

Virtualization Beyond the Data Center: Increase Network Infrastructure Utilization and Efficiency to Reduce Operational Costs

Executive Summary

The concept of virtualization has gotten renewed attention with the advent of server virtualization in the data center, enabling organizations to simplify management and optimize performance of vast computing and networking infrastructures. Server virtualization, part of the Cisco® Unified Computing System, leads to significant cost savings, helping organizations address space, power, cooling, and budget constraints.

The current global economic climate presents an opportune time to fully utilize the benefits of virtualization technologies beyond the data center to achieve greater cost savings through increasing network utilization and efficiency. Network virtualization simplifies how IT departments manage entire campus networks. It offers management and cost benefits for increasingly complex, consolidated networks. Fortunately, the technologies for virtualizing network services throughout the campus network are mature and well understood.

Modern campus network architectures support many services, scalable to hundreds of nodes and thousands of users. Administrators need to segment the campus networks for security and traffic management reasons, and traditional switching solutions are insufficient to meet these needs.

Successful network virtualization solutions use proven technologies to reduce management complexity and service rollout time while increasing operational control and service flexibility. Organizations deploy network virtualization solutions to facilitate efforts to comply with industry and government regulations, maintain security, and reduce total cost of ownership as organizations consolidate multiple networks (data, voice, video, physical and logical security, wireless, and building automation) into a single IP infrastructure.

Network virtualization solutions extend the benefits of virtualization technologies throughout campus and distributed networks, reaching every endpoint and managing every user.

This paper spans the following topics:

- The business need for network virtualization
- Definition of network virtualization
- Overview of Cisco campus network virtualization solutions and their business benefits
- Industry scenarios that illustrate Cisco network virtualization solutions

The Business Need for Virtualization

Users have developed a does-it-all mentality about network-based services. For example, advanced mobile devices such as the Apple iPhone and Research in Motion's BlackBerry Storm have raised user's expectations about how networked applications integrated into one device can help them manage day-to-day activities such as work, driving, shopping, education, and entertainment.

Underlying these capabilities are increasingly complex, consolidated networks that can integrate data, voice, video, and wireless services in ways that are transparent to users. Many organizations are also connecting physical security (such as video surveillance and door access) and building automation systems (such as HVAC) to their IP networks.

Today's collaboration-based businesses require networks that support communication among workgroups and also with business partners. For example, retailers need to allow tenant business and vendor partners to use a common network to access their own resources within stores, yet isolate each partner's traffic from other partners and proprietary store traffic.

In this "new economy" of a globally distributed workforce and global competition, enterprise organizations continue to use collaboration technologies to help connect geographically dispersed user groups to act and feel like a single, centralized entity. These collaboration technologies improve employee productivity while reducing operational expenses by creating a "borderless enterprise" where employees, customers, and partners can all share significant information and connect their business processes more efficiently.

Integrating all services into a single IP infrastructure can reduce the cost of building and maintaining multiple networks while enabling innovative applications that increase user productivity and corporate competitiveness. Businesses need the ability to manage services in a way that optimizes their performance, speeds rollout, offers flexible delivery options, and supports rapid troubleshooting and resolution.

To attain these advantages, network administrators must isolate some services and allow communication among others, all while maintaining security and regulatory compliance. For example, every business needs the ability to manage guest access, preventing guests from accessing confidential information or altering sensitive resources. Banks need to isolate ATM transactions. Manufacturing floors need to protect and prioritize traffic from plant automation systems. And many organizations are familiar with the network and application integration issues that accompany mergers and acquisitions. Today's LAN virtualization technologies can ease the management of these and other services that users expect to use anytime, anywhere.

Business and IT leaders have been seeking an IT infrastructure that is more responsive to business initiatives and that will remove inefficiencies. The traditional campus architecture, which delivers basic connectivity to isolated departments with fortress-like barriers, must evolve into an agile and resilient architecture that delivers orchestrated services to integrated teams collaborating throughout the enterprise, and that supports service-level agreements (SLAs). With these changes, the IT department becomes more of a business unit that delivers services to improve the enterprise rather than burdening it as a cost center. Virtualization helps enable a new, dynamic IT infrastructure that is more responsive to ever-changing business requirements.

What Is Network Virtualization?

Network virtualization enables IT groups to deploy and manage IT resources as logical services instead of physical resources. Using network virtualization, IT administrators can segment and align IT services to meet the specific needs of the users and groups on the network. Logical, secure segmentation also helps IT groups comply with regulations for resource and information security.

In other words, instead of thinking about managing backbones, campus buildings, and branch office domains, IT staff can use network virtualization to manage Internet access, voice and video services, RFID-enabled inventory applications, and so on. By managing the network to correspond more directly with the services that people use, IT personnel can focus on adding value to user productivity and closely managing operational expenditures.

Therefore network virtualization can accomplish many business objectives, helping organizations to deploy and operate services while maintaining security and compliance. Typical objectives include the following:

- **Guest access:** Most organizations allow guest (non-employee) access to the network, usually to use the Internet. A virtualized network prevents guests from accessing confidential information and resources or from inadvertently introducing malware into the network.
- **Partner access:** Business partners often need access to authorized applications and data. For example, shipping companies need access to client inventory systems to manage pickups and deliveries.

- **Protection:** Mobile devices are vulnerable to infections from spyware, viruses and worms, and other malware. The network needs the ability to quarantine devices during Network Admission Control (NAC) remediation; when devices are deemed safe and compliant, the network can log the device into its authorized virtualized network.
- **Divisional separation:** Information security policies define who can access what data and resources. Using virtualization to separate users, groups, stores, or divisions helps protect sensitive information from intrusion, unauthorized alteration, or theft. For example, a university can use virtualization to isolate building automation systems, student services, research groups, and educational departments. People can access their services as they move about campus, yet the separation provides some security against, for example, malware infections spreading from a student laptop into a research server.
- **Device isolation:** Certain devices may need to be isolated from others for security or performance reasons. For example, banks can isolate ATMs on a dedicated virtual network to protect transactions and customer privacy.
- **Hosted services:** Commercial real estate managers may include hosted IT services as part of a lease agreement with tenants. Network virtualization is especially useful for tenants that run point-of-sale transactions.

Cisco Network Virtualization Solution

The Cisco network virtualization architecture usually segments one consolidated network into many logical services, but in some cases it can incorporate multiple networks into a single service, or operate one device (such as a central switch) as many individual ones. Whether the virtualization deployment uses a one-to-many or many-to-one architecture, IT administrators must first ensure that they have a stable, scalable network in place before implementing network virtualization.

The Cisco network virtualization solution addresses three components: access control, path isolation, and the services edge.

- **Access control:** This includes authentication and authorization of entities connecting at the edge of the network and their assignment to authorized network segment and services.
- **Path isolation:** Cisco Multiprotocol Label Switching (MPLS), Virtual Route Forwarding (VRF), and Cisco Generic Routing Encapsulation (GRE) are three technology alternatives for creating independent logical traffic paths over a shared physical network infrastructure.
- **Services edge:** Centralized services allow members of different virtualized LANs to communicate with one another according to policy. Communication is regulated through a firewall.

Business Benefits of Cisco Network Virtualization Solutions

Cisco network virtualization solutions offer these business benefits:

- Regulatory compliance and information security through separation of users, groups, sites, or devices
- Reduction of capital and operational expenses, resulting from physical resource consolidation
- Faster, more flexible response from IT to changing business requirements
- Connecting globally distributed workforce of users (ubiquitous devices and omnipresent users) with an increasing emphasis on service delivery
- Greater energy efficiency by controlling the power and cooling requirements for the network infrastructure and service nodes

Business Applications

Cisco network virtualization solutions solve a variety of business problems and help businesses optimize the value of their networks. Some hypothetical scenarios follow.

Merger and Acquisition

A banking conglomerate acquires a specialty investment firm. To facilitate integration of IT resources, the IT group uses network virtualization in multiple steps to merge the talents of both companies and help them focus on corporate initiatives. The first step isolates divisional operations, allowing corresponding departments (such as HR to HR, or finance to finance) in both companies to share resources. This first step does not allow cross-divisional sharing, such as HR at the conglomerate with finance at the investment firm. This step facilitates business integration efforts until the acquisition receives regulatory approval. After the transaction is finalized, IT can re-segment the network resources to integrate resources at the investment firm with the entire conglomerate according to policy.

Manufacturing

An automobile manufacturing company uses network virtualization across its converged IP network to support disparate requirements for the manufacturing, facilities, and IT groups. It created five virtualized domains: manufacturing floor, voice and video, other mission-critical departments, guest access, and administration. The virtualized architecture segments applications, resources, and users, yet shares a common set of management tools and staff. The solution allows the manufacturer to maximize application availability throughout its manufacturing processes, where downtime can cost tens of thousands of dollars per hour. The network virtualization optimizes network and application performance for enhanced productivity of all groups and helps secure vital resources. In so doing, the firm leverages IT to gain a competitive advantage, improve service flexibility, and reduce manufacturing costs.

Retail

A retail corporation with 2500 stores uses network virtualization to enable partner access to individual stores. The retail company has outsourced its energy management, weight and scales, and in-store video demonstrations to three separate partners. The virtualized network separates each partner's traffic from proprietary store traffic, and from other partners. It reduces cost and complexity, because everyone uses a common infrastructure, and it enables the retailer to hire the best services from multiple partners at a lower overall cost.

Landlord-Tenant

Commercial real estate companies often manage hundreds of tenants on real estate with a high value per square foot. Cisco network virtualization can isolate tenants at a shopping mall, allowing every business to use the same network infrastructure yet maintain separate voice, data, and video services for information privacy and compliance with Payment Card Industry (PCI) Data Security Standard (DSS) requirements. Virtualization allows tenants to access their services from anywhere on the premises, through wired or wireless connections.

Transportation

Airports seek new efficiencies to manage thousands of travelers passing through them each day. They lease space to airlines and supporting companies such as caterers and retailers. Applying network virtualization atop a Cisco Unified Communications network, an airport can attain higher usage rates at gates, and airlines can avoid paying full-time rents for gates they may not always use. Gate agents can log into the system at a particular gate, and the network automatically assigns the feature and application sets associated with that airline and flight to the gate, such as PC workstation applications, boarding pass printers, and overhead flight displays. The Cisco IP Phones at the gate switch to the airline extensions. When the flight leaves, the agent logs out. Agents from another airline can use the same gate immediately afterward in the same way.

Healthcare

Healthcare institutions in the United States are required to protect the privacy of patient records under the Health Insurance Portability and Accountability Act (HIPAA). A network virtualization solution helps institutions maintain compliance by separating users who access patient data from those who do not, and by enforcing information security policies for all virtualized LANs from a central point. Virtualization is useful in hospitals that are moving toward “hotel-type” network services, such as allowing patients to use the phone, watch television, or access the Internet on one domain, while maintaining electronic protected health information (PHI) on another domain.

Government

Governments can facilitate information sharing and collaboration among agencies and control IT costs through a single, distributed, converged network that all agencies share.

Cisco network virtualization enables a central IT group to segment per-agency services, such as applications, databases, and directories, yet centrally enforce consistent security policies and administer common services such as email and phones. With thousands of users, governments can realize substantial cost savings with resource consolidation and centralized IT services, yet each agency can customize its applications and services to meet its particular needs.

Why Cisco?

Cisco offers proven, end-to-end network virtualization solutions that span the entire network infrastructure, from the backbone to every endpoint in every location. When organizations deploy virtualization across an integrated Cisco network infrastructure, they can reduce the management complexity of multiple services such as unified communications, mobility, and security. The Cisco network virtualization solution allows IT staff to manage the services on the network, not just the network itself, making it easier and faster to design and deploy new services and to isolate users, resources, and devices for compliance and security reasons. As the worldwide IP networking leader, Cisco backs its solutions with vast experience and expertise, proven best practices, and world-class service and support.

For More Information

To learn more about Cisco's network virtualization solutions, please visit: <http://www.cisco.com/go/networkvirtualization>.

For LAN solution design guides, please visit: <http://www.cisco.com/go/designzone>.



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