Critical Insights for VoIP and IP Convergence Migrations

A CenturyLink White Paper
Businesses in a constant quest for bottom-line savings and top-line growth should invest in a quick and focused analysis of their communications infrastructure. This is especially important for the majority of companies that still employ multiple, separate networks for voice traffic, interoffice data connections, Internet access, remote server access, and video conferencing. An inspection will likely show that use of a unified architecture for communications can dramatically improve operating efficiency and the reliability of their business.

The technologies supporting business applications are typically a wide mix of private line circuit switched networks, Frame Relay, ATM, and even legacy X.25 packet switching. This specialization of technology for different needs was necessary years ago. Today it has a hidden and now unnecessary cost in duplication of effort, time, and money.

Businesses of all sizes have discovered that the uniform use of IP delivers tangible efficiencies in business operations and ownership costs. This approach – called IP convergence – helps enterprises centralize management and better control costs while improving collaboration and the adoption of new business applications.

Using IP convergence, enterprises can integrate the varied needs of enterprise voice, video, and data connectivity onto a single communications platform. While this trend has grown in popularity, service providers that offer solutions for IP convergence have varying capabilities and philosophies as to how enterprises architect their communications.

Any evaluation of IP convergence should examine these critical considerations:

- Security technology and methodology
- Implementation methods
- Equipment selection
- Data access across locations

This paper outlines the possible benefits of convergence, key considerations, and best practices for a successful project.

**What is IP Convergence?**

Defined in the broadest terms, IP convergence is the result of integrating voice, video, and data communications onto a common IP infrastructure. Despite the potential scope of unifying business communications, it needn’t force a sudden or wholesale shift of all enterprise communications to IP. This migration can be done in one action or as part of a staged plan.

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Many convergence initiatives start small with a simple migration from leased line or Frame Relay data communications to use of Ethernet in a WAN setting or by using Voice over IP (VoIP) to converge voice traffic on to a data network. An even simpler example is seen in the use of a Digital Subscriber Line (DSL) for combining voice and data access for a branch office.

Many enterprises have moved beyond those initial steps and fully embraced convergence by combining all of their voice, data, and video communications onto a common IP network. When planning a migration to IP, enterprises should consider the number of locations to be supported. While integration of a single location involves fewer decisions, interconnection of multiple locations requires decisions around access methods available for each, as demonstrated in Figure 1. These considerations are key when selecting a service provider partner since options will vary as the number of locations increases.

*Figure 1:* Companies can converge all communications and new applications by using a combination of Ethernet, MPLS and Secure Internet Access across a common IP platform.
The promise of IP convergence strategies is only realized when several enterprise requirements are addressed:

- Support for a variety of access methods that range from mobile, to low-speed legacy data (T1 or lower), high-speed optical (OC-3), and high-speed IP access (Ethernet).
- Protocol independence that facilitates connections among endpoints running varying protocols (achieved through Multiprotocol Label Switching or MPLS).
- Security that is robust while being flexible enough to support the dynamic nature of constantly changing authorizations and authentications, and then reliably accounting for them.
- Class of Service controls to ensure that enterprise applications don’t conflict when utilizing a common set of resources. Prevention of this potential contention is achieved through use of MPLS labeling. The successful implementation of these controls requires expertise and understanding of what different data, voice, and video applications require from a throughput, latency, and packet loss standpoint. This is known as Quality of Experience or QoE.
- Integration services that are locally delivered, bringing experience and a disciplined approach to IP convergence projects.

Is Your Business an IP Convergence Candidate?

Initially it may seem that only large companies with sprawling networks would be candidates for IP convergence. In actuality, small to medium sized businesses are often likely to have disparate voice, data, and video networks and should explore unified communications strategies to learn what efficiencies and benefits can be gained. Businesses reap several rewards through convergence:

- Operational efficiencies – By standardizing on one technology and working with a single service provider, enterprises scale technical resources more efficiently. For example, in a post-IP convergence scenario, network engineers are responsible for a single network rather than disparate voice and data networks. A single engineer can be the primary point of contact to a service provider for troubleshooting and managing the moves, adds, and changes typical in network management. What’s more, managed services using MPLS mask the complexity of virtual circuits in Layer 2 networks. The service provider handles all administration of routing tables and addressing schemes.
- Lower capital costs – Layer 2 infrastructure such as Frame Relay and ATM switches are typically more expensive than IP infrastructure. In a converged network, a common base of IP infrastructure handles all traffic. Mass production of IP-based gear has led to price declines in this hardware and that trend is expected to continue.

Among the benefits of convergence, lower costs, operational efficiencies, and access to an enhanced feature set are of top importance to organizations.
• Reduced bandwidth costs – When enterprises maintain separate voice and data networks they miss the significant opportunity to make use of the idle periods or “valleys” within their traffic patterns. Standardizing on IP means capacity is utilized more efficiently as all traffic is consumed under a single Mbps bandwidth model. When data transfer is idle, voice traffic can use that capacity and vice versa. Rather than capacity planning for multiple networks with different pricing models, managers can apply a singular focus and gain leverage in the process.

• Readiness for Future applications – Web applications, voice, and video have all migrated to IP as a standard transport. Industry-wide, innovations are developed on IP sooner and businesses can gain competitive advantages more quickly on a converged network.

• Enhanced collaboration – Integration of voice, data, and video facilitates communications and information sharing within an enterprise. For example, IP-enabled phones can interface with workstations to display customer or patient records for inbound calls automatically.

• Improved scale and redundancy – With the use of carrier Ethernet services and MPLS, enterprises can scale networks to multiple Gbps, well beyond the SONET speeds of OC-3 (155 Mbps). In addition, MPLS routing tables can be configured to reroute traffic over different paths or to a failover facility. Through a managed service, this is done completely transparently to end users.

IP Convergence Examples

As mentioned, IP convergence isn’t an all-or-nothing proposition for an enterprise, and service providers offer a range of options to meet varying business needs. Applications that are commonly found in an IP converged network include VoIP, MPLS VPNs, and Ethernet used in Wide Area Networking.

Voice Over IP

The growing number of VoIP implementations and the bottom-line savings delivered has made it a frequently cited example of IP convergence. As the name implies, this convergence is achieved by placing digitized voice signals in IP packets and interspersing them with data also carried over IP. This can be accomplished at the end-user’s handset (or computer) with hosted IP Centrex or alternatively by connecting a traditional PBX to a VoIP network through a service called Session Initiation
Protocol (SIP) trunking. In the first instance, VoIP phones connect directly to the IP network using Ethernet or Wi-Fi and the service provider hosts the common PBX functions of call initiation, termination, and routing.

Because hosted IP Centrex is operated by a service provider, it eliminates the cost and complexity of maintaining a PBX. At the same time, there is no loss of control. IP Centrex management is handled through intuitive user interfaces that make the frequent moves, adds, and changes of users a simple task for administrators.

When enterprises prefer to maintain their own CPE solutions, some providers offer SIP trunking. SIP provides a standard interface for TDM or IP-based PBXs to use the Internet for voice transmissions. Figure 2 illustrates the efficiency of implementing SIP trunking vs. separate voice and data circuits. Both approaches combine voice and data onto a single IP connection and produce several advantages for businesses.

There are several areas of cost savings. First, as data and voice share the same IP network, bandwidth so there is less idle capacity. This effectively cuts costs as it reduces the number of voice lines or trunks as compared to traditional TDM access. This is possible by prioritizing voice and then reallocating bandwidth to data applications when calls terminate. Another area of savings comes through consolidation of support staff as IP expertise applies to both voice and data applications.

**MPLS VPNs**

Whereas VoIP is the technology that enables convergence of voice, MPLS VPNs are an ideal approach to unify disparate data networks. Most enterprise networks are multiprotocol in nature and use different transmission technologies such as circuit switched, Frame Relay, or ATM for data communications. These separate networks with their individual billing schemes and management systems drive inefficiencies in management effort and costs.

MPLS is a data packet switching technology that encapsulates these varying protocols in “labels,” enabling an MPLS network to make packet-forwarding decisions without understanding the contents of the packet. Secure VPN connections to remote locations are made possible using these traffic-labeling capabilities of MPLS and Virtual Routing/Forwarding (VRF) capabilities of routers. Using MPLS VPNs, enterprises can quickly and easily integrate multiple networks independent of the protocols and access speeds they use.

The ability of MPLS to create meshed networks with flexible routing capabilities provides a reliable platform for applications that require robust Service Level Agreements (SLAs). Its flexibility is possible because it operates independent of Layer 2 protocols or specific link speeds. All business communications – in other words, voice, video and data – are digitized and then encapsulated into IP packets that are carried across a single uniform network. By using MPLS services, enterprises eliminate the need to maintain separate and duplicative networks to support business initiatives. While bottom-line savings is a highly touted benefit of IP convergence, businesses gain several top-line benefits and a competitive advantage when the needs of customers, partners, and suppliers are fulfilled with greater speed and agility.

The result is that businesses use fewer resources and operate at a lower cost per Mbps when using an all-IP infrastructure. Adding and moving locations, supporting remote users, and increasing capacity are all simplified.

**Ethernet and IP Convergence**

Available in configurations that operate on a metropolitan scale or even nationwide, Ethernet-based managed services offer enterprises a compelling alternative to leased line or Frame Relay connections. Providing multi-Mbps to Gbps connections, these services create high-speed point-to-point connections or multipoint virtual circuits that scale to handle all voice, data, and video traffic reliably and securely. The following are the three ways in which Ethernet can be used in IP convergence.

**Ethernet Private Line** – Here Ethernet is used to form point-to-point connections for each circuit throughout the transport network. The most common example of its use in IP convergence is the connection of a PBX to a Session Interface Protocol (SIP) gateway to enable VoIP service.
**Ethernet Virtual Private Line** – When there are multiple locations to be connected, this variant of Ethernet enables point-to-multipoint connections that would be found in the hub-and-spoke topology typical of headquarters to branch office connections.

**Ethernet LANs** – In this instance, Ethernet is used in a metropolitan setting to connect LANs by creating a Metropolitan Area Network (MAN)—sometimes referred to as an Ethernet LAN or ELAN. Alternatively it can create a high-speed connection to the Internet to support an extremely large number of users.

### Comparing Managed Service Providers

Service providers vary widely in their definitions of IP convergence and how to achieve it. As outlined, true convergence requires the ability to handle voice, video, multiple access speeds, varying protocols, robust security, and class of service options while operating in fully and partially meshed configurations. A converged network using MPLS, Ethernet, and other technologies can meet these criteria but is only effective when implemented with a precise understanding of business objectives.

Consequently, managed service providers should be evaluated not for technical capabilities alone but just as importantly, for their methodology and approach to understanding a business’ requirements and then implementing the right strategy to achieve them. Before enterprises rush to pursue an IP convergence strategy, they should query potential providers in the following areas:

- **Security** – Security must be at the forefront of any planning and not applied following the migration to an all IP network. Converged networks are by definition highly distributed and demand a different approach than traditional perimeter-based approaches that segregate users and traffic on separate networks. In particular, converged networks place security at the periphery of access devices as well as at the core applications and databases of a network. As a result, service providers must have extensive experience in construction and maintenance of Virtual LANs and Virtual Routes in MPLS. Expertise in these configurations is what allows traffic to coexist on a single network without any security compromises.

- **Implementation** – A key consideration in any convergence project is the implementation. With critical voice and perhaps data services being transitioned, enterprises require a provider who can seamlessly move their services with little or no downtime. Planning and configuration consultation, as well as a locally based service team, help ensure that convergence moves quickly and outages are prevented. Having a focused project manager who is local to the enterprise IT staff allows that person to be integrated into the existing IT team and provide consultation that is customized to meet business requirements. This project manager is dedicated to managing the implementation from project kickoff to service turn-up and is onsite for the migration to new services.

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In addition, more local service providers deliver after-hours cut-over support to ease transition. End-user training of internal staff on new telephony features is also required for the enterprise to fully utilize the efficiencies of the technology. These locally-based sales representatives and customer support personnel ensure that a migration is successful and once complete, that the enterprise’s services are monitored 24 hours a day, 7 days a week. This close partnership between project manager and enterprise IT also ensures that methods for troubleshooting, incident reporting, and issue escalation are clearly documented and understood.

• **Infrastructure and Maintenance Cost** – Due to volume production of IP infrastructure, prices are declining, making it an economical choice for those that opt to own their infrastructure. For CPE solutions, businesses should also evaluate compelling lease options that some service providers offer as a way to avoid an upfront capital expenditures while staying current with the latest technology. Hosted solutions avoid significant capital costs as the service provider owns and operates the equipment. Regardless of which approach is chosen, prospective buyers should work with managed service providers that support both owned and leased models. When prospective buyers move forward, they should inspect a managed service provider’s history with the suggested network infrastructure. They should examine how old it is and what are the upgrade paths for equipment in both purchase and lease scenarios.

When considering maintenance costs, businesses should understand that standardization of voice and data infrastructure creates economies of scale in implementation and subsequent management as expertise is applied in one area rather than several. Finally, as many aspects of management are outsourced to the managed services provider, enterprises should work to understand the provider’s ongoing commitment to certifications, training, and knowledge base maintenance.

• **Quality of Experience** – Integration of multiple traffic types demands that convergence implementations are carefully planned to ensure applications coexist without any performance degradations, especially for voice or video, which are sensitive to packet loss, latency and jitter. Prospective buyers should ensure that their service provider can differentiate between traffic types and prioritize real-time traffic such as voice and video ahead of less sensitive data traffic. Proven experience with Quality of Service and Class of Service tagging are important requirements in this area.

• **Network Engineering** – Capacity planning for a single application is difficult enough but when an enterprise combines all traffic onto an IP network it is made all the more challenging. Managed service providers should be asked about methodologies used in engineering networks to ensure that capacity stays ahead of demands and that business continuity can be assured during periods of peak demand.

**Summary**

IP convergence can be as holistic as placing all voice, data, and video on a single IP network or as simple as moving a few legacy services running on leased lines to IP as an initial step. Even simple steps help the enterprise understand the benefits of IP convergence and prepare for the future.

Over the past few years many major enterprises have successfully migrated legacy voice and data networks to IP and enjoyed both bottom- and top-line benefits. CenturyLink has extensive experience at both ends of the spectrum having led many successful migrations to convergent networks on both large and small scales. Whether you are taking the first step of implementing a VoIP solution, or migrating to a full MPLS VPN infrastructure, CenturyLink’s expertise in Convergence solutions and local support model can provide a seamless transition.

On the bottom line, Total Cost of Operations (TCO) is significantly lowered with the economies of scale that come with a uniform technology and management. Top-line
Summary (cont.)

benefits come with improved customer satisfaction and revenue as a company becomes more agile and competitive, rolling out new applications for its customers more quickly. Holston Medical Group is a healthcare provider with over a dozen clinics operating in Virginia and Tennessee. To date it has operated as many small- to medium-sized businesses do: running discrete networks for voice and data networking. By using Ethernet in a Metropolitan Area Network (MAN) configuration, Holston gained the capacity to converge voice and data communications while reducing complexity and TCO.

These benefits do not come easily and enterprises must screen potential providers to understand their approaches to security, infrastructure, implementation, and ongoing management. Migration to converged IP networks is now occurring in widespread fashion and the benefits aren’t just for large multinational corporations. Any small- to medium-sized business can gain the same savings and competitive advantages previously reserved for larger companies.

For more information about VoIP and IP convergence migrations, contact your CenturyLink representative or call 1-866-345-0814. Or visit centurylink.com/stronger.

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