Cisco Solutions for Virtualization in Midsize Organizations

White Paper

What You Will Learn

This document provides an overview of the Cisco® Virtualized Foundation Smart Solution, an end-to-end solution for server and network infrastructure. The document discusses the IT challenges addressed by the solution, the business and technology benefits that the solution delivers, and the three key design elements that make the solution compelling for midsize organizations. The solution lets organizations:

- Unify the network: Reduce network costs and streamline network infrastructure by consolidating traffic onto a single, high-performance network.
- Simplify computing and management: Dramatically improve ease of use and lower operating costs.
- Deploy end-to-end virtualization: Support rapid application growth and accelerate new service delivery.

Introduction

Organizations need their applications to be highly available with minimal planned downtime, and to recover quickly from any unplanned outages. To be competitive, they need to be agile, dynamic, and efficient. Organizations of all sizes need to reduce the complexity of their IT infrastructure while lowering their costs and enabling flexible and agile IT service delivery. Consequently, they need to determine how their IT infrastructure can maximize the resources available and be more responsive to the business.

Virtualization of IT infrastructure can yield significant benefits in business agility, cost savings, and ease of management. However, virtualization can also create challenges. Planning, deploying, and operating complex virtualized server rooms and data centers on an ad-hoc basis can exceed budget and staff resources.

The Cisco Virtualized Foundation Smart Solution provides midsize companies with a blend of innovative Cisco products and fully tested reference architectures to achieve the full potential of IT. It can help IT become a strategic business resource that enables the fast delivery of new services using scalable, agile, and cost-efficient infrastructure. The solution is built on the end-to-end reference architectures, device configurations, and best practices of the Cisco Smart Business Architecture (SBA). Together with Cisco and partner services, support, and technologies, the solution simplifies deployment, lowers cost, and alleviates the risk associated with ad-hoc approaches.

IT Challenges

The Cisco Virtualized Foundation Smart Solution provides a tested, cost-effective approach that addresses these critical IT challenges:

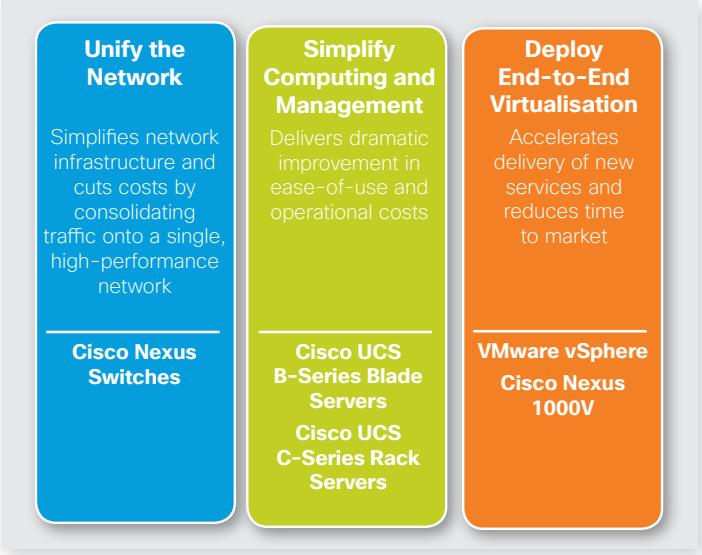
- Reliable access to information: Strategic architectural design increases application availability and user productivity, which can improve customer satisfaction and company profitability.
- Security of critical data: Protecting sensitive and confidential data from malware and hacker attacks is important for regulatory compliance and to build customer trust.
- Support for rapid application growth: Only days, not months, should be needed to scale existing applications to support traffic and user growth and rapid deployment of new applications, enhancing business agility and reducing costs.
- Optimization of server resources: The significant hidden costs of underutilized server processing can prevent an organization from optimizing its investment in existing servers and making full use of its budget for efficient overall growth.
- Control over cost of deploying new IT infrastructure: Use of proven reference architectures and device configurations based on best practices and rigorous testing helps organizations predict and control deployment costs.
- Management of expanding storage requirements: Offloading data storage from individual servers to a centralized storage system helps control costs and accelerates data mirroring, backup, and restore operations.
- Investment protection for critical storage assets: Potential cost-saving solutions must consider the significant investment in storage infrastructure and management tools, staff training and expertise, and established processes for handling and protecting data.

Key Design Elements of the Cisco Solution

Implementing the Cisco Virtualized Foundation Smart Solution enables on-demand provisioning from shared pools of physical and virtual resources and supports more efficient resource management. Combining the power of Cisco Unified Fabric with the innovations of the Cisco Unified Computing System™ (Cisco UCS®), Cisco's fully integrated IT infrastructure was designed specifically for virtualization, not retroactively adapted to accommodate it.

The solution's proposed design approach includes three key elements (Figure 1) for an IT architecture that is right-sized for midsize organizations and fully integrated for optimal business agility and return on investment (ROI).

Figure 1 Three Elements of Virtualization



Unify the Network

A key goal for IT managers is to increase data center productivity. Business opportunities can be lost if IT cannot implement business initiatives quickly and efficiently. By reducing operational complexity, data center managers can shift IT staff resources from maintenance to deployment. In addition, IT needs to address network integration and cabling complexity, increasingly bandwidth-intensive multimedia applications, rapid storage growth, and rising energy costs. IT managers need a reliable and homogeneous network that can handle any device on any port, including all server form factors (blades and racks), storage arrays (network-attached storage [NAS], Fibre Channel, and Small Computer System Interface over IP [iSCSI]), etc., and is ready for virtualization.

The first design element of the Cisco Virtualized Foundation Smart Solution unifies the network infrastructure. This consolidation helps organizations reduce networking costs, provide users with reliable access to information, secure critical data, and manage growing data storage requirements.

The core of the Cisco Virtualized Foundation Smart Solution network is built with Cisco Nexus® 5000 Series Switches, which dramatically consolidate multiple server and storage connections, including IP and SAN, into a streamlined, unified network. Cisco Nexus 5000 Series Switches are designed to support virtualization and virtual machine mobility by mapping virtual machines to network profiles, allowing network services to be allocated on a per-virtual machine basis centrally from the unified fabric. This capability to move virtual machines and network profiles together eases manageability, increases isolation, and enables consistent network and security policies. The Cisco Nexus 5000 Series is an excellent platform for building a scalable, high-performance backbone that supports a diverse range of business requirements.

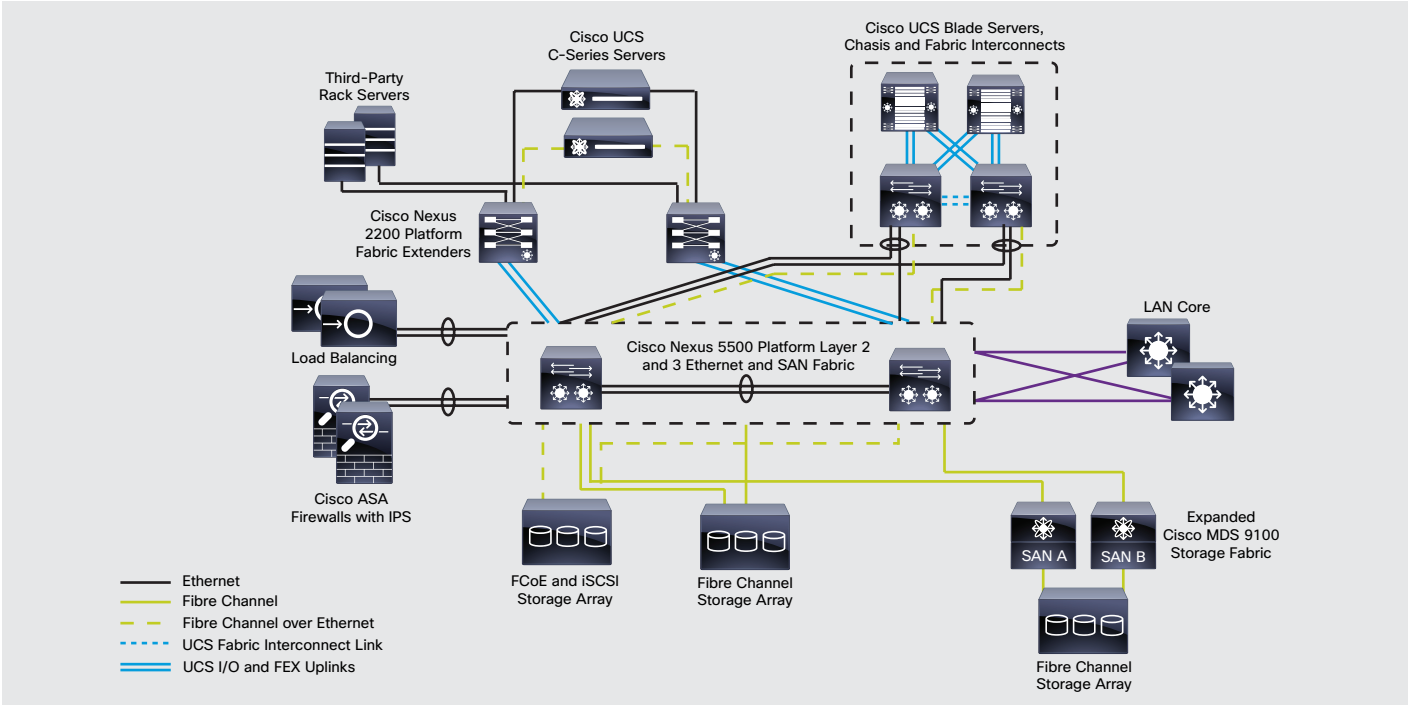
Cisco Nexus 5000 Series Switches are part of the Cisco Unified Fabric portfolio which supports traditional LAN traffic and all types of storage traffic, tying everything together with a single OS (Cisco NX-OS Software), a single management GUI, and full interoperability between the Ethernet and non-Ethernet portions of the network. The unification of these networks can enhance security and increase bandwidth. It includes the following elements:

- Ethernet infrastructure
- Storage networking
- Network security

Ethernet Infrastructure

As the network foundation of the Cisco solution, Cisco Nexus 5000 Series Switches (Figure 2) provide a standards-based, multipurpose, multiprotocol, Ethernet-based fabric. The innovative, extensible switch fabric combines application and storage traffic onto one platform. Its fully redundant design enhances business resilience and supports greater operational continuity through the Cisco NX-OS operating system.

Figure 2 Unify the Network with Cisco Nexus 5000 Series Switches



Storage Networking

Centralized data storage eases the challenges of exponential data growth by separating data repositories from individual servers. The Cisco Nexus 5000 Series offers unified ports that support traditional Ethernet IP traffic, Fibre Channel over Ethernet (FCoE), and native Fibre Channel storage traffic. This flexibility enables the network to support multiple storage networking technologies, including SAN, NAS, and iSCSI. The integrated design reduces the need for rack space and decreases deployment costs.

Network Security

A pair of Cisco ASA 5585-X Adaptive Security Appliances provides resilient firewall and optional intrusion prevention system (IPS) functionality. The pair interconnects with the Cisco Nexus switch fabric to create a firewall that protects the server room and data center from malware, snooping, and other attacks.

Benefits of Unifying Your Network

A unified network infrastructure delivers the following benefits:

- Ease of deployment: With Cisco's fabric-based infrastructure, individual infrastructure components are wired into the network only once and subsequently deployed and redeployed using software, eliminating many manual configuration tasks.
- Cost effectiveness: Integration of network, storage, computing, security, and management resources into a single unified system eliminates redundant components and reduces infrastructure costs and operating complexity.
- Flexibility and scalability: With wire-once deployment, configuration changes can be quickly performed through management software, allowing the organization to respond more rapidly and cost effectively to changing business requirements.
- Resiliency: Cisco's converged network, based on Cisco NX-OS, is inherently more reliable and contains fewer connections, switches, and cables, decreasing possible points of failure.
- Ease of management: Cisco's unified design creates a single platform for managing application, storage, computing, and network assets as a single resource. A single operating environment, Cisco NX-OS, runs across both Ethernet and storage networks for easier management of security, bandwidth, latency, and other network services for applications.

Simplify Computing and Management

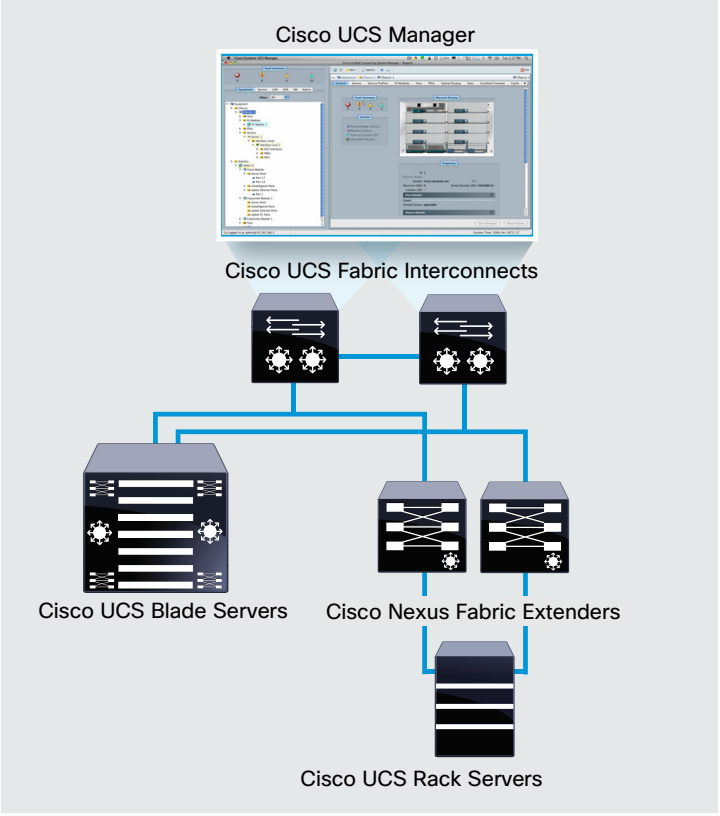
As IT departments shift to provide services through a dynamic, self-service, pay-as-you-go cloud-computing model, they need to support applications running in both bare-metal and virtualized environments. The problems they face include:

- Complex and siloed infrastructure: The infrastructure that results from manual assembly of components is complex and inflexible and does not adapt dynamically to changing workload demands and business requirements.
- Fragmented management: Traditional systems are configured using a collection of individual management tools on discrete management servers that together do not provide an automated, end-to-end way to configure both rack and blade servers all the way from firmware revisions to I/O connectivity.
- Costly scaling: Most blade systems in use today incorporate all the supporting network infrastructure and management points that would normally service an entire rack. As the number of blades increases, cost and complexity escalates.
- Inconsistent switching protocols: Typical virtualized environments include hypervisor-based software switches, blade-server-resident switches, and access-layer switches, often each one having unique features and management interfaces.

To attain the most efficient flexibility, scalability, and resilience from a virtualized IT infrastructure, the second design element of the Cisco Virtualized Foundation Smart Solution optimizes computing resources with a single integrated architecture. This converged architecture enables end-to-end server visibility, management, and control with a single point of management. It combines Cisco networking innovations, converged management, storage access, and industry-leading Intel processors in both blade and rack-mount server configurations. The Cisco UCS solution costs less to deploy and operate than traditional servers, because it requires fewer switches, cables, adapters, and management tools. It helps reduce complexity, power requirements, and cooling costs. Cisco UCS radically simplifies the way that users deploy and manage servers and networks, supporting rapid application growth and scalable business continuance capabilities.

This highly scalable solution consists of a resilient pair of Cisco UCS Fabric Interconnect modules (Figure 3) that provide the management and communication backbone and can support Cisco Blade Server Chassis and C-Series Rack Servers. Additionally, Cisco UCS Fabric Extenders enable the switching access layer to extend and expand all the way to the server hypervisor. Fabric extender technology enables support for multiple architectures, whether physical, virtual, or cloud. It enables the architecture to scale as the business grows, with increased numbers of applications, virtual machines, and servers.

Figure 3 Cisco UCS Single-Wire Connectivity



Embedded in the fabric interconnects is Cisco UCS Manager. Cisco UCS Manager provides unified, embedded management of all software and hardware components of Cisco UCS across multiple chassis, Cisco UCS B-Series Blade Servers and C-Series Rack Servers, and thousands of virtual machines. By enabling automation, Cisco UCS Manager delivers greater agility, integration, and scale for server operations, while reducing complexity and risk. It provides flexible role- and policy-based management with service profiles and templates. Through its simplified, ecosystem-friendly approach, Cisco UCS Manager helps reduce management and administration expenses, which are among the biggest expenses in most IT budgets.

Smaller IT environments may find deployment of Cisco UCS C-Series Rack Servers more cost effective. The Cisco UCS C-Series is also a good choice for applications that require the faster performance of local data storage in multiple server disk drives. Cisco offers servers with a large memory capability for demanding virtualization and large-data-set workloads and a more cost-effective memory footprint for less-demanding workloads.

Deploy End-to-End Virtualization

Virtualization technology simplifies management of the entire server room or data center. It decouples managed assets and services from the physical infrastructure and separates hardware management from software management. It consolidates physical servers, storage, and networking components into a single asset pool, enabling administrators to immediately allocate and reallocate resources to software services on demand. End users see resources as if they were dedicated to them, and administrators can manage and optimize resources to meet business requirements in minutes instead of days.

Although virtualization promises compelling benefits, it also has created challenges, including:

- A proliferation of interfaces, cables, and upstream switch ports to support each server, adding cost and complexity
- Multiple layers of hardware and software switching that makes management difficult
- Too many management points, making it difficult to manage quality of service (QoS) and maintain security
- Scalability made difficult by the amount of time needed to configure servers and integrate them into the network infrastructure
- Performance hampered by the overhead of virtualized environments and constraints on resources

The third design element of the Cisco Virtualized Foundation Smart Solution delivers on the promise of virtualization by providing a single integrated architecture. It deploys virtualized networking components alongside VMware virtualization solutions to simplify the deployment of new hosts and virtual machines. This integrated design reduces day-to-day operational complexity compared to other virtualized environments and provides outstanding flexibility and control.

The VMware solution allows administrators to run multiple workloads and virtual machines on a single physical server. Each virtual machine consists of an operating system and one or more applications. Administrators can move virtual machines from one physical server to another without application downtime. This capability maintains user productivity while allowing administrators to perform more duties during business hours.

The VMware solution consists of several components:

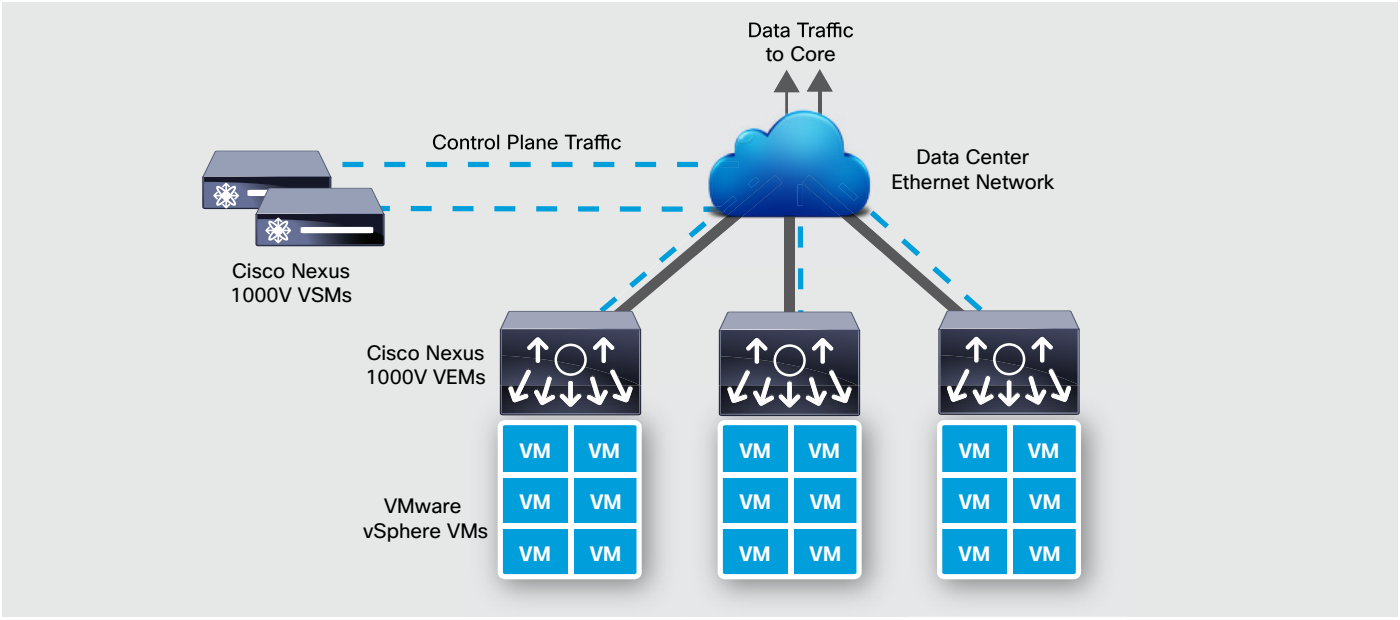
- VMware vSphere: Foundational hypervisor software component that enables creation of virtual machines and application consolidation
- VMware vCenter: Management software for multiple VMware vSphere instances
- VMware High Availability and Fault Tolerance: Resilience modules that provide rapid and automated virtual machine restart and continuous-availability capabilities that maintain the operation of critical applications during hardware failures
- VMware vMotion: Technology that enables live migration of virtual machines from one server to another without disruption or downtime

This solution optimizes performance of VMware virtualization in Cisco UCS environments with a Cisco Nexus 1000V Switch. This software-based switch is designed for hypervisor environments and implements the same Cisco NX-OS operating system as the primary Ethernet switch fabric, allowing consistent operation and support for both physical and virtual switching environments. VMware hypervisor software supports the Cisco Nexus 1000V virtual switch as an integrated part of the VMware vSphere server-virtualization environment.

The Cisco Nexus 1000V virtual switch enables policy-based virtual machine connectivity by using centrally defined port profiles that can be applied to multiple virtualized servers. This capability simplifies deployment of new hosts and virtual machines. When administrators move virtual machines among hardware platforms, virtual machine port configuration automatically migrates too. The virtual switch provides Layer 2 data center access switching to VMware ESX and ESXi hosts and their associated virtual machines.

The two primary components of the Cisco Nexus 1000V solution are the Cisco Nexus Virtual Supervisor Module (VSM), which provides the central intelligence and management of the switching control plane, and the Cisco Nexus Virtual Ethernet Module (VEM), which resides in the hypervisor of each host (Figure 4). Together, the VSM and multiple VEMs compose a distributed logical switch, analogous to a physical chassis-based switch with resilient supervisors and multiple physical line cards. Cisco Virtual Network Link (VN-Link) is a set of features and capabilities in the switch that enable administrators to individually identify, configure, monitor, migrate, and diagnose virtual machine interfaces in a manner that is consistent with the current network operation models for physical servers.

Figure 4 End-to-End Virtualization with Cisco Nexus 1000V Series Switches



Benefits of the Cisco Virtualized Foundation Smart Solution

The Cisco Virtualized Foundation Smart Solution delivers business and technology benefits.

Business Benefits

- Faster infrastructure deployment and service delivery increases business agility and user satisfaction.
- Increased resource utilization holds costs down and improves ROI.
- Scalable architecture supports growth with less expense.

Technology Benefits

- Simplified management increases IT staff productivity.
- Standard infrastructure enables faster scaling with less risk.
- Resilient and secure infrastructure delivers predictable application performance with minimal downtime.

Conclusion

The Cisco Virtualized Foundation Smart Solution helps midsize companies quickly deploy virtualized infrastructure that is scalable, cost efficient, and agile. Underlying the solution are Cisco Unified Fabric and Cisco UCS, which unify network, computing, and storage resources and centralize and simplify infrastructure management. The Cisco Virtualized Foundation Smart Solution builds on Cisco's close relationship with leading hypervisor vendors to deliver a fully tested and comprehensive virtualization foundation that is designed for outstanding flexibility and control. Cisco can help midsize organizations build a virtualized environment that excels today and into the future.

For More Information

Please visit www.cisco.com/go/vfss

Cisco Smart Business Architecture Deployment Guides

Unify the network: Cisco SBA–Data Center Deployment Guide

Simplify computing and management: Cisco SBA–Unified Computing System Deployment Guide

Deploy end-to-end virtualization: Cisco SBA–Virtualization with Cisco UCS, Nexus 1000V, and VMware Deployment Guide

Cisco Nexus Series Switches

Cisco Nexus 5500 Series Switches

Cisco Nexus 1000V Series Switches

Cisco Unified Computing System

Cisco UCS 6100 Series Fabric Interconnects

Cisco UCS 6200 Series Fabric Interconnects

Cisco UCS 2100 Series Fabric Extenders

Cisco UCS 2200 Series Fabric Extenders

Cisco UCS 5100 Series Blade Server Chassis

Cisco UCS B-Series Blade Servers

Cisco UCS C-Series Rack Servers

