# Virtual Design Master

## Challenge 2 – Adaptation and Constraints

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**ABSTRACT**

Our next obstacle is to extend the infrastructure base to the Moon. The Moon is to be used as a stopping point on our journey to Mars, and will serve as the new home for human kind until the colony on Mars is finished.

## Table of Contents

# 1. Purpose and Overview

## 1.1 Executive Summary

The Depot at Cape Canaveral is almost online, and other depots will be coming online soon in the Netherlands, Australia, and New Zealand.

Our next obstacle is to extend the infrastructure base to the Moon. The Moon is to be used as a stopping point on our journey to Mars, and will serve as the new home for human kind until the colony on Mars is finished.

A completely orchestrated infrastructure that is highly reliable and easily deployable is required. We must ensure these sites are up and running as soon as possible.

This design must include the complete solution stack, which includes the application and infrastructure layers.

The application that will run on our Moon base has the following requirements:

- Client facing web layer
- Message queuing middle tier
- Database backend

## 1.2 Summary Analysis

The intent of this design is to repurpose the logical design that was successful on Earth and scale it down to fit within the constraints of our Moon base. There are serious power, cooling, and space limitations imposed onto this project. Additionally, the Moon only has an IPv6 network infrastructure available for our use.

## 1.3 Intended Audience

This document is aimed at the key stakeholders in the project and their supporting technical staff.

## 1.4 Requirements

Below are the requirements as dictated by our current state of survival while taking up residence on the Moon.

Due to the very small physical footprint requirements imposed by the Moon base's environment, we will be eliminating the standalone development and QA environments that were present in the first iteration of the Earth-based design. Infrastructure engineers are expected to execute the design implementation flawlessly and will be provided with a few VMs for testing. It is expected that these VMs will be used for running nested ESXi and the UCS platform emulator.

Application developers will be given a few small VMs for application refinement and QA.

### 1.4.1 Availability

Since the application that will run on the infrastructure stack is key to continued human survival, the criticality of the environment as a whole requires 100% availability as a SLO (service level objective).

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| **R001** | **Production systems require a 100% availability SLO.** |

### 1.4.2 Maintainability

Maintainability must be ensured. Since we are working in an environment with demanding physical constraints we must take special precautions to ensure hardware continues to operate without long periods of downtime.

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| **R002** | **Must be able to quickly diagnose and repair the infrastructure.** |

### 1.4.3 Integrity

System integrity ensures that adds / moves / changes are not done on production systems. Due to the constraints of the Moon base's environment, we are forced into allowing infrastructure changes in the production environment itself. These changes must go through a change control board before implementation, and must be accompanied by validated written procedures for the task at hand. It is expected that all changes be tested as much as possible prior to implementation within the nested ESXi environment available to the infrastructure engineers.

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| **R003** | **A nested ESXi / Cisco UCS emulator environment is required for development operations.** |

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| **R004** | **All production changes must be approved via CCB and accompanied by a validated written procedure.** |

### 1.4.4 Reliability

Reliability of both the application and infrastructure layers of the stack must be guaranteed. The weight of meeting these goals falls onto the application developers and the infrastructure engineers. These people must take all of the necessary precautions to ensure the entire stack runs without errors.

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| **R005** | **A peer-based code review process needs to be put into place.** |
| **R006** | **Infrastructure component configurations must be audited before placing into production.** |

### 1.4.5 Safety

It is assumed that the zombie creating plague has been left behind on planet Earth. With that said, we must still secure the physical location of our datacenter equipment in the event that the disease pops up within the walls of our Moon base.

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| **R007** | **The datacenter must implement physical security.** |

### 1.4.6 Scalability

Due to the constraints imposed by the Moon base's environment, our goal is to ensure maximum scalability within 21U (rack units) of datacenter space.

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| **R008** | **The system must be scalable within the 21U of space available.** |

### 1.4.7 Automation

In order to meet the needs of all other requirements, automation and orchestration is required.

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| **R009** | **The system must make use of automation wherever feasible.** |

## 1.5 Constraints

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| **C001** | **The infrastructure cannot tolerate any serious malfunctions in the production application environment.** |

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| | This is critical, as human lives are at stake! |
| **C002** | **The infrastructure can only use the IPv6 networking stack.**<br>The Moon base only supports IPv6. *This has impacts on the management of the infrastructure itself! These impacts will be described where appropriate.* |
| **C003** | **The same vendors used in our Earth based design must be used in the Moon base environment.**<br>The design can be scaled back, however, no new vendors can be introduced. Different product lines are available from the existing vendors. |
| **C004** | **The entire stack must fit into 21U (rack units).**<br>This is all the space that could be allocated to us for use within the Moon base. |
| **C005** | **Automation must be used.**<br>Automation must be used to meet the needs of all other requirements. |

## 1.6 Risks

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| **I001** | **Adequate power may not be available.**<br>This would impact our ability to scale within the constraints. |
| **I002** | **Adequate cooling may not be available.**<br>This would impact our ability to scale within the constraints. |
| **I003** | **Application execution time may not be fast enough.**<br>Due to the limits of scale, application execution will take longer than the Earth based design. |
| **I004** | **IPv6 support is not 100%**<br>Despite being around for over 10 years, IPv6 still does not have flawless support. |

## 1.7 Assumptions

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|---|---|
| **A001** | **All specified hardware is available.**<br>All desired hardware is available for use. Our vendors sent up all of their Earthly inventory via SpaceX rockets and delivery pods. |
| **A002** | **All equipment in this design is new and validated to function properly.**<br>The equipment has run for 1 week. All tests were passed without issue. |
| **A003** | **All component firmware is at the identical revision.**<br>This is especially important for UCS / VMware interoperability. |
| **A004** | **Software development will not be done by infrastructure team.**<br>A separate team exists to maintain the application stack and deploy it to |

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| | the provided infrastructure. |
| **A005** | **There are a sufficient number of free 10Gbps ports for us to plug into on the Moon base's core router.** |
| | Management of the core router is outside of the scope of this document. |
| **A006** | **All of the "pools" (MAC address, WWN, etc.) in the UCS have been configured.** |
| | Pre-configured via a PowerShell / PowerTool script. |
| **A007** | **An Active Directory environment is available for SSO to connect to for authentication. This environment is fully redundant and offers NTP and DHCP6 services.** |
| | Management is outside of the scope of this document. |
| **A008** | **The management VLAN for this environment is dedicated for Cisco UCS and vSphere only.** |
| | A standalone VLAN for management of our infrastructure only. |
| **A009** | **The upstream devices (routers, firewalls) have been fully configured for IPv6 networking.** |
| | Management of these devices is outside of the scope of this document. |

# 2. Architecture Design

## 2.1 Design Decisions

The architecture is described via a logical design; independent of hardware-specific details.

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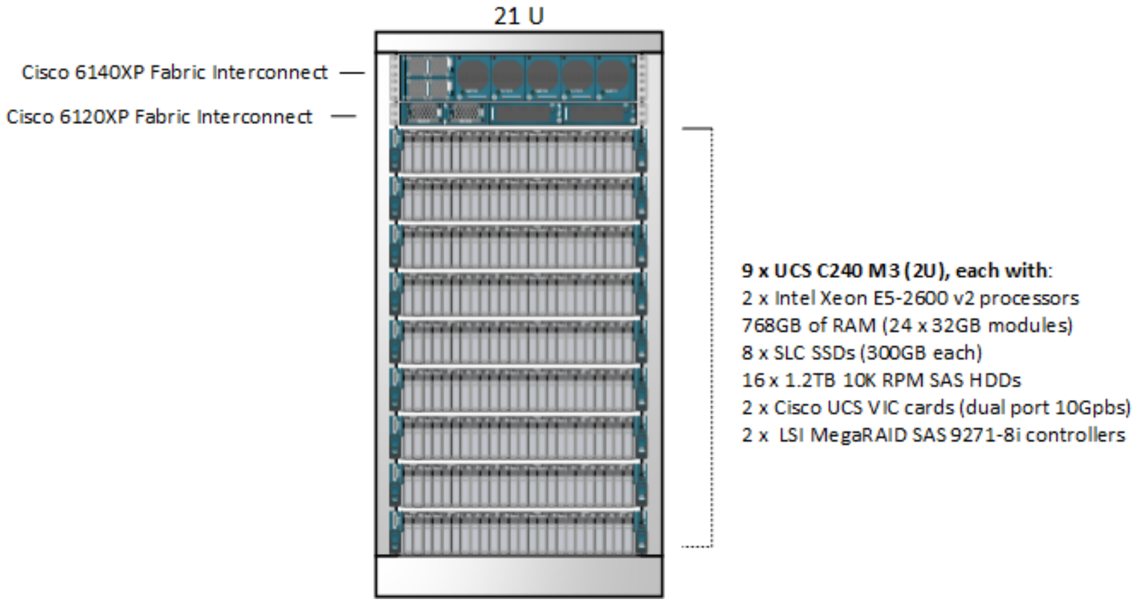
| **D001** | **The system will have the fewest number of logical components possible.** |
| | Complexity should be minimalized for ease of troubleshooting. |
| **D002** | **Automation will make use of scripting opposed to an automation engine.** |
| | Building from D001. The fewest number of logical components possible. |
| **D003** | **There will be a Production, Development, and QA environment.** |
| | This is to meet our requirements. The Development and QA environments will be built upon nested ESXi hosts. |
| **D004** | **The facility will be secure.** |
| | Badge and fingerprint scanning will be required to access the datacenter. |
| **D005** | **Continuous Integration and Continuous Delivery will be implemented.** |
| | Hourly deployments will take place via a version-controlled system. |

## 2.2 Physical Design

The physical design is described in the following sections.

### 2.2.1 Physical rack layout




Above is the rack diagram for our entire deployment. Due to C004, we only have 21U of rack space available for our stack.

### 2.2.2 Cisco UCS architecture

The Cisco UCS infrastructure was chosen for the compute and network environment because of the ease of management, deployment flexibility, and scalability.

In this design, we are taking advantage of the Cisco UCS C240 M3 rack-mount server. The C-series hardware was chosen over blade architecture so due to the physical constraints (21U) we have to work with. The C-series hardware allows for us to take advantage of a scale-up model.

### 2.2.3 Server configuration

Each server is to be deployed with its maximum configuration:

- 2 x Intel® Xeon® Processor E5-2697 v2 processors
    - 12 cores, 30M Cache, 2.70 GHz
    - This equates to 48 logical processors per host (with hyper-threading enabled)
- 768GB of RAM (24 x 32GB modules)
- 8 x SLC SSDs (300GB each)
- 16 x 1.2TB 10K RPM SAS HDDs

- 2 x Cisco UCS VIC cards (dual port 10 Gbps)
- 2 x LSI MegaRAID SAS 9271-8i controllers
- 2 x SD 4GB flash cards (installed internally)

The use of local disk in this environment allows us to eliminate the NetApp component of the previous Earth-based design and fully utilize VMware's VSAN product for storage. This design change allows for the maximum use of the space available by combining both compute and storage into one set of nodes. In many cases, the I/O performance achieved by a virtual machine may be higher than that of the NetApp design due to the direct attached proximity of flash storage in relation to the hypervisor itself. Additionally, this design has discontinued the use of PernixData's FVP, as VSAN itself provides sufficient I/O acceleration.

The servers make use of two LSI MegaRAID SAS 9271-8i controllers. These controllers are certified on the VMware HCL for VSAN compatibility. Each controller can connect 12 drives. The drives are to be connected as follows:

- First LSI controller:
  - 4 x SSDs : Disk bays 1 – 4
  - 8 x HDDs : Disk bays 5-12
- Second LSI controller:
  - 4 x SSDs : Disk bays 13 - 16
  - 8 x HDDs : Disk bays 17 - 24

This design allows for a more balanced bandwidth flow through the controllers.

### 2.2.4 Fabric design

The C-series servers are to be connected with 3 x 10Gbps uplinks to the Cisco 6140XP Fabric Interconnect, and 1 x 10Gbps link to the Cisco 6120XP Fabric Interconnect. This configuration makes use of the limited rack space available to us and still offers redundancy. This design is intended to primarily send most traffic to one fabric (the 6140XP @ 30Gbps). The 6120XP is to be used for management traffic under normal operating conditions and offers redundancy in case of the 6140XP failing (albeit at reduced capacity @ 10Gbps).

The fabric interconnects both have a plentiful number of ports free to connect to the upstream network infrastructure on the Moon base. It is assumed that a minimum of 2 x 10Gbps links will be provided for each fabric interconnect to the core router (not under our management in this scenario) for this purpose.

The fabrics are henceforth referred to as "fabric A", the 6140XP FI; and "fabric B", the 6120XP FI.

### 2.2.5 Environmental properties

The environmental properties of this design are as follows:

**C240 M3 Servers (per server):**

| Description | Specification |
| --- | --- |
| AC input voltage range | 90 to 264 VAC (self-ranging, 180 to 264 VAC nominal) |
| AC input frequency | Range: 47 to 63 Hz (single phase, 50 to 60Hz nominal) |
| Maximum AC inrush current | 30 A |
| Maximum AC input current | 11 A peak at 100 VAC<br>7 A peak at 208 VAC |
| Maximum output power for each power supply | 1200 W at 200 to 240 V<br>800 W at 100 to 120 V |
| Power supply output voltage | Main power: 12 VDC<br>Standby power: 12 VDC |
| Power supply efficiency | CSCI Platinum |

**6120XP Fabric Interconnect:**

| Description | Specification |
| --- | --- |
| AC-input voltage | 90 to 264 VAC |
| AC-input frequency | 50 to 60 Hz nominal (Range: 47 to 63 Hz) |
| AC-input current | 7.5 Amps @ 90 VAC |
| Maximum input VA | 675 VA @ 90 VAC |
| Maximum output power per power supply | 550W @ 12 V (up to two power supplies) |
| Maximum inrush current | 35 A <sub cycle duration |
| Maximum heat output | 1876 BTU/hr |
| Maximum hold up time | 12 ms |
| Power supply output voltage | 12 VDC |
| Efficiency rating | 87% |

**6140XP Fabric Interconnect:**

| Description | Specification |
|---|---|
| AC-input voltage | 90 to 264 VAC |
| AC-input frequency | 50 to 60 Hz nominal (Range: 47 to 63 Hz) |
| AC-input current | 9.2 Amps @ 90 VAC |
| Maximum input VA | 828 VA @ 90 VAC |
| Maximum output power per power supply | 750W @ 12 VDC (up to two power supplies) |
| Maximum inrush current | 35 A <sub cycle duration |
| Maximum heat output | 2561 BTU/hr |
| Maximum hold-up time | 12 ms |
| Power supply output voltage | 12 VDC |
| Efficiency rating | 89% (Climate Savers Gold qualified) |

All of our components make use of redundant power supplies by default. If adequate power or cooling is unavailable, we can scale back to 1 power supply per device. If this contingency is implemented, ensure that each of the fabric interconnects are on separate circuits / PDUs. The servers should also alternate their connections into the circuits / PDUs in this scenario.

## 2.3 Service Profiles

Service profiles are the fundamental mechanism by which the Cisco Unified Computing System models the necessary abstractions of server, storage, and networking.

In this design, we will create service profiles for our hosts with the following configuration:

- Boot from SD card (appears as local disk)
- 8 x virtual NICs
    - 2 x Management
        - vNIC0 on fabric A
        - vNIC1 on to fabric B
        - No failover option checked in UCS
    - 2 x VM Data
        - vNIC2 on fabric A
        - vNIC3 on to fabric B
        - No failover option checked in UCS
    - 2 x vMotion
        - vNIC4 on fabric A
        - vNIC5 on to fabric B
        - No failover option checked in UCS
    - 2 x VSAN
        - vNIC6 on fabric A

        - vNIC7 on fabric B
- Local disk configuration policy set to JBOD

## 2.4 Virtualization Network Layer

### 2.4.1 VLAN definitions

The following VLANs are to be used to separate traffic:

- VLAN 10: Management
- VLAN 20: vMotion
- VLAN 100 – 1000: VM data networks
- VLAN 2000: VSAN
- Out-of-band (OOB) communication will be done on the management network

### 2.4.2 Virtual switch configuration

There will be one vDS (virtual distributed switch) in this environment, making use of all 6 of the virtual NICs per ESXi host.

The following port groups will be defined:

| Name: | VLAN: | Purpose: | Failover Policy: |
|---|---|---|---|
| VLAN10-Mgmt | 10 | Management traffic | vNIC 0 standby<br>vNIC 1 active |
| VLAN20-vMotion | 20 | vMotion | vNIC2 active<br>vNIC3 standby |
| VLAN100-App | 100 | VM data network | vNIC4 active<br>vNIC5 standby |
| VLAN2000-VSAN | 2000 | VSAN replication | vNIC6 active<br>vNIC7 standby |

There is a VMkernel interface on VLAN 10 for management traffic, and a VMkernel interface on VLAN 20 for vMotion traffic.

### 2.4.3 Network I/O control

Network IO control will not be applied on the vDS, as the balancing of traffic will occur at the UCS level via QoS and class of service assignments. This is applied to the vNICs at the UCS level.

### 2.4.4 DNS and Naming Conventions

The domain name for the hosts will be: moon.local

## 2.5 vSphere Design

### 2.5.1 vCenter Server and components

There will only be one vCenter Server, making use of the vCenter Server Appliance. It will be named: vcenter01.moon.local

There will be one datacenter named: Moon-DC-01

VMware Update Manager will be deployed to a standalone VM in this environment.

The embedded database will be used for the vCenter server. A separate Windows server 2008 R2 server with SQL 2008 standard will be used for the shared database for other components, such as VUM.

### 2.5.2 vSphere Single Sign On

Single Sign-on will be used and authenticated to Active Directory.

### 2.5.3 Deployment

ESXi will be installed locally to each of the SD cards in this environment (2 x per host for redundancy). Since it is a static environment, there is no need for a fully orchestrated deployment system (such as Auto Deploy).

### 2.5.4 Clusters and Resource Pools

There will be one cluster spanned across the 9 UCS servers. Resource pools will not be deployed initially, but can be retrofitted if contention becomes an issue.

### 2.5.5 Fault Tolerance (FT)

Fault tolerance will not be used.

### 2.5.6 DRS / HA Configuration

HA and DRS will be enabled and set to aggressive.

vCenter will have affinity rules to the first server in the environment (top of rack).

Any clustered application servers or databases will have anti-host affinity or if required, anti-chassis affinity rules.

HA admission control will be set to 12% tolerance and will not allow violations of this constraint.

### 2.5.7 Management and Monitoring

vCenter Operations Manager will be used to monitor the environment in detail.

Log insight will be used to provide real-time analysis and fast root cause analysis.

### 2.5.8 vCenter Server Users and Groups

Active Directory will be used as the user management system. Roles based on access levels and job function will be applied to the appropriate groups.

### 2.5.9 Management Cluster

Due to the constraints presented in this environment, there will be no separate management cluster.

## 2.6 Virtual Machine Design

### 2.6.1 Virtual Machine Design Considerations

Operating systems will be comprised of a system volume and one or more data volumes. System volumes will not be larger than 50GB in size and will be thin provisioned by default.

Swap files for all VMs will be stored with the VMs. No RDMs can be used.

Virtual Hardware Version 10 will be used by default.

All operating systems that support VMXNET3 will use it as the network adapter of choice.

#### 2.6.2 Guest Operating System Considerations

All VMs will be provisioned from templates and configuration policies applied afterwards. No configuration changes will be applied manually.

#### 2.6.3 General Management Design Guidelines

All management of the environment will be done a dedicated VM named: management01.moon.local. All actions will be audited and reviewed.

*It should be noted that there are reports of the web client remote console not functioning correctly in a pure IPv6 world. As a contingency, we recommend installing the legacy client on the management workstation. It is only to be used to access remote VM consoles if necessary.*

#### 2.6.4 Host Management Considerations

The UCS servers have a built in IP KVM in their management framework for in-band management.

It should be noted that OOB management via the Cisco UCS environment **does not** support IPv6. Therefore an IPv4 network can be built within the management VLAN and only exist within the UCS / vSphere environments. This VLAN can then be accessed via management01.moon.local. This IPv4 network would be flat and not required to exist on any upstream equipment outside of the UCS environment.

#### 2.6.5 Templates

All virtual machines will be created from a master template.

#### 2.6.6 Updating Hosts, Virtual Machines, and Virtual Appliances

vCenter update manager will be used to update hosts, VMs and appliances.

#### 2.6.7 Time Synchronization

No GPS is available on the moon. As such, all hosts will connect to the Active Directory VMs running the NTP service. This is a best-effort approach and ensures that the hosts are synced.

#### 2.6.8 Snapshot Management

VM snapshots will are not to live for any longer than 24 hours. This ensures consistent performance.

#### 2.6.7 Performance Monitoring

Performance monitoring of the infrastructure will be done by vCOPs.

### 2.7 Application provisioning automation

All VMs will be provisioned from templates, and then a puppet infrastructure will apply the appropriate application configuration.

It is expected that the development staff will utilize git version control alongside the puppet infrastructure to implement their continuous integration and continuous deployment model.

## 3. Network Design

### 3.1 IPv6 Addressing Scheme

Our assigned IPv6 prefix and subnet space is:

2607:fad0:12::/48

#### 3.1.2 Address Assignment

Addresses are assigned via a DHCP6 server running on the Active Directory VMs.

The layout of addresses takes into account the VLAN number for which the host resides in.

For the VLANs in our environment, the following ranges will be utilized:

| VLAN ID: | IPv6 Range: |
|---|---|
| 10 | 2607:fad0:12:0010::/64 |
| 20 | 2607:fad0:12:0020::/64 |
| 100 | 2607:fad0:12:0100::/64 |
| 2000 | 2607:fad0:12:2000::/64 |

As new VLANs are added to the environment, additional /64 subnets should be created following this scheme.

### 3.1.3 Special Purpose Subnets

Special purpose subnets can exist without conflicting with our addressing scheme by using any subnet higher than the highest VLAN possible (4095).

Example of a special purpose subnet:  2607:fad0:12:4096::/64

## 3.2 Firewalls, NAT, Routing

Since the IPv6 address pool is many orders of magnitude deeper than its IPv4 counterpart, no NAT'ing is necessary.  All hosts are able to have their own individual IP.

As such, there should be a stateful firewall installed upstream to manage access to our IPv6 hosts.

The routing layers also need to be fully aware of IPv6 and have an interface on each of the VLANs we employ in this design.  Default gateways will be handed out via the DHCP6 service.

Configuration of these upstream devices is out of the scope of this document.

Data Sheet

# Cisco UCS C240 M3 Rack Server

## Product Overview

The form-factor-agnostic Cisco® Unified Computing System™ (Cisco UCS™) combines Cisco UCS C-Series Rack Servers and B-Series Blade Servers with networking and storage access in a single converged system that simplifies management and delivers greater cost efficiency and agility with increased visibility and control. The latest expansion of the Cisco UCS portfolio includes the new Cisco UCS C240 M3 Rack Server (two rack units [2RU]) and Cisco UCS C220 M3 Rack Server (1RU) and the Cisco UCS B200 M3 Blade Server. These three new servers increase compute density through more cores and cache balanced with more memory capacity and disk drives and faster I/O. Together these server improvements and complementary Cisco UCS advancements deliver the combination of features and cost efficiency required to support IT's diverse server needs.

The Cisco UCS C240 M3 Rack Server (Figure 1) is designed for both performance and expandability over a wide range of storage-intensive infrastructure workloads, from big data to collaboration. Building on the success of the Cisco UCS C210 M2 Rack Server, the enterprise-class Cisco UCS C240 M3 server further extends the capabilities of the Cisco UCS portfolio in a 2RU form factor with the addition of the Intel® Xeon® processor E5-2600 and E5-2600 v2 product families, which deliver an outstanding combination of performance, flexibility, and efficiency gains. The Cisco UCS C240 M3 offers up to two Intel® Xeon® processor E5-2600 or E5-2600 v2 processors, 24 DIMM slots, 24 disk drives, and four 1 Gigabit Ethernet LAN-on-motherboard (LOM) ports to provide exceptional levels of internal memory and storage expandability and exceptional performance.

The Cisco UCS C240 M3 interfaces with Cisco UCS using another Cisco innovation, the Cisco UCS Virtual Interface Card. The Cisco UCS Virtual Interface Card is a virtualization-optimized Fibre Channel over Ethernet (FCoE) PCI Express (PCIe) 2.0 x8 10-Gbps adapter designed for use with Cisco UCS C-Series Rack Servers. The VIC is a dual-port 10 Gigabit Ethernet PCIe adapter that can support up to 256 PCIe standards-compliant virtual interfaces, which can be dynamically configured so that both their interface type (network interface card [NIC] or host bus adapter [HBA]) and identity (MAC address and worldwide name [WWN]) are established using just-in-time provisioning. In addition, the Cisco UCS VIC 1225 can support network interface virtualization and Cisco® Data Center Virtual Machine Fabric Extender (VM-FEX) technology.

**Figure 1.** Cisco UCS C240 M3 Server

## Applications

Not all storage-intensive workloads are alike, and the Cisco UCS C240 M3 server's disk configuration delivers balanced performance and expandability to best meet individual workload requirements. With up to 12 LFF (Large Form Factor) or 24 SFF (Small Form Factor) internal drives, the Cisco UCS C240 M3 optionally offers 10,000-RPM and 15,000-RPM SAS drives to deliver a high number of I/O operations per second for transactional workloads such as database management systems. In addition, high-capacity SATA drives provide an economical, large-capacity solution. Superfast SSDs are a third option for workloads that demand extremely fast access to smaller amounts of data. A choice of RAID controller options also helps increase disk performance and reliability.

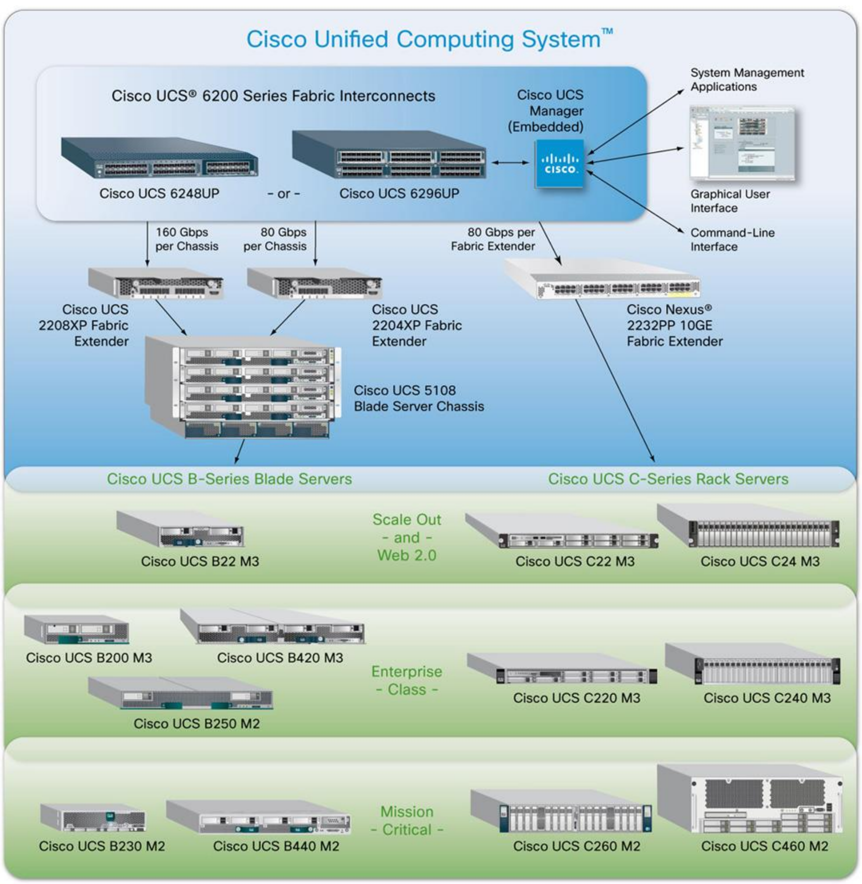
The Cisco UCS C240 M3 further increases performance and customer choice over many types of storage-intensive applications such as:

- Collaboration
- Small and medium-sized business (SMB) databases
- Big data infrastructure
- Virtualization and consolidation
- Storage servers
- High-performance appliances

## Cisco UCS Servers Change the Economics of the Data Center

IT infrastructure matters now more than ever, as organizations seek to achieve the full potential of infrastructure as a service (IaaS), bare metal, virtualized servers, and cloud computing. Cisco continues to lead in data center innovation with the introduction of new building blocks for Cisco Unified Computing System that extend its exceptional simplicity, agility, and efficiency (Figure 2) - Innovations such as the Cisco UCS C240 M3 rack server.

**Figure 2.** Cisco UCS Components



Cisco innovations, such as Cisco UCS Manager, allows administrators to create a software definition for a desired server (using Cisco service profiles and templates) and then instantiate that server and its I/O connectivity by associating a service profile with physical resources. This approach contrasts with the traditional method of configuring each system resource manually, one at a time, through individual element managers. Unlike with the products of other vendors, Cisco service profiles can be moved from rack server to rack or blade server, or between blade or rack servers in different chassis. In other words, Cisco UCS Manager and service profiles are form-factor agnostic.

Other Cisco UCS building blocks include enhanced server I/O options and expanded Cisco UCS fabric interconnects that extend scalability and management simplicity for both blade and rack systems across bare-metal, virtualized, and cloud-computing environments. Cisco helps ensure that nearly all parts of Cisco UCS offer investment protection and are backward compatible. For example, fabric extenders can be upgraded using the same fabric interconnects and same Cisco UCS VIC 1225. Fabric interconnect hardware can be upgraded independently of fabric extenders and blade chassis. Cisco continues to innovate in all these areas, helping ensure that both now and in the future, more powerful, rack servers with larger, faster memory have adequate I/O bandwidth and computing power. Cisco completes this vision through continuous innovation in VIC, ASIC, fabric extender, fabric interconnect, blade server, blade chassis, rack server technologies and form-factor-agnostic Cisco UCS Manager software that ties all these ever-advancing hardware pieces together.

The Cisco UCS C240 M3 is also part of a large family of rack servers: the Cisco C-Series Rack Servers. Designed to operate both in standalone environments and as part of Cisco UCS, the Cisco UCS C-Series servers employ Cisco technology to help customers handle the most challenging workloads. The Cisco UCS C-Series complements a standards-based unified network fabric, Cisco Data Center VM-FEX virtualization support, Cisco UCS Manager Software, Cisco fabric extender and fabric interconnect architectures, and Cisco Extended Memory Technology. Again, Cisco is innovating across all these technologies. With Cisco UCS architectural advantages, software advances, continuous innovation, and unique blade server and chassis designs, Cisco UCS is the first truly unified data center platform. In addition, Cisco UCS can transform IT departments through policy-based automation and deep integration with familiar systems management and orchestration tools.

## Features and Benefits

The Cisco UCS C240 M3 is one of the first rack servers available anywhere with a built-in entry point to unified computing. Table 1 summarizes the features and benefits of the Cisco UCS C240 M3 Rack Server.

**Table 1.** Features and Benefits

| Feature | Benefit |
|---|---|
| **10-Gbps unified network fabric** | • Low-latency, lossless, 10-Gbps Ethernet and industry-standard FCoE and native Fibre Channel fabric<br>• Wire-once deployment model in which changing I/O configurations no longer means installing adapters and recabling racks and switches<br>• Fewer interface cards, cables, and upstream network ports to purchase, power, configure, and maintain |
| **Virtualization optimization** | • Cisco Data Center VM-FEX and Adapter-FEX technologies, I/O virtualization, and Intel Xeon processor E5-2600 and E5-2600 v2 product family features, extending the network directly to virtual machines<br>• Consistent and scalable operational model<br>• Increased security and efficiency with reduced complexity |

| Feature | Benefit |
|---|---|
| **Unified management (when integrated into Cisco Unified Computing System)** | • Entire solution managed as a single entity with Cisco UCS Manager, improving operation efficiency and flexibility<br>• Service profiles and templates that implement role- and policy-based management, enabling more effective use of skilled server, network, and storage administrators<br>• Automated provisioning and increased business agility, allowing data center managers to provision applications in minutes rather than days<br>• Capability to move virtual machines and their security features and policies from rack to rack or rack to blade or blade to blade |
| **Intel Xeon processor E5-2600 and E5-2600 v2 product families** | • Automated energy efficiency reduces energy costs by automatically putting the processor and memory in the lowest available power state while still delivering the performance required and flexible virtualization technology that optimizes performance for virtualized environments, including processor support for migration and direct I/O<br>• Up to twice the performance for floating-point operations. Intel Advanced Vector Extensions (AVX) provides new instructions that can significantly improve performance for applications that rely on floating-point or vector computations<br>• Cisco C-Series servers keep pace with Intel Xeon processor innovation by offering the latest processors with an increase in processor frequency and improved security and availability features. With the increased performance provided by the Intel Xeon processor E5-2600 and E5-2600 v2 product families, Cisco UCS C-Series servers offer an improved price-to-performance ratio, making Cisco UCS servers among the best values in the industry<br>• Advanced reliability features, including Machine Check Architecture Recovery, automatically monitor, report, and recover from hardware errors to maintain data integrity and keep mission-critical services online<br>• Hardened protection for virtual and cloud Environments: Establish trusted pools of virtual resources with Intel® Trusted Execution Technology (Intel® TXT). Intel TXT ensures that physical servers and hypervisors boot only into cryptographically verified “known good states.” It safeguards your business more effectively by protecting your platform from the insertion of malware during or prior to launch |
| **High-capacity, flexible internal storage** | • Up to 12 LFF or 16/24 SFF front-accessible, hot-swappable, SAS, SATA, or SSD drives for local storage, providing redundancy options and ease of serviceability<br>• Balanced performance and capacity to meet application needs:<br>◦ SATA SSDs<br>◦ 15,000 RPM SAS drives for highest performance<br>◦ 10,000 RPM SAS drives for high performance and value<br>◦ 7200-RPM SATA drives for high capacity and value |
| **RAID 0, 1, 5, 6, 10, 50, and 60 support** | A choice of RAID controllers to provide data protection for up to 12 or 24 SAS, SATA, or SSD drives in PCIe and mezzanine card form factors |
| **Cisco UCS C-Series Integrated Management Controller (CIMC)** | • Web user interface for server management; remote keyboard, video, and mouse (KVM); virtual media; and administration<br>• Virtual media support for remote CD and DVD drives as if local<br>• Intelligent Platform Management Interface (IPMI) 2.0 support for out-of-band management through third-party enterprise management systems<br>• Command-line interface (CLI) for server management |
| **Fast-memory support** | 24 DIMM slots supporting up to 1866 MHz of memory for optimal performance |
| **Redundant fans and power supplies** | • Dual-redundant fans and power supplies for enterprise-class reliability and uptime<br>• Power efficiency through Cisco Common Form-Factor Platinum Power Supplies (650W or 1200W or 930W DC) |
| **5 PCIe 3.0 slots** | • Flexibility, increased performance, and compatibility with industry standards<br>• PCIe 3.0 slots, which are estimated to substantially increase the bandwidth over the previous generation and offer more flexibility while maintaining compatibility with PCIe 2.0<br>• 2 PCIe generation 3 x16 slots: both full height, and three-quarters length (10.5-in)<br>• 3 PCIe generation 3 x8 slots: 1 full height and three-quarters length, 1 full height and half length, and 1 half height and half length |
| **Integrated quad-port Gigabit Ethernet** | • Outstanding network I/O performance and increased network efficiency and flexibility<br>• Increased network availability when configured in failover configurations |
| **Trusted Platform Module (TPM)** | • TPM is a chip (microcontroller) that can securely store artifacts used to authenticate the platform (server). These artifacts can include passwords, certificates, or encryption keys<br>• TPM can also be used to store platform measurements that help ensure that the platform remains trustworthy, helping ensure authentication and authorization |
| **Tool-free access** | • Enhanced serviceability through tool-free access to all serviceable items and color coded indicators to guide users to hot-pluggable and serviceable items |

| Feature | Benefit |
| --- | --- |
| **Cisco Flexible Flash (FlexFlash)** | • The server supports up to two internal Cisco FlexFlash drives (secure digital [SD] cards)<br>• The first SD card is preloaded with 4 virtual drives, which contain the Cisco Server Configuration Utility, the Cisco Host Upgrade Utility, the Cisco C-Series server drivers set, and a blank virtual drive on which you can install an OS or a hypervisor. The second SD card is blank and can be used to mirror the first SD card |
| **GPU Virtualization Support** | Offload graphics and compute processing from the C240 M3 server CPU to the NVIDIA Kepler™ enabled GPU and accelerate applications in physical and virtualized environments. For details, refer to NVIDIA Grid K1 and K2 datasheet |

## Product Specifications

Table 2 lists the specifications for the Cisco UCS C240 M3 server.

**Table 2.** Product Specifications

| Item | Specification |
| --- | --- |
| **Processors** | • 1 or 2 Intel Xeon processor E5-2600 or E5-2600 v2 product families<br>• For a complete list of processor options, please refer to the corresponding SFF SpecSheet or LFF SpecSheet |
| **Memory** | • 24 DIMM slots<br>• Support for DDR3 registered DIMMs<br>• Support for DDR3 low-voltage DIMMs<br>• Advanced error-correcting code (ECC)<br>• Mirroring option |
| **PCIe slots** | • 5 PCIe generation-3 slots:<br>◦ 2 PCIe Generation 3, x16 slots: both full height, 3/4 length (10.5-in);<br>◦ 2 PCIe Generation 3, x8 slots: one full height,1/2 length and one full height 3/4 length;<br>◦ 1 PCIe Generation 3, x8 slots: 1/2 height and 1/2 length |
| **RAID card** | • For a complete list of RAID options, please refer to the corresponding SFF SpecSheet or LFF SpecSheet |
| **Hard drives** | Up to 24 front-accessible, hot-swappable, 2.5-inch SAS, SATA or SSD or up to 12 front-accessible, hot-swappable, 3.5-inch SAS, SATA drives |
| **Hard disk options** | **2.5-inch SFF drive options:**<br>• For a complete list of drive options, please refer to the corresponding SFF SpecSheet<br>**3.5-inch LFF drive options:**<br>• For a complete list of drive options, please refer to the corresponding LFF SpecSheet |
| **Cisco Flexible Flash (FlexFlash) Internal USB** | The server supports up to two internal 16GB Cisco FlexFlash drives (SD cards). One SD card is preloaded with four virtual drives. The four virtual drives contain, respectively, the Cisco Server Configuration Utility, the Cisco Host Upgrade Utility, the Cisco C-Series server drivers set, and a blank virtual drive on which you can install an OS or a hypervisor. The second SD card is blank and can be used to mirror the first SD card. |
| **Internal USB** | The server supports one internal USB flash drive |
| **Cisco UCS Integrated Management Controller** | • Integrated Emulex Pilot-3 Baseboard Management Controller (BMC)<br>• IPMI 2.0 compliant for management and control<br>• One 10/100/1000 Ethernet out-of-band management interface<br>• CLI and WebGUI management tool for automated, lights-out management<br>• KVM |
| **Front-panel connector** | One KVM console connector (supplies 2 USB, 1 VGA, and 1 serial connector) |
| **Front-panel locator LED** | Indicator to help direct administrators to specific servers in large data center environments |
| **Additional rear connectors** | Additional interfaces including a VGA video port, 2 USB 2.0 ports, 1 Gigabit Ethernet dedicated management port, quad 1 Gigabit Ethernet ports, and an RJ-45 serial port |
| **Physical dimensions (HxWxD)** | 2RU: 3.4 x 17.5 x 28.0 in. (8.7 x 44.5 x 71.2 cm) |
| **Temperature: Operating** | 41 to 104° F (5 to 40° C) derate the maximum temperature by 1°C per every 305 m of altitude above sea level |
| **Temperature: Nonoperating** | -40 to 158°F (-40 to 70°C) |

| Item | Specification |
|---|---|
| **Humidity: Operating** | 10 to 90% noncondensing |
| **Humidity Nonoperating** | 5 to 93% noncondensing |
| **Altitude: Operating** | 0 to 10,000 ft (0 to 3000m); maximum ambient temperature decreases by 1°C per 300m) |
| **Altitude: Nonoperating** | 40,000 ft (12,000m) |

## Regulatory Standards

Table 3 lists regulatory standards compliance information.

**Table 3.** Regulatory Standards Compliance: Safety and EMC

| Specification | Description |
|---|---|
| **Safety** | • UL 60950-1 No. 21CFR1040 Second Edition<br>• CAN/CSA-C22.2 No. 60950-1 Second Edition<br>• IEC 60950-1 Second Edition<br>• EN 60950-1 Second Edition<br>• IEC 60950-1 Second Edition<br>• AS/NZS 60950-1<br>• GB4943 2001 |
| **EMC: Emissions** | • 47CFR Part 15 (CFR 47) Class A<br>• AS/NZS CISPR22 Class A<br>• CISPR2 2 Class A<br>• EN55022 Class A<br>• ICES003 Class A<br>• VCCI Class A<br>• EN61000-3-2<br>• EN61000-3-3<br>• KN22 Class A<br>• CNS13438 Class A |
| **EMC: Immunity** | • EN55024<br>• CISPR24<br>• EN300386<br>• KN24 |

## Ordering Information

For a complete list of options, please refer to the corresponding SFF SpecSheet or LFF SpecSheet.

## Cisco Unified Computing Services

Using a unified view of data center resources, Cisco and our industry-leading partners deliver services that accelerate your transition to a Cisco UCS C-Series Rack Server solution. Cisco Unified Computing Services helps you quickly deploy the servers, optimize ongoing operations to better meet your business needs, and migrate to Cisco's unified computing architecture. For more information, visit http://www.cisco.com/go/unifiedcomputingservices.

## For More Information

Please visit http://www.cisco.com/go/unifiedcomputing.

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