APPLICATION FLUENCY FOR A HIGH-QUALITY USER EXPERIENCE

ENABLING UNIFIED ACCESS FOR CONVERGED ENTERPRISE NETWORKS

STRATEGIC WHITE PAPER

Enterprise networks are facing unprecedented challenges – challenges that threaten their ability to remain competitive and reduce costs while meeting the rising expectations of users. Today employees expect enterprise networks to provide seamless access to applications and services within the enterprise. In the future this seamless access will expand to support movement across the enterprise boundary, as users shift between different network access technologies: wired, Wi-Fi,® 3G, femtocell, and more. In this new world, the network must evolve to meet expectations; therefore, a new enterprise network is required. The new converged enterprise network must be fluent in a variety of applications to deliver a high-quality end-user experience. It must be engineered to remove the communications barriers imposed on users by siloed access networks and fragmented network services.

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UNPRECEDENTED CHALLENGES FOR ENTERPRISE NETWORKS

Enterprise communications networks are facing unprecedented demands from end users. Accustomed to the freedom they have to access their consumer applications anywhere, at any time and on any device, end users now expect enterprise networks to provide the same seamless access to these applications and services within the enterprise. Eventually users will expect their company to provide the same ubiquitous access as they move across the enterprise boundary. Complicating the issue is the fact that employees also want to use their personal consumer devices on enterprise networks — devices chosen by them, paid by them and loaded with the applications they want. Unfortunately, these mobile devices are not under the control of the information technology (IT) team, which increases the risk of unauthorized access to sensitive corporate information from the outside.

The new end-user demands are the direct result of changes that have taken place in the nature of business conversations. Face-to-face meetings have evolved into conversations with multimodal anytime, anywhere contextual interactions enabled by virtualization technologies on the desktop, in the network, in the data center and in the cloud. E-mails have given way to instant messaging, online presence and social media applications, which have enhanced business processes and made employee interactions with each other, partners, suppliers and customers more effective.

All these changes have created significant challenges for enterprises of all sizes. To remain competitive and enable the ubiquitous access to communications employees now expect, enterprises must evolve their network infrastructures to support end-user mobility with bandwidth hungry applications on a variety of devices. The network must eventually evolve to allow connections to be maintained as end users move across the enterprise boundary and shift between different access technologies: wired, Wi-Fi, 3G, femtocell, and more. At the same time, the network must accommodate new, real-time applications, such as video and collaboration suites, which push legacy networks to their limit by eating up bandwidth.

In this new world, where the network must continuously adapt to meet real-time mobility demands, it is increasingly difficult for network managers to predict bandwidth consumption and prioritize applications to ensure adequate service levels for critical applications. Therefore, a new enterprise network strategy is required to accommodate ever-increasing user demands that dynamically change based on which application or service is needed at any given time and at any location.

The new converged enterprise network must be fluent in a variety of applications to deliver a high-quality end-user experience. It must be engineered to remove the communications barriers imposed on users by siloed access networks and fragmented network services. The ideal solution must be built on a new converged network architecture centered on a high-speed core and enabled by a unified access layer with embedded network services for all devices and applications.

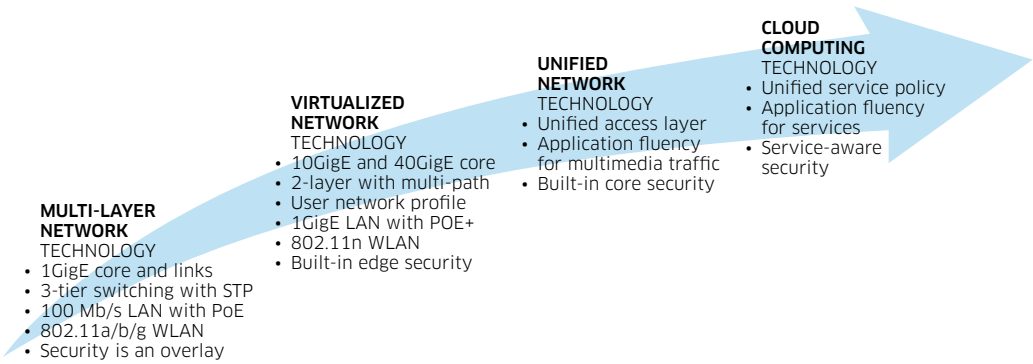
BUILDING THE NEW CONVERGED ENTERPRISE NETWORK

Adding raw bandwidth, which is the traditional approach to addressing end-user demands for new services and applications, will not work in the enterprise networks of the future. Most legacy networks lack the embedded service capabilities needed to deliver traffic that requires quality of service (QoS) levels other than "best effort." As a result, transmission delays and dropped packets degrade the user experience in the form of garbled or dropped calls and jittery video transmissions.

Similarly, continuing to maintain separate networks for many services, such as video streaming and teleconferencing, is an expensive approach to address these issues. Each new network is expensive to establish and expand and requires dedicated staff to maintain. Many IT organizations cannot afford to simply upgrade and extend their costly and complex network structures while they are also being asked to reduce both staffing and operational expenses.

Therefore, a converged, all-IP enterprise network offers the best solution. New converged architectures, higher transmission capacity and automated controls can deliver the quality user experience that is needed, while reducing costs and simplifying administration. Many enterprises have already successfully combined their voice and data networks to the point where voice is viewed as an application or service on the IP network. Convergence will continue to occur with the migration of different applications and associated devices onto the IP network, such as IP video cameras, device sensors, and more. This will make it necessary to upgrade the network edge and core and introduce new network service elements. Eventually, new network architecture will emerge with a unified access layer and a set of embedded network services for all devices. This convergence process may in turn lead to a seamless hybrid cloud model that enables service delivery on any network, to any device and at any location from private data centers or the public cloud with acceptable QoS and security (Figure 1).

Figure 1. The projected evolution of the converged enterprise network



Network development stages

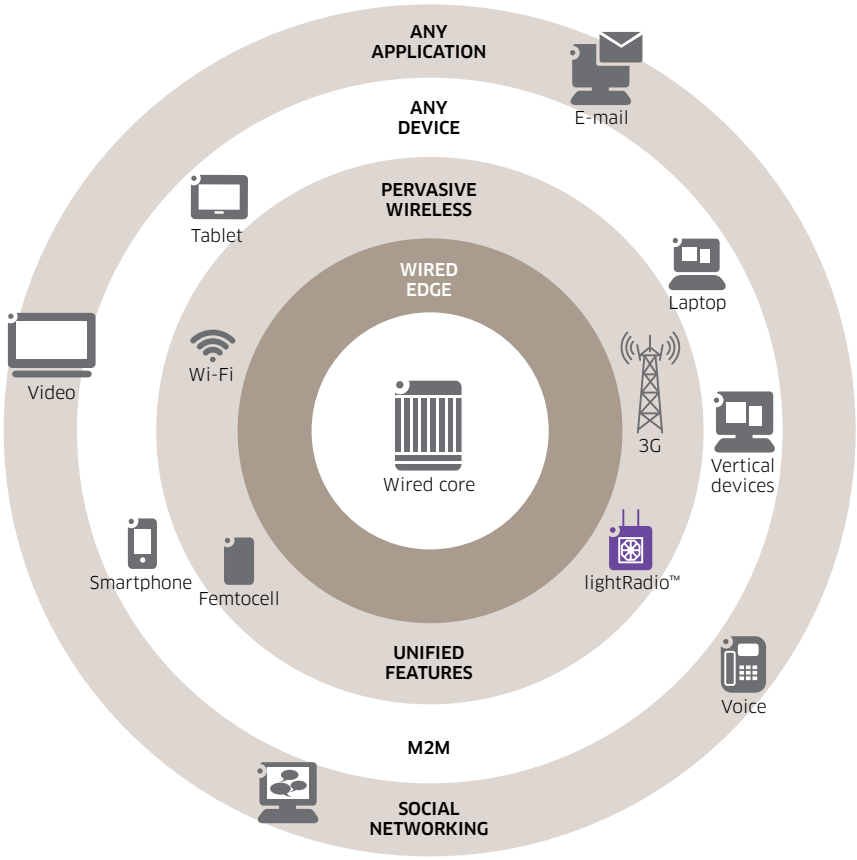
The ideal end-user experience on a converged network — the experience end users will come to expect — is created when mobility, application, and device freedom is possible through unified access. It is maintained when conversations on the network can be seamlessly transitioned from one network to another and from one device to another with context and a high level of service quality. This requires an application fluent network.

Application fluent networks enable a high-quality end-user experience for delivery of real-time applications along with reduced complexity for IT and network managers. This is achieved through simplified, resilient and low-latency network architecture with built-in security. To improve end-user productivity, an application fluent network also features automatic controls for adjusting application delivery based upon profiles, policies and context. Finally, an application fluent network delivers streamlined operations through automated provisioning and low power consumption.

Building an application fluent network can be accomplished in stages. The process should begin with the unification of access policy management, evaluation and enforcement for the Wi-Fi and wired networks in the enterprise. These actions are followed by unification of the physical wired and wireless networks in areas where this can be achieved with cost savings as the driver.

But the unification of the network access layer cannot stop there. To meet end-user expectations, enterprises must also integrate femtocell and 3G/4G technologies to improve the end-user experience and reduce costs. This integration may be enabled by the development of new simplified base station technologies, such as lightRadio™ (Figure 2).

Figure 2. Unification of the access layer to achieve the ideal enterprise end-user experience



Access control

With the transition to a single access layer for the converged network, enterprises can also benefit by migrating from the current wireless control model of using a centralized controller to one in which the control function can be delivered in different forms, based on the existing installed base, network size, and functionalities expected. To make this happen, enterprise IT departments need flexibility and elasticity for the delivery of wireless local area network (WLAN) control functions. For some, a fully distributed model may be necessary; for others, a virtualized model makes sense. Some may require a centralized model, while a hybrid model may be the best option for those who may be implementing a campus versus a branch office deployment.

In addition, policy enforcement for network access control is required. This enforcement can eventually be accomplished by the same access layer switches for both wired and Wi-Fi access. Virtualization of the control function and sharing of the policy enforcement point in this way removes the inefficiencies associated with today's controller-based architectures where all traffic is backhauled to the centralized controller.

Network service orchestration

To support unified access and enable a seamless user experience the unification of wired and Wi-Fi access can be facilitated by the introduction of a network service orchestration layer that enables true value to enterprise end users. Network service orchestration allows applications and devices to discover services that are available on the network and provides a common service provisioning and control portal. It also ensures interoperability between the individual services and delivers the ability to easily share a common policy framework.

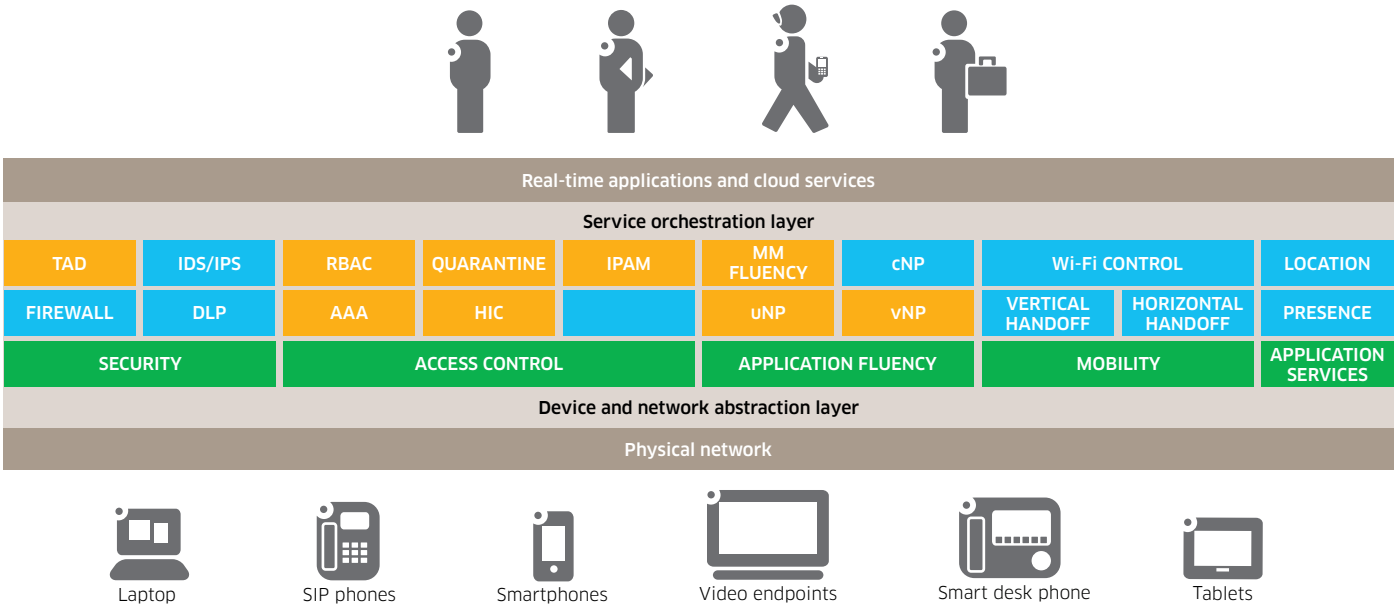
Enabling devices to discover and use available network services is essential for a seamless user experience. As well, common provisioning and control function is essential for a converged network solution that reduces the burden on IT teams and network administrators.

With a service orchestration layer the network can leverage advances in virtualization and computing technologies through a suite of orchestrated network services (Figure 3), including:

- Security services, such as authentication, firewall, and ID S/IPS
- Access control services, such as traditional IP address management (IPAM), and Dynamic Host Configuration Protocol (DHCP), as well as Authentication, Authorization, and Accounting (AAA), and role-based access control (RBAC)
- Application fluency services
- Mobility services, such as Wi-Fi control and network handoff
- Application services, such as presence and location services

Individual services may be hosted on separate appliances, virtualized and hosted on external servers or on blade servers embedded within network switches, or even included in the operating system for the switch itself.

Figure 3. Network service orchestration supports unified access and enables a seamless user experience.



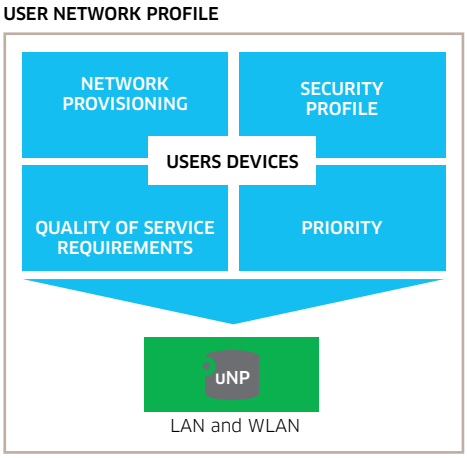
CREATING THE IDEAL END-USER EXPERIENCE

An application fluent network delivers an ideal user experience because it treats each conversation on the network as unique and can provide specific quality control based upon the context of the conversation – that is the user and device in use. In addition the treatment of each conversation can be further refined based upon the actual application in use such as voice or video conferencing. Moving forward the network will evolve to allow for seamless handoff between networks and be able to provide specific QoS and controls and security services for Cloud based services.

Conversations managed in context

Network conversations can be managed in context by leveraging the unique information associated with each user, application, and device. This action can be accomplished with a user network profile (uNP) that provides the network provisioning information, the security profile required by the user of that device, the QoS requirements, and the priority of that user or device within the network (Figure 4).

Figure 4. Network conversations can be managed in context by leveraging a user network profile.



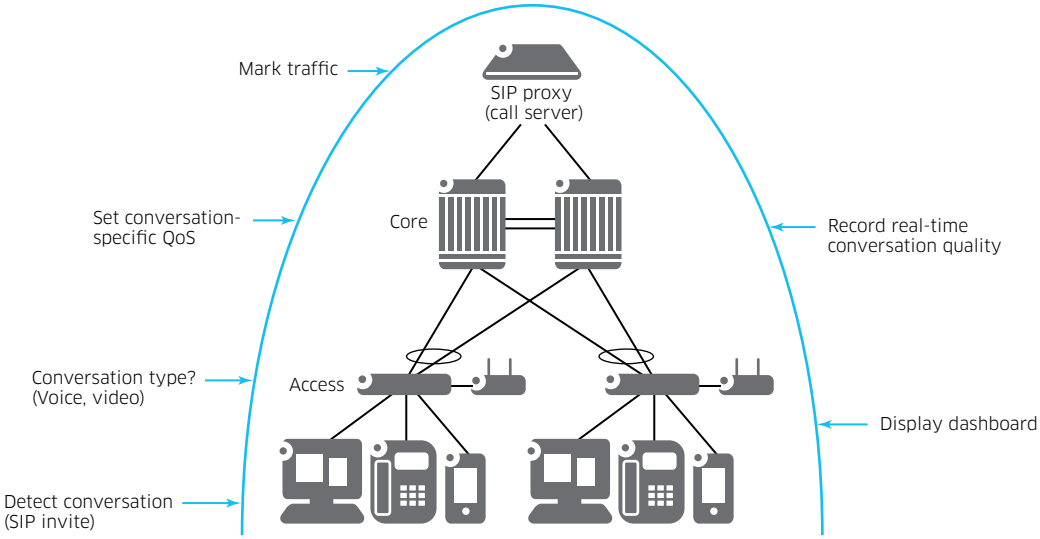
With this information, the network can recognize users and devices and bind them to a uNP. This capacity allows the network to understand each conversation and to automatically adjust to conversation requirements. The network is also able to automatically discover the location of a user or device by monitoring traffic on a specific switch port. It can automatically provision the user and device on that switch port, including security and initial QoS parameters. And the network can designate conversations initiated by a particular user on a specific device that are to be measured for actual QoS received.

Enhanced application fluency for multimedia traffic

Application fluency for multimedia today includes the ability to detect a specific conversation when it is initiated on the network, assign a specific QoS treatment, monitor the actual QoS received and provide a dashboard for IT administrators to have visibility on the quality of the conversation. On a new converged enterprise network optimized with unified access, this can be enhanced by correlating event information to enable recommendations for changes to QoS policy that improve the end-user experience. In the future, it could be further enhanced by enabling autonomous action to tune the quality of the end-user experience as required.

For example, access layer switches can be enabled to detect the start of a Session Initiation Protocol (SIP)-based conversation on the network (Figure 5). The access switch examines SIP control packets to determine which User Datagram Protocol (UDP) ports are assigned to the conversation and which application is being used, such as voice or video communications. With knowledge of the application being used, the switch can then set a specific QoS treatment for each distinct conversation on the network.

Figure 5. Application fluency can be enhanced by correlating event information and managing quality levels.

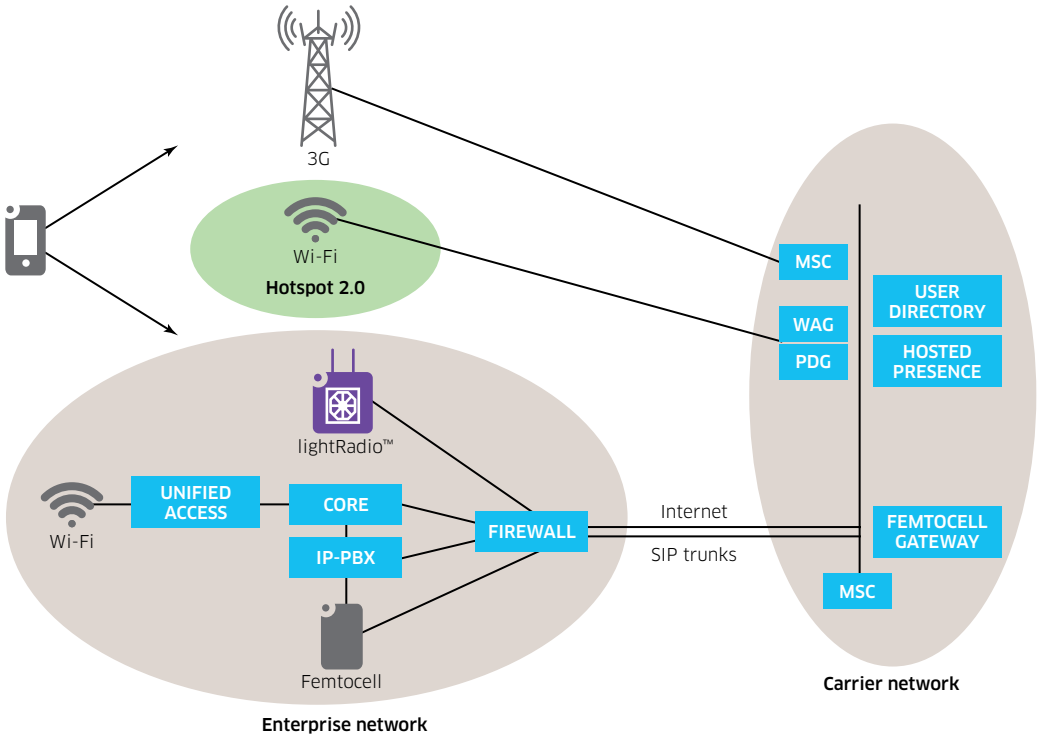


The real-time conversation quality information typically contained in SIP-initiated conversations, such as packet loss, delay, jitter, mean opinion score (MOS), and R-factor, is recorded. The access switch can also mark the traffic for each conversation with appropriate parameters so that proper priority is given to each conversation as it traverses the network core, thereby ensuring that QoS policy is applied end to end. In addition, the real-time information gathered concerning conversation quality can be collected and a dashboard of conversation quality made available. As a result, a voice conversation and a video conversation initiated by the same user on the same device can be treated differently.

Pervasive mobility

Beyond improving the quality of end-user conversations, an enterprise network optimized for conversation management can evolve to further improve the end-user experience by enabling more transparent mobility. This can be achieved by supporting seamless access to applications and services as end users shift between different access technologies and networks (Figure 6).

Figure 6. Conversations must be maintained as end users shift between different access technologies.

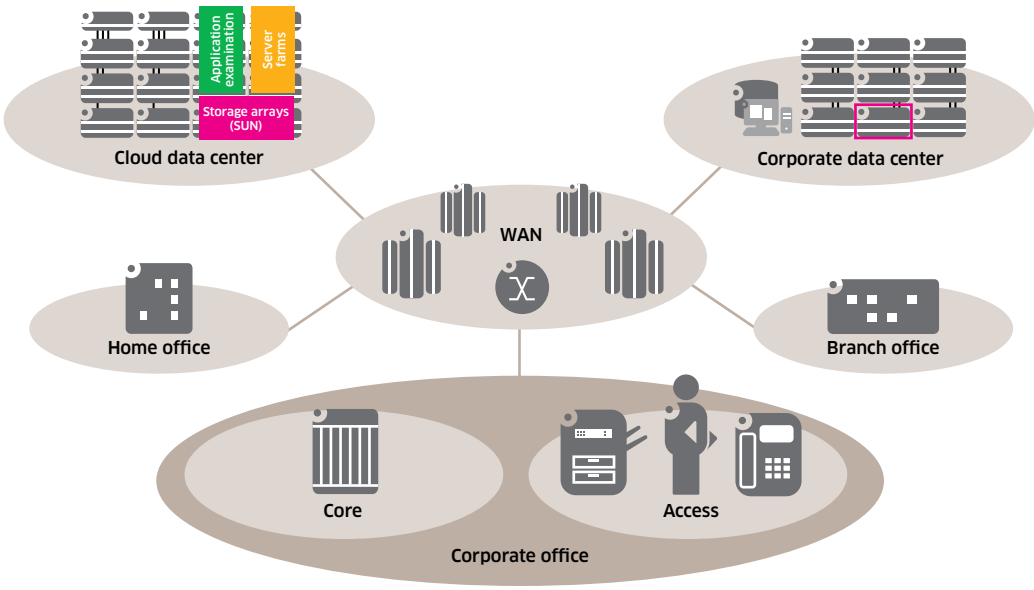


Initially, this may include 3G/4G and Wi-Fi access on service provider networks. Eventually, this may extend to femtocell and lightRadio networks, and Next-Generation Hotspots (NGHs). Providing seamless handoff may also entail leveraging Mobile IP, an Internet Engineering Task Force (IETF) standard designed to allow mobile device users to move from one network to another while maintaining a permanent IP address.

Cloud enablement

Whether an application is hosted in the corporate data center or consumed as a service from the cloud, users will come to expect all applications and services to be orchestrated as part of one conversation (Figure 7). This action can only be achieved with sufficient bandwidth, security, cloud comparable protocols, quality control from the end-user's device all the way to the cloud platform, as well as management tools that can provide end-to-end visibility on service levels provided. By leveraging the conversation management abilities enabled by the uNP, security, and application fluency features, enterprises can apply the security and QoS controls needed to safely adopt cloud services.

Figure 7. Users expect cloud and enterprise services to be orchestrated as one conversation.



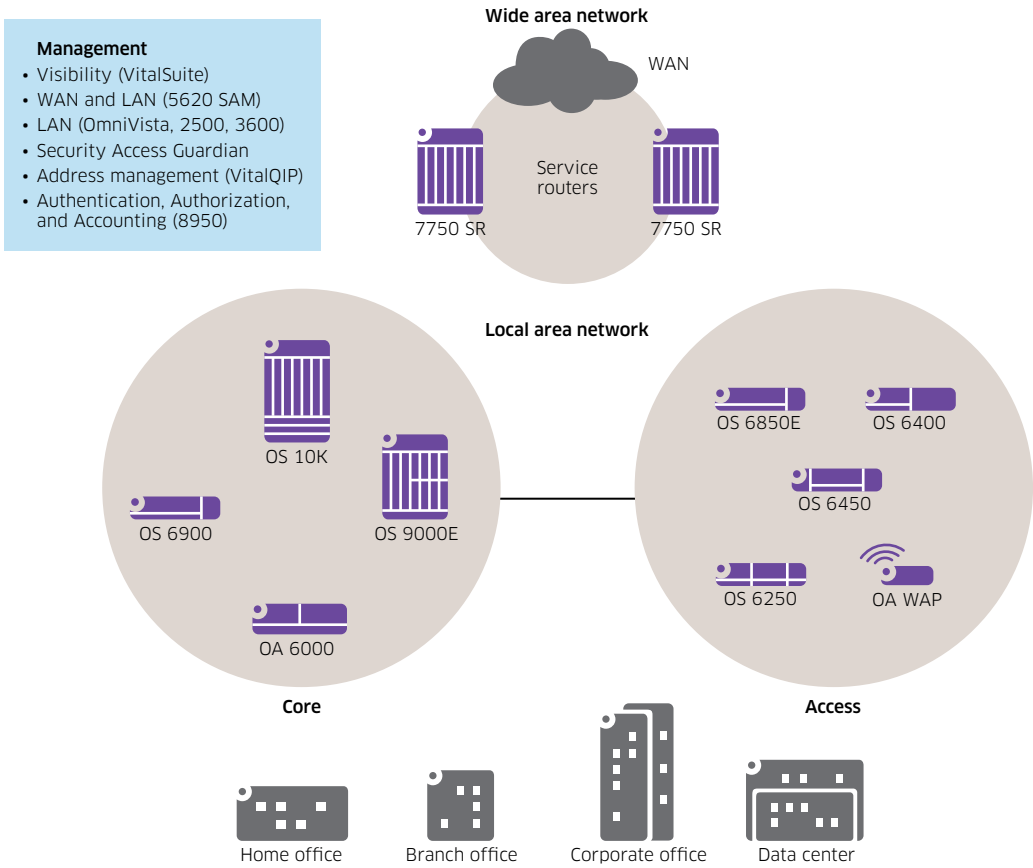
With conversations managed in context, the user and device are known and their conversations are given priority based upon corporate policy. Likewise, multimedia fluency provides a unique ability to determine the cloud service in use and to measure the actual end-user experience, thereby allowing for adjustment of policy on how specific cloud services are treated by the network.

ALCATEL-LUCENT AND APPLICATION FLUENCY

Alcatel-Lucent addresses the needs of enterprises with a converged network solution optimized to enable unified access and conversation management for a high-quality, seamless end-user experience.

The Alcatel-Lucent Enterprise converged network solution delivers innovation with a simplified, flatter architecture and network virtualization technology to remove complexity, improve resiliency and optimize network resource utilization. Embedded security at the edge and the network core ensures that users are protected and corporations are secured while reducing the operational complexity associated with many security systems. The Alcatel-Lucent design also provides a long-term sustainable deployment, as the equipment shipped today supports IPv6 and 40 Gigabit Ethernet (GigE), and is ready to support 100GigE, as well as continued convergence of local area network (LAN) and WLAN without any hardware change out. Figure 8 provides an overview of the Alcatel-Lucent converged network solution.

Figure 8. Overview of the Alcatel-Lucent converged network solution



The heart of the solution is a 10GigE and 40GigE wire-rate core provided by the Alcatel-Lucent OmniSwitch™ 10K and Alcatel-Lucent OmniSwitch™ 6900. The converged network includes a unified access layer where a single policy framework, a common authentication scheme, a single user database and a single set of location-aware variables apply for both wired and wireless devices. Unified wired and wireless access also means that there is one unified policy evaluation and enforcement architecture.

Wired network access is provided by the Alcatel-Lucent OmniSwitch™ 6850E and the ruggedized OmniSwitch™ 6855 stackable series, the OmniSwitch™ 6450 series and the OmniSwitch™ 6250 series LAN switches. Wireless access is provided by wireless access points connected directly to access layer switches. Today wireless control is provided by the Alcatel-Lucent OmniAccess™ 6000/4000 WLAN controllers. Also available are instant access point technologies with integrated virtualized controller functions embedded in the access points.

This converged network solution provides a complete corporate network with seamless service to branch offices and the home office — where connectivity between remote sites can be provided by service provider wide area network (WAN) services or a privately owned WAN. It integrates with the Alcatel-Lucent private WAN solution.

And it is complete with all the elements needed to enable efficient unified access and application fluency, including:

- The ability to manage conversations in context with the Alcatel-Lucent User Network Profile, which is embedded in the access layer switches
- Access layer switches enabled to detect and examine conversations upon initiation, and manage QoS, as required, for an optimal end-user experience
- An emerging service orchestration layer that will allow applications and devices to discover services on the network, provide a common service provisioning and control portal, and ensure interoperability between the individual services, including the ability to share a common policy framework

This complete solution is engineered to remove the communications barriers imposed on users by siloed access networks and fragmented network services. It optimizes enterprise networks with unified access and fluency in a variety of applications to deliver the high-quality experience today's enterprise end users expect.[1]

CONCLUSION

A next-generation converged network that is fluent in a variety of applications and capable of ensuring a high-quality experience must be able to meet the needs of a continuously growing mobile workforce. These employees expect that multimodal anywhere contextual interactions can be accessed using their own consumer devices at any time. Therefore, the network must be able to provide seamless and secure access to applications and services within the enterprise and evolve to provide the same experience as users move across the enterprise boundary.

By providing seamless and secure unified access, the new converged enterprise network delivers benefits to end users, IT teams, and the enterprise itself.

1 For a complete overview of the Alcatel-Lucent converged network solution, see the Alcatel-Lucent Enterprise Application Note *IP Converged Network*.

End users will be able to participate in the new conversation paradigm that has taken hold in society. This interaction is important from several perspectives. It ensures that enterprises are engaged with their customers and that employees are engaged with each other. Users benefit from a seamless experience with applications and services where they can carry on conversations that are multi-device, multi-party, and multimedia, regardless of which network access technology they are using. In addition, users are protected by network delivered security and private data is kept secure.

IT teams benefit from a significant improvement in ease of deployment and operations. Removal of isolated networks and the emergence of a common network service framework reduce complexity, thereby simplifying operations. Plus, the inclusion of application fluency for specific application traffic flows allows for fine control, monitoring and adjustment of application delivery quality, which reduces effort in troubleshooting quality issues.

The enterprise benefits from an increase in employee productivity and competitiveness, while reducing overall IT spending. Employees can use their own devices and the applications they choose. The IT staff can be deployed for more effective purposes because the effort required to keep application delivery performance at desired quality levels is reduced. In addition, moving to next-generation solutions brings significant cost savings through virtualization, simpler architectures with lower device counts, and greener equipment.

ACRONYMS

AAA	Authentication, Authorization, and Accounting
cNP	Provide expansion
DHCP	Dynamic Host Configuration Protocol
DLP	Data Lost Prevention
GigE	Gigabit Ethernet
HIC	Host Integrity Check
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPAM	IP address management
IP-PBX	Internet Protocol private branch exchange
IT	information technology
LAN	local area network
MOS	mean opinion score
MSC	mobile switching center
NGH	Next-Generation Hotspot
PoE	Power over Ethernet
PBX	private branch exchange
QoS	quality of service
RBAC	role-based access control
SAM	Service Aware Manager
SIP	Session Initiation Protocol
STP	Spanning Tree Protocol
UDP	User Datagram Protocol
uNP	user network profile
vNP	user Network Profile
WAG	Wireless Application Gateway
WAN	wide area network
WLAN	wireless local area network

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