

WHITE PAPER

Demonstrating the Value of a Foundation Network

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July 2009

IDC OPINION

Look around and see how much has changed over the past five years. Does your dry cleaner send text messages when your clothes are ready to be picked up? Perhaps your local grocery store is rolling out mobile point-of-sale "line-breaker carts" to shorten checkout lines and increase customer satisfaction. Prominent universities, such as Harvard and Northwestern, are offering long-distance learning with interactive videocasts. To eliminate inventory holding costs, manufacturers are now using wireless connections to stream the latest information to forklifts so drivers can load products directly off the manufacturing lines into the appropriate delivery trucks.

New advanced applications and services delivered over network infrastructure have made all of these solutions a reality — but they are also increasing the stress on today's enterprise IP networks. Consequently, IT managers are seeking ways to manage and control their networks more efficiently, ensure reliability and scalability, achieve other corporate goals — including the mandate to "go green" — and, most important, be prepared for the inevitable changes that will flow over enterprise networks over the next five years.

Companies that invest carefully and wisely in future proofing their IP networks will be well positioned to take advantage of the increased functionality provided by the newest applications and computing models, including software as a service (SaaS) and virtualized services. In contrast, companies that build their networks only in response to today's capacity requirements will be left behind as new applications and delivery paradigms become the norm.

SITUATION OVERVIEW

If enterprises needed network devices only for basic packet forwarding and routing, almost any supplier would suffice. Trade magazines would be filled with performance tests and discussions of throughput and price/performance/port density ratios. Bandwidth would be tightly tied to Moore's law as processors scaled up and drove packet handling performance predictably upward. Unfortunately, this is not the case.

Bandwidth and performance are important. However, the bulk of the business challenges network professionals have solved over the past decade are rarely fixed just by increasing the capacity of a network. The list of improvements deployed in the face of a growing mix of applications over the past five years is long — enhancing network reliability by stamping out single points of failure, improving security, and enabling mobility with wireless network access and virtual private networks (VPNs)

while migrating voice networks to IP (VoIP). These improvements all require additional functionality and resiliency. IDC believes networking vendors have yet to fully satiate user demands for either functionality or capacity. What was once considered "good enough" reliability is now inadequate as a more complex mix of applications and traffic flows traverses the IP network. The introduction of mission-critical, low-latency traffic that reaches far beyond the datacenter is driving a growing need to manage and control the network in new ways.

DEMONSTRATING THE VALUE OF STARTING WITH A FOUNDATION NETWORK

Over the typical five- to seven-year lifetime of an Ethernet switch, router, or wireless LAN, the business and technical demands on the network will change in at least four ways.

1. **Scalability.** The number and/or location of devices the network needs to support will continue to change.
2. **Processing capacity.** The capacity and performance required to support business-critical applications will most often increase, but at the very least traffic flows will likely change in some fashion.
3. **Visibility and control.** The control the IT department exerts over traffic flows on the network will likely increase as the importance of optimizing and planning for changes in capacity and packet delivery quality changes.
4. **Complexity.** Additional services and applications with new laws and regulations will force more parts and pieces to be added to meet organizational demands — deploying applications, adding new security controls, supporting new network access technologies, and ensuring network performance and reliability.

Business Benefits

Chances are good your business is more dependent on networked technologies today than it was five years ago. Sometimes it seems unbelievable that technologies such as mobile email that are so important to many businesses today were barely available five years ago. Network-based technologies enable businesses to optimize their resources and respond to market demands more quickly than we could have imagined a decade ago.

For example, networked technologies are facilitating major improvements in manufacturing. Just-in-time manufacturing is dependent on knowing inventory levels and exactly when something is purchased at a retail store. With accurate information from retailers across the globe, manufacturers can run smaller batch jobs to refill items as they are consumed. By providing only what is needed when it is needed, manufacturers can dramatically decrease inventory expenditures and meet the demands of fickle consumers with lower investment risks.

In a world where we assume constant technological change, information and communications technology (ICT) infrastructure investments are often justified on fulfilling near-term needs; however, this approach is no longer adequate. Today's infrastructure purchases must be designed to accommodate future business needs — not just today's capacity requirements.

Preparing for the Future

The network can be one of the most difficult parts of an IT infrastructure to evolve rapidly. When a business demands more compute or storage functionality, those resources can be enhanced quickly in a variety of ways. When compute or storage infrastructure is purchased, capacity is typically the primary metric. But for the network, capacity is only one measure of the network's ability to support a new application or service.

Investing in a network that has a rich set of functionality gives organizations flexibility in terms of which applications can be adopted and when that adoption occurs. Networks are very expensive. IT managers do not want to be constrained by having to upgrade the network in order to adopt whatever the next application happens to be. No one knows what the next application will require. What is known is that there will undoubtedly be some level of change required of the network in order to adopt that next application.

But IT should not be required to change everything just because there will be some change in the network. By investing early in networking systems that provide high performance and rich functionality now and that can readily and cost-effectively adapt to support onrushing performance or service requirements tomorrow, IT can decide when it is appropriate to deploy a new application based on business needs — as opposed to letting the network dictate when it is possible. By planning ahead, IT will be ready when the time is right.

Protecting Existing Investments

Planning for future network needs will also result in investment protection. Future proofing the enterprise's communications infrastructure is likely to cost only a small premium on day one, versus facing the prospect of a costly year-four forklift upgrade in functionality if the network was designed with only today's capacity as a driver. Such key ingredients as software-driven services, modular hardware designs, stackable platforms, and shared components all contribute not only to ready adaptation but also to system longevity.

Technical Benefits

The technical benefits of implementing a future-proof communications infrastructure include the ability to easily change the scale of the deployment and the ease and speed of adding new technical capabilities to the existing infrastructure.

Changes in Scale

Planning for future business needs provides the ability to gracefully and rapidly scale to adjust to any changes in the number of new users, devices, or locations that are connected to the network. With this flexibility, IT can quickly add new devices to the network or, if cutting back is necessary, take people and devices off the network as required. The ability to scale up as well as down is where a lot of today's network efficiencies come into play. It enables the enterprise to buy rich network functionality now, but avoid overbuying capacity until it is actually needed.

Adding New Technical Capabilities

Over the past 10 years, IT has been able to deploy many new applications (e.g., IP telephony, video services, application acceleration, wide area application services networks, policy management, increased bandwidth on demand) based on functionality that already existed in the network. Many networks were designed with the ability to turn existing functionality on or off, easily add additional functionality in the form of a new switch fabric in a chassis or an operating system update, or even limit adding new functionality into the core of the network.

This flexibility has paid off in a number of ways. Examples of areas where new services and capabilities can be enabled without performing a major network refresh include the following:

- ☒ **New voice deployments.** A variety of new voice deployments have been added to existing networks. These deployments include integration of voice with presence and messaging applications, other communications applications, and voice-enabled business applications. A network infrastructure that offers high-availability capabilities (e.g., hardware redundancy, in-service updates) and advanced traffic management features (e.g., quality of service [QoS], multicast) is vital for new voice deployments.
- ☒ **Security functions.** A number of different features that organizations have purchased ahead of time have enabled them to segment the network into logical domains that would not have been possible otherwise. Security can be increased by partitioning the network into logical workgroups and entities separated by firewalls for compliance reasons or segmented in order to prevent cascading failures across a set of systems. Beyond traditional VLAN and firewall segmentation, security services such as intrusion prevention and network admission control offer heightened and, increasingly, required protection. Network-based (e.g., network access control [NAC] support within a switching device) security services offer an efficient and effective solution.
- ☒ **Quality of service and the ability to prioritize traffic based on business needs.** To improve QoS, an enterprise can prioritize all mission-critical applications (e.g., financial trades) while throttling back all undesirable traffic (e.g., employees downloading YouTube or BitTorrent video files for personal viewing). Traffic management services that scale from a performance standpoint and are easy to set up and maintain drive operational efficiency and end-user satisfaction.

- ☒ **Virtualized services.** As virtualized applications and services become more prolific within the network, the network must have the ability to identify higher layers within the network traffic currently being transported in order to help IT managers maintain control of the network. Functions such as deep packet inspection and stateful application intelligence not only enable greater visibility into network use (and abuse) but also ease the burden of monitoring and regulating the network. Without this capability, the IT manager loses the ability to comprehensively manage the network or grasp the capacity/complexity of the load.

FUTURE OUTLOOK

Over the past decade, business networks have been forced to evolve in order to support new business expectations, new security threats, and an increasing number of communications applications (primarily voice and video). Nothing on the horizon indicates this pace of change is likely to change anytime soon. While it is very difficult to tell exactly which applications business managers will demand over the next five to seven years, several application types are poised not only to stress network bandwidth and controls but also to dramatically change traffic flows in some cases.

So do investments in networks spur adoption of new applications — or is network investment being driven by the demand for new applications? The answer to this chicken-egg scenario is both. The challenge facing every network infrastructure refresh is to make the best "guesstimate" of the pace and type of new applications and to be prepared for their adoption over the lifetime of the network. And bear in mind, with budget conservation moving from today's tactic to tomorrow's strategy, the lifetime of devices that form the network is most likely to extend from today's 4- to 6-year average to life cycles of 7, 8, or even 10 years.

The next section highlights several near-term applications gaining momentum and then discusses several other business challenges for which the network is likely to play a larger role in the future.

Near-Term Trends

IP Voice Beyond the Desk Phone

IDC has found that about 30% of enterprises have already deployed voice over their IP networks, and that number will continue to grow by leaps and bounds as old voice equipment reaches its end of life. Networks that provide for low latency, high availability, advanced traffic management, and voice-specific services are moving from leading edge to mainstream.

Video and the Convergence of Multiple Video Types on the Network

Video is the next big area for bandwidth consumption. Video itself is not a huge problem on the network. It is possible to send fairly small videos quite easily through small pipes. But it gets much harder when IT needs to obtain visibility and control into multiple types of videos and video traffic threatens the performance of critical business applications. Traffic may consist of any combination of telepresence, video conferencing, video Web conferencing, video surveillance, and broadcast video for

marketing, corporate communications, and training. Any one of these can be hard to manage by itself, but in the future, IT will have to manage growing volumes of multiple types of video running over the network (see Table 1). High-performance traffic management and movement becomes paramount as basic networking features such as traffic buffering must match the rise in traffic volume and tightening response times. More advanced features such as QoS must be not only flexible but also fast. Network decisions must be made quickly and accurately.

TABLE 1

Timeline for Next-Generation Applications for the Network

Market Discussion	When Will We Start to See the Value?	When Will We Adopt?	When Will We See Widespread Deployment?
IP voice	1999–2010	2004–2015	2012+
Consumer flash video	2005–2006	2007	2009+
Unified communications	2006–2009	2008–2018	2014+
IP video conferencing	2002–2011	2004–2015	2010–2020
IP video surveillance	2002–2007	2006–2010	2007–2012
"The next video thing"	2010–????	2011–2013	2015+

Source: IDC, 2008

Longer-Term Trends

Collaboration and Social Networking

After years of investments in business process automation, from where will the next wave of productivity come? IDC believes the plethora of collaboration and social networking applications represents the true shift from IT to ICT. While social networks and collaboration technologies available today are daunting in number and may not be deployed for some time, the adoption of rich media collaborative technologies will place demands on networks well beyond the scope of what used to be considered "good enough."

Collaboration and social networking technologies are bringing rich new functionality to the business, but issues are affecting their rate of adoption. The ability to draw on the experience of employees and partners in the field and serve customers requires a way to pull in that information and act on it. This will require a healthy set of network capabilities to branch offices and mobile workers. Demand for first-class service for these "remote" users will grow faster in these locations, driving to become a standard operating practice for IT and the business.

Using the Network to Go Green

The move to reduce energy costs and minimize the carbon footprint of the enterprise is rapidly gaining momentum. There are several ways for enterprises to look at the network when going green. First is simply the actual energy consumption and energy efficiency of the network infrastructure.

When examining the energy efficiency of a network, enterprises should consider and seek out several dynamics and emerging features:

- ☒ The energy consumption curve of each individual piece of network gear as traffic and packet processing capacities rise and fall
- ☒ Management systems that collect energy consumption of all devices, analyze consumption, respond to conditions based on a standard set of policies, and provide reports to ensure compliance with regulations and business policies
- ☒ The ability of a wiring closet switch to dynamically throttle and increase connection speeds over copper Ethernet cabling from an energy-sipping 10MB, to 100MB/Fast Ethernet, to a more energy-intensive 1,000MB/Gigabit connection
- ☒ Optimizing intelligent systems that control Power over Ethernet (PoE) switches to depower network devices not in use or on a regular schedule (The carbon footprint encompasses the device itself, including how it was manufactured and transported and the degree to which the device can be recycled when it has reached its end of life.)
- ☒ Using the network as a conduit for managing devices that traditionally have not been monitored or controlled on a dynamic basis (Examples include a wide variety of building control systems [e.g., heating, air conditioning, lighting, and surveillance infrastructure] or optimizing the use of energy in refrigeration units or anything else that has a large energy consumption footprint.)
- ☒ Consider ways to optimize real estate costs and avoid employee commute times through work at home programs and make efforts to minimize the significant costs and energy consumption as a result of travel through the use of telepresence and video conferencing between companies and across a supply chain (Such practices are in their infancy today, but they are maturing rapidly as companies look to reduce the costs and environmental impact of travel and increase collaboration and agility.)

Software as a Service and Cloud Computing

Traditional networks have been optimized for client/server communications. SaaS and cloud computing add a new Internet-centric traffic flow that is much more important to the running of the business compared with Yahoo!, Google, or eBay. The business dependence on that Internet connection and the traffic flow outside the company network becomes essential. To embrace SaaS or cloud computing, the network needs to be flexible — not only for new applications but also for new traffic flows on the network.

Internet-centric services, cloud computing, and SaaS bend the rules of networks optimized for traditional client/server architectures. Cloud computing and SaaS require a higher level of reliability on the overall system and encourage a new level of prioritization between the enterprise and the cloud service provider to optimize traffic and make sure it is highly available.

Even if an enterprise is not using cloud computing today, it is likely that it will be in the near future or that one of its partners will. In either case, the enterprise will eventually have to accommodate cloud applications — or take the technology that enables cloud computing services and deploy it within its own datacenter. This will change some of the traffic flows within the enterprise, especially if the company's workforce is increasingly mobile or geographically diversified.

Virtualization: In the Datacenter and Across the Network

Today, datacenter virtualization is a way for enterprises to consolidate the current sprawl of compute and storage resources. In the future, datacenter virtualization should also give enterprises the ability to move beyond optimization to scale server nodes and storage within the network or to external cloud services providers, while the network enforces security, regulatory, and application performance policies. Enterprises also need to be able to manage the scale of connections that are growing in the datacenter at a quadratic rate. Virtual server and storage connections layered on top of physical servers, storage, and networks result in very complex environments. Enterprises need the network infrastructure along with management systems to address this complexity.

Beyond the datacenter, network virtualization can simplify how IT departments manage entire campus networks while offering management and cost benefits for these increasingly complex, consolidated networks. Network virtualization also enables more efficient facilities usage and management through heightened flexibility, security, and automation.

Mobility and Connectivity of Nonhumans

As wireless networks permeate our living and working spaces, the cost of connecting things beyond computers opens up numerous possibilities. From medical devices with WLAN tags that can be found when nurses need them and request service when needed, to vending machines calling in for refills, to smart alarm systems that can direct people to a particular exit and create a live inventory of who is out and who is still inside, the potential of networking beyond the computer is still in its infancy but lends yet another reason why the flexibility and resiliency of the network will continue to increase in importance.

Cisco's Foundation Network Strategy

Cisco's strategy in building foundation networks has been driven by a long-term belief in the value of intelligent networks and a technology development, acquisition, and integration process that continually adds intelligence to foundation network equipment. Cisco correctly assumed that the network would be continually presented with new application demands and that basic demands on reliability, resiliency, and

control would continue to intensify. This resulted in the adoption of a path for adding new intelligence to networks over time.

Cisco's road map for integrating services that make the network smarter and more secure continues to follow a fairly predictable path. The emerging functionality, such as a WLAN access point controller, begins as an appliance designed to support the largest networks at the time and to be deployed in a datacenter. As deployment of the appliance accelerates, Cisco then launches new form factors that regularly contain less scalability than the appliance destined for the datacenter but can reduce power and rack footprint by sliding into an Ethernet switch or a router chassis.

These new form factors enable smaller customers to deploy the technology or existing customers to deploy in less expensive or more flexible configurations. Over time, portions of the functionality may migrate to the switch fabric blade or even into the Cisco IOS operating system.

For example, the Cisco Integrated Services Router (ISR) was built from the ground up to support a growing number of services at the WAN gateway. As the demand for different applications at the WAN gateway has evolved, Cisco has responded with a growing number of service modules for major switching and routing platforms such as the ISR and the Catalyst 4500 and 6500.

Recent technologies that Cisco has set down the path of integrating with the core network include:

- ☒ WLAN access point controllers
- ☒ Flow control in the latest Catalyst 6500 switch fabric (server load balancing and deep packet inspection functions, repurposed for campus network functions)
- ☒ Security, including firewall, intrusion detection, and VPN blades for the Cisco ISR and Catalyst 6500
- ☒ IP PBX with the availability of an ISR blade

Cisco's integration of hardware functions to reduce power and space footprints has traditionally been followed by software features that enable streamlined services management across all of the integrated components. This march of functionality into common management tools and interfaces drives the base cost of "keeping the lights on" in the network and allows network managers to spend time addressing the needs of new applications and traffic flows.

CHALLENGES/OPPORTUNITIES

The discussion of intelligent networks often pits brawn against brains — network intelligence against network capacity. While "throwing bandwidth" at network problems has a long history of solving short-term problems, a long-term approach to networks is now essential to take advantage of new applications and communications technologies.

Network technology still needs to see advances in management and optimization capabilities. The network management market is still fairly immature. However, management investments will become increasingly important to enable capacity planning and provide greater visibility into how the network and applications are running. Continued investments in management capabilities will enable higher levels of automation and service with lower operating costs. In addition, there needs to be a high integration level between WLAN, LAN, and WAN and the management system to ensure that deployments of next-generation services and applications are not compromised or cost prohibitive.

CONCLUSION

Many enterprises have already realized how future proofing has benefited their networks. They have already learned that by investing a few extra dollars in future proofing their networking infrastructure today, they can guarantee that they will be well-positioned for the demands they are likely to face over the next five to seven years.

The network infrastructure market is growing faster than other IT markets because customers generally buy most equipment based on tomorrow's possible functionality. What is important to remember is that the need for a future-proof network infrastructure has only intensified over the past several years and shows no signs of abating. Forward-looking companies are continuing to invest in networking technologies that will prepare them for new computing paradigms and applications that are on the horizon.

Cisco has a history of encouraging its customers to plan for the future. It advises customers to build on a product set that eliminates all ad hoc planning on the infrastructure. All network components will eventually reach a point where they limit application performance or reliability. However, by creating a flexible networking foundation before they encounter dead ends with their existing infrastructure, enterprises will gain the ability to scale appropriately, flexibly, easily, and inexpensively when needed.

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