



Technical Report

FlexPod SF Technical Specifications

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1 FlexPod SF Architecture

The FlexPod® with SolidFire® (FlexPod SF) infrastructure solution provides the same reliable converged infrastructure solution that Cisco and NetApp have been developing for years, with the additional benefit of the NetApp® SolidFire all-flash storage platform. The SolidFire storage platform allows environments to build faster, develop sooner, and run multiple projects on one shared infrastructure platform.

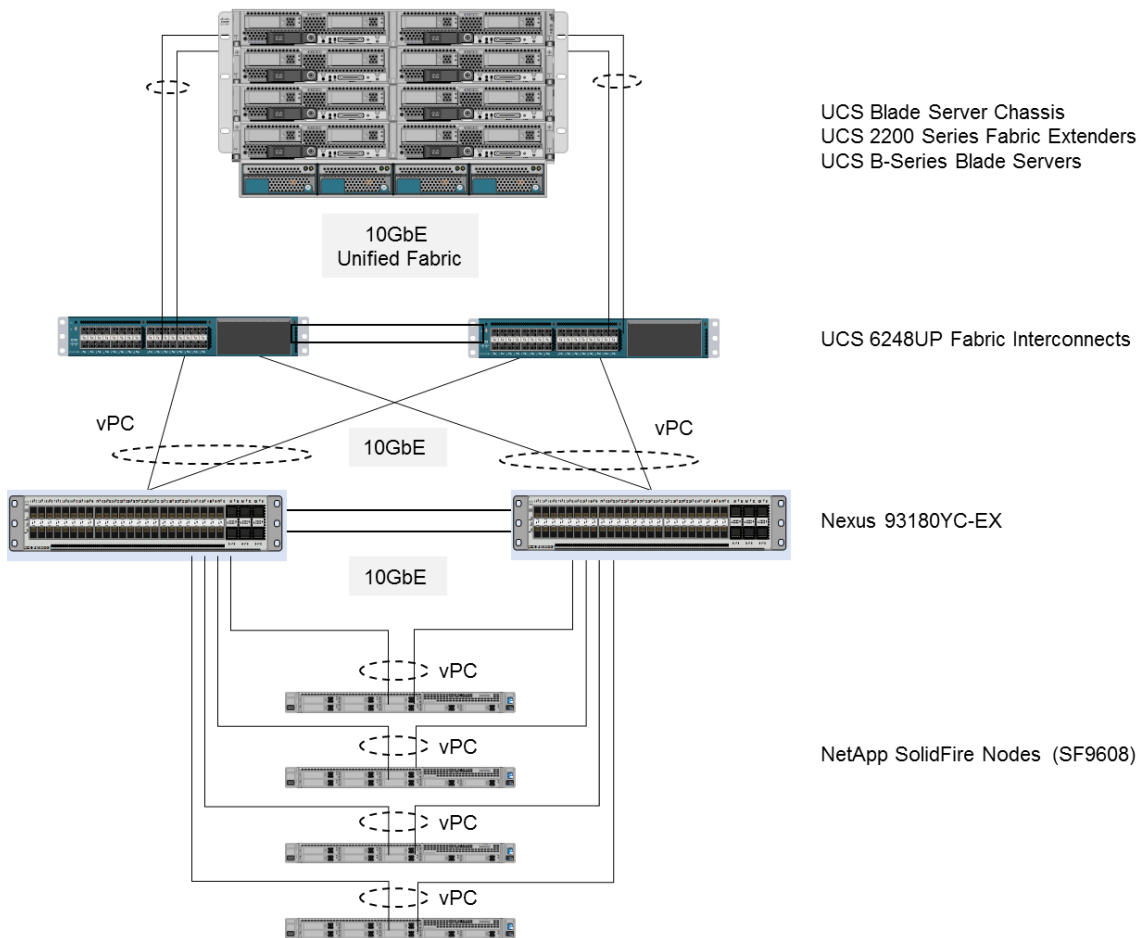
The FlexPod SF architecture is a proven foundation for an innovative infrastructure, focusing on providing a uniquely flexible infrastructure to support your dynamic business environment.

Similar to the FlexPod architecture, the FlexPod SF solution consists of the following components:

- Cisco Unified Computing System (Cisco UCS) Fabric Interconnects
- Cisco UCS servers
- Cisco Nexus 5000 or 9000 Switches
- SolidFire storage nodes

The main difference between the FlexPod and FlexPod SF architectures is the use of SolidFire storage nodes. Figure 1 depicts the FlexPod SF components and how they are connected.

Figure 1) FlexPod SF topology.



FlexPod SF is designed with the following key tenets in mind:

- **Proven performance.** Reliably run hundreds of applications on a single platform.
- **Proven agility.** Seamlessly meet business demands with simplified management and scale.
- **Proven value.** Optimize your IT with a trusted best-in-class solution.

2 Supported Versus Validated FlexPod SF Configurations

The FlexPod SF architecture is defined by the set of rules described in this document. The hardware components and software configurations must be supported by the [Cisco UCS Hardware and Software Compatibility List](#) 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 of the components are listed as compatible in the [Cisco UCS Hardware and Software Compatibility List](#) and NetApp [IMT](#).

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

3 NetApp SolidFire Element OS Versions

The FlexPod SF solution supports the NetApp SolidFire Element® OS version 9.2.1.1 or later. Previous versions of the NetApp SolidFire Element OS are not supported in the FlexPod SF architecture.

4 Minimum Hardware Requirements

The FlexPod SF configuration has minimum hardware requirements, including, but not limited to, switches, fabric interconnects, servers, and NetApp SolidFire storage nodes.

Cisco UCS B-Series servers have been validated in this solution design. You must use Cisco UCS servers in your FlexPod SF configuration. The FlexPod SF solution supports Cisco UCS B-Series servers, which are blades and require a chassis.

The FlexPod SF architecture has the following minimum hardware requirements:

- Two Cisco Nexus switches in a redundant configuration
 - Note:** This configuration can consist of two redundant switches from the Cisco Nexus 5000 or 9000 series.
- Two Cisco UCS 6200 or 6300 Series Fabric Interconnects in a redundant configuration
- Cisco UCS B-Series blade servers:
 - One Cisco UCS 5000 B-Series blade chassis with two FEX installed modules inside, plus a minimum of two Cisco UCS B-Series blade servers
- Four NetApp SolidFire SF9608 storage nodes:
 - The NetApp SolidFire SF9608 storage nodes must be connected to the redundant Cisco Nexus switches using virtual PortChannels.

5 Minimum Software Requirements

The FlexPod SF architecture has the following minimum software requirements:

- SolidFire Element OS 9.2.1.1 or later
- Cisco UCS Manager 3.1(3) or later
- For Cisco Nexus 9000 Series Switches, Cisco NX-OS software release 7.0(3)I4(6) or later
- For Cisco Nexus 5000 Series Switches, Cisco NX-OS software release 7.0(8)N1(1) or later

Note: In the FlexPod SF architecture, the Cisco Nexus Switches must operate in NX-OS or standalone mode.

Note: The software used in the FlexPod SF configuration must be listed and supported in the [Cisco UCS Hardware and Software Compatibility List](#) and the NetApp [IMT](#). Some features might require more recent releases of the software than the ones listed.

6 Connectivity Requirements

The FlexPod SF architecture has the following connectivity requirements:

- The 10G data ports on the NetApp SolidFire storage controllers must be directly connected to Cisco Nexus 5000 or 9000 Series Switches.
- vPCs are required from the Cisco Nexus 5000 or 9000 Series Switches to the NetApp SolidFire storage nodes.
- No additional equipment can be placed inline between the core FlexPod components.
- vPCs are required from the Cisco Nexus 5000 or 9000 Series Switches to the fabric interconnects.
- Jumbo frame support must be enabled throughout the environment.
- A 1G in-band management network is required for management of the cluster through the NetApp SolidFire API and management tools.

Note: In-band management can be moved to the bond 10G interface if desired; however, the 1G ports are used by default.

- A separate 1G out-of-band network is required to administer and monitor the NetApp SolidFire hardware nodes.

Note: iSCSI is the supported storage protocol for the FlexPod SF solution.

7 Other Requirements

The 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](#) and the [Cisco UCS Hardware and Software Compatibility List](#).
- Valid support contracts are required for all equipment, including:
 - Smart Net Total Care support for Cisco equipment
 - SupportEdge Premium support for NetApp equipment

8 Cisco Components

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

8.1 Cisco UCS Fabric Interconnect Options

Redundant fabric interconnects are required in the FlexPod architecture. When adding 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 shown in Table 1 are for the base fabric interconnects. They do not include the power supply unit (PSU), small form factor pluggable plus (SFP+) modules, quad small form factor pluggable (QSFP+) modules, or expansion modules.

Table 1) Cisco UCS fabric interconnect options.

Cisco UCS Fabric Interconnect	Part Number	Technical Specifications
Cisco UCS 6248UP	UCS-FI-6248UP	Cisco UCS 6200 Series Fabric Interconnect
Cisco UCS 6296UP	UCS-PSU-6296UP-AC	
Cisco UCS 6332UP	UCS-FI-6332-UP	Cisco UCS 6332 Fabric Interconnect
Cisco UCS 6324	UCS-FI-6324	Cisco UCS 6324 Fabric Interconnect

8.2 Cisco UCS B-Series Chassis Option

To use Cisco UCS B-Series blades, you must have a Cisco UCS B-Series chassis. If you intend to use Cisco UCS C-Series rack-mount servers, a chassis is not required. Table 2 describes the Cisco UCS B-Series chassis option.

Table 2) Cisco UCS B-Series chassis option.

Cisco UCS 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 Series FEX adapters installed within it to provide redundant connectivity to the fabric interconnects. For more information about which combinations of fabric interconnect and Cisco UCS 5108 FEXs can be accommodated, see the fabric interconnect technical specifications link in Table 2.

8.3 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 listed in Table 3 are for the base server; they do not include the CPU, memory, disk drives, or mezzanine adapter cards. Multiple configuration options are available and supported in FlexPod.

Table 3) Cisco UCS B-Series blade server options.

Cisco UCS Blade	Part Number	Technical Specifications
Cisco UCS B200 M4	UCSB-B200-M4	Cisco UCS B200 M4 Blade Server
Cisco UCS B420 M4	UCSB-B420-M4	Cisco UCS B420 M4 Blade Server

Previous generations of Cisco UCS B-Series blades can be used in the FlexPod architecture, as long as they are supported on the [Cisco UCS Hardware and Software Compatibility List](#). The Cisco UCS B-Series blade servers must also have a valid Smart Net Total Care support contract.

8.4 Cisco Nexus 9000 Series Switch Options

Redundant Cisco Nexus 9000 Series Switches are required in the FlexPod architecture. The part numbers listed in Table 4 are for the Cisco Nexus 9000 Series chassis; they do not include SFP modules or Ethernet modules.

Table 4) Cisco Nexus 9000 Series Switch options.

Cisco Nexus 9000 Series Switch	Part Number	Technical Specifications
Cisco Nexus 93180YC-EX	N9K-93180YC-EX	Cisco Nexus 9000 Series Switches Cisco Nexus 9300 Series Switches
Cisco Nexus 9336PQ	N9K-C9336PQ	
Cisco Nexus 9372PX	N9K-M4PC-CFP2	
Cisco Nexus 9396PX	N9K-C9396PX	
Cisco Nexus 9504	N9K-C9504-B2	Cisco Nexus 9500 Series Switches
Cisco Nexus 9508	N9K-C9508-B2	
Cisco Nexus 9516	N9K-C9516-B2	

8.5 Cisco Nexus 5000 Series Switch Options

Redundant Cisco Nexus 5000 or 9000 Series Switches are required in the FlexPod architecture. The part numbers listed in Table 5 are for the Cisco Nexus 5000 series chassis; they do not include SFP modules or Ethernet modules.

Table 5) Cisco Nexus 5000 Series Switch options.

Cisco Nexus 5000 Series Switch	Part Number	Technical Specifications
Cisco Nexus 56128P Switch	N5K-C56128P	Cisco Nexus 5600 Platform Switches
Cisco Nexus 5696Q Switch	N5K-C5696Q	
Cisco Nexus 5672UP Switch	N5K-C5672UP	
Cisco Nexus 5672-UP-16G Switch	N5K-C5672UP-16G	
Cisco Nexus 5648Q Switch	N5K-C5648Q	
Cisco Nexus 5624Q Switch	N5K-C5624Q	
Cisco Nexus 5596T Switch	N5K-C5596UP-FA	Cisco Nexus 5548 and 5596 Switches
Cisco Nexus 5596UP Switch	N5K-C5596UP-FA	
Cisco Nexus 5548UP Switch	N5K-C5548UP-FA	

8.6 Cisco Software Licensing Options

All the Cisco Nexus switch ports used in the NetApp SF architecture must be licensed. Consult your sales representative for additional information.

8.7 Cisco Support Licensing Options

All Cisco components must have a valid Smart Net Total Care support contract.

9 NetApp Components

NetApp SolidFire storage nodes are at the core of the FlexPod SF solution. NetApp has contributed substantially to the FlexPod SF design and architecture. FlexPod SF supports NetApp SolidFire nodes running Element OS 9.2.1.1 and later.

9.1 NetApp SolidFire Storage Node Options

The NetApp SolidFire SF9608 storage nodes are used in the FlexPod SF architecture. The FlexPod SF base solution uses four SF9608 nodes. Additional SolidFire storage nodes can be added to the cluster in increments of one.

Note: Nodes must be running a minimum of Element OS 9.2.1.1 to be supported as part of a FlexPod SF solution. All nodes in the cluster must be running the same Element OS version.

9.2 NetApp SolidFire Software Licensing Options

The required SolidFire software licensing is included with the purchase of the NetApp SolidFire storage node.

9.3 NetApp Support Licensing Options

NetApp SolidFire storage nodes must be part of a valid SupportEdge Premium contract.

10 FlexPod SF Power and Cabling Requirements

The FlexPod SF design has specific power and cabling requirements. The power requirements vary based on the equipment load. The cable requirements vary based on the equipment being installed. The following sections describe these power and cabling requirements.

10.1 Power Requirements

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

For additional data about the maximum power required and other detailed power information, consult the technical specifications for each hardware component linked earlier.

For detailed Cisco UCS power data, see the [Cisco UCS power calculator](#).

For NetApp SolidFire storage node power data, see the [NetApp Hardware Universe](#). Select your Element OS version (9.2 or later), the SF9608 node, and then Show Results.

10.2 Minimum Cable Requirements

The number and type of cables and adapters vary per FlexPod SF deployment. Cable type, transceiver type, and number are determined during the design process based on customer requirements. Table 6 lists the minimum number of cables required.

Table 6) Minimum cable requirements.

Hardware	Model Number	Cables Required
Cisco UCS chassis	Cisco UCS 5108	At least two cables per Cisco UCS FEX: <ul style="list-style-type: none">• SFP+ compatible for 2204 and 2208 models• QSFP+ compatible for 2304 model

Hardware	Model Number	Cables Required
Cisco UCS fabric interconnects	Cisco UCS 6248UP	<ul style="list-style-type: none"> • Two Cat5e cables for management ports • Two Cat5e cables for the L1, L2 interconnects, per pair of fabric interconnects • At least four twinax or fiber cables per fabric interconnect
	Cisco UCS 6296UP	
	Cisco UCS 6632UP	
Cisco Nexus Switches	Cisco Nexus 5000 Series	<ul style="list-style-type: none"> • At least two 10GbE fiber or twinax cables per switch
	Cisco Nexus 9000 Series	
NetApp SolidFire	SF9608	<ul style="list-style-type: none"> • Two 10GbE fiber or twinax cables per node • Two to four Cat5e cables per node

Where to Find Additional Information

To learn more about the information described in this document, refer to the following documents and/or websites:

- NetApp FlexPod SF Next-Generation Converged Infrastructure product page
<http://www.netapp.com/us/products/converged-systems/flexpod-sf-converged-infrastructure.aspx>
- NVA-0027-DEPLOY: NetApp FlexPod Datacenter with SolidFire All-Flash Array Add-on
<http://www.netapp.com/us/media/nva-0027-deploy.pdf>

Note: This NVA describes the process for adding NetApp SolidFire nodes to an existing FlexPod Datacenter configuration based on FAS or All Flash FAS.

Version History

Version	Date	Document Version History
Version 1.0	June 2017	Initial release
Version 1.1	September 2017	Minor update from Cisco: removed UCS C-Series server in two locations.

Refer to the [Interoperability Matrix Tool \(IMT\)](#) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

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