# FlexPod Data Center with VMware vSphere 5.1 Update 1

The IT industry today faces the challenge of transitioning to virtualized and cloud-based data center infrastructure for improved efficiency, agility, and cost effectiveness. To enable this migration with reduced risk and cost, Cisco, in partnership with NetApp, has developed the FlexPod data center solution. FlexPod is a predesigned, unified computing, storage, and network infrastructure composed of Cisco Unified Computing System™ (Cisco UCS®) servers, Cisco UCS Manager, the Cisco Nexus® family of switches, and NetApp Fabric-Attached Storage (FAS) arrays. FlexPod provides a standard, flexible data center building block that can be used to build an optimized data center to support a variety of workloads and applications.

Cisco, through its Cisco® Validated Designs, offers a comprehensive suite of pretested FlexPod solutions, developed using various system components, configurations, and hypervisor and application software. Using a solution based on the Cisco Validated Design for FlexPod as the baseline platform, IT customers can deploy a virtualized and cloud-enabled data center quickly, with low risk and cost.

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**Benefits of Cisco Validated Design for FlexPod**

- **Reduced risk:** Prevalidated configurations help ensure proper deployment of the current applications on the new infrastructure.
- **Accelerated deployment:** Unified and standard architecture reduces transition downtime and management overhead.
- **Flexibility:** A wide variety of applications and workloads is supported through proven hardware and software combinations.
- **Scalability and flexibility:** Modular architecture supports future expansion through scale-up and scale-out strategies.
- **Lower total cost of ownership (TCO):**
  - Standardized architecture reduces management and training overhead.
  - Modular infrastructure enables IT to build a right-sized data center and avoid underutilization of resources.
  - Pretested solutions reduce deployment, procurement, and setup times.

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## Cisco FlexPod Design Elements

FlexPod is a unified data center platform composed of Cisco UCS servers, Cisco Nexus network switches, and NetApp FAS or V-Series systems. Figure 1 shows the FlexPod base configuration and design elements. The FlexPod modules can be configured to match the application requirements by mixing and matching the component versions to achieve the optimum capacity, price, and performance targets. The solution can be scaled by augmenting the elements of a single FlexPod instance and by adding multiple FlexPod instances to build numerous solutions for a virtualized and nonvirtualized data center.

**Figure 1.**   FlexPod Design Elements
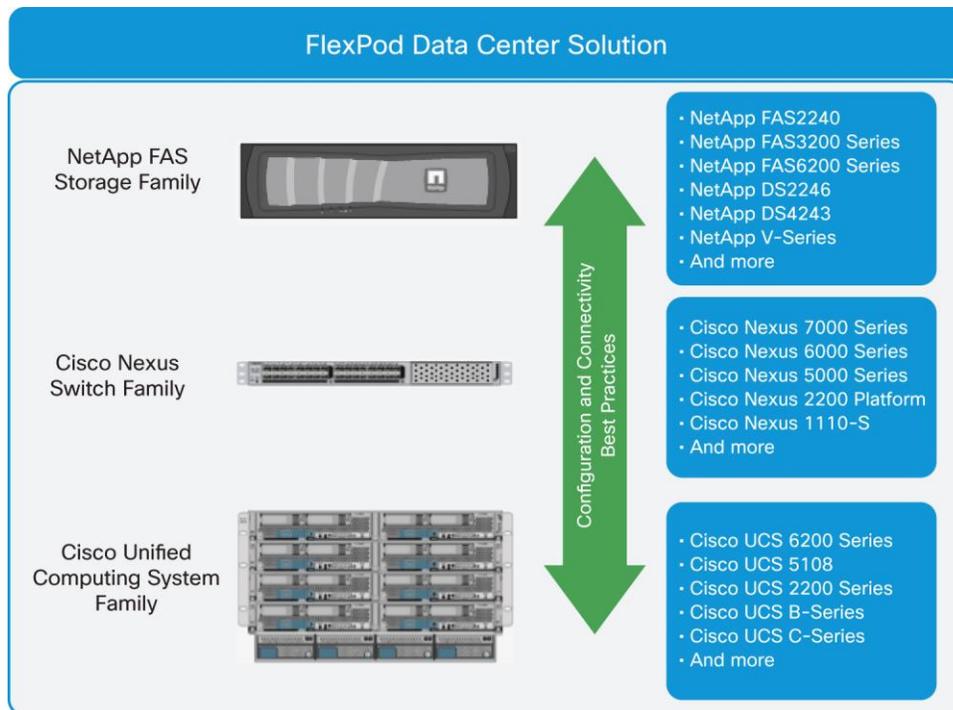


## Cisco UCS Family

Cisco UCS is a next-generation data center platform that unites computing, networking, and storage access and virtualization into a cohesive server system for superior performance and cost effectiveness. All resources participate in a unified management domain in an integrated multi-chassis platform. This platform is composed of Cisco UCS B-Series Blade Servers and C-Series Rack Servers, fabric interconnects, blade server chassis, and adapter connectivity.

Cisco UCS Manager device management software enables unified management of the entire computing environment. It provides role-based and policy-based management by using the service profiles of the resources and reduces maintenance overhead.

Cisco UCS fabric interconnects are the communication and management backbone for the Cisco UCS solution, providing LAN and SAN connectivity to the server blades. They connect the Cisco UCS B-Series and C-Series servers (connected through Cisco Nexus 2220 platform fabric extenders) and the blade server chassis to form a unified fabric. This fabric becomes a single management domain, providing high availability and simplicity of management.

The Cisco UCS B-Series Blade Servers comprise an enterprise-class computing platform designed to efficiently deliver a broad range of IT workloads, ranging from web infrastructure to distributed database.

Cisco UCS C-Series Rack Servers extend the unified computing model to further increase scalability and business agility. The Cisco UCS C-Series implements innovative technologies, including a standards-based unified network fabric, support for Cisco Data Center Machine Fabric Extender (VM-FEX) virtualization, and Cisco Extended Memory Technology.

For more information, see www.cisco.com/en/US/products/ps10265/index.html.

## Cisco Nexus Family

The Cisco Nexus Family of switches forms the networking foundation for a FlexPod deployment. These switches support any transport over Ethernet, including Layer 2 and Layer 3 traffic and storage traffic, on one common data center–class platform to transform the data center network into a standards-based, multipurpose, multiprotocol, Ethernet-based fabric. All switches in the Cisco Nexus Family use the Cisco NX-OS Software operating system for high reliability and ease of management.

The Cisco Nexus 5500 platform used in this Cisco Validation Design is well-suited for enterprise-class server access-layer applications and supports small-scale, midmarket data center deployments. It extends the capabilities of the industry-standard Cisco Nexus 5000 Series Switches to provide a high-density, low-latency data center switch platform that can support multilayer services. The Cisco Nexus 5500 platform implements cut-through switching technology and provides a low-latency Ethernet solution for a diverse set of physical, virtual, storage-access, and high-performance computing (HPC) data center environments. The Cisco Nexus 5500 platform extends the Cisco fabric extension technology to the servers and virtual machine with Cisco Adapter FEX and Cisco Data Center VM-FEX.

## NetApp FAS Family

NetApp FAS provides the scalable storage element in a FlexPod platform. It uses the NetApp Data ONTAP operating system, and NetApp Data ONTAP 7-Mode and Clustered Data ONTAP Mode both are supported in this FlexPod design. Both operating systems provide SAN (Fibre Channel over Ethernet [FCoE], Fibre Channel, and Small Computer System Interface over IP [iSCSI]), network-attached storage (NAS), Common Internet File System [CIFS] and Network File System [NFS]), and primary and secondary storage in a single unified platform so that all virtual desktop data components can be hosted on the same storage array.

The NetApp FAS3200 Series supports midsize storage enterprises and offers an exceptional level of support for flash memory and enterprise clustering by integrating the NetApp Flash Accel software and Fusion-io technologies with the NetApp ONTAP operating system. NetApp FAS provides hot-swappable redundant components with fault tolerance through clustered storage controllers that offer scalability of up to several terabytes (TB).

## Cisco Validated Design for FlexPod

The Cisco Validated Design validates the cohesive operation of industry-standard hypervisors and applications running on various FlexPod configurations. Figure 2 provides a comprehensive list of supported hypervisors, management, and FlexPod design elements. The highlighted components compose the Cisco Validated Design for FlexPod described in this document. The objective of this verification is to functionally validate VMware vSphere 5.1 Update 1 on the latest FlexPod architecture for various hardware and software combinations and provide extendable infrastructure based on VMware for mixed workloads and applications.

**Figure 2.**    Components of the Cisco Validated Design for FlexPod



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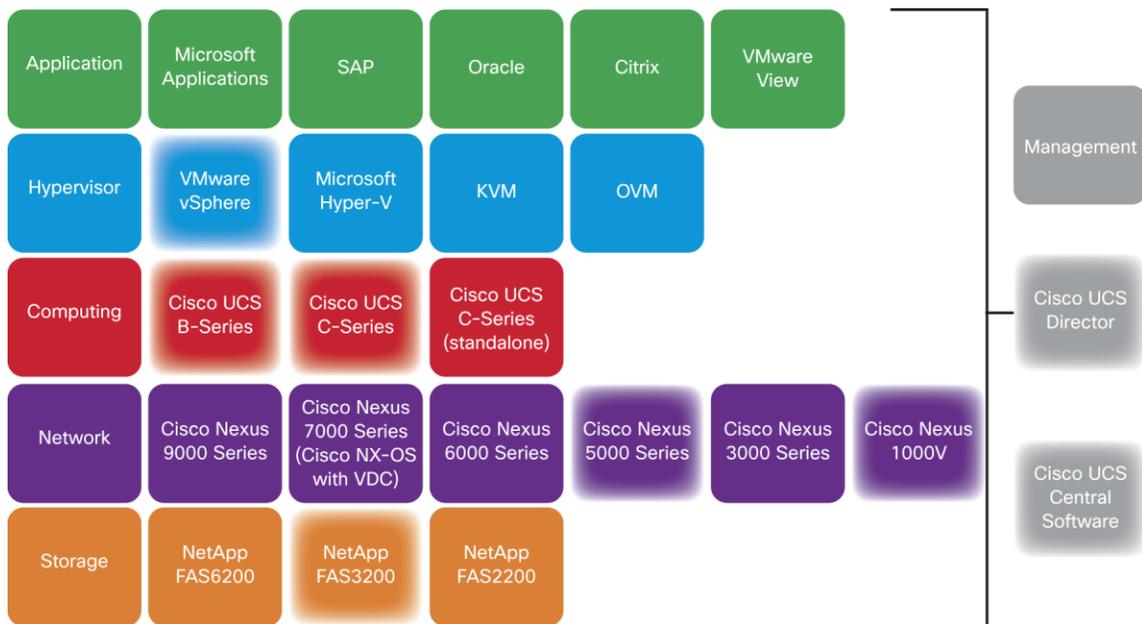
**Cisco Validated Design for FlexPod with VMware vSphere 5.1 Update 1: New Features**

- Cisco UCS Central Software 1.1 provides centralized management of policies and service profiles for multiple Cisco UCS domains.
- The new Intel® Xeon® processor E5 v2 family is supported for higher performance.
- The NetApp Clustered Data ONTAP 8.2 operating system can scale to tens of petabytes (PB) of storage.
- NetApp Flash Accel software helps achieve higher throughput and lower latency through server-side flash-memory storage
- Support for server-side flash-memory storage—in particular, Fusion-io flash memory—increases application performance through local caching.
- Support for VMware vSphere 5.1 Update 1 provides a single-sign-on (SSO) server manager.
- The VMware vSphere 5.1 Update 1 AutoDeploy feature enables stateless computing by allowing servers to boot from the network.

The Cisco Validated Design described in this document uses the FlexPod Distinct Uplink Design architecture for validation. This is an end-to-end Ethernet transport system supporting multiple LAN and SAN protocols, including Fibre Channel and FCoE (which is used by the Cisco Nexus switches and NetApp FAS controllers). It provides a unified 10 Gigabit Ethernet fabric with dedicated FCoE uplinks and dedicated Ethernet uplinks between the Cisco UCS fabric interconnects and the Cisco Nexus switches, and converged connectivity between the NetApp storage devices and multipurpose Cisco Nexus switch platforms. The features of the Cisco Nexus 5500 platform used in this Cisco Validated Design include N-Port ID Virtualization (NPIV) and virtual PortChannel (vPC) technology. The NetApp ONTAP 8.2 operating system used in this validation integrates the NetApp Flash Accel and Fusion-io flash memory to achieve higher performance and lower latency. The NetApp Flash Accel feature provides intelligent end-to-end data coherency, cache persistence, and support for VMware VSphere services.

The VMware vSphere 5.1 Update 1 features used in this validation effort include VMware ESXi, vCenter Server, vSphere software deployment kits (SDKs), Virtual Machine File System (VMFS), High Availability (HA), and Distributed Resource Scheduler (DRS). In addition, this validation effort uses the VMware vSphere AutoDeploy feature, which allows servers to boot from the network through the preboot execution environment (PXE) instead of from local or SAN storage.

**Note:**   Cisco has integration points with VMware vSphere AutoDeploy that allow users to connect the VMware ESXi server instance to the service profile so that states can travel with policies.

The FlexPod storage configurations used in this validation effort are:

- FlexPod with NetApp Clustered Data ONTAP Mode
- FlexPod with NetApp Data ONTAP 7-Mode

Figures 3 and 4 illustrate the FlexPod Distinct Uplink topologies for these configurations and highlight the design elements used in each mode. Note that the configurations of the Cisco UCS and Cisco Nexus elements are identical in both topologies. The NetApp FAS controller topology is different—in Clustered Data ONTAP mode, Cisco Nexus 5596UP Switch cluster interconnects are used to network the NetApp FAS controllers with the disk storage to create a storage pool. In Data ONTAP 7-Mode, the disk storage connects with the NetApp FAS controllers using dedicated links, as shown in Figure 4. The FlexPod design can support Cisco UCS C-Series Rack Servers using single-wire management, providing further consolidation of the infrastructure and improved rack-mount server density. The FlexPod design also supports dual-wire management.

**Figure 3.**     FlexPod Distinct Uplink Design: Clustered Data ONTAP Mode
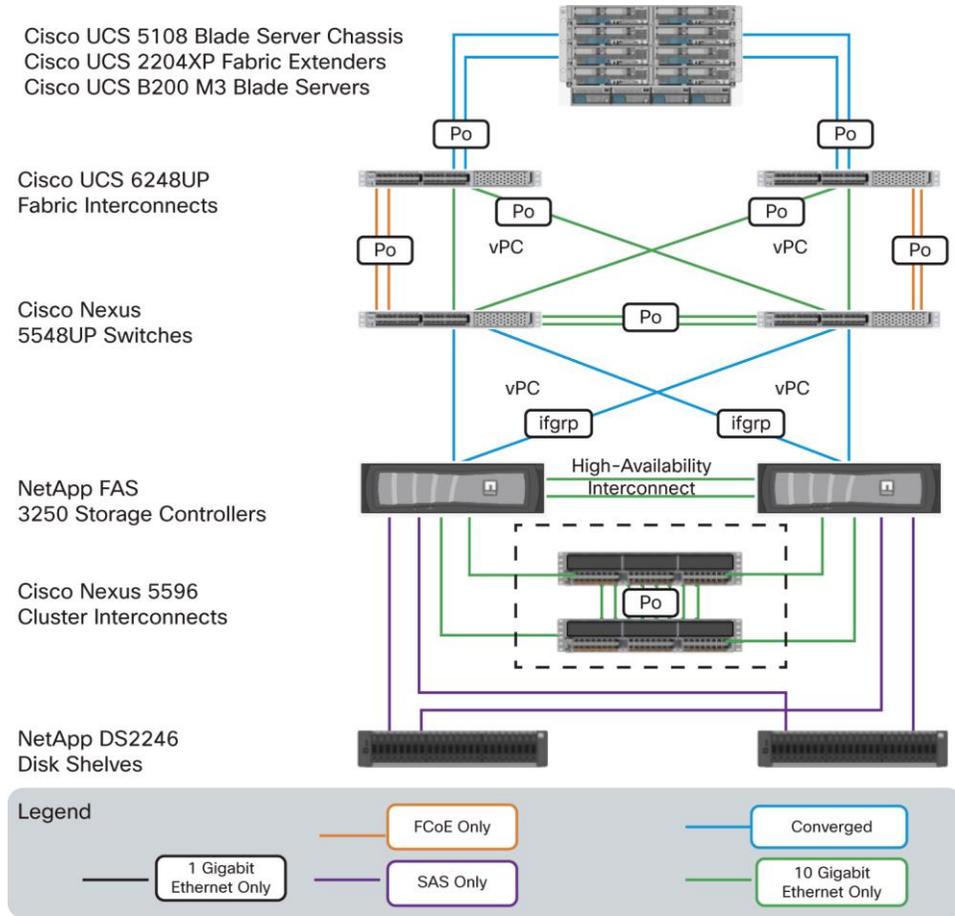
**Figure 4.**    FlexPod Distinct Uplink Design: Data ONTAP 7-Mode
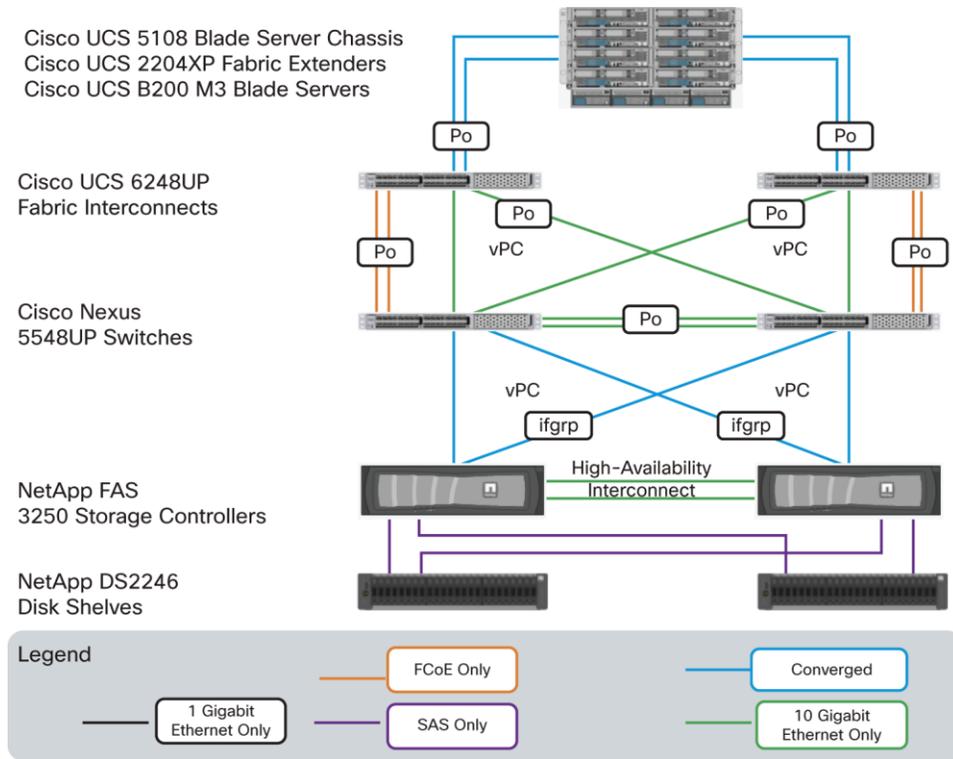


## Hardware and Software Versions Used in the Cisco Validated Design for FlexPod

**Table 1.**    FlexPod Hardware and Software Design Elements Tested

| Layer | Device | Image |
|---|---|---|
| Compute | Cisco UCS 6200 Fabric Interconnects 6200 Series | 2.1(3a) |
| | Cisco UCS B-200 M3 | 2.1(3a) |
| | Cisco eNIC | 2.1.2.38 |
| | Cisco fNIC | 1.5.0.45 |
| | Cisco UCS C-220 M3 | 2.1(3a) |
| Network | Cisco Nexus 5548YO NX-OS | 6.0(2)N1(2a) |
| Storage | NetApp FAS 3250-AE | Data ONTAP 8.2 P4 |
| Software | VMware vShere ESXi | 5.1 U1, 1065491 |
| | VMware vCenter | 5.1 U1c, 1364042 |
| | Cisco Nexus 1000V | 4.2(1)SV2(2.1a) |
| | OnCommand Unified Manager for Clustered Data ONTAP | 6 |
| | OnCommand Unified Manager Core Package for Data ONTAP 7-Mode | 5.2 |
| | NetApp Virtual Storage Console (VSC) | 4.2.1 |
| | Cisco Nexus 1110-X | 4.2(1)SP1(6.2) |

In addition to the configurations discussed so far, data center architects can design FlexPod using a wide range of hardware and software versions. To verify support for a specific implementation of FlexPod and to identify compatible hardware and software configurations, refer to the following compatibility guides:

- NetApp Interoperability Matrix Tool
- Cisco UCS Hardware and Software Interoperability Tool
- VMware Compatibility Guide

**Note:** The FlexPod Cooperative Support model applies to both FlexPod architecture component versions validated in this Cisco Validated Design and the individual component versions listed as supported in the interoperability matrix. Cooperative support is available for all FlexPod components and versions as long as customers have purchased the appropriate levels of support contracts. This approach allows customization of the FlexPod solution according to the organizations' specific requirements.

## Conclusion

FlexPod is an integrated, standardized, and prevalidated data center module that can be used to build a right-sized data center for a variety of IT applications. Its flexible architecture is composed of Cisco UCS servers, Cisco Nexus switches, and NetApp FAS storage arrays. With the appropriate versions of these design elements, the customer can deploy a flexible and scalable data center optimized for workload requirements. The Cisco Validated Design referenced in this document uses VMware vSphere 5.1 Update 1 running on FlexPod using NetApp FAS3200 storage controllers and the NetApp ONTAP 8.2 operating system with integrated NetApp Flash Accel and Fusion-io flash memory. With this Cisco Validated Design for FlexPod as the foundation, customer IT departments can transition to a scalable, virtualized IT infrastructure with less cost and time.

## For More Information

- FlexPod Datacenter with VMware vSphere 5.1 Update 1 Design Guide
- VMware vSphere 5.1 on FlexPod Clustered Data ONTAP Deployment Guide
- VMware vSphere 5.1 on FlexPod Data ONTAP Operating in 7-Mode Deployment Guide