

IT Agility Delivered: Cisco Unified Computing System



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Information technology organizations are in the midst of a major transition. As they move from being cost centers to integrated, strategic parts of the business, IT administrators, managers, and executives are keenly aware of the challenges they face.

As IT organizations shift to providing services through an elastic, self-service, pay-as-you-go cloud-computing model, they still must continue to support applications running in bare-metal and virtualized environments. The problems they face include:

- **Manual assembly:** To support every step from server refresh to cloud computing, administrators are still burdened with the time-consuming, error-prone, manual assembly of server, storage, and networking components into infrastructure that supports applications.
- **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.
- **Rack-in-a-box architectures:** Most blade systems in use today incorporate all the supporting network infrastructure and management points that would normally service an entire rack. As the infrastructure is scaled, cost and complexity escalates.
- **Multiple switching layers:** 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. Multiple

switching layers make network traffic even more difficult to observe, manage, and debug in virtualized environments.

While the pace of most industries has been accelerated through the use of standardized components and automation, traditional environments require numerous administrators rushing to configure new servers to keep up with the scale that virtual environments demand.

Changing the Way Organizations Do Business

The Cisco Unified Computing System™ (Cisco UCS™) changes the way organizations do business through policy-based automation and standardization of IT processes. The industry's first unified data center platform, Cisco UCS combines industry-standard x86-architecture blade and rack servers, networking, and enterprise-class management into a single system. The system's configuration is entirely programmable using unified, model-based management to simplify, and accelerate deployment of enterprise-class applications and services running in bare-metal, virtualized, and cloud-computing environments. A unified I/O infrastructure uses a high-bandwidth, low-latency unified fabric to support networking, storage I/O, and management traffic. The Cisco® Fabric Extender Technology (FEX Technology) directly connects the fabric to servers and virtual machines for increased performance, security, and manageability.

IT Agility Delivered: First Unified System Available Anywhere



Cisco UCS is a massively scalable, distributed, unified system with a single point of connectivity and management

First Unified System Available Anywhere

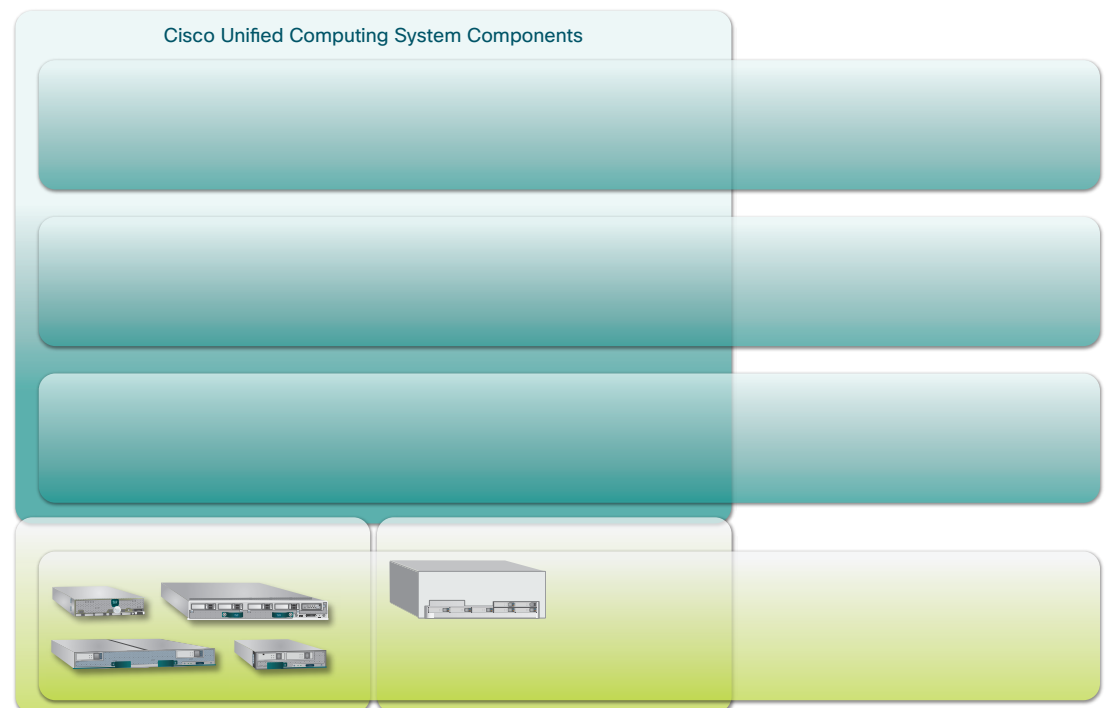
Cisco UCS goes beyond convergence to bring the benefits of centralized computing to the scale-out nature of many of today's applications: simplified management, greater deployment flexibility, and easier scalability. A self-integrating, self-aware system, Cisco UCS consists of a single management domain interconnected by a unified I/O infrastructure. The system is designed as a single virtual blade chassis that incorporates and scales across multiple blade chassis, rack servers, and racks.

Radically Simplified Architecture

The system implements a radically simplified architecture that eliminates the multiple redundant devices that populate traditional blade server chassis and result in layers of complexity: Ethernet switches, Fibre Channel switches, and chassis management modules. Cisco UCS consists of a redundant pair of Cisco 6200 Series Fabric Interconnects that provide a single point of management, and a single point of control, for all I/O traffic.

Lower Cost of Scale

Cisco UCS scales with less cost and less complexity. Instead of expanding the system by adding layers of switching in racks, blade



IT Agility Delivered: First Unified System Available Anywhere



Consolidate 168 Management Points to Two with Cisco UCS

When NetApp needed to deploy a scalable testing cloud capable of hosting 23,000 virtual machines, the company's engineering support services chose Cisco Unified Computing System. The first step consolidated 714 existing servers onto 120 blade servers in a single Cisco UCS platform, reducing 168 management points to just two: the pair of Cisco UCS 6100 Series Fabric Interconnects.

http://www.cisco.com/en/US/solutions/collateral/ns340/ns517/ns224/case_study_NetApp_Cisco_Kilo_Lab.pdf

servers, and hypervisors, Cisco UCS uses low-cost, low-energy-consuming fabric extenders to connect the data and management planes directly to blade and rack servers. Cisco fabric extenders bring up to 160 Gbps of network, storage, and management bandwidth to each chassis, and multiple 10-Gbps connections to each rack-mount server. This significant reduction in components enables a lower-cost, more graceful scaling model in which the per-server infrastructure cost, including the cost of blade chassis and switching, is as little as half that of HP blade servers. (See "Scale at Half the Cost and Complexity" on page 10.)

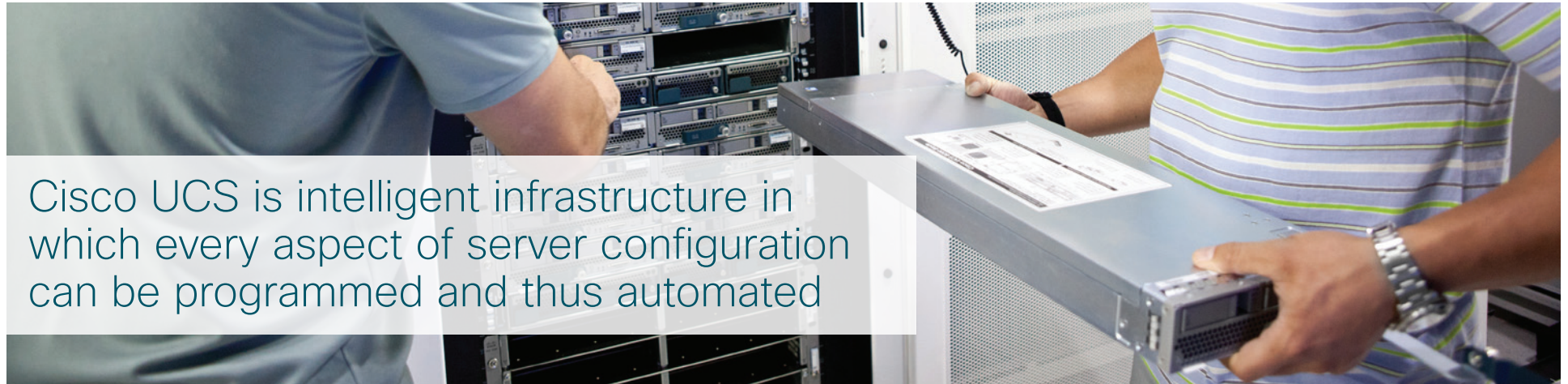
Industry-Standard x86-Architecture Servers

Cisco UCS servers are industry-standard, x86-architecture blade and rack systems that are powered exclusively by Intel® Xeon® processors. These industry-standard servers deliver world-record performance to power mission-critical workloads. Cisco servers, combined with a simplified, unified architecture, promote increased IT productivity and a superior price-to-performance ratio for lower total cost of ownership (TCO).



Intel Xeon processors are designed to solve the mission-critical IT challenge of managing and keeping business-critical data secure. Powerful, reliable Cisco UCS servers are equipped with the top-of-the-line Intel Xeon processor E7 family to power the most critical business needs, and with the versatile Intel Xeon Processor E5 family to power the core of a flexible, efficient data center. These processors help businesses quickly adapt to short-term changes in business demands while addressing requirements for long-term business growth. Advanced reliability and security features work to maintain data integrity, accelerate encrypted transactions, and increase the availability of mission-critical applications.

IT Agility Delivered: Intelligent Infrastructure



Cisco UCS is intelligent infrastructure in which every aspect of server configuration can be programmed and thus automated

Intelligent Infrastructure Means Rapid Deployment

“... we can very quickly reconfigure any server blade so that it's ready for production in 15–20 minutes. Rapid configuration is critical in our environment, where a server outage is simply unacceptable.”

Ken Brande
Vice President, IT
NightHawk Radiology Services

http://www.cisco.com/en/US/solutions/collateral/ns340/ns517/ns224/case_study_c36_604664_ns944_Networking_Solutions_Case_Study.html

Intelligent Infrastructure

Cisco UCS does for physical infrastructure what hypervisors do for virtual machines: it allows physical infrastructure to be built and configured automatically through software rather than through the tedious, manual, error-prone configuration of individual components using separate element managers.

Automated Configuration

Cisco UCS is intelligent infrastructure in which server identity, personality, and I/O connectivity is abstracted from the hardware and can be applied on demand, allowing any workload to run on any server at a moment's notice. Cisco UCS is designed so that every aspect of a server's configuration, from firmware revisions and BIOS settings to network profiles, can be assigned through the system's open, documented, standards-based XML API. This API can be accessed through the Cisco UCS Manager GUI, through a comprehensive ecosystem of third-party management and orchestration tools, or directly through custom

software—all of which help organizations achieve even greater operational scale.

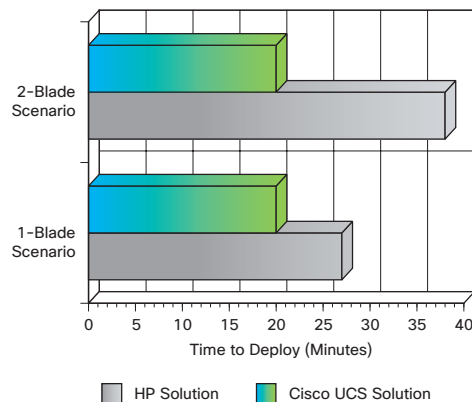
Increased Agility and More Uptime

Intelligent infrastructure results in exceptional business agility because any resource can be used for any purpose based on policies and business needs. Repetitive tasks are automated, increasing resource utilization by speeding servers from the loading dock into production. Servers no longer have to be dedicated to a single specific function because server and adapter firmware levels can be adjusted dynamically to make any server available to run any workload in minutes, rather than the hours or days needed using traditional processes. At one moment a Cisco UCS server can propel a bare-metal database instance, and later the same server can be repurposed and joined into a pool of servers supporting a cloud-computing environment. Ideal for cloud-computing environments, Cisco UCS can support service catalogs with bare metal or virtual machines.

IT Agility Delivered: Integrated, Model-Based Management

Model-Based Management Automates IT

Cisco UCS B250 M2 Extended Memory Blade Servers can be integrated in nearly half the time it takes to add HP c-Class blade servers with HP Virtual Connect, with 67 percent fewer steps, taking advantage of the largely automated process.



Principled Technologies, March 2011
(http://principledtechnologies.com/clients/reports/Cisco/UCS_vs_HP_Deployment.pdf)



Integrated, Model-Based Management

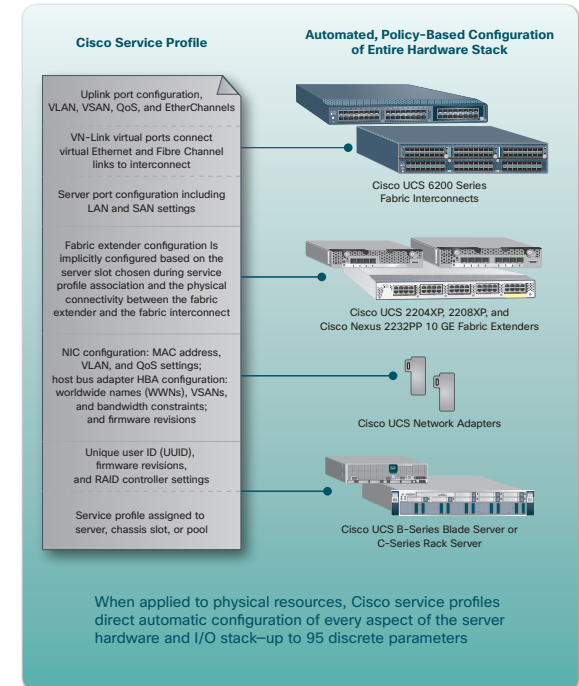
Cisco UCS uses integrated, model-based management to provision servers automatically. Simply by associating a model with system resources, IT organizations can consistently align policy, server personality, and workloads. The result is increased IT staff productivity, improved compliance, increased availability, and reduced risk of failures due to inconsistent configurations.

Self-Aware, Self-Integrating Infrastructure

Cisco UCS Manager recognizes components as they are connected to the system and incorporates them into an abstract model that includes every available resource. The model is always an accurate representation of the system and can be extracted into configuration management databases in support of ITIL processes. In contrast to traditional systems, in which manual tracking of system resources is required, Cisco UCS Manager maintains its inventory automatically and accurately.

Automation with Cisco Service Profiles

Administrators create models of desired server and I/O configurations in the form of Cisco service profiles. When a



IT Agility Delivered: Integrated, Model-Based Management



service profile is associated with a physical server, its entire configuration is provisioned automatically, from firmware revisions to network and I/O connectivity. Service profiles can be created for specific serial numbers, essentially preconfiguring them before they arrive on the loading dock: install the rack-mount server or insert the blade server into a blade-chassis slot, and the system discovers it and configures it automatically.

Cisco service profile templates describe policies for creating service profiles, empowering administrators to create 100 server configurations as easily as they create one. This approach contrasts significantly with the manual approach of configuring each component with a separate element manager, or the use of incomplete management tools that handle some, but not all, server configuration steps.

Policy-Based Server Configuration

Model-based management has a profound effect on data center operations. Through Cisco UCS Manager's role- and policy-based management, senior system

administrators can define policies that dictate how to configure specific server types. These policies can be created once and then used by administrators with any level of experience to deploy servers. Experienced administrators are free to focus on strategic business initiatives, while lower-level administrators have the power to deploy servers quickly and accurately. It is impossible to create an inconsistent configuration. Cisco UCS Manager validates model consistency before configuring a server. Consistency accelerates problem resolution, because if a failure occurs, a service can be rehosted on an alternative server in minutes. If the problem is resolved, it was a hardware issue; if not, it was a software issue.

Preserves Data Center Roles

Cisco UCS Manager promotes visibility and collaboration between server, network, and storage administrator roles while allowing role definitions to be changed to align with any organization's division of labor. Cisco UCS Manager provides the single point of management for the entire system, and it also

aggregates element management and monitoring, allowing traditional enterprise management tools to obtain status information about every system component with only a single query, further increasing operational scale.



IT Agility Delivered: Unified Fabric



The system's unified fabric unites data and management planes and network and storage traffic

Cut Switching Infrastructure in Half with FCoE

Chinese University of Hong Kong transformed its IT infrastructure with a unified fabric implemented with the Cisco Unified Computing System and Cisco Nexus® switches. The new architecture using FCoE allowed Chinese University to reduce the number of Ethernet and Fibre Channel switches by up to 50 percent, with a savings of up to 80 percent in cabling and rack space compared to a traditional data center.

http://www.cisco.com/en/US/solutions/collateral/ns340/ns517/ns224/cuhk_case_study.pdf

Unified Fabric

Cisco UCS is designed with a unified fabric that condenses three network types—IP, storage, and management—into one. This “wire-once” philosophy means that the system is wired only once, when it is installed, with bandwidth allocations and I/O configurations managed dynamically through the system’s embedded management features. Since all servers are physically wired with the same 10 Gigabit Ethernet and Fibre Channel over Ethernet (FCoE) network, they all can host the same workloads simply by changing configurations through software. This “zero-touch” approach increases business agility because connectivity is uniform, and therefore hardware configurations no longer limit the applications that can be supported. The use of a single network technology reduces rack-level infrastructure costs by up to two-thirds by eliminating discrete Fibre Channel, interprocess communication, and management networks.

Transparency with Cisco Virtual Interface Cards

Inside each server, Cisco virtual interface cards (VICs) can make the unified fabric’s existence completely transparent by presenting both Ethernet network interface cards (NICs) and Fibre Channel host bus adapters (HBAs) to the host operating system or hypervisor. This approach facilitates the use of existing drivers, management tools, and data center best practices. The fabric interconnects can pass storage traffic onto native Fibre Channel SANs and can connect directly to FCoE-capable storage systems.

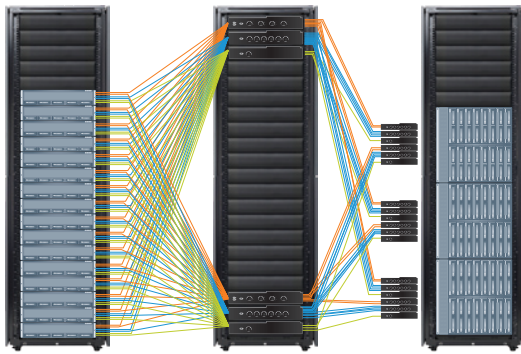
The standards-based, high-bandwidth, low-latency unified fabric is supported by up to two Cisco fabric interconnects, that provide cut-through switching and lossless handling of FCoE traffic for faithful support of Fibre Channel protocols. The fabric has sufficiently low latency to fully support interprocess communication mechanisms that are essential for applications, including high-performance computing, high-frequency trading applications, and parallel database management systems.

IT Agility Delivered: Unified Fabric

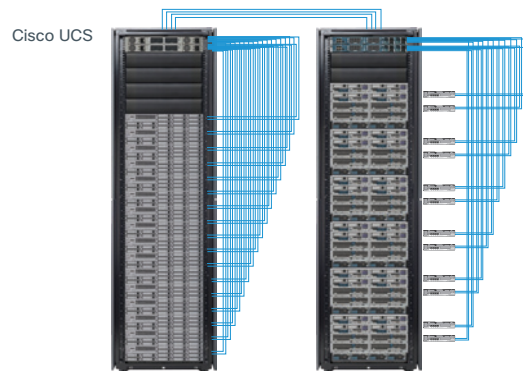
Unified Fabric Yields Massive Infrastructure Reduction

Traditional rack and blade server environments use separate infrastructure for IP, storage, and management networks, resulting in a massive number of cables, I/O interfaces, and upstream switch ports to support the servers. Total number of network cables in this example: 138.

Traditional Blade and Rack Servers



Cisco's unified fabric carries IP, storage, and management traffic over a single infrastructure, reducing cost and complexity while establishing uniform I/O connectivity to each server. Total number of network cables in this example: 60.



Active-Active Model with Fabric Failover

Internally, the fabric interconnects support three independent networks through an active-active model that allows available bandwidth to be more fully utilized. Fabric failover supports continuous availability even in the event of a single fabric interconnect loss. Externally, the fabric interconnects appear as the system itself. This LAN-safe approach simplifies integration of the system into the data center fabric, in contrast to traditional systems which increase complexity by adding a hierarchy of switches to handle IP, storage, and management networking.

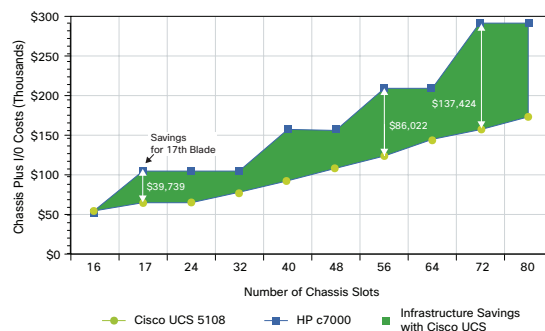
Unified I/O Means Investment Protection

Cisco integrates the unified fabric into Cisco UCS through a modular approach that offers increased investment protection. Customers have already been able to increase the system's external Fibre Channel connection speed from 4 Gbps to 8 Gbps simply by upgrading a single fabric interconnect component. Today, customers can use the universal ports on Cisco UCS 6200 Series Fabric Extenders to connect any port to 10 Gigabit Ethernet or native Fibre Channel networks or to directly connect to FCoE storage devices—all while achieving up to 160 Gbps of bandwidth per server.

IT Agility Delivered: Cisco Fabric Extender Technology

Scale at Half the Cost and Complexity

Server costs are significant, but so is the cost of the infrastructure to support each server. Cisco FEX Technology dramatically reduces the number of interfaces, cables, and switches needed to support Cisco UCS blade servers. The result is that the average per-server infrastructure cost is US\$2343 for Cisco UCS compared to US\$3761 for an HP system.* Every time an HP chassis is added to a rack, it imposes a cost of up to US\$39,739 more than the cost of adding one more chassis to the Cisco Unified Computing System.



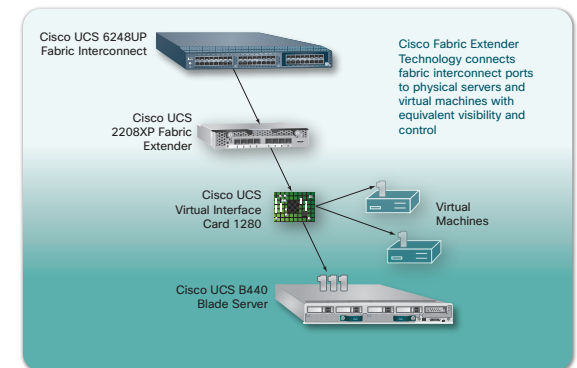
* Based on the Cisco UCS manufacturer's suggested retail price (MSRP) and HP retail price on January 4, 2012.



Cisco FEX Technology condenses switching layers for exceptional visibility and control

Cisco Fabric Extender Technology

Traditional blade servers replicate all of a typical rack's components inside each chassis, escalating customer costs. These chassis host six devices: two Ethernet and two Fibre Channel switches plus two management modules. In Cisco UCS, a single pair of fabric extenders bring the management and data plane of the fabric interconnects to the blade chassis or server rack, condensing up to three network layers into one. The entire system becomes a distributed, virtual blade chassis that incorporates a full range of blade and rack server products able to handle any workload. The integrated system efficiently and consistently manages all network traffic at a single point. Cisco FEX Technology decouples complexity from capacity, enabling Cisco UCS to scale more gracefully and at lower cost.



Directly Connecting Network Fabric to Servers and Virtual Machines

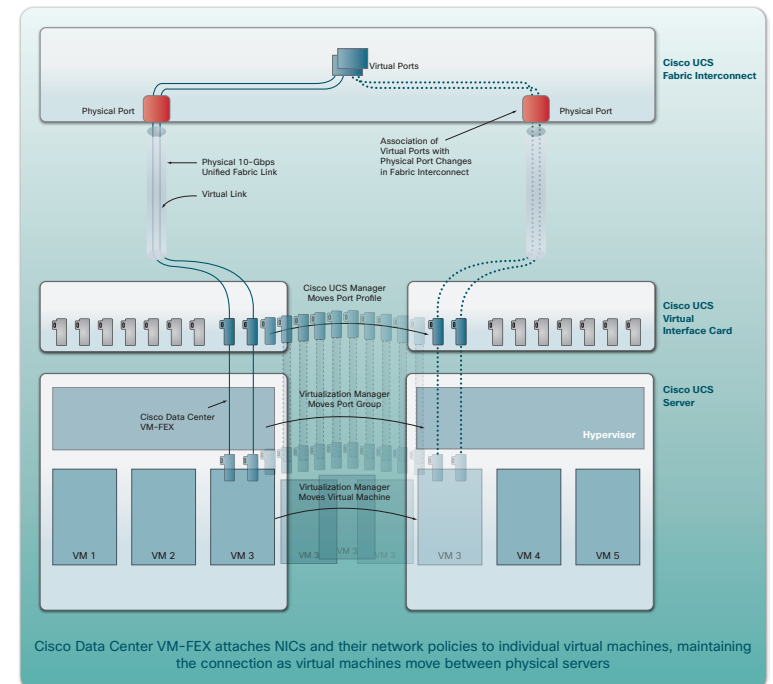
Through Cisco VICs, Cisco FEX Technology brings the network directly to servers and virtual machines using the same technology. These connections terminate in the fabric interconnects as virtual ports that are managed exactly the same way as physical ports. This design combines the performance and management of physical networks with the scalability of virtual networks. Cisco UCS brings exceptional visibility and control over virtual environments, an essential characteristic for scalable, secure, and manageable cloud-computing environments.

IT Agility Delivered: Cisco Fabric Extender Architecture



- **Cisco fabric extenders** directly connect fabric interconnect ports to blade and rack servers. These low-cost, low-power-consuming devices pass all management and data traffic to the fabric interconnects for consistent, centralized management. When used in a top-of-rack configuration, Cisco Nexus 2232PP 10GE Fabric Extenders aggregate in-rack cabling so that only a few uplink cables need to be connected when a new rack of servers is rolled into the data center. Blade chassis are connected directly to the fabric interconnects with only one set of cables supporting management, IP, and storage networks.
- **Cisco VICs** directly connect fabric interconnects to hypervisors, operating systems, and virtual machines. Cisco Data Center Virtual Machine Fabric Extender (VM-FEX) technology directly connects fabric interconnect ports to virtual machines without hypervisor intervention. Virtual NICs are attached to virtual machines, and their network profiles remain constant even as virtual machines are moved from server to server to balance workloads, enhancing mobility and security. Passing all traffic through the fabric interconnects results in consistent latency for I/O traffic between virtual machines. Eliminating the need for hypervisor-based switches can increase network throughput by as much as 38 percent, while making more CPU cycles available to deliver greater application performance.

Cisco FEX Technology helps organizations maintain existing administrator roles as they transition from bare-metal to virtualized to cloud-computing environments. Because the network remains always in the domain of network administrators, Cisco FEX Technology eliminates the overlap of server and network administrator roles that often occurs with traditional blade chassis.



IT Agility Delivered

IT Agility Delivered

Servers using the x86 architecture have essentially become the standard for every application, from enterprise infrastructure to mission-critical applications. While traditional vendors have been focusing on delivering incremental improvements in efficiency, Cisco has been developing technologies that transform the way that IT organizations do business, making them truly more effective as integral parts of the companies they support.

The Cisco Unified Computing System is IT agility delivered. Its Intel Xeon processor-powered servers deliver performance without compromise to workloads running in bare-metal, virtualized, and cloud-computing environments. Through five main technologies, Cisco UCS helps transform the way IT organizations work:

- **Single unified system:** Cisco UCS goes beyond convergence by providing a massively scalable, distributed virtual blade chassis with a single integrated point of connectivity and management.
- **Intelligent infrastructure:** Every aspect of the system's configuration is programmable through an intuitive GUI, third-party management tools, or an open-standard XML API, bringing automation to server configuration.
- **Integrated, model-based management:** The system's model-based management amplifies the knowledge of



subject-matter experts by enabling consistent, error-free alignment of policy, server personality, and workloads.

- **Unified fabric:** The system's high-speed, low-latency unified fabric brings the data and management planes, Ethernet, and FCoE to each blade server, reducing the number of components needed and delivers uniform connectivity to each server.
- **Cisco FEX Technology:** This design condenses three layers of networking into one, providing scalability with less cost and no additional complexity and it brings visibility and control to virtualized environments

Cisco Unified Computing System demonstrates that Cisco innovates in ways that traditional vendors with traditional

product lines cannot. The market has demonstrated the value of Cisco UCS by making Cisco one of the top three x86-architecture blade server vendors in less than two years since the first product shipment. Cisco UCS demonstrates Cisco's dedication to the market and the quality and investment protection built into Cisco products. More important than Cisco's innovations, the market's embrace of the product, or Cisco's corporate value are the business-transforming benefits that Cisco UCS can bring to your organization.

For More Information

Please visit <http://www.cisco.com/go/ucs>.



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