Cisco Unified Computing System and Red Hat Solution: Enable High-Performance, Highly Scalable and Manageable, Peer-to-Peer Web Video Service

What You Will Learn

This solution overview describes a highly successful infrastructure deployment achieved with the combination of Cisco® and Red Hat® technologies by a joint customer to support an on-demand subscription service for peer-to-peer high-definition video content over the Internet. The company's infrastructure requirements included capital and operating cost efficiencies that allowed for modest expenditures, low staffing levels, high uptime, rapid scalability, and integrated management of network, compute, and storage resources.

Solution Components

Solution components from Cisco and Red Hat used in the customer deployment include:

- The Cisco Unified Computing System™ (UCS), which unites computational, network, storage, and virtualization resources into a cohesive system, simplifying its setup, helping customers improve business metrics, and enabling timely resource provisioning
- Red Hat Enterprise Virtualization, which enables the virtualization of up to 96 CPU cores per host and up to 16 virtual CPUs per virtual machine, among many other features
- Red Hat Enterprise Virtualization Manager, which provides central management of all virtual machines and hypervisors, greatly reducing administrative requirements
- Red Hat Enterprise Linux, the trusted platform for running mission-critical application workloads, offering customers an easy-to-adopt, open alternative for enterprise computing; it offers a base operating platform, outstanding security and high-availability capabilities, and comprehensive networking capabilities
- Red Hat Network Satellite, which works together with Cisco UCS Manager to manage data center servers with far less complexity than standard methods, reducing administrative requirements

Challenge: Addressing Network, Server, and Storage Requirements for Highly Distributed File Sharing

Aiming to be one of the largest peer-to-peer high-definition (HD) movie and TV providers in Europe, the customer, in a new venture, created a proprietary bit-torrenting file-sharing technology and was looking for a network, server, and storage infrastructure to deploy it commercially on the Web. Torrenting allows users to distribute large amounts of data-in this case, portions of videos-in an efficient way that avoids large, simultaneous data flows, which can overtax a data center's servers. Instead, with torrenting, users devote a portion of their hard drives to hosting content for other users, or peers. As one user is watching a program, the torrenting program pulls new pieces of content from other peers and allows those peers to pull content from the first user and from each other. This process happens transparently so that each user is unaware that, in the course of watching an entire movie, sections of content are being accessed from the hard drives of perhaps a dozen different users.

In signing up for this free service with the European company, which generates most of its income from advertising and also offers a pay-per-view service, customers have to agree to allocate and share 10 GB of their hard disks to hosting pieces of content. One of the unique features of this company's technology is that it has been able to compress large pieces of video without degrading quality, allowing more content pieces to be hosted by each peer. The company's file-sharing application distributes these compressed, encrypted pieces of content to customers automatically, creating a distributed network of video content pieces. When a user watches 15 minutes of a movie or TV show, the company's application begins deleting the first 10 minutes while reaching out to a peer on the network for the next 15 minutes of content, and so on.

Anticipating hundreds of thousands of subscribers in the first year, the company was looking for a stable, converged, high-performance network environment with robust network, computing, and storage infrastructure. The environment had to continually monitor the file-sharing application that replaces the content on each customer's hard drive and interact with storage repositories for all the movies and TV shows to make sure that each user got the right content pieces, in the right order, as needed. If the content was not readily available from a peer, the system was designed to immediately pull and distribute it from the data center. Additionally, all the account setup and management applications had to be highly available in the infrastructure.

The company considered designing and deploying a traditional solution in the data center, with parallel LAN and SAN infrastructures and multiple (usually more than five) connections per server, including all the adapters and cabling that go with them. This would have entailed downstream port costs and capital and operating costs for equipment and management. Server provisioning and the complexity of firmware upgrades, driver patching, and versioning would all add to the lead time required for moves, adds, and changes to the infrastructure.

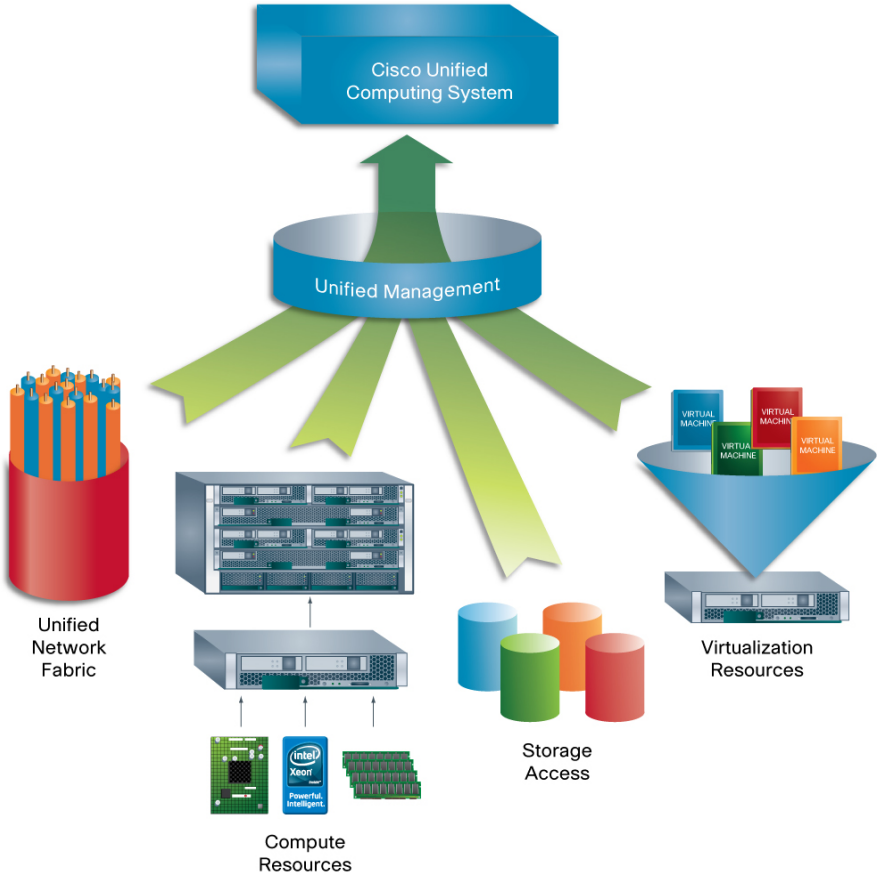
Comprehensive Solution with Cisco Unified Computing System and Red Hat Enterprise Virtualization

Virtualization technologies have transformed the architecture of the next-generation data center, providing lower facilities and power and cooling costs, better server utilization, higher service levels, and faster deployment of applications. As the peer-to-peer video company evaluated an optimal infrastructure for file sharing on a massive scale, virtualization was seen as an important attribute of the data center environment. Virtualization has also revealed to data center administrators the complexity of managing exponentially increasing numbers of disconnected physical and virtual compute, storage, and network resources, so a solution that would have highly integrated, simplified management features was also a priority.

For its network, computing, storage, and development environment, the company chose platforms and technologies from Cisco and Red Hat, because they jointly offer an optimal, cost-efficient, high-performance, global, complete solution.

The Cisco Unified Computing System represents a radical simplification of traditional data center architectures, dramatically reducing the number of devices that must be purchased, cabled, configured, powered, cooled, and secured. This simplification is made possible through the system's ability to unite network, compute, and virtualization resources into a cohesive system that simplifies setup, improves business metrics, and enables just-in-time resource provisioning. Cisco Unified Computing System integrates a low-latency unified network fabric with enterprise-class x86-architecture servers. Resources within the integrated, scalable, Cisco Unified Computing System participate in a unified management domain (Figure 1).

Figure 1. Cisco Unified Computing System



Main features that led to the choice of the Cisco Unified Computing System for the video streaming infrastructure, include:

- Embedded management: The Cisco Unified Computing System does not require a separate management server since it has an embedded management processor with global visibility of all the elements.
- Unified fabric: The Cisco Unified Computing System is designed based on the concept of a unified fabric, which encompasses the high-performance computing, LAN, SAN, and management networks.
- Optimized virtualized environment: The Cisco Unified Computing System is designed to support a large number of virtual machines. A single system can scale to include up to a 40-blade chassis, 320 compute nodes, and thousands of virtual machines. Policy enforcement, mobility, control, and diagnostics can also scale along with the number of physical platforms, compute nodes, and virtual machines.
- Fewer servers with more memory: The Cisco Unified Computing System server blades use Cisco Extended Memory Technology and can support up to four times more memory than competing servers with the same processor.

The company chose software from Red Hat, the world's leading provider of open source solutions, including:

- Red Hat Enterprise Virtualization: This end-to-end virtualization solution allows a single server to run multiple server operating systems. Fully integrated into the Cisco Unified Computing System environment, it includes Red Hat Enterprise Virtualization Hypervisor and Red Hat Enterprise Virtualization Manager for Servers. The hypervisor is a virtual machine technology that can be deployed as a standalone bare-metal hypervisor or as a hypervisor host. The manager is a feature-rich server virtualization management system that provides advanced capabilities for hosts and guests, including high availability, live migration, and storage management, system schedulers, and power savers. Together, these technologies

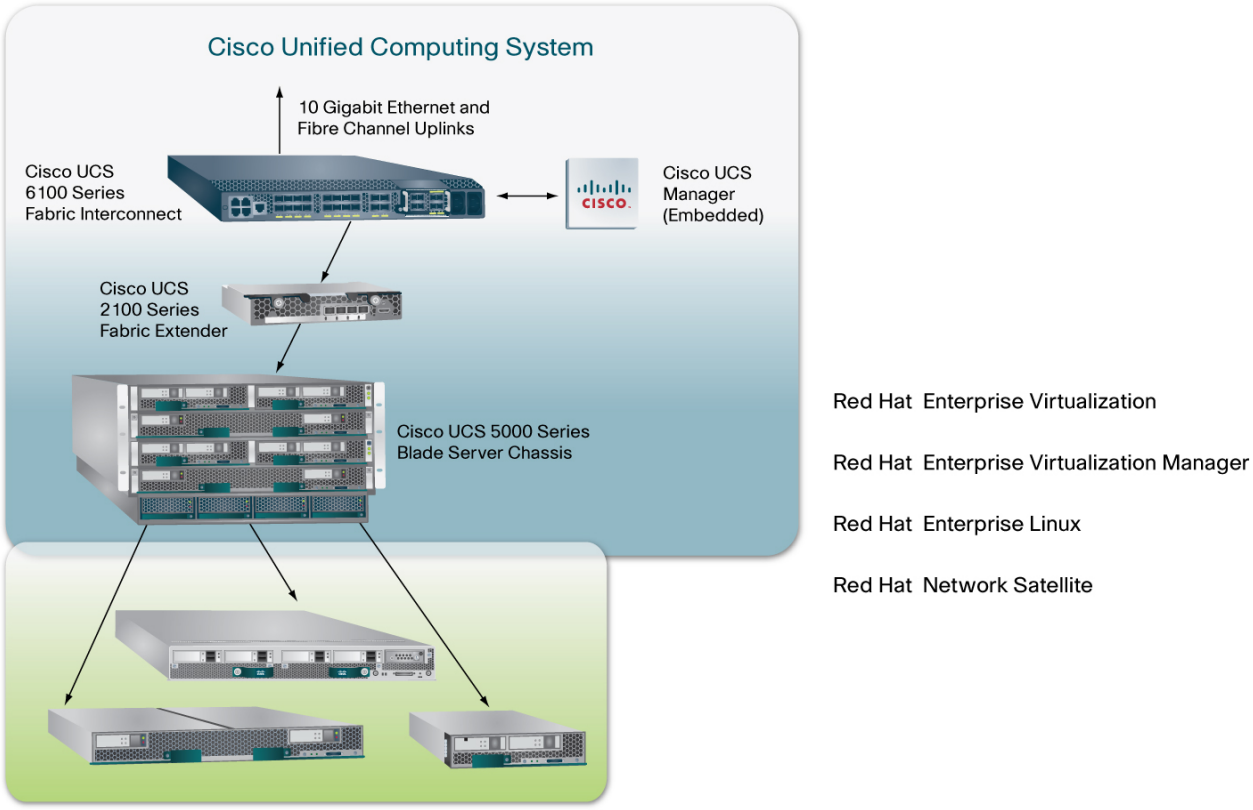
allow administrators to move services between physical hardware, as needed. As the video company grows, it will also be able to move services between hardware in different data centers quickly and easily with Red Hat Enterprise Virtualization.

- Red Hat Enterprise Linux: Linux is the world's leading open source application platform and was chosen as the core application environment for the peer-to-peer environment's back end. The application that was developed handles user accounts, Web requests, and the movie database. The Red Hat Enterprise Linux platform also offers a choice of thousands of certified applications designed by independent software vendors, broad deployment options, and full interoperability with the Cisco Unified Computing System.
- Red Hat Network Satellite: This is an easy-to-use systems management platform for expanding Red Hat Enterprise Linux infrastructure. Built on open standards, it provides powerful systems administration capabilities such as management, provisioning, and monitoring for large deployments. Used together with Cisco UCS Manager, Red Hat Network Satellite lets administrators manage many servers as easily as they would one server.

Cisco Unified Computing System Architecture

The Cisco Unified Computing System deployment for the peer-to-peer video-file-sharing infrastructure is composed of a comprehensive management solution, fabric interconnects, fabric extenders, blade server chassis, blade servers, consolidated network adapters, memory extender technology, and access-layer switches (Figure 2).

Figure 2. Cisco Unified Computing System Architecture



- Cisco UCS Manager software integrates the components of the Cisco Unified Computing System into a single, cohesive entity. It can manage up to 320 blade servers as a single system using an intuitive GUI, with both command-line interface (CLI) and XML API options, enabling near real-time configuration and reconfiguration of resources. Tasks that used to require days or hours can now can be accomplished in minutes.

- Cisco UCS 6100 Series Fabric Interconnects are a portfolio of line-rate, low-latency, lossless, 10 Gigabit Ethernet and Fibre Channel over Ethernet (FCoE) switches. They consolidate I/O at the system level. Based on the same switching technology as the Cisco Nexus® 5000 Series Switches, the Cisco UCS Series 6100 Series supplies a unified network fabric that connects every server resource in the system wire with 10 Gigabit Ethernet and FCoE downlinks and flexible 10 Gigabit Ethernet and 1/2/4-Gbps Fibre Channel uplinks.
- Cisco UCS 2100 Series Fabric Extenders extend the I/O fabric into the blade server enclosure, providing up to four 10-Gbps connections between blade servers and the fabric switch, simplifying diagnostics, cabling, and management. The fabric extender multiplexes and forwards all traffic using a cut-through architecture over one to four 10-Gbps unified fabric connections. All traffic is forwarded to the parent fabric switch, where network profiles are managed efficiently and effectively by the switch.
- Cisco UCS 5100 Series Blade Server Chassis contain Cisco UCS B-Series Blade Servers with network interface cards (NICs), host bus adapters (HBAs), and RAID controllers. The six-rack-unit (6RU) enclosure supports up to 56 servers per rack. Compared to complex traditional blade enclosures, the Cisco UCS 5108 Blade Server Chassis is dramatically simple in its design, with support for up to eight half-slot or four full-slot blade servers with four power supplies and eight cooling fans. Both power supplies and fans are redundant and hot swappable.
- Cisco UCS B-Series Blade Servers are designed for compatibility, performance, energy efficiency, large memory footprints, manageability, and unified I/O connectivity. Based on Intel Xeon 5500 series processors, the Cisco UCS B-Series adapts to application demands, intelligently scales energy use, and offers best-in-class virtualization. Each Cisco UCS B-Series Blade Server uses converged network adapters (CNAs) for consolidated access to the unified fabric with various levels of transparency to the operating system. This design reduces the number of adapters, cables, and access-layer switches for LAN and SAN connectivity at the rack level. This Cisco innovation significantly reduces capital and operating expenses, including administrative overhead, power, and cooling costs.

The following are also included in the infrastructure, for storage:

- Cisco MDS 9500 Series Multilayer Directors are part of a Cisco family of storage switches with hardware and software features specifically designed to support Small Computer System Interface over IP (iSCSI), which is supported in the unified fabric

This Cisco Unified Computing System architecture enhances the portability of both physical and virtual machines, with server identity, LAN and SAN addressing, I/O configurations, firmware, and network connectivity profiles dynamically provisioning and integrating server and network resources. Definition of hardware properties and deployment of systems is fast and easy with the use of service profiles, which allow administrators to associate any compatible firmware with any component on the switch and server stack at any time, using templates. Administrators can download the firmware versions needed from Cisco and then, within minutes, totally provision firmware on components within the server, fabric interconnect, and fabric extender, based on required network, server, and storage policies per application and operating system. This dynamic and stateless environment can be adapted to meet rapidly changing business requirements. Just-in-time deployment of new computing resources and simplified, reliable movement of traditional and virtual workloads gives the video company improved availability, security, performance, and business agility.

Solution Benefits

Currently supporting more than 500,000 users, the peer-to-peer video service is working smoothly. Company executives are preparing for major expansion throughout Europe, knowing that the Cisco and Red Hat infrastructure provides measurable benefits, including:

- Allowing the company to manage its infrastructure with a limited number of IT staff
- Increasing the productivity of IT staff and the system's agility through just-in-time provisioning and mobility support for the virtualized environment

- Reducing total cost of ownership (TCO) at the platform, site, and organizational levels
- Allowing the infrastructure to be managed, serviced, and tested as a whole, cohesive, integrated system
- Enabling server, virtual machine, and I/O bandwidth scalability to match demand
- Providing flexibility with open industry standards supported by a partner ecosystem of industry leaders

The solution currently is scaling smoothly to add 2500 subscribers per week, making it a showcase subscription service infrastructure for a reliable, high-performance, scalable, cost-effective approach to peer-to-peer video.

Why Cisco and Red Hat?

In delivering the industry's first unified computing platform, Cisco and its industry partners, including Red Hat, have delivered on the promise of data center virtualization. The Cisco Unified Computing System architecture, along with Red Hat Enterprise Virtualization and Red Hat Enterprise Linux technologies, deliver a more manageable, reliable, flexible, and scalable solution in comparison to alternatives on the market. With a unique systems approach to architecture, technology, partnerships, and services, the Cisco Unified Computing System streamlines data center resources, scales service delivery, and radically reduces the number of devices requiring setup, management, power and cooling, and cabling.

For More Information

Cisco Unified Computing System: http://www.cisco.com/go/ucs

Unified fabric: http://www.cisco.com/en/US/netsol/ns945/index.html

Red Hat Enterprise Linux: http://www.redhat.com/rhel/

Red Hat Enterprise Virtualization: http://www.redhat.com/rhev/

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA

www.cisco.com

Tel: 1-408-526-4000 or 1-800-553-NETS (6387)
Fax: 1-408-527-0883

Red Hat, Inc.
1801 Varsity Drive
Raleigh, North Carolina 27606
USA

www.redhat.com

Tel: 1-919-754-3700
Fax: 1-919-754-3701

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