CDW PEOPLE WHO GET IT

TOP NETWORK OPTIMIZATION PROJECTS FOR 2014

CDW research shows that optimization is top of mind with IT pros for smarter, faster and better network capabilities.

Executive Summary

Network-related initiatives are on the rise, and for good reason. Network optimization delivers improvements across the entire organization – regardless of size. In small- and medium-sized organizations, upgrade plans primarily focus on efforts to refresh or improve routers and switches, enabling IT shops to take advantage of advanced device capabilities and "smart" features.

Also slated for upgrades are data center servers and storage systems – geared to reap the benefits of hardware refreshes, virtualization, 10 Gigabit Ethernet (10 Gig-E) backbones and improved backup processes – as well as WANs, wireless networks and security tools.

This white paper, driven by new research from CDW, maps where the network technology and service marketplace is headed in 2014, the tools and trends in play and what organizations are doing to stay ahead of the networking curve. See what IT teams in other organizations are planning and implementing – and where they're seeing successes and challenges – as you consider options for upgrading your own network infrastructure.

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Situation: What's Happening and What It Means

CDW's *Surveying Your Network* report, an August 2013 study of network initiatives planned by IT decision-makers from the CDW Advisory Board (CAB), polled IT professionals to determine the kinds of network optimization efforts they're considering, the technologies they're implementing and why.

The study, targeting medium- to large-sized companies and small- to medium-sized businesses (SMBs), is designed to help organizations understand key networking trends and see how their peers are tackling infrastructure improvements.

For the *Surveying Your Network* report, CDW surveyed 1105 customers; 624 CAB members responded — 67 percent from medium-sized and large organizations, the rest from small organizations. Ninety percent of respondents were in-house IT professionals, with 69 percent serving in high-level IT positions as C-suite IT executives, IT managers or IT directors.

Respondents work in a wide range of industries, including manufacturing, financial services, healthcare, computers/electronics, distribution/warehousing, insurance, retail, energy, construction, legal, media, engineering, real estate, telecommunications, commercial transportation, value-added resale and hospitality.

Among the key findings:

More than half (56 percent) of respondents are planning to make network infrastructure changes within the next year, with 38 percent of these intending to do so within the next six months. The latter group consists of companies from industries such as engineering, food, healthcare and legal.

Nearly a quarter (24 percent) said they had upgrade plans, but they wouldn't start within the next year. The three reasons they gave for holding off: They had recently completed a network infrastructure project, believed their current implementation was serving their organization effectively or didn't have the budget for an upgrade.

The remaining 20 percent were not sure when they would make any changes.

The most commonly planned optimizations involve the core network fabric. Of those planning optimization projects, 35 percent said they would concentrate efforts on upgrading routers and switches, and 28 percent cited data center servers and storage updates as their primary focus. Other plans include wireless network (17 percent), security (7 percent) and WAN (7 percent) improvements. Some organizations are focusing on smaller upgrades rather than major modernization projects.

Beyond Budget: Top Networking Hurdles

Network complexities can make infrastructure upgrades difficult, even for IT organizations with dedicated network specialists. Indeed, such upgrades can be beyond the scope of many small IT teams. Though organizations continuously strive to optimize the network environment, IT departments face numerous obstacles on this front. Budget is a perennial issue for many, but what other obstacles stand in the way?

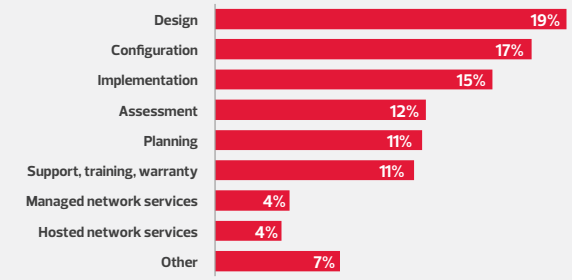
Many hurdles, according to the CAB membership, are related to lack of specific network know-how. Scarcity of specialized skills, insufficient manpower to add network projects to the departmental workload and senior managers who don't see the advantages of upgrades — all are factors in stalled initiatives.

Small IT departments usually don't have staff dedicated to network administration, much less the specialized skill sets needed to design and implement an optimized network infrastructure. Said one survey respondent (an IT manager for a transportation firm): "Without a network engineer on staff, I'm responsible for the entire IT environment, from network to server administration."

Even larger oganizations that employ dedicated network administrators may find they don't have the planning, design and configuration skills needed to overhaul their network or re-engineer segments to improve performance, application availability and security.

Areas Where IT Teams Need Help with Network Services Upgrades

In what area do you feel you will most need help with your planned network services upgrades?



SOURCE: Quick Poll Question (CDW Advisory Board, August 2013)

Out of Touch at the Top?

Another barrier stems from a different personnel segment — senior business executives. Many executives don't understand the business drivers for network optimization projects. Convincing senior managers that network upgrades are critical to operations requires IT leaders to tie investments to tangible business value — never a simple proposition in projects that involve IT infrastructure. Survey respondents also noted that they needed help to build the business case for upgrades.

Once they have the go-ahead, IT departments face challenges finding the right time to perform upgrades. They have a very small window — a matter of hours, in some cases — when the

network can be brought down without disrupting operations. Even if they have the skills in-house, that's often not enough time to perform necessary upgrades.

Everybody Wins with WAN and Other Upgrades

Nonetheless, nearly half of respondents said their entire organization would benefit from network optimization. As for lines of business that would profit most from network improvements, 35 percent said the IT department, 15 percent named sales and marketing, and 5 percent cited finance and accounting.

"Better, more reliable equipment and alignment with our current standards will make it easier for us to manage our network and improve uptime," said an IT staff member at a large manufacturer. Other CAB members said network upgrades yield significant cost savings due to better use of IT resources, with one stating that the organization would "save more than 30 percent annually in WAN costs."

Network Infrastructure Wish Lists

CDW asked IT leaders to name the network upgrades they'd make. Among the items on their wish lists were technologies for improving network speed, reliability and security.

Speed Thrills: To make their networks faster — and to improve connectivity, throughput and application performance for remote offices — many IT leaders said they'd install fiber cabling, migrate to 10 Gig-E backbones and optimize WANs and LANs.

"If money were no object, we would install several miles of fiber cabling and add the associated hardware to support the infrastructure," said an IT manager working at a medium-sized financial services institution. Another respondent, an IT manager at a midsized transportation company, echoed the need for speed: "If budget weren't an issue, WAN optimizers would be on my list, because I've never heard a user complain that the WAN was too fast."

Up for Anything: For improved reliability, wish lists included upgrading the core infrastructure through improvements to routers and switches, firewalls and virtual private networks (VPNs); developing better backup and recovery processes; and deploying high-performance storage area networks (SANs).

Make Management Matter-of-Fact: Also on IT lists are automated tools and proactive endpoint devices to simplify network management. Ways to ease complexity include deploying network management systems that centralize management; automated monitoring; virtualizing networks, servers and desktops; and migrating to an infrastructure as a service (IaaS) cloud environment.

An IT manager from a large manufacturing company noted, "We have an extensive network that spans many sites throughout the globe. We should have network monitoring tools or probes in place to help us better manage our network, but we don't."

"From a maintenance, security and backup perspective, it makes sense to move the network infrastructure to the cloud," said the IT director of an SMB in the computers/electronics industry.

In Control: With no spending ceiling, CAB members said they'd improve traffic management and security by deploying central controllers for managing switch configuration, traffic flow, and access points (APs), as well as smarter switches and firewall devices.

"I see our network broadening and users hungering for data and accessibility," said a network engineer at a large company in the distribution/warehousing industry. "I'd like to increase visibility into what's going on with our network, and secure and manage it."

Routers and Switches

While routers and switches may seem to be small tactical targets when viewed within the overall network fabric, they are, in fact, instrumental to performance and reliability.

An organization with many of its routers or switches at the end of their lifecycle is at risk of a failure that could bring down the entire network.

What's more, businesses running outdated devices can't take advantage of enhancements, including faster port speeds, new endpoint management features and higher-level communication with network management systems. Device upgrades are also necessary if the business wants to leverage new technologies and protocols — such as IPv6, software-defined networking (SDN), wireless integration, video conferencing and Voice over IP (VoIP) — that require a robust, reliable infrastructure.

"Our routers and switches are some of the oldest pieces of hardware on the network, with some so old that they're not even managed," said an IT executive at a small financial services firm. "We'd like to be able to standardize on a model and functionality."

Enterprise Design Considerations

With the growing demands placed on them, today's networks are increasingly complex. IP-based networks now support converged voice, video and data traffic and must be highly available to provide users with anytime, anywhere access to a range of business applications.

Meanwhile, businesses are more distributed, as are their workforces. Network users range from office-based employees (who also use mobile devices for remote access) and true mobile workers to external partners, suppliers, customers and guests.

Network upgrades, especially major overhauls, aren't easy to perform. Designing a highly available network requires extensive expertise. Indeed, members of the CAB expressed a

greater need for early-stage assistance for network upgrades — citing design, configuration and implementation as areas where they most needed help — than for help during later phases related to post-implementation support.

In addressing today's network requirements, architects face increasingly difficult challenges. Machine virtualization, which opened the virtualization floodgates, has tested network flexibility, while the infrastructure is increasingly a hybrid-cloud platform connecting dedicated servers and public- and private-cloud services. Designs, too, must evolve to these changing traffic patterns.

Traditional designs were location-centric, focused on ensuring connectivity between offices and among remote workers. Application performance relied on bandwidth sizing. In response to shifting IT trends, including those empowering users, architects have restructured the hierarchy, with users, devices and application characteristics driving design considerations. The emphasis on bandwidth and speed shifted to latency and the user experience.

Monitoring and Maintaining

Critical to maximizing performance is the ability to monitor core fabric devices. With visibility into the entire network through network management systems as well as smart routers and switches, network monitoring enables IT organizations to see early-warning signs in devices and address them before they become major problems. The collective data gathered through regular monitoring also helps direct IT resources to areas requiring maintenance.

Hierarchical Inter-networking Model

Networks must be architected to meet current needs, with the flexibility to adapt to changing needs as the organization evolves. In response, network design has moved toward a more modular infrastructure, simplifying upgrades.

Many organizations today rely on a three-layer design called the hierarchical inter-networking model. The model's logical network layers include:

1. Core layer **2.** Distribution layer **3.** Access layer

The core layer — the network's backbone — connects the network's individual building blocks. With redundancy and resilience built-in, network professionals can bring components online or take them out of service without affecting performance. This layer is capable of forwarding large traffic volumes rapidly and reliably, while also handling WAN traffic.

Designing the core as a Layer 3 switching environment enables faster convergence, scalability and bandwidth utilization. Designers should include transmission standards and technologies — like Gigabit Ethernet — that promote speed and reliability.

The distribution layer — the communication point between the core and access layers – handles quality-of-service (QoS) tuning, load balancing and provisioning. It controls packet queuing, routing, filtering and access to the WAN, and contains network and security policy controls. Distribution layer designs typically include Layer 3 switches for core connectivity and Layer 2 switches for access layer connectivity.

The access layer — serves as the entry point for desktops, servers and edge devices accessing network resources. The design goal here is to minimize the cost per port, so switching services at this layer use commodity-based technologies.

Designing for Maximum Benefit

Network architects designing a high-availability network should consider IT staff, users and costs when choosing the type and number of devices that constitute the core fabric. It's important to streamline the infrastructure (as over-designing will hinder performance and availability) and to incorporate multiple features that work together to maximize network uptime.

Designs should also build redundancy into the network topology. A redundant infrastructure relies on a series of interconnections that link components throughout various layers to overcome device malfunctions. When a device fails, another takes over its traffic-forwarding duties so that the network continues to function normally or suffers only short-term degradation.

A Paradigm Shift in Network Design

The network — as connector of all systems, components, applications and people that support the organization — has an extensive and growing job description that doesn't allow for time off. Its latest duties include accommodating the virtualization of everything, cloud services, mobility, bring-you-own-device (BYOD) initiatives, Big Data and instantaneous access to applications at any time, from any location.

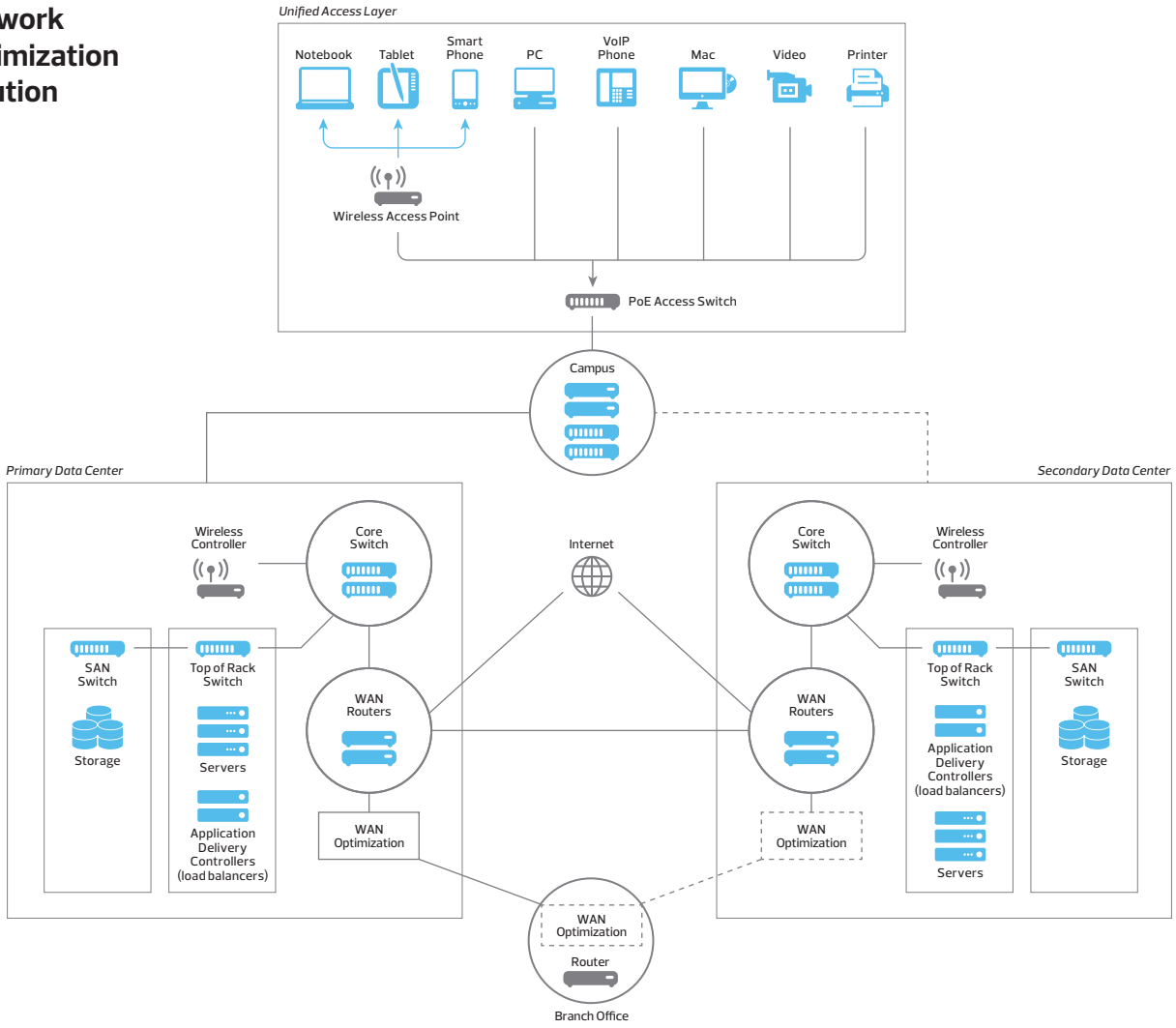
Ensuring high availability for applications is driving network designs that incorporate newer protocols and processes that connect geographically dispersed data centers. Distributed data centers themselves help optimize application response times through redundancy, workload mobility, capacity management, optimally located sites and disaster protection and recovery.

Data Center Mobility

Data center mobility leverages stateless computing and other capabilities to distribute application workloads within the primary data center, between data centers and into cloud environments for optimum resource utilization, uptime and performance.

To realize these benefits, the network has to extend Layer 2 and Layer 3 connectivity across data centers. To overcome the limitations of Layer 2 switch forwarding, IT teams can leverage Overlay Transport Virtualization (OTV) interconnect technology, which optimizes LAN extensions across data centers.

Network Optimization Solution



These extensions unlock distributed clustering and other capabilities at the web, application and database layers. IP-based OTV can also deliver value inside the data center, where it improves mobility by working with Layer 3 interconnects, which effectively segment the network.

For Layer 3 mobility between data centers, the Locator/Identifier Separation Protocol (LISP), which reassembles distributed applications, supports both IPv4 and IPv6 addressing.

Software-Defined Networking

The emerging software-defined networking (SDN) approach offers a set of scalable applications, protocols and processes that create a new layer for improved management, control, resource allocation and user services. This helps businesses better support mobility, virtual machines (VMs) and cloud services.

Switches and routers usually incorporate a data plane, which handles packet forwarding, and a control plane, which contains forwarding rules. SDN decouples the hardware of the two planes, abstracts the underlying network infrastructure and centralizes network intelligence. It basically transfers the control plane's decision-making capabilities into a flow controller, a logical interface between the new SDN layer and the physical infrastructure. This centralized controller has visibility into all routing, access and traffic flows to make more intelligent decisions.

SDN is poised to explode, thanks to the network innovation, virtualization, mobility and cloud hosting it supports. Market research firm IDC, in its study *Five Emerging SDN Vendors to Watch in 2013*, predicts the $360 million generated by the segment in 2013 will rocket to $3.7 billion by 2016.

WAN and Application Optimization

The distributed nature of today's workforce — and by extension, the network that supports it — has IT directors considering WAN optimization investments. WAN optimizers and application accelerators incorporate traffic prioritization, data deduplication and other techniques to improve application access response times and reduce traffic chatter. In short, these technologies make WANs perform like LANs.

CAB members cited numerous reasons for these upgrades, including the desire to improve data delivery to remote offices, both to speed access to centralized applications and to ensure smooth data transmission between offices. WAN upgrades also decrease latency between geographically distributed data centers.

Meanwhile, load balancers, also referred to as application delivery controllers (ADCs), which historically have handled switching for applications, now incorporate capabilities that allow them to support a growing number of entrenched and emerging applications. Virtualization through cloud migration, according to IDC, enables IT to better align network services with application workloads. Such benefits are increasing demand for ADCs, and IDC estimates the market for such products will exceed $2.1 billion by 2017.

Core WAN Solution Sets to Maximize Bandwidth and Reliability

To address common WAN problems, IT shops need a well-stocked toolkit. The primary problems that plague WANs — and the techniques and technologies for addressing them — include:

Insufficient bandwidth. Techniques that optimize bandwidth include data compression and reduction. IT can reduce the data it stores and sends over WANs through deduplication (to remove redundancies) and caching (which leverages a stored version of recently requested data). WAN optimization controllers (WOCs) are the primary technology supporting compression and reduction. Web security gateways include some of these capabilities as well.

Poorly performing applications. Application misfires can be addressed by deploying an ADC near the application server. Other options include leveraging WOCs that include optimization features and instituting web layer controls using web application firewalls.

Application contention. When applications compete for network resources, the resulting contention slows performance. Addressing this requires traffic prioritization, using QoS tools and WOCs, as well as better bandwidth allocation. Next-generation firewalls incorporate basic bandwidth management and prioritization.

Network reliability. To improve reliability by reducing link downtime, organizations may deploy multiple links at various network points and then attempt dynamic routing and link balancing. Most use combination router/VPN devices or edge firewalls built on routing protocols.

Application reliability. IT shops tackle reliability through load balancing. Local load balancing takes advantage of a Layer 2 or Layer 3 ADC device that forwards requests based on a set algorithm. Global load balancing, designed to provide balance across data centers, is more complicated and generally less effective.

Security concerns. WAN security solutions include access control tools, anti-malware, intrusion prevention, web security gateways and proxy servers. Leveraging their position on the edge, next-generation branch firewall devices include some of these security features, allowing IT to get additional return from their firewall investments. Web security gateways and proxy servers include limited web-oriented WAN security.

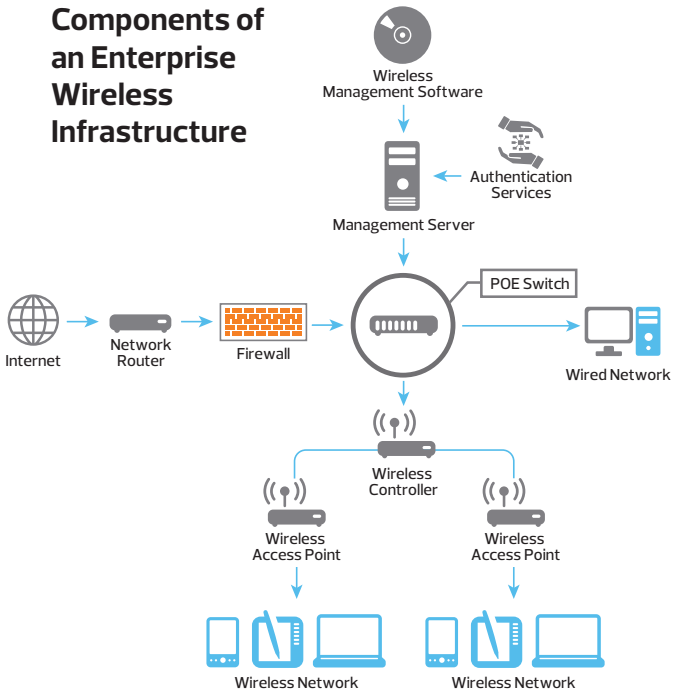
Wireless

The emergence of mobile technologies has forced organizations to seriously consider the state of their wireless networking infrastructure. Serving mobile users requires an agile, scalable wireless network infrastructure.

In terms of upgrades, IT leaders intend to refresh and expand their wireless networks. Many *Surveying Your Network* respondents plan to refresh their wireless infrastructure and add wireless access points, with the goal of bringing them under centralized wireless controllers, supporting more service set identifiers (SSIDs), and improving throughput and coverage.

"The current wireless routers that we're using don't give the range or management options that we need at some of our sites, so we're upgrading," said an IT manager at a large healthcare organization.

Components of an Enterprise Wireless Infrastructure



To deploy an enterprise-class wireless infrastructure, IT leaders should follow this five-step process:

1. Identify requirements. Defining the needs of a wireless network starts with reviewing coverage and security. Coverage dictates where and how fast the network will operate, while security dictates how different users will connect and what access controls will apply to each.

2. Conduct a site survey. This determines the appropriate number and placement of access points.

3. Select products. Many IT chiefs opt to simplify acquisition by choosing their wired network vendor to handle wireless too. Because engineering practices discourage merged wired and wireless networks, IT should explore all options.

4. Installation. Installing wireless equipment generally involves new cabling, patch panels and Power over Ethernet, as well as testing, verification and (possibly) enterprise integration requirements.

5. Management and tuning. After access points have been installed, a second site survey will verify network performance. Dead spots and other issues may require moving or adding APs.

Organizations can make sure wireless investments pay off by employing these implementation best practices:

Adopt fully managed wireless solutions. Wireless controllers that treat the network as a single organism (rather than a collection of APs) simplify management, configuration and upgrades.

Manage proactively and prioritize usage. Network administrators should identify problems before they can affect performance or access to services.

Enforce smart guest access policies. While enabling guest access to the wireless LAN (WLAN) is important, it should be restricted. IT should make the connection process straightforward and simple, avoiding approaches that require users to register or request a temporary user name and password.

Optimizing Network Performance with 802.11n

The IEEE 802.11n specification set is the gold standard for developing a wireless infrastructure. Administrators have numerous ways to optimize performance using these specs, such as best band choice, APs and power management.

WLANs should take advantage of both the 2.4- and 5-gigahertz bands. When feasible, dual-band routers should use the 5GHz band, which leverages the higher capacity provided by 40-megahertz channels.

From an access standpoint, wireless networks deliver the highest speed through 802.11n 3x3:3 APs, which newer devices support. In this multistream design, a device has three streams and three antennae. Meanwhile, keeping a wireless AP's power level below its capacity reduces interference noise, extends device battery life and increases network performance.

Network performance also improves when IT blocks access attempts by older 802.11b devices, whose low data rate use can impede other users trying to gain access. Network staff can accomplish this by setting higher default thresholds for data rate usage and the minimum connection speed allowed.

Next-Generation 802.11ac

Next up for wireless networks are devices built on the 802.11ac standard. In 5GHz frequencies, data rates can jet above 1 gigabit per second through 80MHz and even 160MHz channels. Because network optimization shouldn't be postponed, IT should incorporate the AP standards available as they wait for 802.11ac devices to become commercially available. Adding pre-standard 802.11ac components is acceptable as long as the software is upgradeable to the final ratified standard.

Security's Role in Network Health

The security upgrades planned by CAB survey respondents are motivated by three primary concerns: aging hardware, new technologies requiring new security approaches and regulatory compliance.

Hardware refreshes, especially for firewall devices, are a key initiative in security strategies. IT chiefs want to invest in advanced firewalls, while eliminating obsolete devices.

Survey respondents cite concerns around suspicious activity and finding ways to better monitor network access to resources and their data. Today, organizations are more at risk than ever before and data loss prevention and advanced persistent threat protection are critical components of the healthy network.

"Business objectives have changed in favor of more virtual desktop infrastructure or VDI," said one respondent, an IT executive. "To succeed, this effort requires a restructuring of the network security model."

Another driver behind planned security infrastructure upgrades is the need to comply with state and federal regulations and internal policies. Laws regulating network security are complicated, but the financial penalties some organizations face for a data breach can be powerful motivators.

Data Center Upgrades to Servers and Storage

To take advantage of advanced data center technologies and infrastructure models, IT teams intend to refresh their servers and storage hardware.

IT leaders surveyed for the CAB study named several drivers for upgrading server and storage solutions. Among them: the need for a data center refresh to provide fundamental user services. Organizations also can improve service delivery, as well as uptime-related processes, by leveraging new supporting technologies.

Data centers are getting leaner. Many IT organizations have virtualized some if not all of their servers, reducing support costs, improving hardware utilization and simplifying provisioning. Other drivers include managing the increased traffic hitting virtual servers, degrading network performance and overwhelming traditional storage approaches.

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