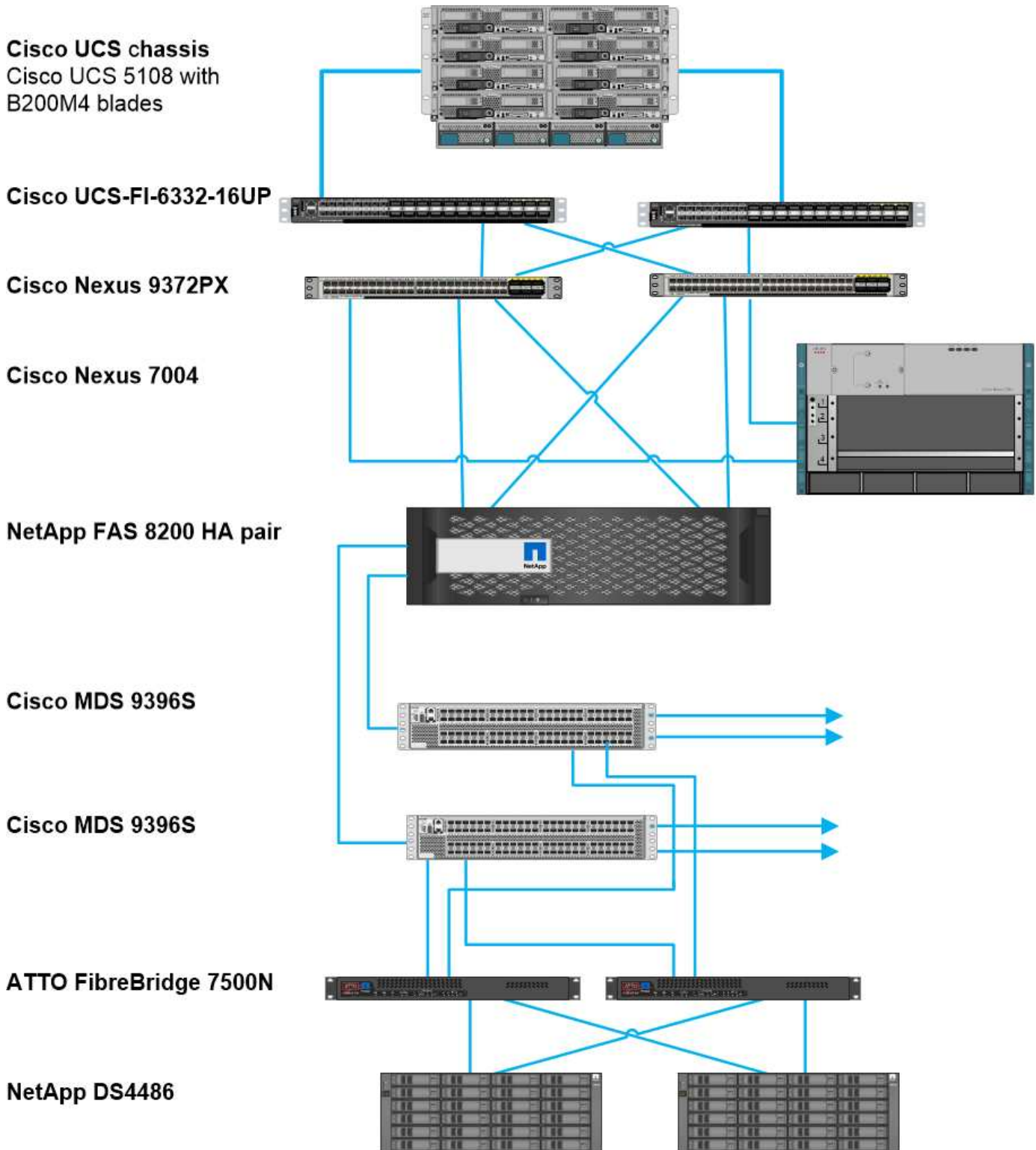
For more information, see the NetApp IMT.

Optional features

NetApp supports several optional components to further enhance FlexPod Datacenter architectures. Optional components are outlined in the following subsections.
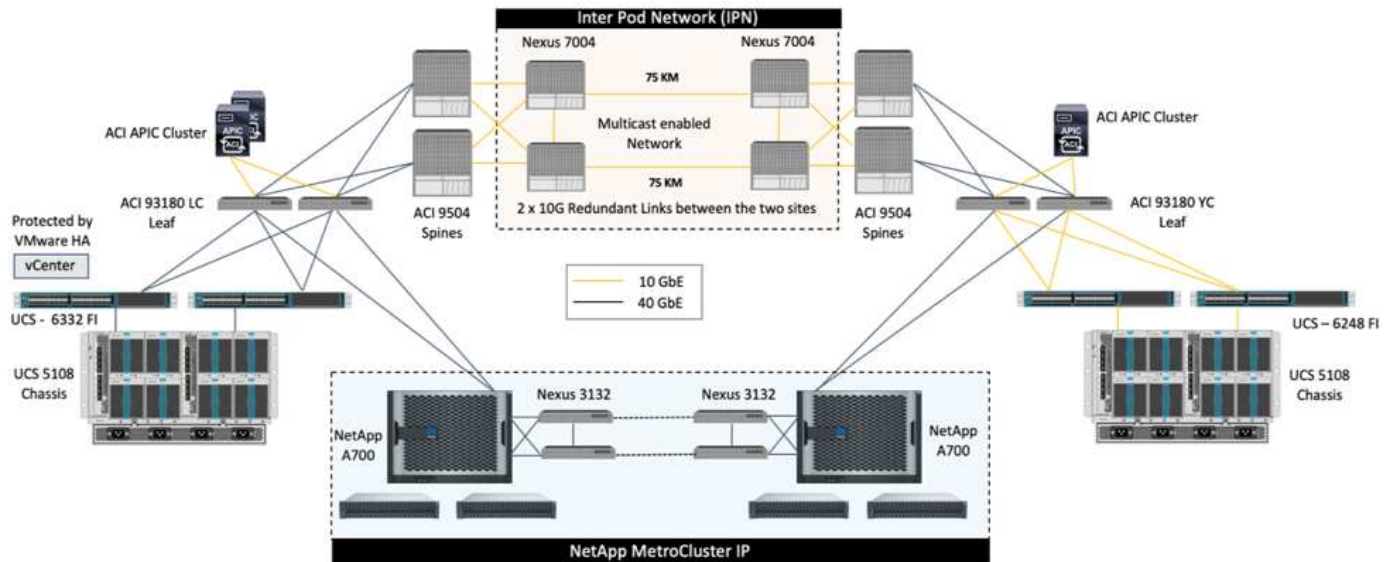
MetroCluster

FlexPod supports both variants of the NetApp MetroCluster software for continuous availability, in either two- or four-node cluster configurations. MetroCluster provides synchronous replication for critical workloads. It requires a dual-site configuration that is connected with Cisco switching. The maximum supported distance between the sites is approximately 186 miles (300km) for MetroCluster FC and increases to approximately 435 miles (700km) for MetroCluster IP. The following figures illustrate a FlexPod Datacenter with NetApp MetroCluster architecture and FlexPod Datacenter with NetApp MetroCluster IP architecture, respectively.

The following figure depicts FlexPod Datacenter with NetApp MetroCluster architecture.

Cisco UCS chassis
Cisco UCS 5108 with
B200M4 blades

Cisco UCS-FI-6332-16UP

Cisco Nexus 9372PX

Cisco Nexus 7004

NetApp FAS 8200 HA pair

Cisco MDS 9396S

Cisco MDS 9396S

ATTO FibreBridge 7500N

NetApp DS4486

The following figure depicts the FlexPod Datacenter with NetApp MetroCluster IP architecture.

Starting with ONTAP 9.8, ONTAP Mediator can be deployed at a third site to monitor the MetroCluster IP solution and to facilitate automated unplanned switchover when a site disaster occurs.
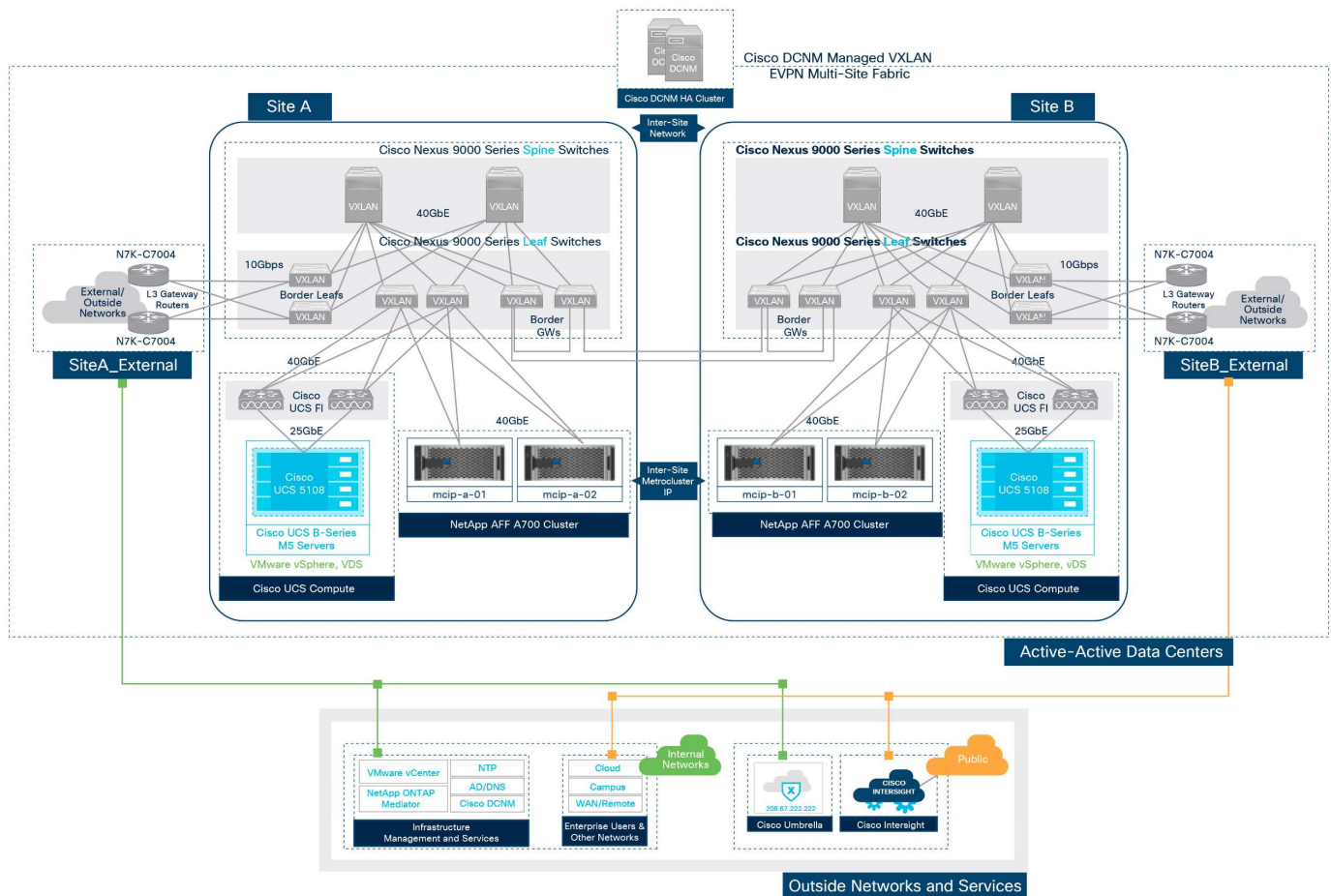
For a FlexPod MetroCluster IP solution deployment with extended layer-2 site-to-site connectivity, you can achieve cost savings by sharing ISL and using FlexPod switches as compliant MetroCluster IP switches if the network bandwidth and switches meet the requirements as illustrated in the following figure, which depicts the FlexPod MetroCluster IP solution with ISL sharing and compliant switches.
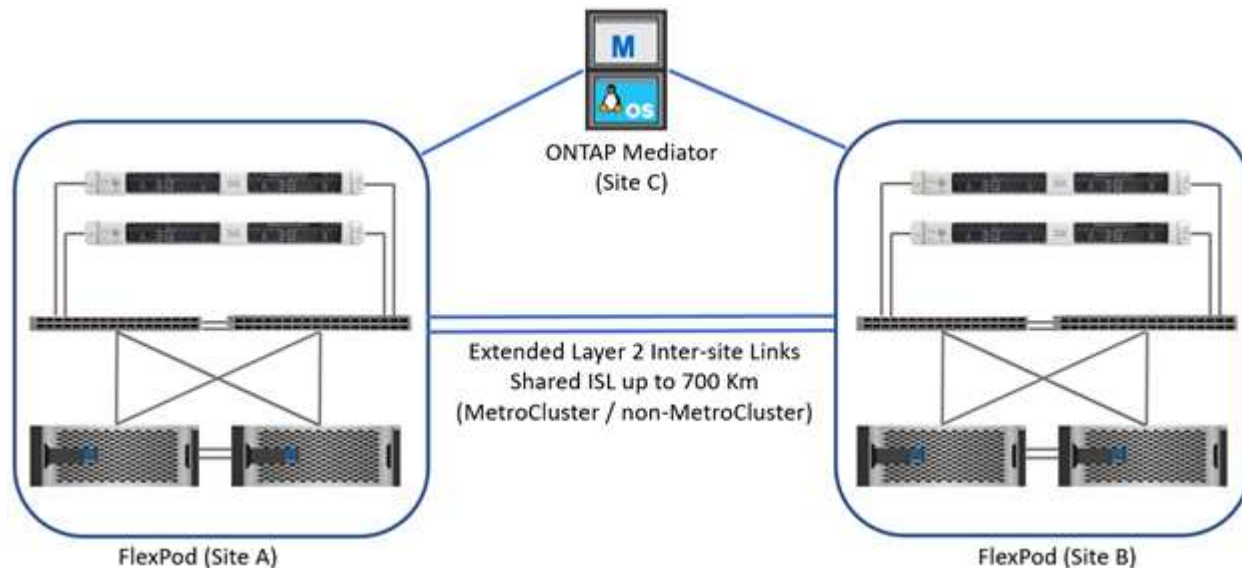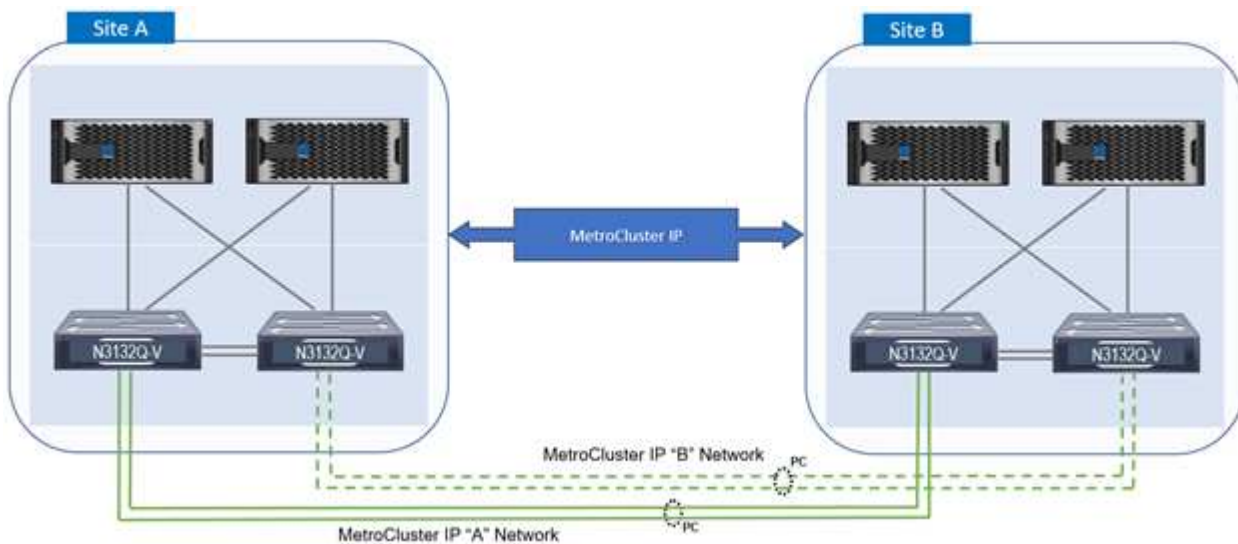

The following two figures depict the VXLAN Multi-Site fabric and the MetroCluster IP storage fabric for a FlexPod MetroCluster IP solution with VXLAN Multi-Site fabric deployment.

- VXLAN Multi-Site fabric for FlexPod MetroCluster IP solution

- MetroCluster IP storage fabric for FlexPod MetroCluster IP solution


End-to-end FC-NVMe

An end-to-end FC-NVMe seamlessly extends a customer's existing SAN infrastructure for real-time applications while simultaneously delivering improved IOPS and throughput with reduced latency.

An existing 32G FC SAN transport can be used to simultaneously transport both NVMe and SCSI workloads.

The following figure illustrates the Flexpod Datacenter for FC with Cisco MDS.

More details about the FlexPod configurations and performance benefits, see Introducing End-to-End NVMe for FlexPod White Paper.

For more information about ONTAP implementation, see TR-4684: Implementing and Configuring Modern SANs with NVMe.
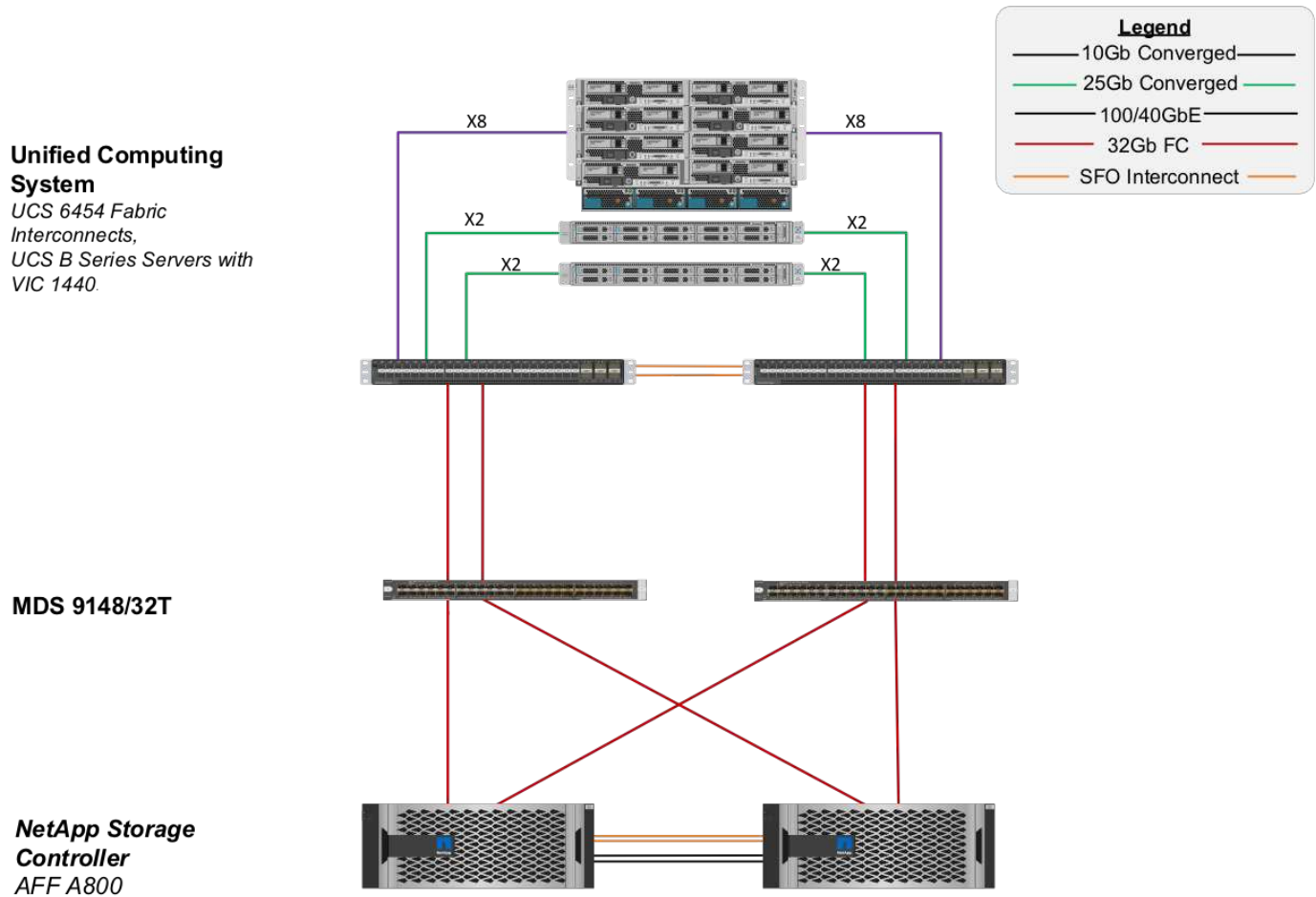
FC SAN boot through Cisco MDS

To provide increased scalability by using a dedicated SAN network, FlexPod supports FC through Cisco MDS switches and Nexus switches with FC support such as Cisco Nexus 93108TC-FX. The FC SAN boot option through Cisco MDS has the following licensing and hardware requirements:

- A minimum of two FC ports per NetApp storage controller; one port for each SAN fabric
- An FC license on each NetApp storage controller
- Cisco MDS switches and firmware versions that are supported on the NetApp IMT

For more guidance on an MDS-based design, see the CVD FlexPod Datacenter with VMware vSphere 6.7U1 Fibre Channel and iSCSI Deployment Guide.

The following figures show an example of FlexPod Datacenter for FC with MDS connectivity and FlexPod Datacenter for FC with Cisco Nexus 93180YC-FX, respectively.
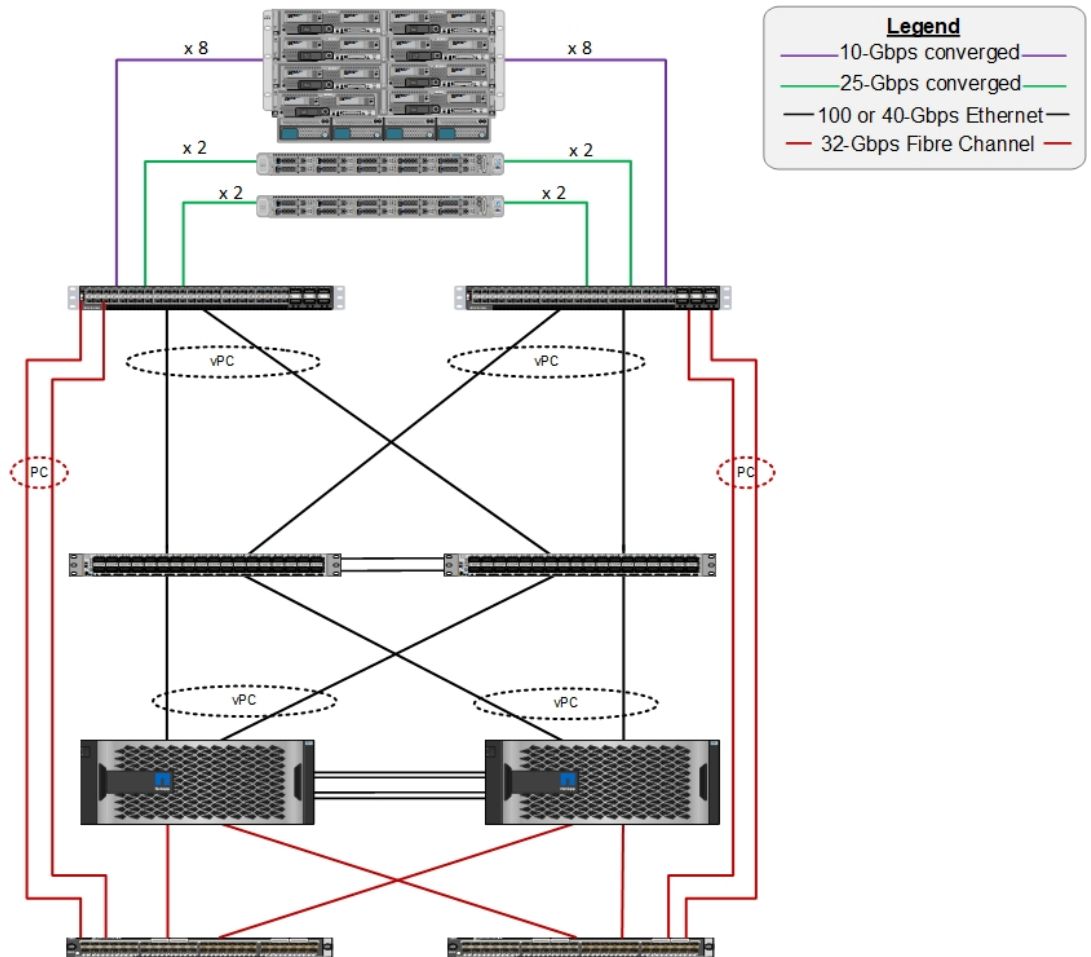
Cisco Unified Computing System
Cisco UCS 6454 Fabric Interconnects,
UCS B-Series Blade Servers with UCS VIC 1440, and UCS C-Series Rack Servers with UCS VIC 1457

x 8   x 8

x 2   x 2

x 2   x 2

Cisco Nexus 9336C-FX2

NetApp storage controllers AFF-A800

Cisco MDS 9148T or 9132T switch
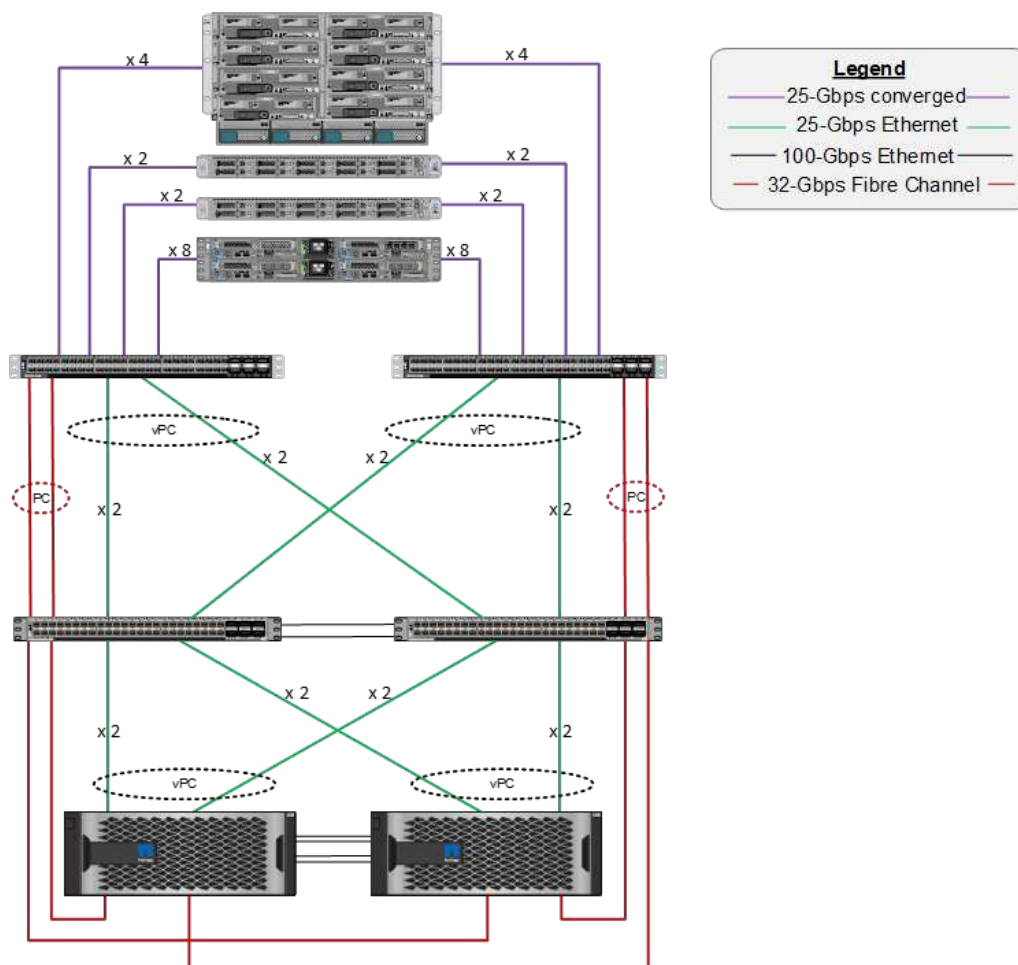
vPC   vPC

PC   PC

vPC   vPC

Cisco Unified
Computing System
*Cisco UCS 6454 Fabric
Interconnects, UCS 2408
Fabric Extenders, UCS B-
Series Blade Servers with
UCS VIC 1440, UCS C-
Series Rack Servers with
UCS VIC 1457, UCS C4200
Chassis, and UCS C125
Servers with UCS VIC 1455*

x 4   x 4
x 2   x 2
x 2   x 2
x 8   x 8

Legend
— 25-Gbps converged —
— 25-Gbps Ethernet —
— 100-Gbps Ethernet —
— 32-Gbps Fibre Channel —

vPC   vPC
x 2   x 2
PC   PC
x 2   x 2

Cisco Nexus
93180YC-FX

x 2   x 2
x 2   x 2
vPC   vPC

NetApp storage
controllers
AFF-A400
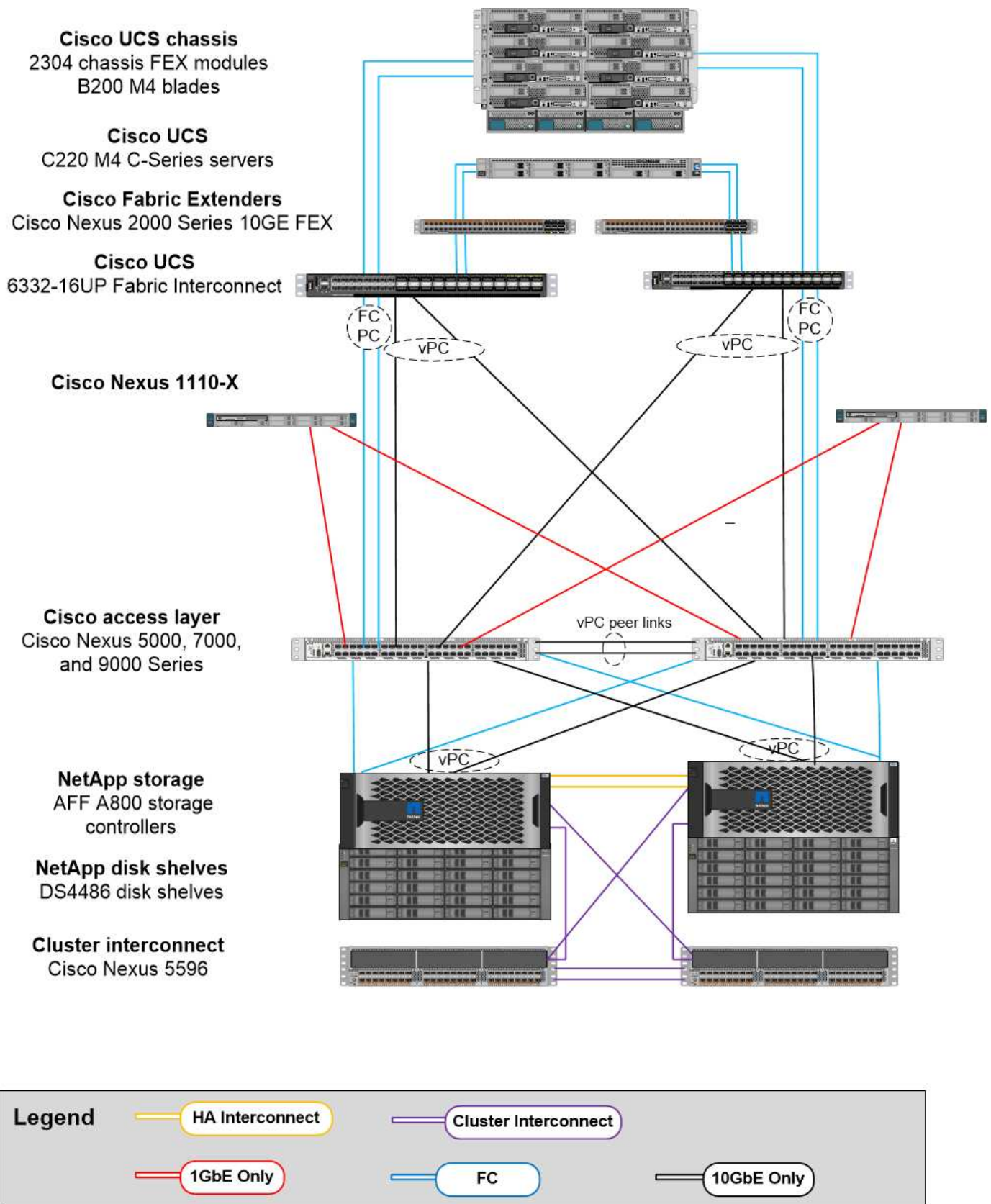
FC SAN boot with Cisco Nexus

The classic FC SAN boot option has the following licensing and hardware requirements:

- When FC zoning is performed in the Cisco Nexus 5000 Series Switch, a Storage Protocols Service Package license for the Cisco Nexus 5000 Series Switches (FC_FEATURES_PKG) is required.

- When FC zoning is performed in the Cisco Nexus 5000 Series Switch, SAN links are required between the fabric interconnect and the Cisco Nexus 5000 Series Switch. For additional redundancy, SAN port channels are recommended between the links.

- The Cisco Nexus 5010, 5020, and 5548P Switches require a separate FC or universal port (UP) module for connectivity into the Cisco UCS Fabric Interconnect and into the NetApp storage controller.

- The Cisco Nexus 93180YC-FX requires an FC feature license for capabilities to enable FC.

- Each NetApp storage controller requires a minimum of two 8/16/32Gb FC ports for connectivity.

- An FC license on the NetApp storage controller is required.

> (i) The use of the Cisco Nexus 7000 or 9000 family of switches precludes the use of traditional FC unless FC zoning is performed in the fabric interconnect. In that case, SAN uplinks to the switch are not supported.

The following figure shows an FC connectivity configuration.

Cisco UCS chassis
2304 chassis FEX modules
B200 M4 blades

Cisco UCS
C220 M4 C-Series servers

Cisco Fabric Extenders
Cisco Nexus 2000 Series 10GE FEX

Cisco UCS
6332-16UP Fabric Interconnect

Cisco Nexus 1110-X

Cisco access layer
Cisco Nexus 5000, 7000,
and 9000 Series

NetApp storage
AFF A800 storage
controllers

NetApp disk shelves
DS4486 disk shelves

Cluster interconnect
Cisco Nexus 5596

Legend	HA Interconnect	Cluster Interconnect
	1GbE Only	FC	10GbE Only

FCoE SAN boot option

The FCoE SAN boot option has the following licensing and hardware requirements:

- When FC zoning is performed in the switch, a Storage Protocols Service Package license for the Cisco

17

Nexus 5000 or 7000 Series Switches `(FC_FEATURES_PKG)` is required.

- When FC zoning is performed in the switch, FCoE uplinks are required between the fabric interconnect and the Cisco Nexus 5000 or 7000 Series Switches. For additional redundancy, FCoE port channels are also recommended between the links.

- Each NetApp storage controller requires at least one dual-port unified target adapter (UTA) add-on card for FCoE connectivity unless onboard unified target adapter 2 (UTA2) ports are present.

- This option requires an FC license on the NetApp storage controller.

- If you use the Cisco Nexus 7000 Series Switches and FC zoning is performed in the switch, a line card that is capable of supporting FCoE is required.

> ⓘ The use of the Cisco Nexus 9000 Series Switches precludes the use of FCoE unless FC zoning is performed in the fabric interconnect and storage is connected to the fabric interconnects with appliance ports. In that case, FCoE uplinks to the switch are not supported.

The following figure shows an FCoE boot scenario.

Cisco UCS chassis
2304 chassis FEX modules
B200 M4 blades

Cisco UCS
C220 M4 C-Series servers

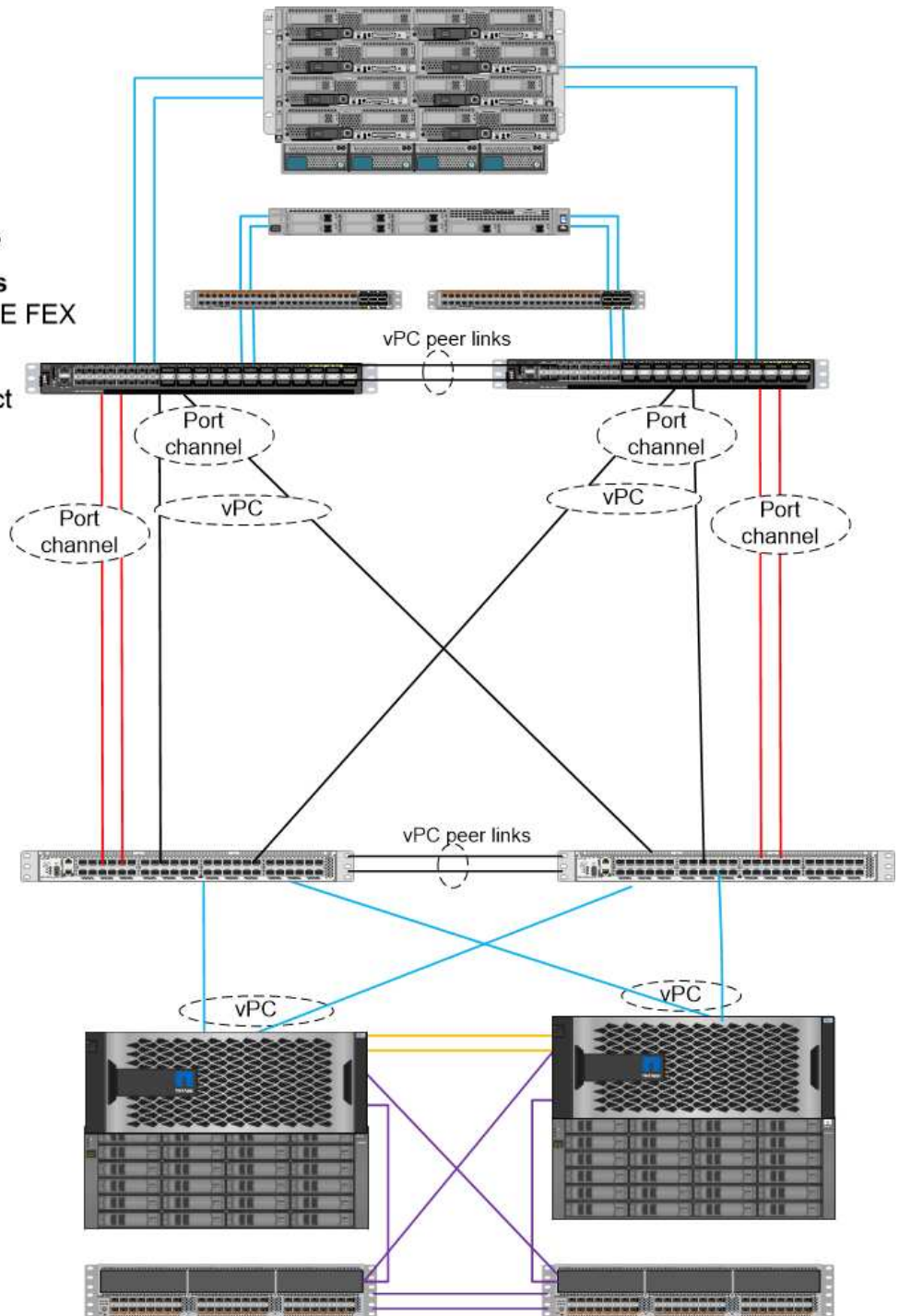**Cisco Fabric Extenders**
Cisco Nexus 2000 Series 10GE FEX

Cisco UCS
6332-16UP Fabric Interconnect

vPC peer links

Port channel

Port channel

Port channel

vPC

vPC

Port channel

Cisco access layer
Cisco Nexus 5000, 7000, and 9000 Series

vPC peer links

NetApp storage
AFF A800 storage controllers

NetApp disk shelves
DS4486 disk shelves

Cluster interconnect
Cisco Nexus 5596

vPC

vPC

Legend

HA Interconnect	Cluster Interconnect	
FCoE Only	FCoE and 10GbE	10GbE Only

iSCSI boot option

The iSCSI boot option has the following licensing and hardware requirements:

- An iSCSI license on the NetApp storage controller is required.
- An adapter in the Cisco UCS Server that is capable of iSCSI boot is required.
- A two-port 10Gbps Ethernet adapter on the NetApp storage controller is required.

The following figure shows an Ethernet-only configuration that is booted by using iSCSI.
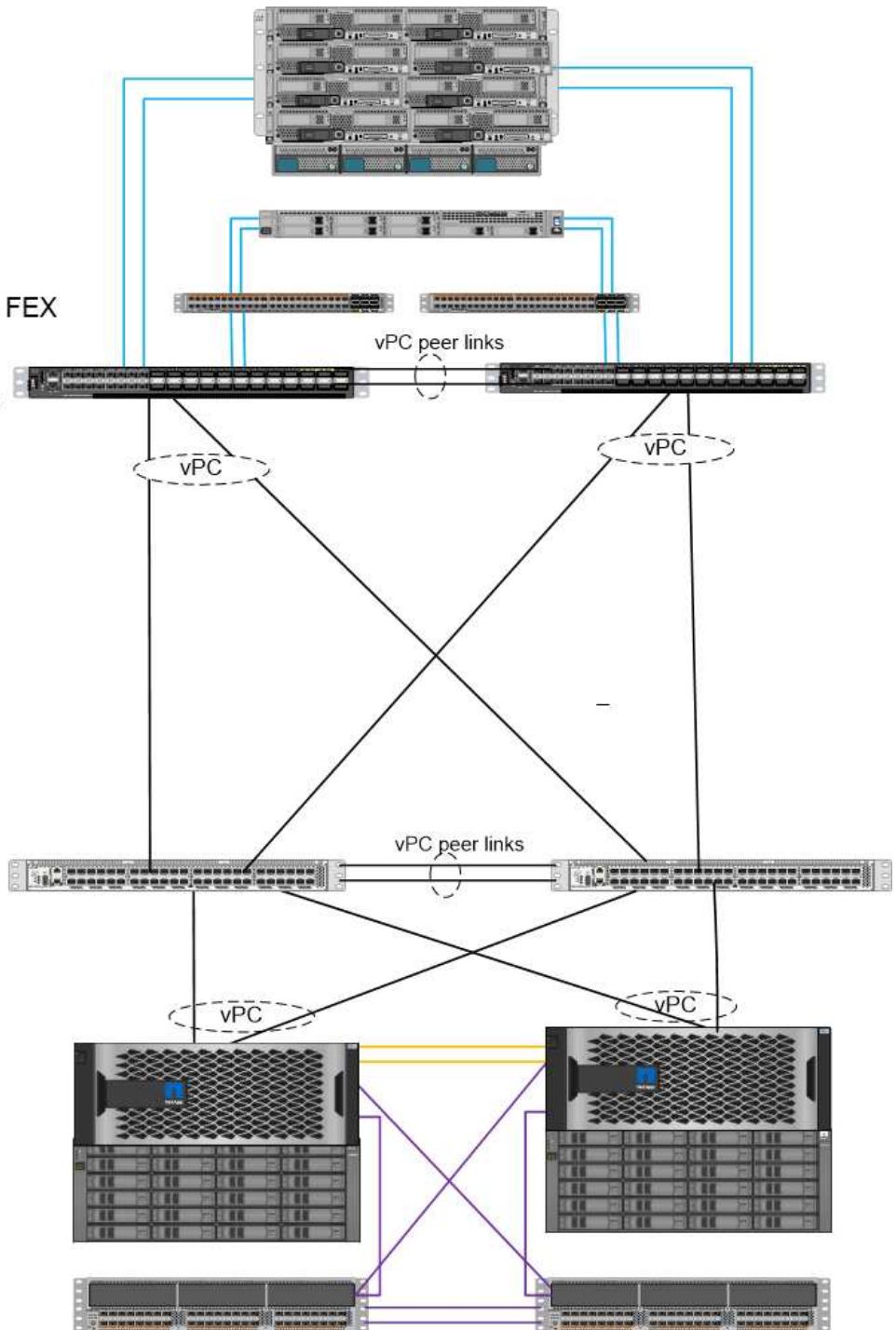
Cisco UCS chassis
2304 Chassis FEX modules
B200 M4 blades

Cisco UCS
C220 M4 C-Series servers

Cisco Fabric Extenders
Cisco Nexus 2000 Series 10GE FEX

Cisco UCS
6332-16UP Fabric Interconnect

vPC peer links

vPC

vPC

Cisco access layer
Cisco Nexus 5000, 7000,
and 9000 Series

vPC peer links

vPC

vPC

NetApp storage
AFF A800 storage
controllers

NetApp disk shelves
DS4486 Disk shelves

Cluster Interconnect
Cisco Nexus 5596

Legend

— HA Interconnect   — 10GbE Only

— Cluster Interconnect   — FCoE

Cisco UCS direct connect with NetApp storage

NetApp AFF and FAS controllers can be directly connected to the Cisco UCS fabric interconnects without any upstream SAN switch.

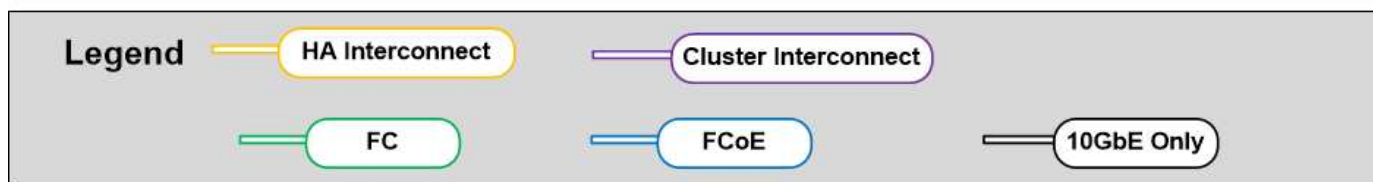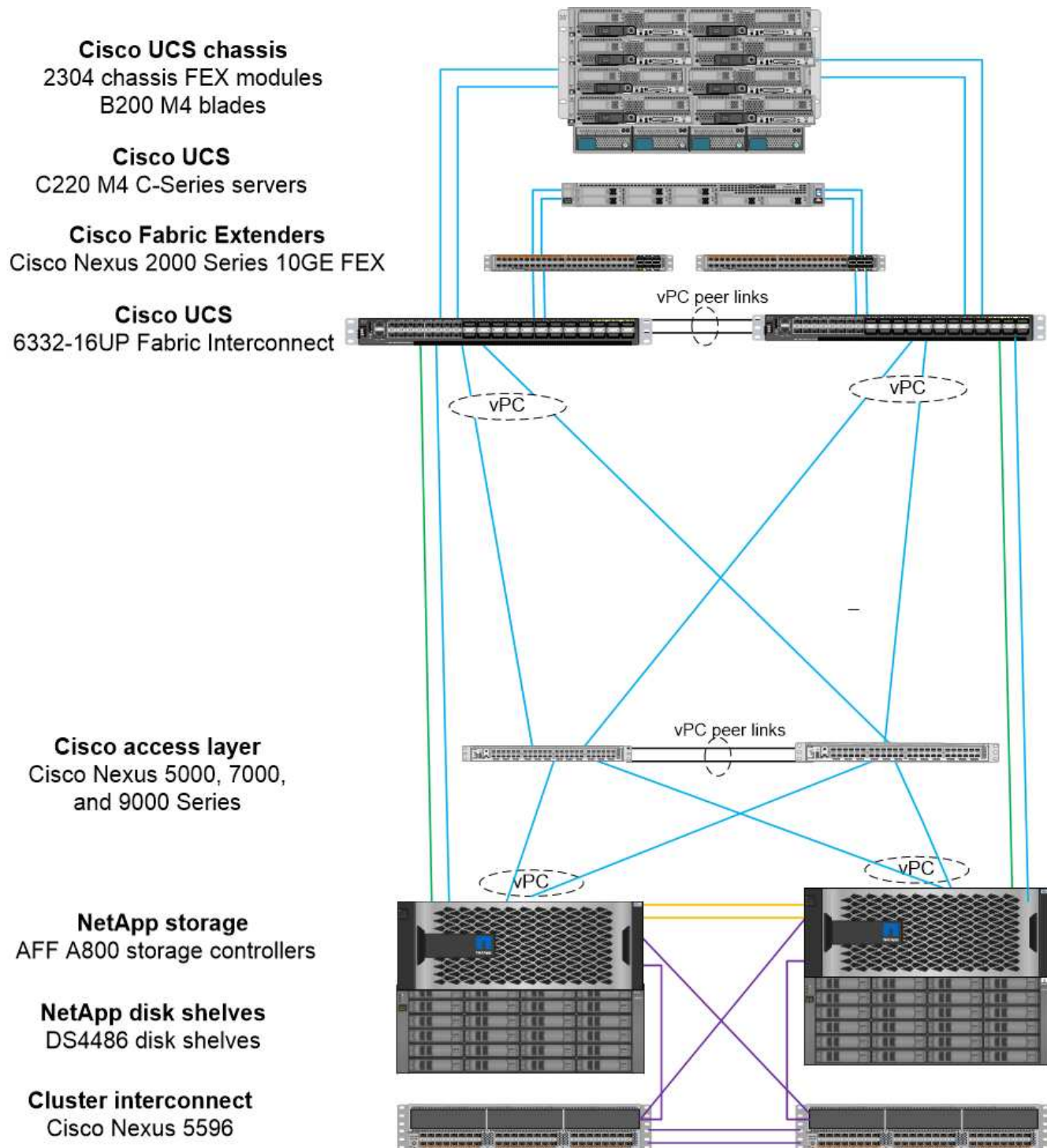Four Cisco UCS port types can be used to directly connect to NetApp storage:

- **Storage FC port.** Directly connect this port to an FC port on NetApp storage.
- **Storage FCoE port.** Directly connect this port to an FCoE port on NetApp storage.
- **Appliance port.** Directly connect this port to a 10GbE port on NetApp storage.
- **Unified storage port.** Directly connect this port to a NetApp UTA.

The licensing and hardware requirements are as follows:

- A protocol license on the NetApp storage controller is required.
- A Cisco UCS adapter (initiator) is required on the server. For a list of supported Cisco UCS adapters, see the NetApp IMT.
- A target adapter on the NetApp storage controller is required.

The following figure shows an FC direct-connect configuration.

Cisco UCS chassis
2304 chassis FEX modules
B200 M4 blades

Cisco UCS
C220 M4 C-Series servers

Cisco Fabric Extenders
Cisco Nexus 2000 Series 10GE FEX

Cisco UCS
6332-16UP Fabric Interconnect

vPC peer links

vPC

vPC

Cisco access layer
Cisco Nexus 5000, 7000,
and 9000 Series

vPC peer links

vPC

vPC

NetApp storage
AFF A800 storage controllers

NetApp disk shelves
DS4486 disk shelves

Cluster interconnect
Cisco Nexus 5596

Legend

HA Interconnect	Cluster Interconnect
FC	FCoE	10GbE Only

Notes:

- Cisco UCS is configured in FC switching mode.
- FCoE ports from the target to fabric interconnects are configured as FCoE storage ports.
- FC ports from the target to fabric interconnects are configured as FC storage ports.

The following figure shows an iSCSI/Unified IP direct-connect configuration.
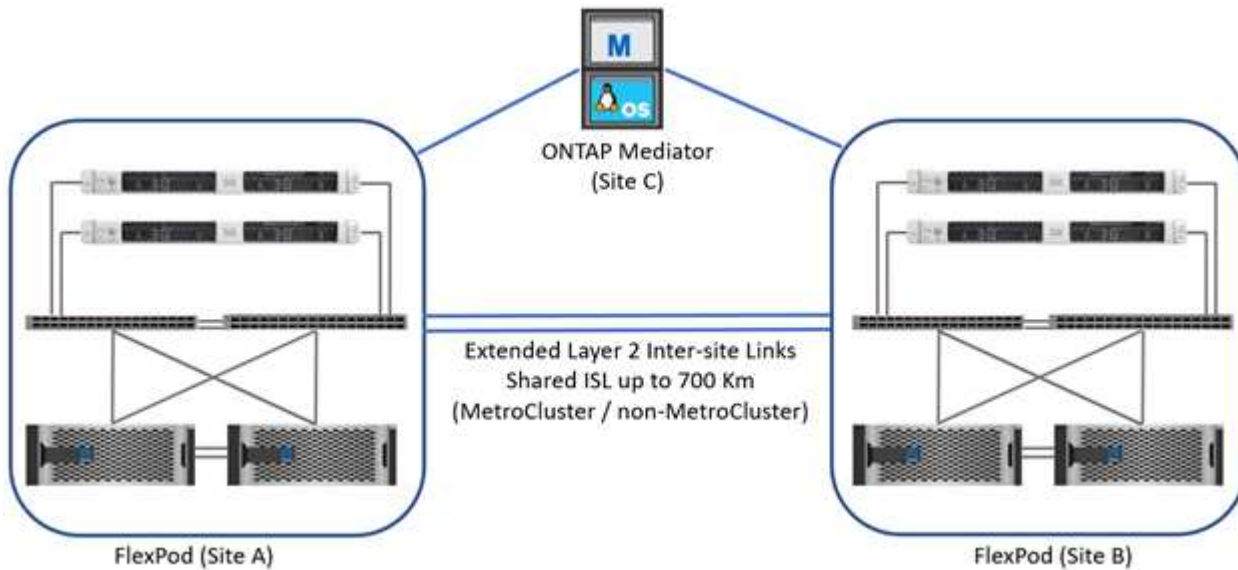
Notes:

- Cisco UCS is configured in Ethernet switching mode.
- iSCSI ports from the target to fabric interconnects are configured as Ethernet storage ports for iSCSI data.
- Ethernet ports from the target to fabric interconnects are configured as Ethernet storage ports for CIFS/NFS data.

Cisco components

Cisco has contributed substantially to the FlexPod design and architecture, covering both the compute and networking layers of the solution. This section describes the Cisco UCS and Cisco Nexus options that are available for FlexPod. FlexPod supports both Cisco UCS B-Series and C-Series servers.

Cisco UCS fabric interconnect options

Redundant fabric interconnects are required in the FlexPod architecture. When you add multiple Cisco UCS chassis to a pair of fabric interconnects, remember that the maximum number of chassis in an environment is determined by both an architectural and a port limit.

The part numbers that are shown in the following table are for the base fabric interconnects. They do not include the power supply unit (PSU) or SFP+, QSFP+, or expansion modules. Additional fabric interconnects are supported; see the NetApp IMT for a complete list.

Cisco UCS fabric interconnect	Part number	Technical specifications
Cisco UCS 6332UP	UCS-FI-6332-UP	Cisco UCS 6332 Fabric Interconnect

Cisco UCS fabric interconnect	Part number	Technical specifications
Cisco UCS 6454	UCS-FI-6454-U	Cisco UCS 6454 Fabric Interconnect

Cisco UCS 6454

The Cisco UCS 6454 Series offers line-rate, low-latency, lossless 10/25/40/100GbE Ethernet and FCoE connectivity, as well as unified ports that are capable of either Ethernet or FC operation. The 44 10/25Gbps ports can operate as 10Gbps or 25Gbps converged Ethernet, of which eight are unified ports capable of operating at 8/16/32Gbps for FC. Four ports operate at 1/10/25Gbps for legacy connectivity, and six QSFP ports serve as 40/100Gbps uplink ports or breakout ports. You can establish 100Gbps end-to-end network connectivity with NetApp storage controllers that support 100Gbps adapters. For adapters and platform support, see the NetApp Hardware Universe.

For details about ports, see the Cisco UCS 6454 Fabric Interconnect Datasheet.

For technical specifications about the 100Gb QSFP data modules, see the Cisco 100GBASE QSFP Modules Datasheet.

Cisco UCS B-Series chassis option

To use Cisco UCS B-Series blades, you must have a Cisco UCS B-Series chassis. The table below describes the Cisco UCS BSeries chassis option.

Cisco UCS B-Series chassis	Part number	Technical specifications
Cisco UCS 5108	N20-C6508	Cisco UCS 5100 Series Blade Server Chassis

Each Cisco UCS 5108 blade chassis must have two Cisco UCS 2200/2300/2400 Series IOMs to provide redundant connectivity to the fabric interconnects.

Cisco UCS B-Series blade server options

Cisco UCS B-Series Blade Servers are available in half-width and full-width varieties, with various CPU, memory, and I/O options. The part numbers that are listed in the following table are for the base server. They do not include the CPU, memory, drives, or mezzanine adapter cards. Multiple configuration options are available and are supported in the FlexPod architecture.

Cisco UCS B-Series blade	Part number	Technical specifications
Cisco UCS B200 M6	UCSB-B200-M6	Cisco UCS B200 M6 Blade Server

Previous generations of Cisco UCS B-Series blades can be used in the FlexPod architecture, if they are supported on the Cisco UCS Hardware and Software Compatibility List. The Cisco UCS B-Series Blade Servers must also have a valid SmartNet support contract.

Cisco UCS X-Series chassis option

To use Cisco UCS X-Series compute nodes, you must have a Cisco UCS X-Series chassis. The following table describes the Cisco UCS X-Series chassis option.

Cisco UCS X-Series blade	Part number	Technical specifications
Cisco UCS 9508 M6	UCSX-9508	Cisco UCX9508 X-Series Chassis

Each Cisco UCS 9508 chassis must have two Cisco UCS 9108 Intelligent Fabric Modules (IFMs) to provide redundant connectivity to the fabric interconnects.

Cisco UCS X-Series device options

Cisco UCS X-Series compute nodes are available with various CPU, memory, and I/O options. The part numbers listed in the following table are for the base node. They do not include the CPU, memory, drives, or mezzanine adapter cards. Multiple configuration options are available and are supported in the FlexPod architecture.

Cisco UCS X-Series compute nodes	Part number	Technical specifications
Cisco UCS X210c M6	UCSX-210C-M6	Cisco UCS X210c M6 Compute Node

Cisco UCS C-Series rack server options

Cisco UCS C-Series Rack Servers are available in one and two rack-unit (RU) varieties, with various CPU, memory, and I/O options. The part numbers that are listed in the second table below are for the base server. They do not include CPUs, memory, drives, Peripheral Component Interconnect Express (PCIe) cards, or the Cisco Fabric Extender. Multiple configuration options are available and are supported in the FlexPod architecture.

The following table lists the Cisco UCS C-Series Rack Server options.

Cisco UCS C-Series rack server	Part number	Technical specifications
Cisco UCS C220 M6	UCSC-C220-M6	Cisco UCS C220 M6 Rack Server
Cisco UCS C225 M6	UCSC-C225-M6	Cisco UCS C225 M6 Rack Server
Cisco UCS C240 M6	UCSC-C240-M6	Cisco UCS C240 M6 Rack Server
Cisco UCS C245 M6	UCSC-C245-M6	Cisco UCS C245 M6 Rack Server

Previous generations of Cisco UCS C-Series servers can be used in the FlexPod architecture, if they are supported on the Cisco UCS Hardware and Software Compatibility List. The Cisco UCS C-Series servers must also have a valid SmartNet support contract.

Cisco Nexus 5000 Series switch options

Redundant Cisco Nexus 5000, 7000, or 9000 Series Switches are required in the FlexPod architecture. The part numbers that are listed in the table below are for the Cisco Nexus 5000 Series chassis; they do not include SFP modules, add-on FC, or Ethernet modules.

Cisco Nexus 5000 Series switch	Part number	Technical specifications
Cisco Nexus 56128P	N5K-C56128P	Cisco Nexus 5600 Platform Switches
Cisco Nexus 5672UP-16G	N5K-C5672UP-16G	

Cisco Nexus 5000 Series switch	Part number	Technical specifications
Cisco Nexus 5596UP	N5K-C5596UP-FA	Cisco Nexus 5548 and 5596 Switches
Cisco Nexus 5548UP	N5K-C5548UP-FA	

Cisco Nexus 7000 series switch options

Redundant Cisco Nexus 5000, 7000, or 9000 Series Switches are required in the FlexPod architecture. The part numbers that are listed in the table below are for the Cisco Nexus 7000 Series chassis; they do not include SFP modules, line cards, or power supplies, but they do include fan trays.

Cisco Nexus 7000 Series Switch	Part number	Technical specifications
Cisco Nexus 7004	N7K-C7004	Cisco Nexus 7000 4-Slot Switch
Cisco Nexus 7009	N7K-C7009	Cisco Nexus 7000 9-Slot Switch
Cisco Nexus 7702	N7K-C7702	Cisco Nexus 7700 2-Slot Switch
Cisco Nexus 7706	N77-C7706	Cisco Nexus 7700 6-Slot Switch

Cisco Nexus 9000 series switch options

Redundant Cisco Nexus 5000, 7000, or 9000 Series Switches are required in the FlexPod architecture. The part numbers that are listed in the table below are for the Cisco Nexus 9000 Series chassis; they do not include SFP modules or Ethernet modules.

Cisco Nexus 9000 Series Switch	Part Number	Technical Specifications
Cisco Nexus 93180YC-FX	N9K-C93180YC-FX	Cisco Nexus 9300 Series Switches
Cisco Nexus 93180YC-EX	N9K-93180YC-EX	
Cisco Nexus 9336PQ ACI Spine	N9K-C9336PQ	
Cisco Nexus 9332PQ	N9K-C9332PQ	
Cisco Nexus 9336C-FX2	N9K-C9336C-FX2	
Cisco Nexus 92304QC	N9K-C92304QC	Cisco Nexus 9200 Series Switches
Cisco Nexus 9236C	N9K-9236C	

> ⓘ Some Cisco Nexus 9000 Series Switches have additional variants. These variants are supported as part of the FlexPod solution. For the complete list of Cisco Nexus 9000 Series Switches, see Cisco Nexus 9000 Series Switches on the Cisco website.

Cisco APIC options

When deploying Cisco ACI, you must configure the three Cisco APICs in addition to the items in the section Cisco Nexus 9000 Series Switches. For more information about the Cisco APIC sizes, see the Cisco Application Centric Infrastructure Datasheet.

For more information about APIC product specifications refer to Table 1 through Table 3 on the Cisco Application Policy Infrastructure Controller Datasheet.

Cisco Nexus fabric extender options

Redundant Cisco Nexus 2000 Series rack-mount FEXs are recommended for large FlexPod architectures that use C-Series servers. The table below describes a few Cisco Nexus FEX options. Alternate FEX models are also supported. For more information, see the Cisco UCS Hardware and Software Compatibility List.

Cisco Nexus rack-mount FEX	Part number	Technical specifications
Cisco Nexus 2232PP	N2K-C2232PP	Cisco Nexus 2000 Series Fabric Extenders
Cisco Nexus 2232TM-E	N2K-C2232TM-E	
Cisco Nexus 2348UPQ	N2K-C2348UPQ	Cisco Nexus 2300 Platform Fabric Extenders
Cisco Nexus 2348TQCisco Nexus 2348TQ-E	N2K-C2348TQN2K-C2348TQ-E	

Cisco MDS options

Cisco MDS switches are an optional component in the FlexPod architecture. Redundant SAN switch fabrics are required when you implement the Cisco MDS switch for FC SAN. The table below lists the part numbers and details for a subset of the supported Cisco MDS switches. See the NetApp IMT and Cisco Hardware and Software Compatibility List for a complete list of supported SAN switches.

Cisco MDS 9000 series switch	Part number	Description
Cisco MDS 9148T	DS-C9148T-24IK	Cisco MDS 9100 Series Switches
Cisco MDS 9132T	DS-C9132T-MEK9	
Cisco MDS 9396S	DS-C9396S-K9	Cisco MDS 9300 Series Switches

Cisco software licensing options

Licenses are required to enable storage protocols on the Cisco Nexus switches. The Cisco Nexus 5000 and 7000 Series of switches all require a storage services license to enable the FC or FCoE protocol for SAN boot implementations. The Cisco Nexus 9000 Series Switches currently do not support FC or FCoE.

The required licenses and the part numbers for those licenses vary depending on the options that you select for each component of the FlexPod solution. For example, software license part numbers vary depending on the number of ports and which Cisco Nexus 5000 or 7000 Series Switches you choose. Consult your sales representative for the exact part numbers. The table below lists the Cisco software licensing options.

Cisco software licensing	Part number	License information
Cisco Nexus 5500 Storage License, 8-, 48-, and 96-port	N55-8P-SSK9/N55-48P-SSK9/N55-96P-SSK9	Licensing Cisco NX-OS Software Features
Cisco Nexus 5010/5020 Storage Protocols License	N5010-SSK9/N5020-SSK9	
Cisco Nexus 5600 Storage Protocols License	N56-16p-SSK9/N5672-72P-SSK9/N56128-128P-SSK9	
Cisco Nexus 7000 Storage Enterprise License	N7K-SAN1K9	
Cisco Nexus 9000 Enterprise Services License	N95-LAN1K9/N93-LAN1K9	

Cisco support licensing options

Valid SmartNet support contracts are required on all Cisco equipment in the FlexPod architecture.

The required licenses and the part numbers for those licenses must be verified by your sales representative because they can vary for different products. The table below lists the Cisco support licensing options.

Cisco Support licensing	License guide
Smart Net Total Care Onsite Premium	Cisco Smart Net Total Care Service

NetApp components

NetApp storage controllers provide the storage foundation in the FlexPod architecture for both boot and application data storage. NetApp components include storage controllers, cluster interconnect switches, drives and disk shelves, and licensing options.

NetApp storage controller options

Redundant NetApp FAS, AFF, or AFF ASA controllers are required in the FlexPod architecture. The controllers run ONTAP software. When the storage controllers are ordered, the preferred software version can be preloaded on the controllers. For ONTAP, a complete cluster is ordered. A complete cluster includes a pair of storage controllers and a cluster interconnect (switch or switchless).

Different options and configurations are available, depending on the selected storage platform. Consult your sales representative for details about these additional components.

The controller families that are listed in the table below are appropriate for use in a FlexPod Datacenter solution because their connection to the Cisco Nexus switches is seamless. See the NetApp Hardware Universe for specific compatibility details on each controller model.

Storage controller family	Technical specifications
AFF A-Series	AFF A-Series Documentation
AFF ASA A-Series	AFF ASA A-Series Documentation
FAS Series	FAS Series Documentation

Cluster interconnect switch options

The following table lists the Nexus cluster interconnect switches that are available for FlexPod architectures. In addition, FlexPod supports all ONTAP supported cluster switches including non-Cisco switches, provided they are compatible with the version of ONTAP being deployed. See the NetApp Hardware Universe for additional compatibility details for specific switch models.

Cluster interconnect switch	Technical specifications
Cisco Nexus 3132Q-V	NetApp Documentation: Cisco Nexus 3132Q-V switches
Cisco Nexus 9336C-FX2	NetApp Documentation: Cisco Nexus 9336C-FX2 switches

NetApp disk shelf and drive options

A minimum of one NetApp disk shelf is required for all storage controllers.

The selected NetApp shelf type determines which drive types are available within that shelf.

> ℹ️ For all disk shelves and disk part numbers, consult your sales representative.

For more information about the supported drives, click the NetApp Hardware Universe link in the following table and then select Supported Drives.

Disk shelf	Technical specifications
DS224C	Disk Shelves and Storage Media Supported Drives on NetApp Hardware Universe
DS212C	
DS460C	
NS224	

NetApp software licensing options

The following table lists the NetApp software licensing options that are available for the FlexPod Datacenter architecture. NetApp software is licensed at the FAS and AFF controller level.

NetApp software licensing	Part number	Technical specifications
SW, Complete BNDL (Controller), -C	SW-8XXX-COMP-BNDL-C	Product Library A–Z
SW, ONTAP Essentials (Controller), -C	SW-8XXX-ONTAP9-C	

NetApp support licensing options

NetApp SupportEdge Premium licenses are required for the FlexPod architecture, but the part numbers for those licenses vary based on the options that you select in the FlexPod design. For example, software license part numbers are different depending on which FAS controller you choose. Consult your sales representative for information about the exact part numbers for individual support licenses. The table below shows an example of a SupportEdge license.

NetApp support licensing	Part number	Technical specifications
SupportEdge Premium 4 hours on site—months: 36	CS-O2-4HR	NetApp SupportEdge Premium

Power and cabling requirements

A FlexPod design has minimum requirements for power and cabling.

Power requirements

Power requirements for FlexPod Datacenter differ based on the location where the FlexPod Datacenter configuration is installed.

For more data about the maximum power that is required and for other detailed power information, consult the technical specifications for each hardware component listed in the section Technical Specifications and References: Hardware Components.

For detailed Cisco UCS power data, see the Cisco UCS power calculator.

For NetApp storage controller power data, see the NetApp Hardware Universe. Under Platforms, select the storage platform that you want to use in the configuration (FAS/V-Series or AFF). Select the ONTAP version and storage controller, and then click the Show Results button.

Minimum cable requirements

The number and type of cables and adapters that are required vary per FlexPod Datacenter deployment. The cable type, transceiver type, and number are determined during the design process based on your requirements. The table below lists the minimum number of cables required.

Hardware	Model number	Cables required
Cisco UCS chassis	Cisco UCS 5108	At least two twinaxial cables per Cisco UCS 2104XP, 2204XP, or 2208XP module

Hardware	Model number	Cables required
Cisco UCS Fabric Interconnects	Cisco UCS 6248UP	• Two Cat5e cables for management ports
	Cisco UCS 6296UP	• Two Cat5e cables for the L1, L2 interconnects, per pair of fabric interconnects
	Cisco UCS 6332-16UP	• At least four twinaxial cables per fabric interconnect
	Cisco UCS 6454	• At least four FC cables per fabric interconnect
	Cisco UCS 6332	• Two Cat5e cables for management ports • Two Cat5e cables for the L1, L2 interconnects, per pair of fabric interconnects • At least four twinaxial cables per fabric interconnect
	Cisco UCS 6324	• Two 10/100/1000Mbps management ports • At least two twinaxial cables per fabric interconnect
Cisco Nexus 5000 and 7000 Series Switches	Cisco Nexus 5000 Series	• At least two 10GbE fiber or twinaxial cables per switch
	Cisco Nexus 7000 Series	• At least two FC cables per switch (if FC/FCoE connectivity is required)
Cisco Nexus 9000 Series Switches	Cisco Nexus 9000 Series	At least two 10GbE cables per switch
NetApp FAS controllers	AFF A-Series	• A pair of SAS or SATA cables per storage controller • At least two FC cables per controller, if using legacy FC • At least two 10GbE cables per controller
	FAS Series	• At least one GbE cable for management per controller • For ONTAP, eight short twinaxial cables are required per pair of cluster interconnect switches

Hardware	Model number	Cables required
NetApp disk shelves	DS212C	Two SAS, SATA, or FC cables per disk shelf
	DS224C	
	DS460C	
	NS224	Two 100Gbps copper cables per disk shelf

Technical specifications and references

Technical specifications provide details about the hardware components in a FlexPod solution, such as chassis, FEXs, servers, switches, and storage controllers.

Cisco UCS B-Series blade server chassis

The technical specifications for Cisco UCS B-Series Blade Server chassis, as shown in the table below, include the following components:

- Number of rack units
- Maximum number of blades
- Unified Fabric capability
- Midplane I/O bandwidth per server
- Number of I/O bays for FEXs

Component	Cisco UCS 5100 Series blade server chassis
Rack units	6
Maximum full-width blades	4
Maximum half-width blades	8
Capable of Unified Fabric	Yes
Midplane I/O	Up to 80Gbps of I/O bandwidth per server
I/O bays for FEXs	Two bays for Cisco UCS 2104XP, 2204/8XP, 2408XP, and 2304 FEXs

For more information, see the Cisco UCS 5100 Series Blade Server Chassis Datasheet.

Cisco UCS B-Series blade servers

The technical specifications for Cisco UCS B-Series Blade Servers, as shown in the table below, include the following components:

- Number of processor sockets
- Processor support
- Memory capacity
- Size and speed

- SAN boot support

- Number of mezzanine adapter slots

- I/O maximum throughput

- Form factor

- Maximum number of servers per chassis

Component	Cisco UCS datasheet
Cisco UCS B200 M6	Cisco UCS B200 M6 Blade Server

Cisco UCS C-Series rack servers

The technical specifications for the Cisco UCS C-Series rack servers include processor support, maximum memory capacity, the number of PCIe slots, and the size of the form factor. For additional details on compatible UCS server models, see the Cisco Hardware Compatibility list. The following tables illustrate the C-Series Rack Server datasheets and Cisco UCS C-Series chassis option, respectively.

Component	Cisco UCS datasheet
Cisco UCS C220 M6	Cisco UCS C220 M6 Rack Server
Cisco UCS C225 M6	Cisco UCS C225 M6 Rack Server
Cisco UCS C240 M6	Cisco UCS C240 M6 Rack Server
Cisco UCS C245 M6	Cisco UCS C245 M6 Rack Server

Cisco UCS X-Series chassis

The technical specifications for Cisco UCS X-Series chassis, as shown in the table below, include the following components:

- Number of rack units

- Maximum number of nodes

- Unified Fabric capability

- Number of I/O bays for IFMs

Component	Cisco UCS 9508 X-Series compute node chassis
Rack units	7
Maximum number of nodes	8
Capable of Unified Fabric	Yes
I/O bays for IFMs	Two bays for Cisco UCS 9108 Intelligent Fabric Modules (IFMs)

For more information, see the Cisco UCS X9508 X-Series Chassis Datasheet.

Cisco UCS X-Series compute node

The technical specifications for Cisco UCS X-Series compute node, as shown in the following table below,

include the following components:

- Number of processor sockets
- Processor support
- Memory capacity
- Size and speed
- SAN boot support
- Number of mezzanine adapter slots
- I/O maximum throughput
- Form factor
- Maximum number of compute nodes per chassis

Component	Cisco UCS datasheet
Cisco UCS X210c M6	Cisco UCS X210c M6 Compute Node

GPU recommendation for FlexPod AI, ML, and DL

The Cisco UCS C-Series Rack Servers listed in the table below can be used in a FlexPod architecture for hosting AI, ML, and DL workloads. The Cisco UCS C480 ML M5 Servers are purpose built for AI, ML, and DL workloads and use NVIDIA's SXM2- based GPUs while the other servers use PCIe- based GPUs.

The table below also lists the recommended GPUs that can be used with these servers.

Server	GPUs
Cisco UCS C220 M6	NVIDIA T4
Cisco UCS C225 M6	NVIDIA T4
Cisco UCS C240 M6	NVIDIA TESLA A10, A100
Cisco UCS C245 M6	NVIDIA TESLA A10, A100

Cisco UCS VIC adapters for Cisco UCS B-Series blade servers

The technical specifications for Cisco UCS Virtual Interface Card (VIC) adapters for Cisco UCS B-Series Blade Servers include the following components:

- Number of uplink ports
- Performance per port (IOPS)
- Power
- Number of blade ports
- Hardware offload
- Single root input/output virtualization (SR-IOV) support

All currently validated FlexPod architectures use a Cisco UCS VIC. Other adapters are supported if they are listed on the NetApp IMT and are compatible with your deployment of FlexPod, but they might not deliver all the features that are outlined in corresponding reference architectures. The following table illustrates the Cisco UCS VIC adapter datasheets.

Component	Cisco UCS datasheet
Cisco UCS Virtual Interface Adapters	Cisco UCS VIC Datasheets

Cisco UCS fabric interconnects

The technical specifications for Cisco UCS fabric interconnects include form factor size, the total number of ports and expansion slots, and throughput capacity. The following table illustrates the Cisco UCS fabric interconnect datasheets.

Component	Cisco UCS datasheet
Cisco UCS 6248UP	Cisco UCS 6200 Series Fabric Interconnects
Cisco UCS 6296UP	
Cisco UCS 6324	Cisco UCS 6324 Fabric Interconnect
Cisco UCS 6300	Cisco UCS 6300 Series Fabric Interconnects
Cisco UCS 6454	Cisco UCS 6400 Series Fabric Interconnects

Cisco Nexus 5000 Series switches

The technical specifications for Cisco Nexus 5000 Series Switches, including the form factor size, the total number of ports, and layer- 3 module and daughter card support, are contained in the datasheet for each model family. These datasheets can be found in the following table.

Component	Cisco Nexus datasheet
Cisco Nexus 5548UP	Cisco Nexus 5548UP Switch
Cisco Nexus 5596UP (2U)	Cisco Nexus 5596UP Switch
Cisco Nexus 56128P	Cisco Nexus 56128P Switch
Cisco Nexus 5672UP	Cisco Nexus 5672UP Switch

Cisco Nexus 7000 Series switches

The technical specifications for Cisco Nexus 7000 Series Switches, including the form factor size and the maximum number of ports, are contained in the datasheet for each model family. These datasheets can be found in the following table.

Component	Cisco Nexus datasheet
Cisco Nexus 7004	Cisco Nexus 7000 Series Switches
Cisco Nexus 7009	
Cisco Nexus 7010	
Cisco Nexus 7018	

Component	Cisco Nexus datasheet
Cisco Nexus 7702	Cisco Nexus 7700 Series Switches
Cisco Nexus 7706	
Cisco Nexus 7710	
Cisco Nexus 7718	

Cisco Nexus 9000 Series switches

The technical specifications for Cisco Nexus 9000 Series Switches are contained in the datasheet for each model. Specifications include the form factor size; the number of supervisors, fabric module, and line card slots; and the maximum number of ports. These datasheets can be found in the following table.

Component	Cisco Nexus datasheet
Cisco Nexus 9000 Series	Cisco Nexus 9000 Series Switches
Cisco Nexus 9500 Series	Cisco Nexus 9500 Series Switches
Cisco Nexus 9300 Series	Cisco Nexus 9300 Series Switches
Cisco Nexus 9336PQ ACI Spine Switch	Cisco Nexus 9336PQ ACI Spine Switch
Cisco Nexus 9200 Series	Cisco Nexus 9200 Platform Switches

Cisco Application Policy Infrastructure controller

When you deploy Cisco ACI, in addition to the items in the section Cisco Nexus 9000 Series Switches, you must configure three Cisco APICs. The following table lists the Cisco APIC datasheet.

Component	Cisco Application Policy Infrastructure datasheet
Cisco Application Policy Infrastructure Controller	Cisco APIC Datasheet

Cisco Nexus fabric extender details

The technical specifications for the Cisco Nexus FEX include speed, the number of fixed ports and links, and form factor size.

The following table lists the Cisco Nexus 2000 Series FEX datasheet.

Component	Cisco Nexus fabric extender datasheet
Cisco Nexus 2000 Series Fabric Extenders	Nexus 2000 Series FEX Datasheet

SFP modules

For information about the SFP modules, review the following resources:

- For information about the Cisco 10Gb SFP, see Cisco 10 Gigabit Modules.
- For information about the Cisco 25Gb SFP, see Cisco 25 Gigabit Modules.
- For information about the Cisco QSFP module, see the Cisco 40GBASE QSFP Modules datasheet.

- For information about the Cisco 100Gb SFP, see Cisco 100 Gigabit Modules.

- For information about the Cisco FC SFP module, see the Cisco MDS 9000 Family Pluggable Transceivers datasheet.

- For information about all supported Cisco SFP and transceiver modules, see Cisco SFP and SFP+ Transceiver Module Installation Notes and Cisco Transceiver Modules.

NetApp storage controllers

The technical specifications for NetApp storage controllers include the following components:

- Chassis configuration

- Number of rack units

- Amount of memory

- NetApp FlashCache caching

- Aggregate size

- Volume size

- Number of LUNs

- Supported network storage

- Maximum number of NetApp FlexVol volumes

- Maximum number of supported SAN hosts

- Maximum number of Snapshot copies

FAS Series

All available models of FAS storage controllers are supported for use in a FlexPod Datacenter. Detailed specifications for all FAS series storage controllers are available in the NetApp Hardware Universe. See the platform-specific documentation listed in the following table for detailed information about a specific FAS model.

Component	FAS Series controller platform documentation
FAS9000 Series	FAS9000 Series Datasheet
FAS8700 Series	FAS8700 Series Datasheet
FAS8300 Series	FAS8300 Series Datasheet
FAS500f Series	FAS500f Series Datasheet
FAS2700 Series	FAS2700 Series Datasheet

AFF A-Series

All current models of NetApp AFF A-Series storage controllers are supported for use in FlexPod. Additional information can be found in the AFF Technical Specifications datasheet and in the NetApp Hardware Universe. See the platform- specific documentation listed in the following table for detailed information about a specific AFF Model.

Component	AFF A-Series controller platform documentation
NetApp AFF A800	AFF A800 Platform Documentation
NetApp AFF A700	AFF A700 Platform Documentation
NetApp AFF A700s	AFF A700s Platform Documentation
NetApp AFF A400	AFF A400 Platform Documentation
NetApp AFF A250	AFF A250 Platform Documentation

AFF ASA A-Series

All current models of NetApp AFF ASA A-Series storage controllers are supported for use in FlexPod. Additional information can be found in the All SAN Array documentation resources, ONTAP AFF All SAN Array System technical report, and in the NetApp Hardware Universe. See the platform-specific documentation listed in the following table for detailed information about a specific AFF Model.

Component	AFF A-Series controller platform documentation
NetApp AFF ASA A800	AFF ASA A800 Platform Documentation
NetApp AFF ASA A700	AFF ASA A700 Platform Documentation
NetApp AFF ASA A400	AFF ASA A400 Platform Documentation
NetApp AFF ASA A250	AFF ASA A250 Platform Documentation
NetApp AFF ASA A220	AFF ASA A220 Platform Documentation

NetApp disk shelves

The technical specifications for NetApp disk shelves include the form factor size, the number of drives per enclosure, and the shelf I/O modules; this documentation can be found in the following table. For more information, see the NetApp Disk Shelves and Storage Media Technical Specifications and the NetApp Hardware Universe.

Component	NetApp FAS/AFF disk shelf documentation
NetApp DS212C Disk Shelf	DS212C Disk Shelf Documentation
NetApp DS224C Disk Shelf	DS224C Disk Shelf Documentation
NetApp DS460C Disk Shelf	DS460C Disk Shelf Documentation
NetApp NS224 NVMe-SSD Disk Shelf	NS224 Disk Shelf Documentation

NetApp drives

The technical specifications for NetApp drives include the form factor size, disk capacity, disk RPM, supporting controllers, and ONTAP version requirements. These specifications can be found in the Drives section of the NetApp Hardware Universe.

Legacy equipment

FlexPod is a flexible solution that enables you to use your existing equipment and new equipment that is currently for sale by Cisco and NetApp. Occasionally, certain models of

equipment from both Cisco and NetApp are designated as end of life (EOL).

Even though these equipment models are no longer available, if you purchased one of these models before the end-of-availability (EOA) date, you can use that equipment in a FlexPod configuration. A complete list of the legacy equipment models that are supported in FlexPod that are no longer for sale can be referenced on the NetApp Service and Support Product Programs End of Availability Index.

For more information on legacy Cisco equipment, see the Cisco EOL and EOA notices for Cisco UCS C-Series Rack Servers, Cisco UCS B-Series Blade Servers, and Nexus switches.

Legacy FC Fabric support includes the following:

- 2Gb Fabric
- 4Gb Fabric

Legacy software includes the following:

- NetApp Data ONTAP operating in 7-Mode, 7.3.5 and later
- ONTAP 8.1.x through 9.0.x
- Cisco UCS Manager 1.3 and later
- Cisco UCS Manager 2.1 through 2.2.7

Where to find additional Information

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

- NetApp Product Documentation

  https://docs.netapp.com/

- NetApp Support Communications

  https://mysupport.netapp.com/info/communications/index.html

- NetApp Interoperability Matrix Tool (IMT)

  https://mysupport.netapp.com/matrix/#welcome

- NetApp Hardware Universe

  https://hwu.netapp.com/

- NetApp Support

  https://mysupport.netapp.com/