OVERCOMING THE TOP FIVE CORE NETWORK CHALLENGES

APPLICATION NOTE

Alcatel·Lucent

Enterprise

ABSTRACT

With enterprise networks under pressure to meet new demands and information technology (IT) staff challenged to reduce costs, the need for a new approach to enterprise networks is growing. This paper describes how the Alcatel-Lucent Application Fluent Converged Network solution enables enterprise networks to support new capabilities and devices while reducing costs. It describes the architectural advantages of the Enterprise solution and provides an example of how this architecture helps enterprises reduce total cost of ownership (TCO).

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ENTERPRISE NETWORKS ARE UNDER PRESSURE

The enterprise network is under pressure. Today, corporate networks face unprecedented challenges, many of which are due to the rise of the bring your own device (BYOD) trend. Here are the top five core network challenges for enterprises:

1. Security risks
2. Mobility demands
3. Multimedia user experience
4. Virtualization of the desktop, data center and cloud
5. Reducing costs

All of these trends drive higher bandwidth demands, pushing legacy networks to their limits. New smart devices and increased mobility increase the pressure, making it difficult to predict bandwidth consumption. Virtualization strains the network from inside the enterprise. As information technology (IT) groups embrace virtualization, demand for raw bandwidth increases and the network must automatically respond to the needs of virtualized systems — something legacy networks were never designed to do.

Faced with these challenges, enterprises need a new approach to create a network that can:
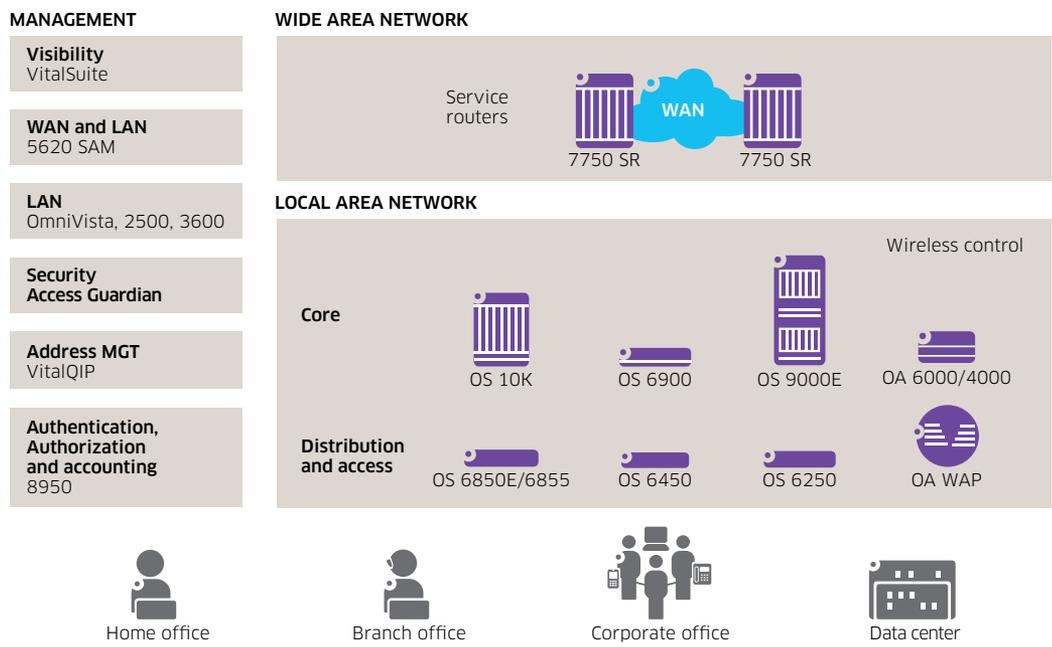
- Deliver a high-quality user experience for voice and video through a resilient architecture, with fast convergence time, minimal jitter and latency, and the ability to selectively allocate bandwidth to specific applications.
- Accommodate user and device mobility with a high degree of integration between the wired and wireless LAN.
- Free IT staff from their daily struggles by being far easier to manage and maintain than legacy networks.
- Resolve all of these challenges in a cost-effective way.

To address these challenges, Alcatel-Lucent Enterprise brings its Application Fluent network approach to the converged network.

THE APPLICATION FLUENT CONVERGED NETWORK

Our vision of an Application Fluent Network is based on a resilient architecture with streamlined operations that reduce network complexity and provide automatic control with dynamic tuning of network performance. This Application Fluent Network possesses broad knowledge of both network devices and the applications to which they connect. Most importantly, it understands the context of the conversation between the user, device and application — and makes decisions based on that understanding.

Figure 1. The Application Fluent Converged Network solution

MANAGEMENT

Visibility
VitalSuite

WAN and LAN
5620 SAM

LAN
OmniVista, 2500, 3600

Security
Access Guardian

Address MGT
VitalQIP

**Authentication,
Authorization
and accounting**
8950

WIDE AREA NETWORK

Service routers

WAN

7750 SR   7750 SR

LOCAL AREA NETWORK

Wireless control

Core

OS 10K   OS 6900   OS 9000E   OA 6000/4000

**Distribution
and access**

OS 6850E/6855   OS 6450   OS 6250   OA WAP

Home office   Branch office   Corporate office   Data center

The converged network solution offers a new architecture that is simplified and flattened, with two layers instead of the traditional three-layer architecture. In many cases, it is possible to eliminate the need for a distribution layer by introducing new-generation, wire-rate 10 Gigabit Ethernet (GbE) and 40 GbE core switches such as the Alcatel-Lucent OmniSwitch™ 6900 Stackable LAN Switch and the Alcatel-Lucent OmniSwitch 10K Modular LAN Chassis, which offer market-leading port density and switching capacity.

The Enterprise Pod

Since the majority of future of traffic in core networks and data centers will shift from client-to-server to server-to-server, Alcatel-Lucent Enterprise has created an innovative architectural design based on the "Pod". The Pod ensures low latency and high performance by providing server-to-server connectivity through a unique direct-connect architecture without relying on a core switch to carry traffic. This single management entity, or virtual chassis, can be created with as few as two Alcatel-Lucent OmniSwitch 6900s, which is ideal for small and medium-sized businesses (SMBs), and can scale as needed.
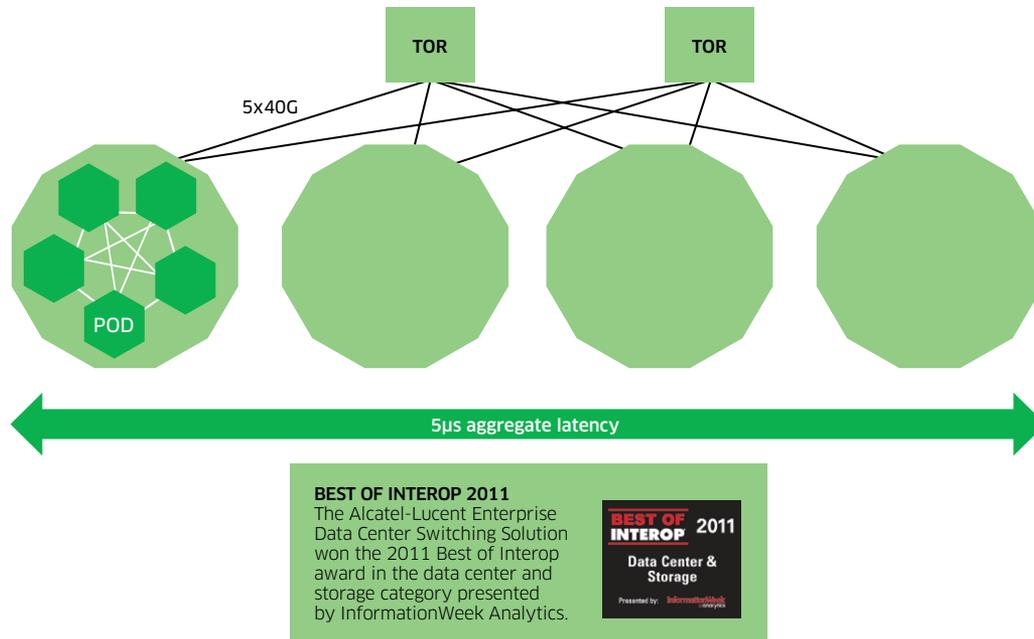
Figure 2. The Pod provides a direct-connect architecture

POD

TOR   TOR

TOR   240   TOR

TOR   TOR

2µs latency
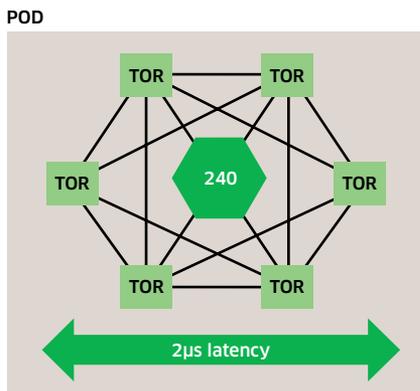
The Enterprise Mesh

The Mesh is composed of Pods connected to each other and to core switches to combine more than 14,000 server-facing ports with aggregate end-to-end latency of less than five microseconds.

Figure 3. The Mesh combines thousands of server-facing ports with low latency

BEST OF INTEROP 2011
The Alcatel-Lucent Enterprise Data Center Switching Solution won the 2011 Best of Interop award in the data center and storage category presented by InformationWeek Analytics.

With the new architecture, enterprises can save 80 percent on total cost of ownership (TCO), 90 percent on rack space costs and 100 percent on warranty costs. The solution provides:

- 10 GbE port density in one rack unit (RU) to increase density in a single rack and support next-generation service requirements. Modular slots offer versatility by supporting 40 GbE uplinks and the resulting oversubscription.

- The lowest power consumption per 10 GbE port in its class to ensure efficient power management, reduce operating expenses and lower TCO.

- A free lifetime warranty on hardware on all stackable switches, including the dual-purpose Alcatel-Lucent OmniSwitch 6900 40G switch, which can function as a top-of-rack or a compact core switch.

ADDRESSING ENTERPRISE CORE NETWORK CHALLENGES

With an Application Fluent Converged Network, enterprises are well positioned to address their top five core network challenges.

Addressing challenge #1: Security risks

One of the hottest topics for IT staff these days is the increasing pressure from end users to use their own devices on the corporate network. This can be a positive experience for the company and its employees. However, the BYOD trend also introduces a number of security and support concerns.

The critical requirements are to make sure that the right people on the right devices can get to the proper resources with a high quality of experience and that unauthorized people and non-compliant devices cannot access corporate resources. As a result:

- The first component of any BYOD solution has to be a strong Network Access Control (NAC) solution that authenticates both the user and the device.
- Second, it's important to know that the devices accessing the network are healthy and not going to infect the network or other devices on the network. This requirement is perceived as more manageable when only corporate-controlled devices are allowed onto the network. Most companies now require some type of Host Integrity Check (HIC) for non-corporate devices that attempt to access the network.
- Third, it's important is to ensure that once on the network, the next generation of applications designed for BYOD functions properly for end users. As a result, the network must ensure end-to-end quality of service (QoS) and prioritization.

The Alcatel-Lucent SafeNAC solution handles all enterprise NAC and HIC needs to meet these requirements. It can also notify the network infrastructure of the rights and bandwidth allowed to any user on any device. From that point, the Alcatel-Lucent OmniSwitches will manage network rights while the SafeNAC HIC feature continues to monitor the health and compliance of the device. These capabilities can all be applied to employees, contractors and guests as they enter the network.

Addressing challenge #2: Mobility demands

Network edge security services provided with the Converged Networks solution are applied on each device using role-based access control lists (ACLs) for post-admission controls rather than simply fixed to the switch port. Capabilities include an edge security framework that provides:

- Automatic endpoint authentication and profile assignment through User Network Profiles (uNPs)
- Dynamic user authentication and profile assignment
- Automatic HIC with network quarantine
- Rogue device detection and isolation
- Role-based post-admission controls
- Traffic anomaly detection

The ability to manage conversations in context with the uNP is unique to the solution and is embedded in the access layer switches.

Figure 4.uNPs help to manage mobility demands

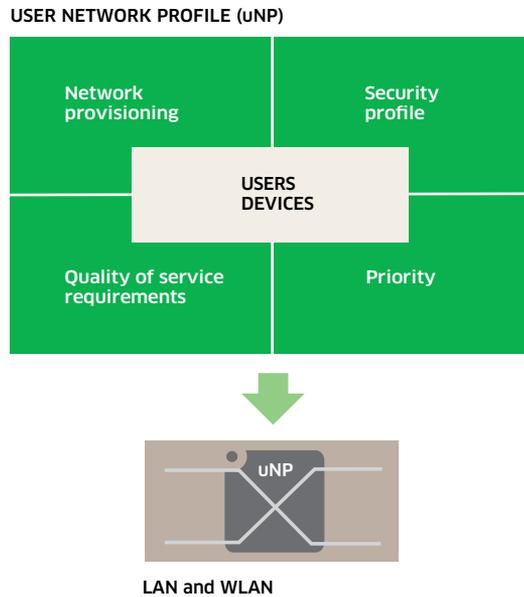**USER NETWORK PROFILE (uNP)**

LAN and WLAN

Figure 4 shows the uNP conceptually, with the user and devices surrounded by the information required to manage them. The uNP enables the network to automatically adjust its configuration depending on the movement of users and devices in the network, instead of the traditional approach of static configurations based on switch ports.

A uNP:
• Minimizes effort by eliminating the need to manually reconfigure the network when devices are moved around.
• Improves application delivery performance for user mobility by fine-tuning the network so end users enjoy the same experience wherever they are connected.
• Provides consistent security throughout the network.

Addressing challenge #3: Multimedia user experience

To expanding on the application fluency approach, Alcatel-Lucent Enterprise has introduced multimedia fluency. With multimedia fluency access layer switches can:
• Detect the initiation of a Session Initiation Protocol (SIP)-based conversation on the network
• Assign specific QoS treatment
• Monitor the actual QoS received
• Provide a dashboard that gives administrators visibility of conversation quality on the network

With multimedia fluency, a specific user can, for example, receive differentiated QoS for voice and video sessions but not for other applications. Even among voice and video sessions, a user could have different QoS based on specific needs. The first implementation of multimedia fluency is based on SIP traffic. This technology enables adjustment of wireless operations to prioritize traffic and avoid service interruption. Future releases will expand multimedia fluency to include Virtual Desktop Interface (VDI) applications and http-based services.

Figure 5. Multimedia fluency provides differentiated QoS based session type
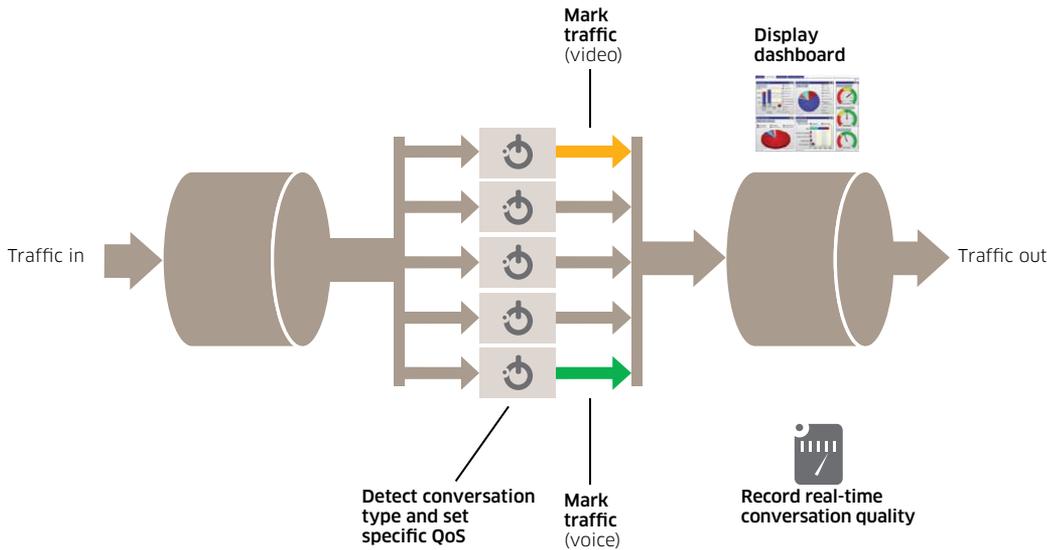
Addressing challenge #4: Virtualization at the desktop, data center and cloud

Virtualization helps to achieve a flattened and simplified architecture because it removes the inefficiencies of the Spanning Tree Protocol (STP) and enables the network to keep all links active and to fully utilize all available resources. Traditional methods would disable all redundant links and use them only in the event of main link or switch failures.

Figure 6. Virtualization flattens and simplifies network architecture
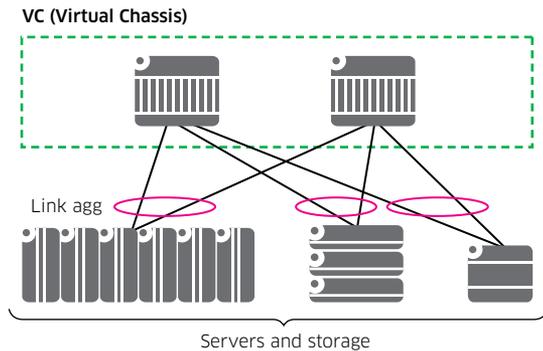
The configuration illustrated in Figure 6 facilitates dual-homing of servers/storage and access devices to the Virtual Chassis (VC). Benefits include:

• A single point of management using a single IP address
• A loop-free edge without STP

- Node-level and link-level redundancy
- Switches that are geo-independent and do not need to be co-located
- Switches that are interconnected using standard 10G and 40G Ethernet optics
- Redundancy and resiliency support across switches
- Full routing similar to single chassis support over the dual-homed link aggregates
- In-service software upgrades (ISSUs) across the chassis

The core network composed of the Alcatel-Lucent OmniSwitch 6900 and Alcatel-Lucent OmniSwitch 10K can also be used as a data center switching solution to help increase agility and speed in deploying new services and applications. A pay-as-you-grow business model and direct connect architecture enable enterprises to start with a "right sized" initial deployment and grow as needed.

With an application-fluent approach to network virtualization, IT teams enjoy automated virtual machine movement. For larger enterprises, specific corporate departmental data centers can be partitioned to create virtual data centers and reduce complexity. Looking ahead, enterprises of all sizes can achieve seamless co-existence with cloud-based services, helping to simplify cloud service delivery to corporate networks.

Enterprises can:
- Manage applications as services with a network that understands each application and automatically adapts to follow virtual machine movement within or between data center sites.
- Take advantage of a hybrid cloud model with seamless coexistence of service provider-delivered cloud services and applications served from the enterprise data center.
- Prepare for the future with Alcatel-Lucent Enterprise's innovative award-winning data center fabric. The Pod and Mesh direct-connect architecture delivers low latency, high density and a long term sustainable design. In addition, our standards-based approach means enterprises are not locked-in to a specific vendor.

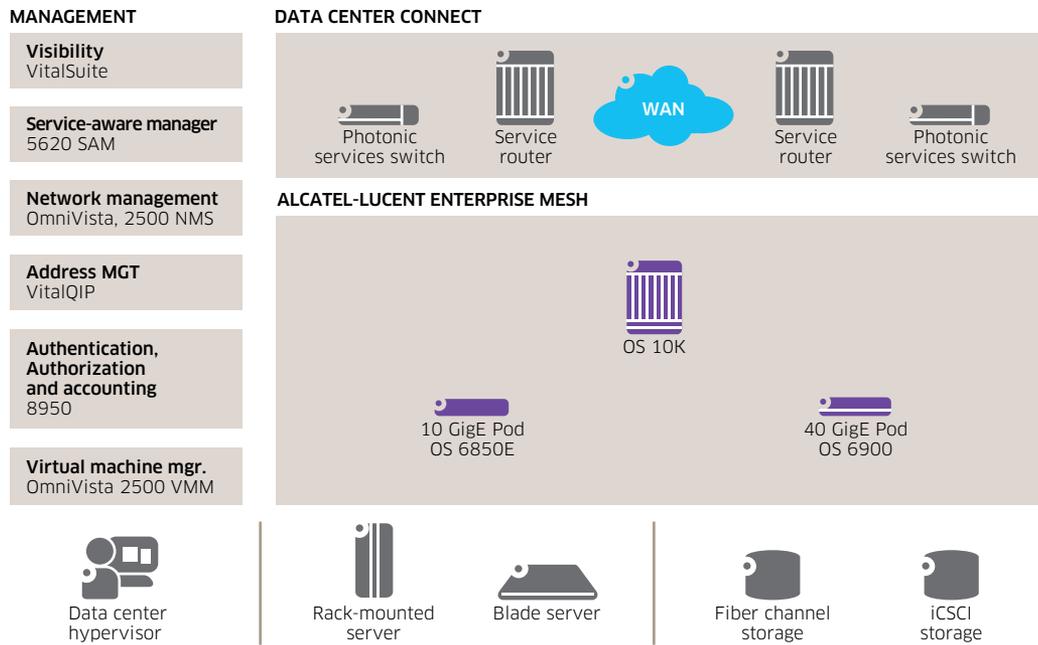## Addressing challenge #5: Reducing costs

IT departments are under unprecedented stress. Not only do they need to support innovative new devices and applications, but they also are asked to increase quality and reduce costs. To achieve this objective, it is necessary to streamline operations with automated provisioning and a powerful and unified management system.

Alcatel-Lucent Enterprise leverages its extensive experience managing carrier networks to provide end-to-end network and application visibility, as well as carrier-class troubleshooting tools. The Alcatel-Lucent OmniVista™ 2500 Network Management System (NMS) provides a common network management experience for access and core networks, meeting the requirement to easily manage corporate, branch and home office sites for both wired and wireless users. The Alcatel-Lucent OmniVista 2500 NMS also includes integrated security management for consistent application of security across the corporation.

Additionally:
- Alcatel-Lucent VitalSuite® Network Performance Management Software provides end-to-end application performance visibility
- Alcatel-Lucent VitalQIP™ DNS/DHCP IP Management Software provides IP address management.
- Alcatel-Lucent 8950 AAA provides Authentication, Authorization and Accounting

Figure 7. Network and performance management help to reduce costs

MANAGEMENT

Visibility
VitalSuite

Service-aware manager
5620 SAM

Network management
OmniVista, 2500 NMS

Address MGT
VitalQIP

**Authentication,
Authorization
and accounting**
8950

Virtual machine mgr.
OmniVista 2500 VMM

DATA CENTER CONNECT

Photonic services switch | Service router | WAN | Service router | Photonic services switch

ALCATEL-LUCENT ENTERPRISE MESH

OS 10K

10 GigE Pod
OS 6850E

40 GigE Pod
OS 6900

Data center hypervisor | Rack-mounted server | Blade server | Fiber channel storage | iCSCI storage

With the Application Fluent Converged Network, enterprises benefit from the best return on investment (ROI) in the industry and a sustainable solution for the years to come. Enterprises enjoy:

• A flatter network and better use of switch ports and network links due to network virtualization that requires less equipment and reduces capital costs.

• Reduced operational costs due to market-leading low power consumption. Energy consumption from competitors can range from 50 percent to 100 percent more than an Alcatel-Lucent Application Fluent Converged Network.

• Simplified management and maintenance that frees IT staff from the daily struggle to ensure application performance for users. The resulting streamlined operations reduces operational costs.

• The smallest core network switch in the world — the Alcatel-Lucent OmniSwitch 6900 with 64 10 GbE ports in 1 RU — which increases density in a single rack and supports next-generation services to reduce TCO.

• Equipment that already supports IPv6 and 40 GbE and is ready to support new technologies, including 100 GbE, enabling future growth with the same hardware that supports current needs.

• A free lifetime warranty on hardware on all stackable switches including the Alcatel-Lucent OmniSwitch 6900 40 GbE switch.

• TCO that can be 60 percent lower than competitors' solutions.

THE APPLICATION FLUENT NETWORK IN A TYPICAL DEPLOYMENT

Assume that company X has a single site with fewer than 1000 employees, and it needs to deliver voice, video and collaboration applications to a full range of devices, including employee-owned smartphones and tablets. The IT team is currently under pressure to maintain a quality user experience, and the company wants to free them from this burden so they can make better use of their time across a range of corporate priorities.

The Enterprise Converged Network solution saves money over typical solutions from the beginning because it provides a simplified architecture with only the core and access layers. A high-density 10 GbE or 40 GbE Alcatel-Lucent switch in the network core and virtualized technologies eliminate the need for a distribution layer, which is integrated into most networks simply to overcome switching limitations.

Figure 8. The Alcatel-Lucent Converged Network solution has only two layers
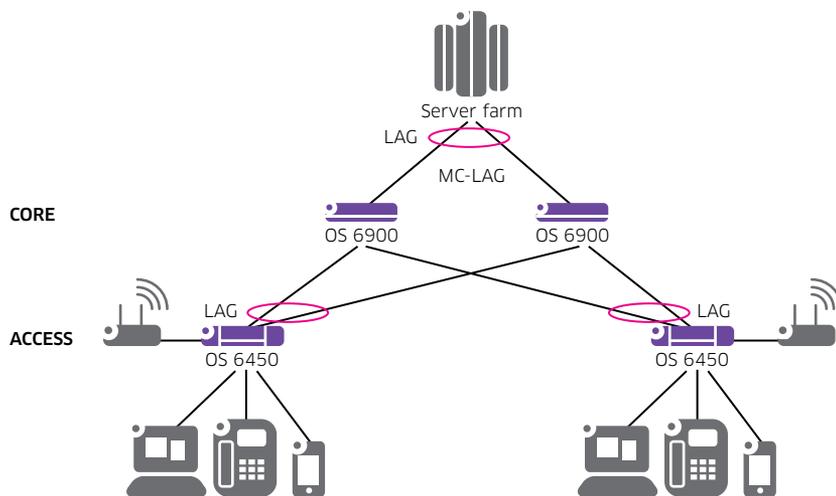
This architecture provides a fully redundant and resilient network with a very fast convergence time. It is able to recognize users, devices and applications and automatically adjust the network configuration to provide quality real-time application delivery.

The access layer features 1 GbE switches with 10 GbE uplinks. It anticipates the convergence of wired and wireless access with wireless access points attached to the access switches. This extends the access layer to wireless devices on each floor or building section, as needed. The access layer switches also include stacking technology that enables all stacked switches to be managed as a single node. The switches used in the Alcatel-Lucent Enterprise Converged Network feature the industry's lowest power consumption, dramatically reducing energy and cooling costs when compared to typical network solutions. Company X is able to directly connect its 10 GbE server farm to the network core, using Multi-Chassis Link Aggregation Group (MC-LAG) for redundancy.

How company X saves money by choosing the Alcatel-Lucent Enterprise solution

Because the Alcatel-Lucent Enterprise solution architecture requires less equipment than a typical converged network, the company was able to accomplish its goals with a reduced capital outlay. With streamlined management and operations, IT staff members are now available for other projects that make the business run more effectively.

If company X were to choose a similarly sized solution from one of our two largest competitors, they would spend up to 100 percent more in energy costs. Because this architecture anticipates upcoming changes and already supports future technologies, company X will be able to keep up with evolving demands without changing hardware. By choosing the Alcatel-Lucent Converged Network solution, rather than a solution from one of the two largest vendors in the market, company X:

• Gets the performance it needs

• Makes the best use of all of its IT and network resources

• Is already prepared for the next technological advances

• Achieves faster ROI

As illustrated in Figure 9, competing solutions that serve an equal number of users require a TCO that ranges from 56 percent to 68 percent higher than the Alcatel-Lucent Enterprise Converged Network solution.

Figure 9. The Alcatel-Lucent Converged Network solution reduces TCO
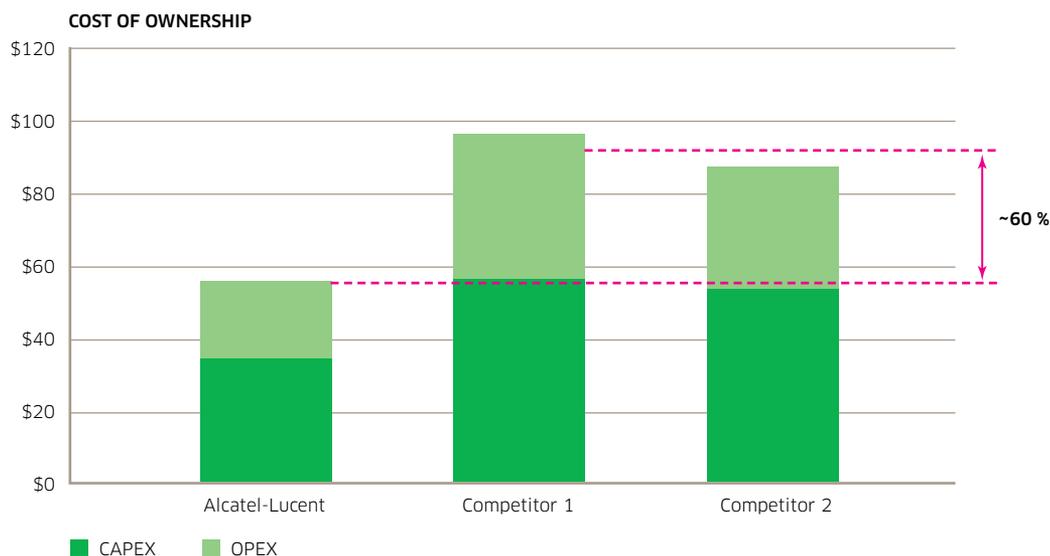
COST OF OWNERSHIP

• Analysis based on user cases with 100 GigE core, 1 GigE access and 800 users (~1200 ports)
• Cost of ownership includes equipment cost, maintenance, power and cooling over a 5-year period.

CONCLUSION: THE BENEFITS ARE REAL AND RECOGNIZED

The benefits of the Alcatel-Lucent Application Fluent Converged Network approach to enterprise networks are being recognized by major organizations. In October 2012, Alcatel-Lucent announced that the California State University system is upgrading its state-wide infrastructure covering more than 20 sites with Alcatel-Lucent Enterprise products. The solution cost $100 million United States dollars less than that of a major competitor.

According to Michel Davidoff, Director Cyber Infrastructure CSU, Chancellor's Office, "CSU's IT network project is a long-term investment strategy, not just a reaction to current budget issues. Alcatel-Lucent Enterprise equipment provides a simple yet flexible and eco-friendly design using a small number of platforms in diverse roles to maximize best practices across our campuses."

Davidoff added, "We expect to gain significant operational efficiencies with this infrastructure that will also open doors to the future with its flexibility. We can easily evolve the network to provide more advanced services in the future with minimal investment, such as linking kiosk technology or security. And as a result, we expect to avoid considerable costs over the next eight years."

Along with cost avoidance of equipment spending, CSU expects to experience 'green' savings in the range of millions of dollars over the eight-year agreement by deploying Alcatel-Lucent's highly energy-efficient OmniSwitch product line.

ABBREVIATIONS

AAA	Authentication, Authorization and Accounting
ACL	access control list
BYOD	bring your own device
GbE	Gigabit Ethernet
HIC	Health Integrity Check
ISSU	in-service software upgrade
IT	information technology
MC-LAG	Multi-Chassis Link Aggregation Group
NAC	Network Access Control
NMS	Network Management System
QoS	quality of service
ROI	return on investment
RU	rack unit
SIP	Session Initiation Protocol
SMB	small and medium-sized business
STP	Spanning Tree Protocol
TCO	total cost of ownership
uNP	User Network Profile
VC	Virtual Chassis
VDI	Virtual Desktop Interface

RESOURCES

- Alcatel-Lucent Enterprise Application Fluent Network
  http://enterprise.alcatel-lucent.com/?solution = ApplicationFluentNetwork&page = homepage
- Alcatel-Lucent Enterprise Converged Networks
  http://enterprise.alcatel-lucent.com/?solution = NetworkConvergence&page = homepage
- Alcatel-Lucent to transform IT network of largest US university system
  http://www3.alcatel-lucent.com/wps/portal/!ut/p/kcxml/04_Sj9SPykssy0xPLMn Mz0vM0Y_QjzKLd4x3tXDUL8h2VAQAURh_Yw!!?LMSG_CABINET = Docs_and_ Resource_Ctr&LMSG_CONTENT_FILE = News_Releases_2012/News_Article_ 002730.xml
- Cisco network really was $100 million more
  California State explains RFP that produced wide delta in Cisco, Alcatel-Lucent bids
  http://m.networkworld.com/news/2012/102512-cisco-csu-263711.html?page = 1
- Country's largest 4-year university expels Cisco, saves $100 million
  California State replacing 3,316 switches with Alcatel-Lucent gear
  http://www.networkworld.com/news/2012/102212-cal-state-cisco-263588.html

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