



## Overview

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# Cisco UCS Manager Getting Started Guide Overview

This guide provides an overview of Cisco Unified Computing System (Cisco UCS) essentials, procedures for performing Cisco UCS Manager initial configuration and best practices. The following table summarizes the overall organization of the guide.

Chapter	Description
Overview	Conceptual overview of Cisco UCS architecture including Cisco Fabric Interconnects, I/O Module and key server components; Introduction to Cisco UCS Central.
System Requirements	Hardware, browser, and port requirements for Cisco UCS Manager initial configuration.
Initial Configuration	Initial Configuration workflow in the following sequence: <ol style="list-style-type: none"><li>1. Console Setup</li><li>2. Configure Administration Policies</li><li>3. Configure Equipment Policies</li><li>4. Configure Unified Ports</li><li>5. Configure Fabric Interconnect Server Ports</li><li>6. Configure LAN Connectivity</li><li>7. Configure SAN Connectivity</li><li>8. Define Workloads</li></ol>
Appendix	Recommendations, best practices, configuration examples, and a glossary.

# Cisco UCS Manager User Documentation

Cisco UCS Manager offers you a new set of smaller, use-case based documentation described in the following table:

Guide	Description
<a href="#">Cisco UCS Manager Getting Started Guide</a>	Discusses Cisco UCS architecture and Day 0 operations, including Cisco UCS Manager initial configuration and configuration best practices.
<a href="#">Cisco UCS Manager Administration Guide</a>	Discusses password management, role-based access configuration, remote authentication, communication services, CIMC session management, organizations, backup and restore, scheduling options, BIOS tokens, and deferred deployments.
<a href="#">Cisco UCS Manager Infrastructure Management Guide</a>	Discusses physical and virtual infrastructure components used and managed by Cisco UCS Manager.
<a href="#">Cisco UCS Manager Firmware Management Guide</a>	Discusses downloading and managing firmware, upgrading through Auto Install, upgrading through service profiles, directly upgrading at endpoints using firmware auto sync, managing the capability catalog, deployment scenarios, and troubleshooting.
<a href="#">Cisco UCS Manager Server Management Guide</a>	Discusses the new licenses, registering Cisco UCS domain with Cisco UCS Central, power capping, server boot, server profiles, and server-related policies.
<a href="#">Cisco UCS Manager Storage Management Guide</a>	Discusses all aspects of storage management, such as SAN and VSAN in Cisco UCS Manager.
<a href="#">Cisco UCS Manager Network Management Guide</a>	Discusses all aspects of network management, such as LAN and VLAN connectivity in Cisco UCS Manager.
<a href="#">Cisco UCS Manager System Monitoring Guide</a>	Discusses all aspects of system and health monitoring, including system statistics in Cisco UCS Manager.
<a href="#">Cisco UCS S3260 Server Integration with Cisco UCS Manager</a>	Discusses all aspects of management of UCS S-Series servers that are managed through Cisco UCS Manager.

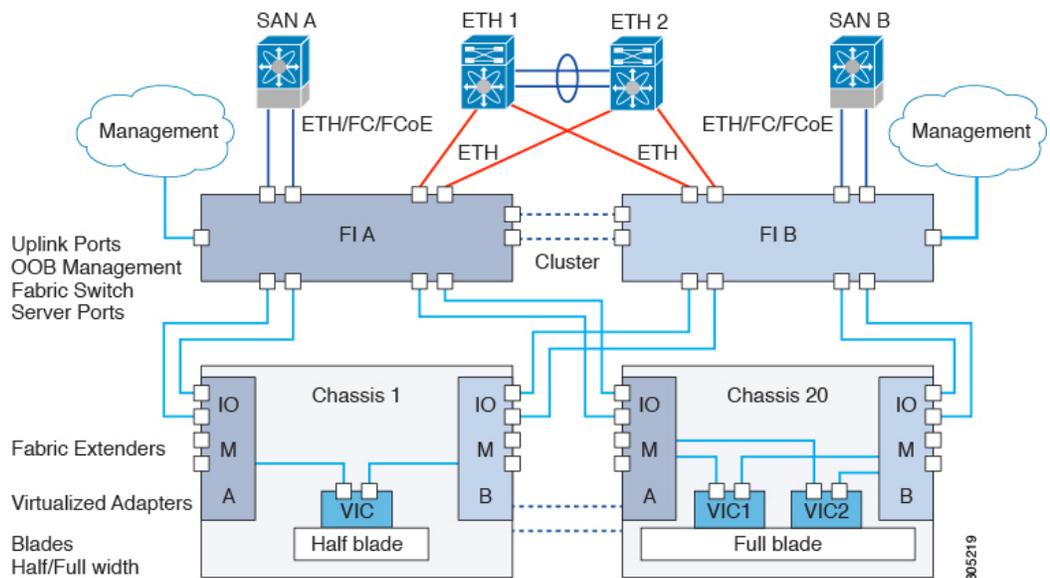
# Fundamentals of Cisco Unified Computing System

## Cisco Unified Computing System Overview

Cisco UCS has a unique architecture that integrates compute, data network access, and storage network access into a common set of components under a single-pane-of-glass management interface.

Cisco UCS fuses access layer networking and servers. This high-performance, next-generation server system provides a data center with a high degree of workload agility and scalability. The hardware and software components support Cisco's unified fabric, which runs multiple types of data center traffic over a single converged network adapter.

**Figure 1: Cisco Unified Computing System Architecture**



### Architectural Simplification

The simplified architecture of Cisco UCS reduces the number of required devices and centralizes switching resources. By eliminating switching inside a chassis, network access-layer fragmentation is significantly reduced. Cisco UCS implements Cisco unified fabric within racks and groups of racks, supporting Ethernet and Fibre Channel protocols over 10/25/40 Gigabit Cisco Data Center Ethernet and Fibre Channel over Ethernet (FCoE) links. This radical simplification reduces the number of switches, cables, adapters, and management points by up to two-thirds. All devices in a Cisco UCS domain remain under a single management domain, which remains highly available through the use of redundant components.

### High Availability

The management and data plane of Cisco UCS is designed for high availability and redundant access layer fabric interconnects. In addition, Cisco UCS supports existing high availability and disaster recovery solutions for the data center, such as data replication and application-level clustering technologies.

### Scalability

A single Cisco UCS domain supports multiple chassis and their servers, all of which are administered through one Cisco UCS Manager. For more detailed information about the scalability, speak to your Cisco representative.

### Flexibility

A Cisco UCS domain allows you to quickly align computing resources in the data center with rapidly changing business requirements. This built-in flexibility is determined by whether you choose to fully implement the stateless computing feature. Pools of servers and other system resources can be applied as necessary to respond to workload fluctuations, support new applications, scale existing software and business services, and accommodate both scheduled and unscheduled downtime. Server identity can be abstracted into a mobile service profile that can be moved from server to server with minimal downtime and no need for additional network configuration.

With this level of flexibility, you can quickly and easily scale server capacity without having to change the server identity or reconfigure the server, LAN, or SAN. During a maintenance window, you can quickly do the following:

- Deploy new servers to meet unexpected workload demand and rebalance resources and traffic.
- Shut down an application, such as a database management system, on one server and then boot it up again on another server with increased I/O capacity and memory resources.

### Optimized for Server Virtualization

Cisco UCS has been optimized to implement VM-FEX technology. This technology provides improved support for server virtualization, including better policy-based configuration and security, conformance with a company's operational model, and accommodation for VMware's VMotion.

## Unified Fabric

With unified fabric, multiple types of data center traffic can run over a single Data Center Ethernet (DCE) network. Instead of having a series of different host bus adapters (HBAs) and network interface cards (NICs) present in a server, unified fabric uses a single converged network adapter. This type of adapter can carry LAN and SAN traffic on the same cable.

Cisco UCS uses Fibre Channel over Ethernet (FCoE) to carry Fibre Channel and Ethernet traffic on the same physical Ethernet connection between the fabric interconnect and the server. This connection terminates at a converged network adapter on the server, and the unified fabric terminates on the uplink ports of the fabric interconnect. On the core network, the LAN and SAN traffic remains separated. Cisco UCS does not require that you implement unified fabric across the data center.

The converged network adapter presents an Ethernet interface and Fibre Channel interface to the operating system. At the server, the operating system is not aware of the FCoE encapsulation because it sees a standard Fibre Channel HBA.

At the fabric interconnect, the server-facing Ethernet port receives the Ethernet and Fibre Channel traffic. The fabric interconnect (using Ethertype to differentiate the frames) separates the two traffic types. Ethernet frames and Fibre Channel frames are switched to their respective uplink interfaces.

## Fibre Channel over Ethernet

Cisco UCS leverages Fibre Channel over Ethernet (FCoE) standard protocol to deliver Fibre Channel. The upper Fibre Channel layers are unchanged, so the Fibre Channel operational model is maintained. FCoE network management and configuration is similar to a native Fibre Channel network.

FCoE encapsulates Fibre Channel traffic over a physical Ethernet link. FCoE is encapsulated over Ethernet with the use of a dedicated Ethertype, 0x8906, so that FCoE traffic and standard Ethernet traffic can be carried on the same link. FCoE has been standardized by the ANSI T11 Standards Committee.

Fibre Channel traffic requires a lossless transport layer. Instead of the buffer-to-buffer credit system used by native Fibre Channel, FCoE depends upon the Ethernet link to implement lossless service.

Ethernet links on the fabric interconnect provide two mechanisms to ensure lossless transport for FCoE traffic:

- Link-level flow control
- Priority flow control

### Link-Level Flow Control

IEEE 802.3x link-level flow control allows a congested receiver to signal the endpoint to pause data transmission for a short time. This link-level flow control pauses all traffic on the link.

The transmit and receive directions are separately configurable. By default, link-level flow control is disabled for both directions.

On each Ethernet interface, the fabric interconnect can enable either priority flow control or link-level flow control (but not both).

When an interface on a Cisco UCS 6500 Series Fabric Interconnect, Cisco UCS 6454 Fabric Interconnect and has Priority Flow Control (PFC) admin configured as **auto** and Link-Level Flow Control (LLFC) admin configured as **on**, the PFC operation mode will be **off** and the LLFC operation mode will be **on**. On UCS 6300 Series and earlier Fabric Interconnects, the same configuration will result in the PFC operation mode being **on** and the LLFC operation mode being **off**.

### Priority Flow Control

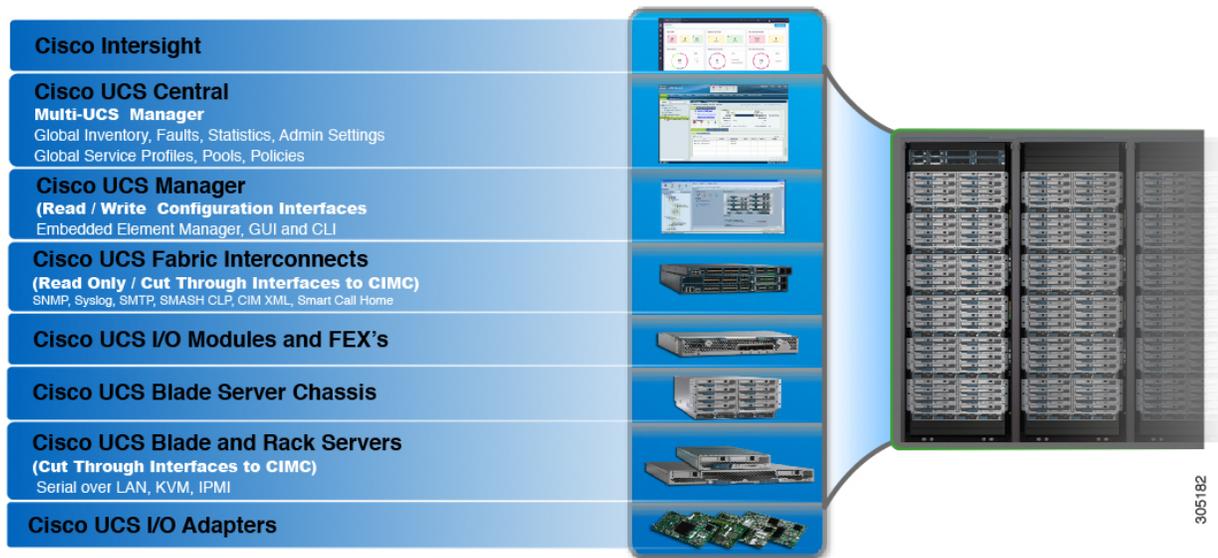
The priority flow control (PFC) feature applies pause functionality to specific classes of traffic on the Ethernet link. For example, PFC can provide lossless service for the FCoE traffic, and best-effort service for the standard Ethernet traffic. PFC can provide different levels of service to specific classes of Ethernet traffic (using IEEE 802.1p traffic classes).

PFC decides whether to apply pause based on the IEEE 802.1p CoS value. When the fabric interconnect enables PFC, it configures the connected adapter to apply the pause functionality to packets with specific CoS values.

By default, the fabric interconnect negotiates to enable the PFC capability. If the negotiation succeeds, PFC is enabled and link-level flow control remains disabled (regardless of its configuration settings). If the PFC negotiation fails, you can either force PFC to be enabled on the interface or you can enable IEEE 802.x link-level flow control.

# Cisco UCS Building Blocks and Connectivity

Figure 2: Cisco UCS Building Blocks and Connectivity



As shown in the figure above, the primary components included within Cisco UCS are as follows:

- **Cisco UCS Manager**—Cisco UCS Manager is the centralized management interface for Cisco UCS. For more information on Cisco UCS Manager, see *Introduction to Cisco UCS Manager* in *Cisco UCS Manager Getting Started Guide*
- **Cisco UCS Fabric Interconnects**—The Cisco UCS Fabric Interconnect is the core component of Cisco UCS deployments, providing both network connectivity and management capabilities for the Cisco UCS system. The Cisco UCS Fabric Interconnects run the Cisco UCS Manager control software and consist of the following components:
  - Cisco UCS 6454 Fabric Interconnect, Cisco UCS 6332 Series Fabric Interconnects, Cisco UCS 6200 Series Fabric Interconnects, and Cisco UCS Mini
  - Transceivers for network and storage connectivity
  - Expansion modules for the various Fabric Interconnects
  - Cisco UCS Manager software

For more information on Cisco UCS Fabric Interconnects, see [Cisco UCS Fabric Infrastructure Portfolio](#), on page 7.

- **Cisco UCS I/O Modules and Cisco UCS Fabric Extender**—IOM modules are also known as Cisco FEXs or simply FEX modules. These modules serve as line cards to the FIs in the same way that Cisco Nexus Series switches can have remote line cards. IOM modules also provide interface connections to blade servers. They multiplex data from blade servers and provide this data to FIs and do the same in the reverse direction. In production environments, IOM modules are always used in pairs to provide redundancy and failover.



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**Important** The 40G backplane setting is not applicable for 22xx IOMs.

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- **Cisco UCS Blade Server Chassis**—The Cisco UCS 5100 Series Blade Server Chassis is a crucial building block of Cisco UCS, delivering a scalable and flexible architecture for current and future data center needs, while helping reduce total cost of ownership.
- **Cisco UCS Blade and Rack Servers**—Cisco UCS Blade servers are at the heart of the UCS solution. They come in various system resource configurations in terms of CPU, memory, and hard disk capacity. The Cisco UCS rack-mount servers are standalone servers that can be installed and controlled individually. Cisco provides Fabric Extenders (FEXs) for the rack-mount servers. FEXs can be used to connect and manage rack-mount servers from FIs. Rack-mount servers can also be directly attached to the fabric interconnect.

Small and Medium Businesses (SMBs) can choose from different blade configurations as per business needs.

- **Cisco UCS I/O Adapters**—Cisco UCS B-Series Blade Servers are designed to support up to two network adapters. This design can reduce the number of adapters, cables, and access-layer switches by as much as half because it eliminates the need for multiple parallel infrastructure for both LAN and SAN at the server, chassis, and rack levels.

## Cisco UCS Fabric Infrastructure Portfolio

The Cisco UCS fabric interconnects are top-of-rack devices and provide unified access to the Cisco UCS domain. The Cisco UCS fabric interconnect hardware is now in its fourth generation. The following fabric interconnects are available in the Cisco UCS fabric interconnects product family:

- Cisco UCS 6454 Fabric Interconnects
- Cisco UCS 6300 Series Fabric Interconnects
- Cisco UCS 6200 Series Fabric Interconnects
- Cisco UCS 6324 Fabric Interconnects



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**Note** The Cisco UCS 6100 Series Fabric Interconnects and Cisco UCS 2104 I/O Modules have reached end of life.

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## Expansion Modules

The Cisco UCS 6200 Series supports expansion modules that can be used to increase the number of 10G, FCoE, and Fibre Channel ports.

- The Cisco UCS 6248 UP has 32 ports on the base system. It can be upgraded with one expansion module providing an additional 16 ports.
- The Cisco UCS 6296 UP has 48 ports on the base system. It can be upgraded with three expansion modules providing an additional 48 ports.

## Cisco UCS 6454 Fabric Interconnect

### Cisco UCS 6454 Fabric Interconnect Overview

The Cisco UCS 6454 Fabric Interconnect provides both network connectivity and management capabilities to the Cisco UCS system. The fabric interconnect provides Ethernet and Fibre Channel to the servers in the system, the servers connect to the fabric interconnect, and then to the LAN or SAN.

Each Cisco UCS 6454 Fabric Interconnect runs Cisco UCS Manager to fully manage all Cisco UCS elements. The fabric interconnect supports 10/25 Gigabit ports in the fabric with 40/100 Gigabit uplink ports. High availability can be achieved when a Cisco UCS 6454 Fabric Interconnect is connected to another Cisco UCS 6454 Fabric Interconnect through the L1 or L2 port on each device.

### Cisco UCS 6454 Fabric Interconnect

The Cisco UCS 6454 Fabric Interconnect (FI) is a 1-RU top-of-rack switch that mounts in a standard 19-inch rack such as the Cisco R Series rack.

The Cisco UCS 6454 Fabric Interconnect has 48 10/25 Gb SFP28 ports (16 unified ports) and 6 40/100 Gb QSFP28 ports. Each 40/100 Gb port can break out into 4 x 10/25 Gb uplink ports. The sixteen unified ports support 10/25 GbE or 8/16/32G Fibre Channel speeds.




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**Note** The Cisco UCS 6454 Fabric Interconnect supported 8 unified ports (ports 1 - 8) with Cisco UCS Manager 4.0(1) and 4.0(2), but with release 4.0(4) and later it supports 16 unified ports (ports 1 - 16).

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The Cisco UCS 6454 Fabric Interconnect supports:

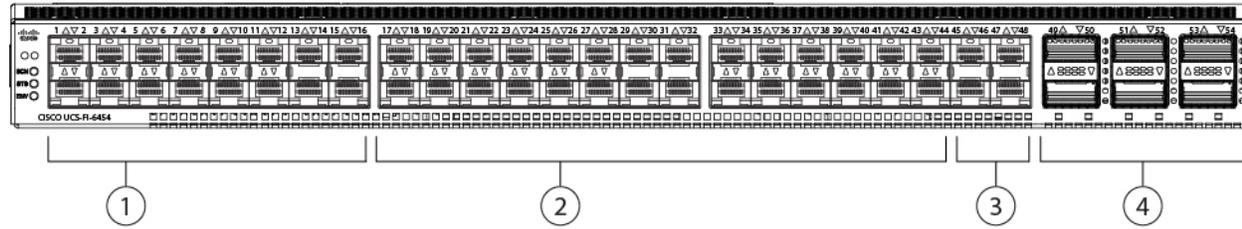
- Maximum of 8 FCoE port channels
- Or 4 SAN port channels
- Or a maximum of 8 SAN port channels and FCoE port channels (4 each)

The Cisco UCS 6454 Fabric Interconnect also has one network management port, one console port for setting the initial configuration, and one USB port for saving or loading configurations. The FI also includes L1/L2 ports for connecting two fabric interconnects for high availability.

The Cisco UCS 6454 Fabric Interconnect also contains a CPU board that consists of:

- Intel Xeon D-1528 v4 Processor, 1.6 GHz
- 64 GB of RAM
- 8 MB of NVRAM (4 x NVRAM chips)
- 128 GB SSD (bootflash)

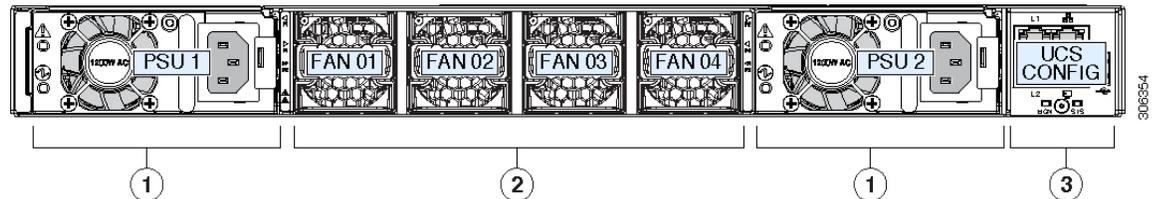
Figure 3: Cisco UCS 6454 Fabric Interconnect Rear View



1	Ports 1-16 (Unified Ports 10/25 Gbps Ethernet or FCoE or 8/16/32 Gbps Fibre Channel)  <b>Note</b> When using Cisco UCS Manager releases earlier than 4.0(4), only ports 1-8 are Unified Ports.	2	Ports 17-44 (10/25 Gbps Ethernet or FCoE)  <b>Note</b> When using Cisco UCS Manager releases earlier than 4.0(4), ports 9-44 are 10/25 Gbps Ethernet or FCoE.
3	Ports 45-48 (1/10/25 Gbps Ethernet or FCoE)	4	Uplink Ports 49-54 (40/100 Gbps Ethernet or FCoE)  Each of these ports can be 4 x 10/25 Gbps Ethernet or FCoE uplink ports when using an appropriate breakout cable.

The Cisco UCS 6454 Fabric Interconnect chassis has two power supplies and four fans. Two of the fans provide front to rear airflow.

Figure 4: Cisco UCS 6454 Fabric Interconnect Front View



1	Power supply and power cord connector	2	Fans 1 through 4, numbered left to right, when facing the front of the chassis.
3	L1 port, L2 port, RJ45, console, USB port, and LEDs		

### Ports on the Cisco UCS 6454 Fabric Interconnects

The ports on the fabric interconnects can be configured to carry either Ethernet or Fibre Channel traffic. You can configure only ports 1-16 to carry Fibre Channel traffic. The ports cannot be used by a Cisco UCS domain until you configure them.



**Note** When you configure a port on a Fabric Interconnect, the administrative state is automatically set to enabled. If the port is connected to another device, this may cause traffic disruption. The port can be disabled and enabled after it has been configured.

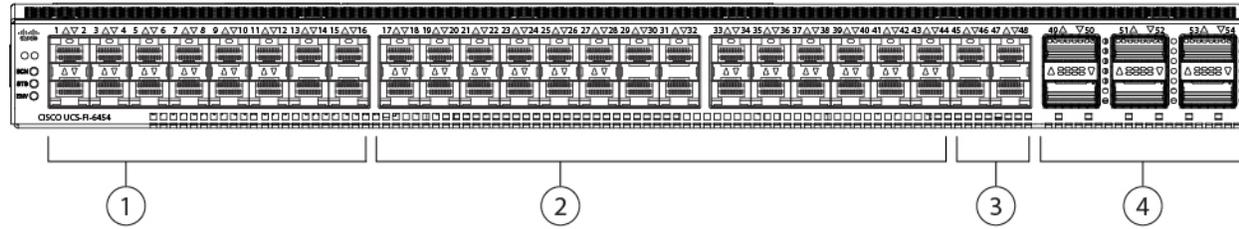
The following table summarizes the Cisco UCS 6454 Fabric Interconnects.

	<b>Cisco UCS 6454 FI</b>
Description	54-Port Fabric Interconnect
Form factor	1-RU
Number of fixed 10 GB Interfaces	48 10/25G interfaces
Number of Unified Ports	16 This FI supported 8 unified ports (ports 1 - 8) with Cisco UCS Manager 4.0(1) and 4.0(2), but with Release 4.0(4) and later it supports 16 unified ports (ports 1 - 16).
Unified Port Range	Ports 1-16
Unified Port Speeds	10/25 Gbps or 8/16/32-Gbps FC
Number of 40-Gbps ports	6 40/100 Gigabit ports
Compatibility with the IOM	UCS 2204, UCS 2208, UCS 2408
Compatibility with the FEX	Cisco Nexus 2232PP Cisco Nexus 2232TM-E
Expansion Slots	None
Fan Modules	4
Power Supplies	2 (AC/DC/HVDC available)

## Port Speeds and Types

Ports on the fabric interconnects are numbered and grouped according to their function. The ports are numbered top to bottom and left to right. The following figures show the port numbering and define port speeds and the types of ports that can be configured. For more information on how to configure the port modes, refer to *"Configuring Port Modes for a 6454 Fabric Interconnect"* in the *Cisco UCS Network Management Guide, Release 4.04.0*.

Figure 5: Rear View of Cisco UCS 6454 FI, Port Numbers



<p>1</p>	<p>Ports 1–16.</p> <p>Unified Ports can operate as 10/25 Gbps Ethernet or FCoE; or 8/16/32 Gbps Fibre Channel.</p> <p>Port type in 8G/16G/32G FC mode: FC uplink port</p> <p>Port types in 10G/25G mode:</p> <ul style="list-style-type: none"> <li>• FCoE uplink port</li> <li>• Server port</li> <li>• Appliance port (the FI must be in Ethernet-End-Host mode)</li> <li>• Monitor port</li> </ul> <p><b>Note</b> When using Cisco UCS Manager releases earlier than 4.0(4), only ports 1-8 are Unified Ports.</p>	<p>2</p>	<p>Ports 17–44.</p> <p>Each port can operate as 10G/25G Ethernet.</p> <p>Port types in 10G/25G mode:</p> <ul style="list-style-type: none"> <li>• FCoE uplink port</li> <li>• Server port</li> <li>• Appliance port (the FI must be in Ethernet-End-Host mode)</li> <li>• Monitor port</li> </ul> <p><b>Note</b> When using Cisco UCS Manager releases earlier than 4.0(4), ports 9-44 are 10/25 Gbps Ethernet or FCoE. (Only ports 1-8 were Unified Ports in earlier releases.)</p>
<p>3</p>	<p>Ports 45–48.</p> <p>Each port can operate as 1G/10G/25G Ethernet or FCoE port.</p>	<p>4</p>	<p>Uplink Ports 49–54.</p> <p>Each port can operate as 40G/100G Ethernet or FCoE. With a breakout cable, each of these ports can operate as 4 x 10G or 4 x 25G Ethernet or FCoE ports.</p> <p>Port types:</p> <ul style="list-style-type: none"> <li>• Uplink port</li> <li>• FCoE uplink port</li> <li>• Monitor port</li> </ul>

Port Configuration

The front ports on the Cisco UCS 6454 Fabric Interconnect can be configured as the following port types:

Front Port Number	Port Speed	Port Type	
1-16	10G/25G	Ethernet	<ul style="list-style-type: none"> <li>• Uplink port</li> <li>• FCOE uplink port</li> <li>• Server port</li> <li>• Appliance port</li> <li>• Monitor port</li> </ul>
	8G/16G/32G	Native FC	<ul style="list-style-type: none"> <li>• FC uplink port</li> </ul>
17-44	10G/25G	<ul style="list-style-type: none"> <li>• Uplink port</li> <li>• FCOE uplink port</li> <li>• Server port</li> <li>• Appliance port</li> <li>• Monitor port</li> </ul>	
45-48	1G/10G/25G	<ul style="list-style-type: none"> <li>• Uplink port</li> <li>• FCOE uplink port</li> <li>• Server port</li> <li>• Appliance port</li> <li>• Monitor port</li> </ul>	
49-54	40G/100G or 4x10G/25G using a supported breakout cable	<ul style="list-style-type: none"> <li>• Uplink port</li> <li>• FCOE uplink port</li> </ul>	

## Port Breakout Functionality on Cisco UCS 6454 Fabric Interconnects

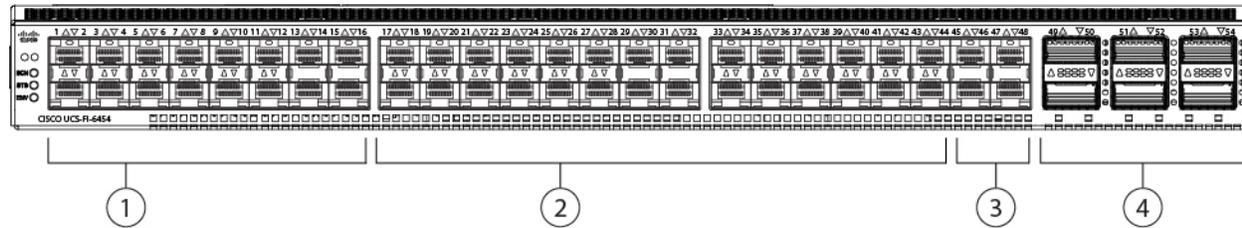
### About Breakout Ports

Cisco UCS 6454 fabric interconnects support splitting a single 40/100G QSFP port into four 10/25G ports using a supported breakout cable. These ports can be used only as uplink ports connecting to a 10/25G switch. On the UCS 6454 fabric interconnect, by default, there are 6 ports in the 40/100G mode. These are ports 49 to 54. These 40/100G ports are numbered in a 2-tuple naming convention. For example, the second 40G port is numbered as 1/50. The process of changing the configuration from 40G to 10 G, or from 100G to 25G is called breakout, and the process of changing the configuration from [4X]10G to 40G or from [4X]25G to 100G is called unconfigure.

When you break out a 40G port into 10G ports or a 100G port into 25G ports, the resulting ports are numbered using a 3-tuple naming convention. For example, the breakout ports of the second 40-Gigabit Ethernet port are numbered as 1/50/1, 1/50/2, 1/50/3, 1/50/4.

The following image shows the rear view of the Cisco UCS 6454 fabric interconnect, and includes the ports that support breakout port functionality:

**Figure 6: Cisco UCS 6454 Fabric Interconnect Rear View**



1	Ports 1-16 (Unified Ports 10/25 Gbps Ethernet or FCoE or 8/16/32 Gbps Fibre Channel)	2	Ports 17-44 (10/25 Gbps Ethernet or FCoE)
3	Ports 45-48 (1/10/25 Gbps Ethernet or FCoE)	4	Uplink Ports 49-54 (40/100 Gbps Ethernet or FCoE)

### Breakout Port Guidelines

The following are the guidelines for breakout functionality for Cisco UCS 6454 fabric interconnects:

- The breakout configurable ports are ports 49-54.
- You cannot configure the speed for each breakout port. Each breakout port is in auto mode.
- The fabric interconnect is rebooted after you configure the breakout mode for any of the supported fabric interconnect ports (1/49 to 1/54).
- In Cisco UCS Manager Release 4.0(2), breakout ports are not supported as destinations for traffic monitoring.
- Ports 49-54 can only be configured as uplink ports. They cannot be configured as any of the following:
  - Server ports
  - FCoE storage ports
  - Appliance ports

### Software Feature Configuration

Cisco UCS Manager Release 4.0(2) introduces support for the following features on Cisco UCS 6454 Fabric Interconnects. These features were not supported on Cisco UCS 6454 Fabric Interconnects in Cisco UCS Manager Release 4.0(1).

- **Switching Modes**—In Cisco UCS Manager Release 4.0(1), Cisco UCS 6454 Fabric Interconnects did not support Ethernet or FC switching modes. Cisco UCS Manager Release 4.0(2) and later releases support Ethernet and FC switching modes on Cisco UCS 6454 Fabric Interconnects support .
- **MAC Security**—In Cisco UCS Manager Release 4.0(1), Cisco UCS 6454 Fabric Interconnects did not support MAC security. Cisco UCS Manager Release 4.0(2) and later releases support MAC security on Cisco UCS 6454 Fabric Interconnects.

- Breakout Uplink Ports—Cisco UCS Manager Release 4.0(2) and later releases support splitting a single 40/100G QSFP port into four 10/25G ports using a supported breakout cable. These ports can be used only as Ethernet uplink or FCoE uplink ports connecting to a 10/25G switch. They cannot be configured as server ports, FCoE storage ports, appliance ports or monitoring ports.

Cisco UCS 6454 Fabric Interconnects do not support the following software features that were supported on UCS 6200 and 6300 Series Fabric Interconnects in Cisco UCS Manager 3.2 and earlier releases:

- Chassis Discovery Policy in Non-Port Channel Mode—Cisco UCS 6454 Fabric Interconnects support only Port Channel mode.
- Chassis Connectivity Policy in Non-Port Channel Mode—Cisco UCS 6454 Fabric Interconnects support only Port Channel mode.
- Multicast Hardware Hash—Cisco UCS 6454 Fabric Interconnects do not support multicast hardware hash.
- Service Profiles with Dynamic vNICs—Cisco UCS 6454 Fabric Interconnects do not support Dynamic vNIC Connection Policies.
- Multicast Optimize—Cisco UCS 6454 Fabric Interconnects do not support Multicast Optimize for QoS.
- NetFlow—Cisco UCS 6454 Fabric Interconnects do not support NetFlow related configuration.
- Port profiles and DVS Related Configurations—Cisco UCS 6454 Fabric Interconnects do not support configurations related to port profiles and distributed virtual switches (DVS).

Configuration of the following software features has changed for Cisco UCS 6454 Fabric Interconnects:

- Unified Ports—Cisco UCS 6454 Fabric Interconnects support up to 8 unified ports, which can be configured as FC. These ports appear at the beginning of the module. On UCS 6200 Series Fabric Interconnects, all ports are unified ports. The Ethernet ports must be contiguous followed by contiguous FC Ports. FC ports on UCS 6200 Series Fabric Interconnects appear towards the end of the module.
- VLAN Optimization—On Cisco UCS 6454 Fabric Interconnects, VLAN port count optimization is performed through port VLAN (VP) grouping when the PV count exceeds 16000. The following table illustrates the PV Count with VLAN port count optimization enabled and disabled on Cisco UCS 6454 Fabric Interconnects, Cisco UCS 6300 Series Fabric Interconnects, and Cisco UCS 6200 Series Fabric Interconnects.

	6200 Series FI	6300 Series FI	6454 FI
<b>PV Count with VLAN Port Count Optimization Disabled</b>	32000	16000	16000
<b>PV Count with VLAN Port Count Optimization Enabled</b>	64000	64000	64000

When the Cisco UCS 6454 Fabric Interconnect is in Ethernet switching mode:

- The Fabric Interconnect does not support **VLAN Port Count Optimization Enabled**
- The Fabric Interconnect supports 16000 PVs, similar to EHM mode, when set to **VLAN Port Count Optimization Disabled**

- Limited Restriction on VLAN—Cisco UCS 6454 Fabric Interconnects reserve 128 additional VLANs for system purposes.

## Cisco UCS 6300 Series Fabric Interconnects

### Fabric Interconnect Features

A Cisco UCS 6300 Series Fabric Interconnect provides both network connectivity and management capabilities to a Cisco UCS system. The fabric interconnect provides Ethernet and Fibre Channel to the servers in the system, the servers connect to the fabric interconnect, and the fabric interconnect connects to the LAN or SAN.

Each Cisco UCS 6300 Series Fabric Interconnect runs Cisco UCS Manager to fully manage all Cisco UCS elements. The fabric interconnect supports full end-to-end 40-Gigabit capabilities in the fabric and enables 16-Gigabit Fibre Channel capabilities. High availability can be achieved when a Cisco UCS 6300 Series Fabric Interconnect is connected to another Cisco UCS 6300 Series Fabric Interconnect through the L1 or L2 port on each device.

The Cisco UCS 6300 Series Fabric Interconnect joins next-generation UCS products, including the following hardware:

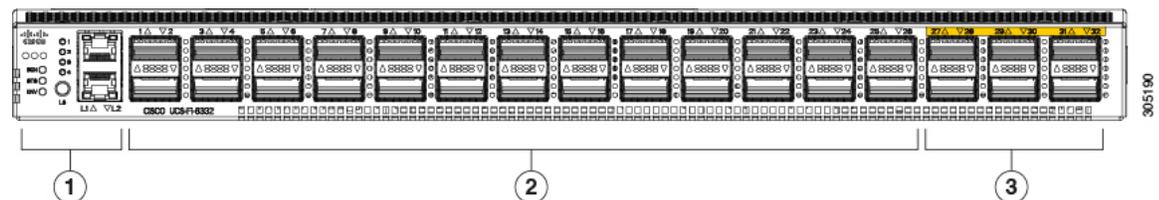
- Cisco UCS 6332 Fabric Interconnect, an Ethernet or Fibre Channel over Ethernet (FCoE) chassis with 32 40-Gigabit QSFP+ ports
- Cisco UCS 6332-16UP Fabric Interconnect, an Ethernet, FCoE, and Fibre Channel chassis with 16 1- or 10-Gigabit SFP+ ports or 16 4-, 8-, or 16-Gigabit Fibre Channel ports, 24 40-Gigabit QSFP+ ports
- Cisco 2304 IOM or Cisco 2304V2, I/O modules with 8 40-Gigabit backplane ports and 4 40-Gigabit uplink ports
- Multiple VICs

### Cisco UCS 6332 Fabric Interconnect

The Cisco UCS 6332 Fabric Interconnect is a 1-RU, top-of-rack switch with 32 40-Gigabit QSFP+ ports, one 100/1000 network management port, one RS-232 console port for setting the initial configuration, and two USB ports for saving or loading configurations. The switch also includes an L1 port and an L2 port for connecting two fabric interconnects to provide high availability. The switch mounts in a standard 19-inch rack, such as the Cisco R Series rack.

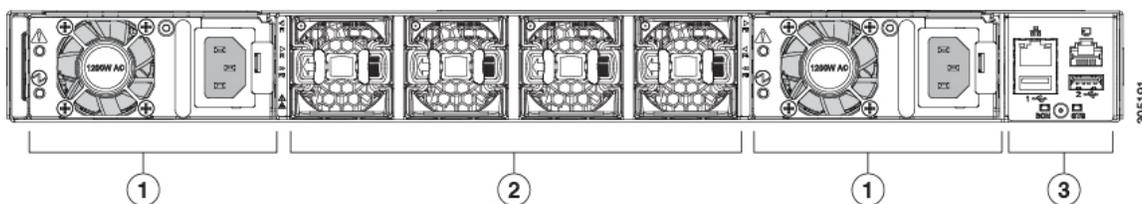
Cooling fans pull air front-to-rear. That is, air intake is on the fan side and air exhaust is on the port side.

**Figure 7: Cisco UCS 6332 Fabric Interconnect Rear View**



1	Port lane switch button, port lane LEDs, and L1 and L2 ports.	2	Ports 1–12 and ports 15–26 can operate as 40-Gbps QSFP+ ports, or as 4 x 10-Gbps SFP+ breakout ports.  Ports 1 - 4 support Quad to SFP or SFP+ (QSA) adapters to provide 1-Gbps/10 Gbps operation.  Ports 13 and 14 can operate as 40-Gbps QSFP+ ports. They cannot operate as 4 x 10-Gbps SFP+ breakout ports.
3	Ports 27–32 operate as 40-Gbps QSFP+ ports.		

Figure 8: Cisco UCS 6332 Fabric Interconnect Front View



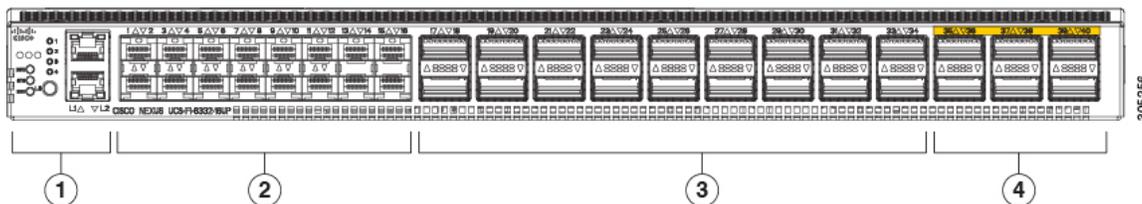
1	Power supply and power cord connector	2	Fans 1 through 4, numbered left to right, when facing the front of the chassis.
3	Management, console, and USB ports, and LEDs.		

Cisco UCS 6332-16UP Fabric Interconnect

The Cisco UCS 6332-16UP Fabric Interconnect is a 1-RU top-of-rack switch with 24 40-Gb QSFP+ ports, 16 10-Gb SFP ports, one 100/1000 network management port, one RS-232 console port for setting the initial configuration, and two USB ports for saving or loading configurations. The switch also includes an L1 port and an L2 port for connecting two fabric interconnects to provide high availability. The switch mounts in a standard 19-inch rack, such as the Cisco R Series rack.

Cooling fans pull air front-to-rear. That is, air intake is on the fan side and air exhaust is on the port side.

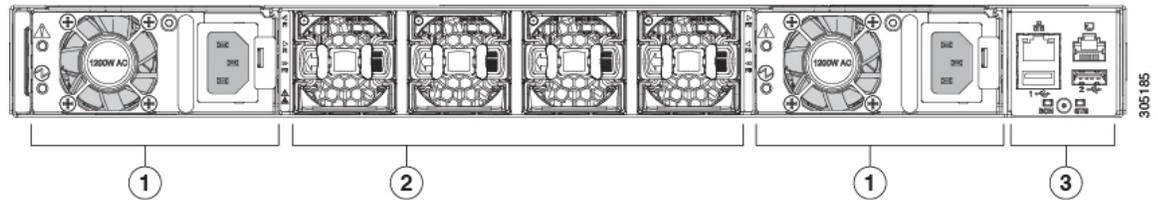
Figure 9: Cisco UCS 3223-16UP Fabric Interconnect Rear View



1	Port lane switch button, port lane LEDs, and L1 and L2 ports.	2	Ports 1–16 are Unified Ports (UP) that operate either as 1- or 10-Gbps SFP+ fixed Ethernet ports; or as 4-, 8-, or 16-Gigabit Fibre Channel ports.
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<b>3</b>	Ports 17–34 operate either as 40-Gbps QSFP+ ports, breakout mode for 4 x 10-Gigabit SFP+ breakout ports, or QSA for 10G.	<b>4</b>	Ports 35–40 operate as 40-Gbps QSFP+ ports.
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Figure 10: Cisco UCS 6332-16UP Fabric Interconnect Front View



<b>1</b>	Power supply and power cord connector	<b>2</b>	Fans 1 through 4, numbered left to right, when facing the front of the chassis.
<b>3</b>	Management, console, and USB ports, and LEDs.		

### Ports on the Cisco UCS 6300 Series Fabric Interconnects

Ports on the Cisco UCS 6300 Series Fabric Interconnects can be configured to carry either Ethernet or Fibre Channel traffic. These ports are not reserved. They cannot be used by a Cisco UCS domain until you configure them.



**Note** When you configure a port on a fabric interconnect, the administrative state is automatically set to enabled. If the port is connected to another device, this may cause traffic disruption. You can disable the port after it has been configured.

The following table summarizes the second and third generation ports for the Cisco UCS fabric interconnects.

	Cisco UCS Mini	Second Generation		Third Generation	
Item	Cisco UCS 6324	Cisco UCS 6248 UP	Cisco UCS 6296 UP	Cisco UCS 6332	Cisco UCS 6332-16UP
Description	Fabric Interconnect with 4 unified ports and 1 scalability port	48-Port Fabric Interconnect	96-Port Fabric Interconnect	32-Port Fabric Interconnect	40-Port Fabric Interconnect
Form factor	1 RU	1 RU	2 RU	1 RU	1 RU
Number of fixed 40 GB Interfaces	—	—	—	6(Ports 17–32)	6(Ports 35–40)

	Cisco UCS Mini	Second Generation		Third Generation	
Number of 1GB/10GB Interfaces (depending on the SFP module installed)	All	All	All	Ports 5–26 using breakout cable	Ports 17–34 using breakout cable
Unified Ports (8 Gb/s, FC, FCoE)	4	All	All	None	Ports 1–16
Compatibility with all IOMs	All	All	All	All	All
Expansion Slots	None	1 (16 port)	3 (16 port)	None	None
Fan Modules	4	2	5	4	4
Power Supplies	—	2 (AC/DC available)	2 (AC/DC available)	2 (AC/DC available)	2 (AC/DC available)



**Note** Cisco UCS 6300 Series Fabric Interconnects support breakout capability for ports. For more information on how the 40G ports can be converted into four 10G ports, see [Port Breakout Functionality on Cisco UCS 6300 Series Fabric Interconnects, on page 19](#).

## Port Modes

The port mode determines whether a unified port on the fabric interconnect is configured to carry Ethernet or Fibre Channel traffic. You configure the port mode in Cisco UCS Manager. However, the fabric interconnect does not automatically discover the port mode.

Changing the port mode deletes the existing port configuration and replaces it with a new logical port. Any objects associated with that port configuration, such as VLANs and VSANS, are also removed. There is no restriction on the number of times you can change the port mode for a unified port.

## Port Types

The port type defines the type of traffic carried over a unified port connection.

By default, unified ports changed to Ethernet port mode are set to the Ethernet uplink port type. Unified ports changed to Fibre Channel port mode are set to the Fibre Channel uplink port type. You cannot unconfigure Fibre Channel ports.

Changing the port type does not require a reboot.

### Ethernet Port Mode

When you set the port mode to Ethernet, you can configure the following port types:

- Server ports
- Ethernet uplink ports
- Ethernet port channel members
- FCoE ports
- Appliance ports
- Appliance port channel members
- SPAN destination ports
- SPAN source ports



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**Note** For SPAN source ports, configure one of the port types and then configure the port as SPAN source.

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### Fibre Channel Port Mode

When you set the port mode to Fibre Channel, you can configure the following port types:

- Fibre Channel uplink ports
- Fibre Channel port channel members
- Fibre Channel storage ports
- SPAN source ports



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**Note** For SPAN source ports, configure one of the port types and then configure the port as SPAN source.

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## Port Breakout Functionality on Cisco UCS 6300 Series Fabric Interconnects

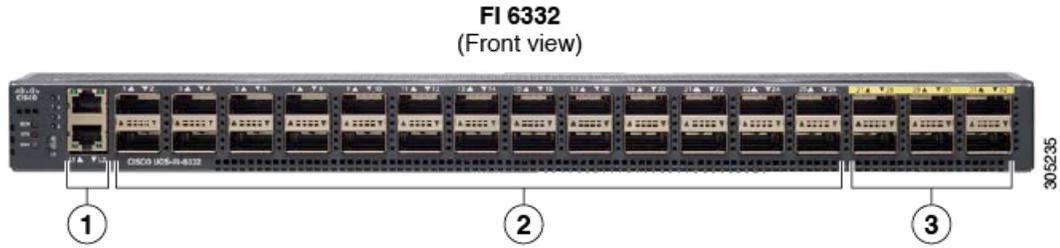
### About Breakout Ports

Cisco UCS fabric interconnect 6300 series supports splitting a single QSFP port into four 10G ports using a supported breakout cable. By default, there are 32 ports in the 40G mode. These 40G ports are numbered in a 2-tuple naming convention. For example, the second 40G port is numbered as 1/2. The process of changing the configuration from 40G to 10G is called breakout and the process of changing the configuration from [4X]10G to 40G is called unconfigure.

When you break out a 40G port into 10G ports, the resulting ports are numbered using a 3-tuple naming convention. For example, the breakout ports of the second 40-Gigabit Ethernet port are numbered as 1/2/1, 1/2/2, 1/2/3, 1/2/4.

The following image shows the front view for the Cisco UCS 6332 series fabric interconnects, and includes the ports that may support breakout port functionality:

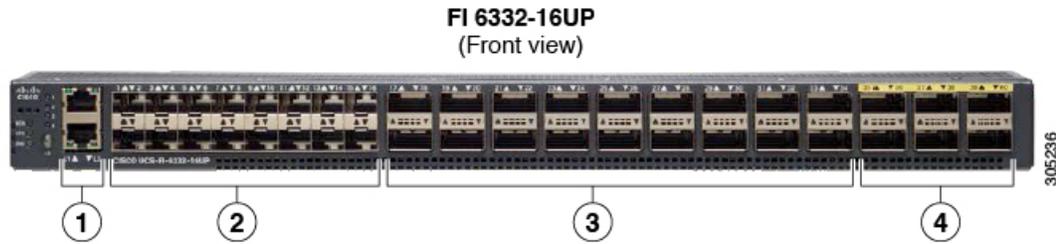
Figure 11: Cisco UCS 6332 Series Fabric Interconnects Front View



1	L1 and L2 high availability ports
2	28 X 40G QSFP ports ( 98 X 10G SFP ports) <b>Note</b> <ul style="list-style-type: none"> <li>• QSA module is required on ports 13–14</li> <li>• A QSFP to 4XSFP breakout cable is required for 10G support.</li> </ul>
3	6 X 40G QSFP ports

The following image shows the front view for the Cisco UCS 6332-16UP series fabric interconnects, and includes the ports that may support breakout port functionality:

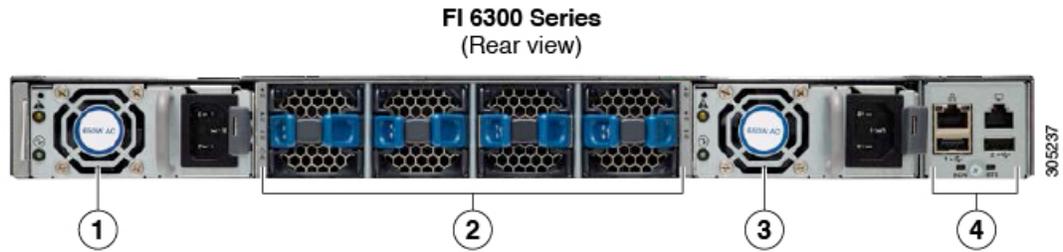
Figure 12: Cisco UCS 6332-16UP Series Fabric Interconnects Front View



1	L1 and L2 high availability ports
2	16 X 1/10G SFP (16 X 4/8/16G FC ports)
3	18 X 40G QSFP(72 X 10G SFP+) <b>Note</b> <ul style="list-style-type: none"> <li>• A QSFP to 4XSFP breakout cable is required for 10G support.</li> </ul>
4	6 X 40G QSFP ports

The following image shows the rear view of the Cisco UCS 6300 series fabric interconnects.

Figure 13: Cisco UCS 6300 Series Fabric Interconnects Rear View



1	Power supply
2	Four fans
3	Power supply
4	Serial ports

### Breakout Port Constraints

The following table summarizes the constraints for breakout functionality for Cisco UCS 6300 series fabric interconnects:

Cisco UCS 6300 Series Fabric Interconnect Series	Breakout Configurable Ports	Ports without breakout functionality support
Cisco UCS 6332	1–12, 15–26	13–14, 27–32 <b>Note</b> • Auto-negotiate behavior is not supported on ports 27–32.
Cisco UCS 6332-16UP	17–34	1–16, 35–40 <b>Note</b> • Auto-negotiate behavior is not supported on ports 35–40



**Important** Up to four breakout ports are allowed if QoS jumbo frames are used.

## Introduction to Cisco UCS Manager

Cisco UCS Manager is embedded software that resides on the fabric interconnects, providing complete configuration and management capabilities for all of the components in the Cisco UCS system. This configuration information is replicated between the two fabric interconnects, providing a highly available solution for this critical function. The most common way to access Cisco UCS Manager for simple tasks is

to use a Web browser. A command-line interface (CLI) and an XML API are also included for command-line or programmatic operations.

The Cisco UCS Manager GUI provides role-based access control (RBAC) to allow multiple levels of users administrative rights to system objects. Users can be restricted to certain portions of the system based on locale, which corresponds to an optional organizational structure that can be created. Users can also be classified based on their access levels or areas of expertise, such as Storage Administrator, Server Equipment Administrator, or Read-Only.

Cisco UCS Manager provides unified, embedded management of all software and hardware components. Every instance of Cisco UCS Manager and all of the components managed by it form a domain. For organizations that deploy multiple Cisco UCS domains, Cisco UCS Central software provides a centralized user interface that allows you to manage multiple, globally distributed Cisco UCS domains with thousands of servers. Cisco UCS Central integrates with Cisco UCS Manager and utilizes it to provide global configuration capabilities for pools, policies, and firmware.

## Configuration Options

You can configure a Cisco UCS domain in the following ways:

- As a single fabric interconnect in a standalone configuration
- As a redundant pair of fabric interconnects in a cluster configuration

A cluster configuration provides high availability. If one fabric interconnect becomes unavailable, the other takes over. Only one management port (Mgmt0) connection is required to support a cluster configuration. However, both Mgmt0 ports should be connected to provide link-level redundancy. In a cluster configuration, the master and slave slots are identified as primary and subordinate.

In addition, a cluster configuration actively enhances failover recovery time for redundant virtual interface (VIF) connections. When an adapter has an active VIF connection to one fabric interconnect and a standby VIF connection to the second, the learned MAC addresses of the active VIF are replicated but not installed on the second fabric interconnect. If the active VIF fails, the second fabric interconnect installs the replicated MAC addresses and broadcasts them to the network through gratuitous ARP messages, shortening the switchover time.



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**Note** The cluster configuration provides redundancy only for the management plane. Data redundancy is dependent on the user configuration and might require a third-party tool to support data redundancy.

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