



CHAPTER 1

Technology Overview

In this chapter the following UCS technology areas are detailed.

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Cisco Unified Computing System

The Cisco Unified Computing System is a next-generation data center platform that unites compute, network, and storage access. The platform, optimized for virtual environments, is designed using open industry-standard technologies and aims to reduce total cost of ownership (TCO) and increase business agility. The system integrates a low-latency, lossless 10 Gigabit Ethernet unified network fabric with enterprise-class, x86-architecture servers. It is an integrated, scalable, multi chassis platform in which all resources participate in a unified management domain.

The main components of the Cisco Unified Computing System are:

- **Computing**—The system is based on an entirely new class of computing system that incorporates blade servers based on Intel Xeon E5-2650 V2 Series Processors. The Cisco UCS servers offer the patented Cisco Extended Memory Technology to support applications with large datasets and allow more virtual machines per server.
- **Network**—The system is integrated onto a low-latency, lossless, 10-Gbps unified network fabric. This network foundation consolidates LANs, SANs, and high-performance computing networks which are separate networks today. The unified fabric lowers costs by reducing the number of network adapters, switches, and cables, and by decreasing the power and cooling requirements.

- **Virtualization**—The system unleashes the full potential of virtualization by enhancing the scalability, performance, and operational control of virtual environments. Cisco security, policy enforcement, and diagnostic features are now extended into virtualized environments to better support changing business and IT requirements.
- **Storage Access**—Cisco C-Series servers can host large number of local SATA hard disks. The system provides consolidated access to both SAN storage and Network Attached Storage (NAS) over the unified fabric. By unifying the storage access the Cisco Unified Computing System can access storage over Ethernet, Fibre Channel, Fibre Channel over Ethernet (FCoE), and iSCSI. This provides customers with choice for storage access and investment protection. In addition, the server administrators can preassign storage access policies for system connectivity to storage resources, simplifying storage connectivity, and management for increased productivity.

The Cisco Unified Computing System is designed to deliver:

- A reduced Total Cost of Ownership (TCO) and increased business agility.
- Increased IT staff productivity through just-in-time provisioning and mobility support.
- A cohesive, integrated system, which unifies the technology in the data center.
- Industry standards supported by a partner ecosystem of industry leaders.

Cisco UCS Manager

Cisco UCS Manager provides unified, embedded management of all software and hardware components of the Cisco Unified Computing System through an intuitive GUI, a command line interface (CLI), or an XML API. The Cisco UCS Manager provides unified management domain with centralized management capabilities and controls multiple chassis and thousands of virtual machines.

Cisco UCS Fabric Interconnect

The Cisco® UCS 6200 Series Fabric Interconnect is a core part of the Cisco Unified Computing System, providing both network connectivity and management capabilities for the system. The Cisco UCS 6200 Series offers line-rate, low-latency, lossless 10 Gigabit Ethernet, Fiber Channel over Ethernet (FCoE) and Fiber Channel functions.

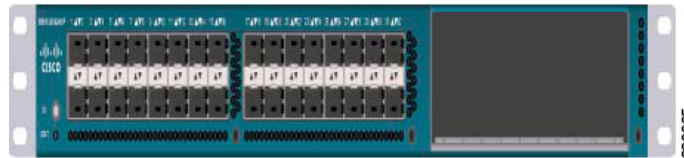
The Cisco UCS 6200 Series provides the management and communication backbone for the Cisco UCS C-Series Servers. All servers are attached to the Cisco UCS 6200 Series Fabric Interconnects become part of a single, highly available management domain. In addition, by supporting unified fabric, the Cisco UCS 6200 Series provides both the LAN and SAN connectivity for all blades within its domain.

From a networking perspective, the Cisco UCS 6200 Series uses a cut-through architecture, supporting deterministic, low-latency, line-rate 10 Gigabit Ethernet on all ports, 1 Tb switching capacity, 160 Gbps bandwidth per chassis, independent of packet size and enabled services. The product family supports Cisco low-latency, lossless 10 Gigabit Ethernet unified network fabric capabilities, which increase the reliability, efficiency, and scalability of Ethernet networks. The Fabric Interconnect supports multiple traffic classes over a lossless Ethernet fabric from a blade server through an interconnect. Significant TCO savings come from an FCoE-optimized server design in which network interface cards (NICs), host bus adapters (HBAs), cables, and switches can be consolidated.

Cisco UCS 6248UP Fabric Interconnect

The Cisco UCS 6248UP 48-Port Fabric Interconnect (Figure 1-1) is a one-rack-unit (1RU) 10 Gigabit Ethernet, FCoE and Fiber Channel switch offering up to 960-Gbps throughputs and up to 48 ports. The switch has 32 1/10-Gbps fixed Ethernet, FCoE and FC ports and one expansion slot.

Figure 1-1 Cisco UCS 6248UP Fabric Interconnect



Cisco UCS Fabric Extenders

Fabric Extenders are zero-management, low-cost, low-power consuming devices that distribute the system's connectivity and management planes into rack and blade chassis to scale the system without complexity. Designed never to lose a packet, Cisco fabric extenders eliminate the need for top-of-rack Ethernet and Fiber Channel switches and management modules, dramatically reducing infrastructure cost per server.

Cisco UCS 2232PP Fabric Extender

The Cisco Nexus® 2000 Series Fabric Extenders comprise a category of data center products designed to simplify data center access architecture and operations. The Cisco Nexus 2000 Series uses the Cisco® Fabric Extender architecture to provide a highly scalable unified server-access platform across a range of 100 Megabit Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, unified fabric, copper and fiber connectivity, rack, and blade server environments. The platform is ideal to support today's traditional Gigabit Ethernet while allowing transparent migration to 10 Gigabit Ethernet, virtual machine-aware unified fabric technologies.

The Cisco Nexus 2000 Series Fabric Extenders (Figure 1-2) behave as remote line cards for a parent Cisco Nexus switch or Fabric Interconnect. The fabric extenders are essentially extensions of the parent Cisco UCS Fabric Interconnect switch fabric, with the fabric extenders and the parent Cisco Nexus switch together forming a distributed modular system. This architecture enables physical topologies with the flexibility and benefits of both top-of-rack (ToR) and end-of-row (EoR) deployments.

Today's data centers must have massive scalability to manage the combination of an increasing number of servers and a higher demand for bandwidth from each server. The Cisco Nexus 2000 Series increases the scalability of the access layer to accommodate both sets of demands without increasing management points within the network.

Figure 1-2 Cisco UCS 2232PP Fabric Extender



Cisco C220 M3 Rack Mount Servers

Building on the success of the Cisco UCS C220 M3 Rack Servers, the enterprise-class Cisco UCS C220 M3 server (Figure 1-3) further extends the capabilities of the Cisco Unified Computing System portfolio in a 1-rack-unit (1RU) form factor. And with the addition of the Intel® Xeon® processor E5-2650 product family, it delivers significant performance and efficiency gains.

Figure 1-3 Cisco UCS C220 M3 Rack Mount Server



The Cisco UCS C220 M3 also offers up to 256 GB of RAM, eight drives or SSDs, and two 1GE LAN interfaces built into the motherboard, delivering outstanding levels of density and performance in a compact package.

Cisco C240 M3 Rack Mount Servers

The UCS C240 M3 High Density Small Form Factory Disk Drive Model rack server is designed for both performance and expandability over a wide range of storage-intensive infrastructure workloads from big data to collaboration. The enterprise-class UCS C240 M3 server (Figure 1-4) extends the capabilities of Cisco's Unified Computing System portfolio in a 2U form factor with the addition of the Intel® Xeon E5-2650 v2 and E5-2650 series processor family CPUs that deliver the best combination of performance, flexibility and efficiency gains. In addition, the UCS C240 M3 server provides 24 DIMM slots, up to 24 drives and 4 x 1 GbE LOM ports to provide outstanding levels of internal memory and storage expandability along with exceptional performance.

Figure 1-4 Cisco UCS C240 M3 Rack Mount Server



Cisco I/O Adapters

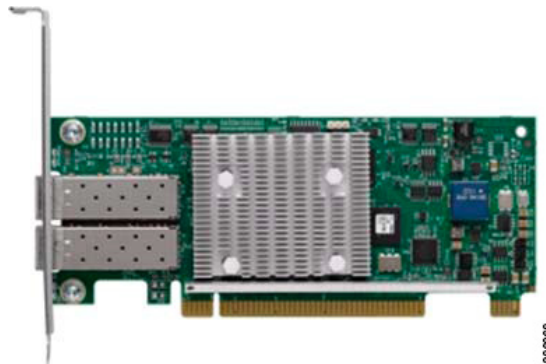
The Cisco UCS rack mount server has various Converged Network Adapters (CNA) options. The UCS 1225 Virtual Interface Card (VIC) option is used in this implementation (Figure 1-5).

A Cisco® innovation, the Cisco UCS Virtual Interface Card (VIC) 1225 is a dual-port Enhanced Small Form-Factor Pluggable (SFP+) 10 Gigabit Ethernet and Fiber Channel over Ethernet (FCoE)-capable PCI Express (PCIe) card designed exclusively for Cisco UCS C-Series Rack Servers.

UCS 1225 VIC provides the capability to create multiple vNICs (up to 128) on the CNA. This allows complete I/O configurations to be provisioned in virtualized or non-virtualized environments using just-in-time provisioning, providing tremendous system flexibility and allowing consolidation of multiple physical adapters.

System security and manageability is improved by providing visibility and portability of network policies and security all the way to the virtual machines. Additional 1225 features like VM-FEX technology and pass-through switching, minimize implementation overhead and complexity.

Figure 1-5 Cisco UCS 1225 VIC



UCS 2.1 Single Wire Management

Cisco UCS Manager 2.1 supports an additional option to integrate the C-Series Rack Mount Server with Cisco UCS Manager called “single-wire management”. This option enables Cisco UCS Manager to manage the C-Series Rack-Mount Servers using a single 10 GE link for both management traffic and data traffic. When you use the single-wire management mode, one host facing port on the FEX is sufficient to manage one rack-mount server, instead of the two ports you will use in the Shared-LOM mode. Cisco VIC 1225, Cisco UCS 2232PP FEX and Single-Wire management feature of UCS 2.1 tremendously increases the scale of C-Series server manageability. By consuming as little as one port on the UCS Fabric Interconnect, you can manage up to 32 C-Series server using single-wire management feature.

The Cisco Nexus 3064 Switch, part of the [Unified Fabric](#) family, is a compact 1-rack-unit (1RU) form factor switch. It delivers ultra-low latency, low power, and wire-rate Layer 2/3 switching on a data center class [Cisco NX-OS](#) operating system.

Features and Capabilities

The following features and capabilities are highlighted in this document.

- [Ultra Low Latency Switching](#), page 1-5
- [Ease of Operations](#), page 1-6

Ultra Low Latency Switching

The Nexus 3064 Switch offers:

- Line-rate Layer-2 and Layer-3 ultra-low latency switching on all 64 ports
- Phyless design on all ports to optimize latency
- Throughput of 1.2 terabits per second (Tbps) and 950 million packets per second (Mpps)

- Support for 1/10/40 Gbps and 100 Mbps speeds for maximum physical layer flexibility
- Low typical power consumption of approximately two Watts per 10 Gigabit port

Ease of Operations

The modular, resilient Cisco NX-OS operating system is purpose-built with unrivaled support for Layer 3 unicast and multicast routing protocols. Manageability features promote ease of use and include the following:

- Power On Auto Provisioning (POAP) which can enable touchless boot-up and configuration
- EEM and Python scripting to enable automation and remote operations
- Built-in Ether Analyzer for monitoring and troubleshooting control-plane traffic
- Advanced buffer monitoring capability to monitor traffic bursts and application traffic patterns in real time
- Integration with Data Center Network Manager (DCNM) and XML management tools

Cisco NX-OS Software Overview

Cisco NX-OS is a data center-class operating system built with modularity, resiliency, and serviceability at its foundation. Cisco NX-OS helps ensure continuous availability and sets the standard for mission-critical data center environments. The self-healing and highly modular design of Cisco NX-OS makes zero-impact operations a reality and provides exceptional operation flexibility.

Focused on the requirements of the data center, Cisco NX-OS provides a robust and comprehensive feature set that meets the networking requirements of present and future data centers. With an XML interface and a command-line interface (CLI) like that of Cisco IOS® Software, Cisco NX-OS provides state-of-the-art implementations of relevant networking standards as well as a variety of true data center-class Cisco innovations.

UCS Differentiators

Cisco's Unified Compute System is revolutionizing the way servers are managed in data-center. Following are the unique differentiators of UCS and UCS Manager.

1. **Embedded management**—In UCS, the servers are managed by the embedded firmware in the Fabric Interconnects, eliminating need for any external physical or virtual devices to manage the servers. Also, a pair of FIs can manage up to 40 chassis, each containing 8-blade servers. This gives enormous scaling on the management plane.
2. **Unified fabric**—In UCS, from blade server chassis or rack server fabric-extender to FI, there is a single Ethernet cable used for LAN, SAN and management traffic. This converged I/O results in reduced cables, SFPs and adapters – reducing capital and operational expenses of overall solution.
3. **Auto Discovery**—By simply inserting the blade server in the chassis or connecting rack server to the fabric extender, discovery and inventory of compute resource occurs automatically without any management intervention. The combination of unified fabric and auto-discovery enables the wire-once architecture of UCS, where compute capability of UCS can be extended easily while keeping the existing external connectivity to LAN, SAN and management networks.

4. **Policy based resource classification**—Once a compute resource is discovered by UCS Manager, it can be automatically classified to a given resource pool based on policies defined. This capability is useful in multi-tenant cloud computing. This CVD showcases the policy based resource classification of UCS Manager.
5. **Combined Rack and Blade server management**—UCS Manager can manage B-series blade servers and C-series rack server under the same UCS domain. This feature, along with stateless computing makes compute resources truly hardware form factor agnostic. In this CVD, we are showcasing combinations of B and C series servers to demonstrate stateless and form-factor independent computing work load.
6. **Model based management architecture**—UCS Manager architecture and management database is model based and data driven. An open, standard based XML API is provided to operate on the management model. This enables easy and scalable integration of UCS Manager with other management system, such as VMware vCloud director, Microsoft System Center, and Citrix Cloud Platform.
7. **Policies, Pools, Templates**—The management approach in UCS Manager is based on defining policies, pools and templates, instead of cluttered configuration, which enables a simple, loosely coupled, data driven approach in managing compute, network and storage resources.
8. **Loose referential integrity**—In UCS Manager, a service profile, port profile or policies can refer to other policies or logical resources with loose referential integrity. A referred policy cannot exist at the time of authoring the referring policy or a referred policy can be deleted even though other policies are referring to it. This provides different subject matter experts to work independently from each-other. This provides great flexibility where different experts from different domains, such as network, storage, security, server and virtualization work together to accomplish a complex task.
9. **Policy resolution**—In UCS Manager, a tree structure of organizational unit hierarchy can be created that mimics the real life tenants and/or organization relationships. Various policies, pools and templates can be defined at different levels of organization hierarchy. A policy referring to another policy by name is resolved in the organization hierarchy with closest policy match. If no policy with specific name is found in the hierarchy of the root organization, then special policy named “default” is searched. This policy resolution practice enables automation friendly management APIs and provides great flexibility to owners of different organizations.
10. **Service profiles and stateless computing**—A service profile is a logical representation of a server, carrying its various identities and policies. This logical server can be assigned to any physical compute resource as far as it meets the resource requirements. Stateless computing enables procurement of a server within minutes, which used to take days in legacy server management systems.
11. **Built-in multi-tenancy support**—The combination of policies, pools and templates, loose referential integrity, policy resolution in organization hierarchy and a service profiles based approach to compute resources makes UCS Manager inherently friendly to multi-tenant environment typically observed in private and public clouds.
12. **Extended Memory**—The extended memory architecture of UCS servers allows up to 760 GB RAM per server – allowing huge VM to physical server ratio required in many deployments, or allowing large memory operations required by certain architectures like Big-Data.
13. **Virtualization aware network**—VM-FEX technology makes access layer of network aware about host virtualization. This prevents domain pollution of compute and network domains with virtualization when virtual network is managed by port-profiles defined by the network administrators’ team. VM-FEX also off loads hypervisor CPU by performing switching in the hardware, thus allowing hypervisor CPU to do more virtualization related tasks. VM-FEX technology is well integrated with VMware vCenter, Linux KVM and Hyper-V SR-IOV to simplify cloud management.

14. **Simplified QoS**—Even though Fiber Channel and Ethernet are converged in UCS fabric, built-in support for QoS and lossless Ethernet makes it seamless. Network Quality of Service (QoS) is simplified in UCS Manager by representing all system classes in one GUI panel.