



Migrating from TDM to IP: Getting the Ball Rolling

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Executive Summary

Enterprise businesses are approaching an important crossroads in meeting their telephony needs. Traditional telecommunications systems are nearing the end of their product lifecycles, and now is the time to decide whether to repair it, replace it or head down a new but potentially more viable path — deploy Voice over Internet Protocol (VoIP), an Internet Protocol (IP)-based solution for voice.

Many companies are currently thinking about, looking at or deploying VoIP, and the number of enterprises using VoIP continues to increase significantly year-over-year. These current and predicted surges in adoption rates aren't surprising, given the opportunity for VoIP to enable companies to realize new avenues for cost-savings, and to achieve unprecedented levels of flexibility and control.

The opportunities presented by VoIP are too great to be ignored. And now is the time to learn how this technology can help enterprises converge their network infrastructures, increase immediate bandwidth access, consolidate termination traffic, and reduce long-distance charges. Understanding the value of IP and VoIP will enable businesses to prepare for the important initial steps that will lead to a successful VoIP deployment.

Planning a Successful Migration

As the global marketplace continues to become more and more competitive, enterprises are looking for ways to increase their agility and adaptiveness so they can retain their edge. Many companies have already migrated their records databases, inventories, and other back-end systems to IP. Replacing antiquated systems can help cut costs, increase scalability, enhance flexibility and improve efficiencies. Upgrading the phone system to VoIP is another important facet of this strategy.

Because VoIP sends multiple packets of information over many different routes at the same time, it enables enterprises to move massive amounts of information more efficiently and at a much lower cost than traditional circuit switched networks. VoIP can simultaneously transmit voice, data and multimedia; share bandwidth between applications; and more effectively use network resources than time-division multiplexing (TDM). In addition, Session Initiation Protocol (SIP)-based VoIP, which is built on open standards, is non-proprietary and allows for easy interoperability with new and emerging SIP-based applications and technologies from various vendors. As a result, SIP-based VoIP can simplify integration, enhance communication and improve customer service.

Many enterprises today struggle with how to best move from point "A" (TDM) to point "B" (VoIP) without experiencing business interruptions. But this migration is not an all-or-nothing proposition. A hybrid approach is often the best solution, because it enables an enterprise to adopt VoIP while still using elements of its legacy telephone system. A successful migration strategy focuses on bridging the gap. In doing so, an enterprise can continue to operate efficiently while maximizing its investment in existing technologies and beginning to take advantage of all that VoIP has to offer.

Benefitting from an IP-Based Infrastructure

IP infrastructure can be significantly less expensive than TDM networks. Why? IP allows an enterprise to realize reduced operational and capital expenditures through lower cost of equipment and an increased ability to mix and match products and services from multiple vendors to create the best possible solution at the right price.

Specifically, IP-based systems can reduce the “cost of doing business” through:

- **Converged network infrastructure** – Enterprises have traditionally maintained separate networks for private data, voice and Internet applications. IP allows businesses to combine the two disparate TDM voice and data networks into one network to handle voice and data, as well as video. This convergence reduces the capital and operating expenses that were previously associated with maintaining, upgrading, and managing multiple networks. It also paves the way for advanced communications applications, such as video conferencing.
- **Increased immediate bandwidth access** – Enterprises can now purchase Ethernet-based connectivity at the access level, an activity that has traditionally been a chokepoint in deploying converged network solutions.
- **Consolidated telephony architecture and aggregated PSTN termination traffic** – IP architecture allows an enterprise to aggregate all of its branches into a single ingress and egress location, or gateway site. This enables greater control of telecommunications expenses, elevates buying power to upstream providers, and increases control and monitoring of network activity.
- **Reduced long distance charges** – IP systems give enterprises the ability to route calls internally rather than send them over the public switched telephone network (PSTN), reducing “per minute” charges. Enterprises with significant interoffice communication, or with both domestic and international calling patterns, can use IP to drastically reduce long-distance charges. Enterprises can also utilize IP to replace expensive toll-free numbers with local numbers to realize additional cost savings.

IP-based infrastructures enable businesses to employ a wide array of features that increase efficiency and effectiveness:

- **Easier integration of applications** – IP is the widely accepted standard upon which most of today’s applications are built. Enterprises that use IP as a foundation can achieve near-seamless integration and interoperability between applications such as VoiceXML-based interactive voice response (IVR) systems and Web-based conferencing.
- **Improved support for remote workers** – IP provides traveling workers and teleworkers access to the corporate network from anywhere in the world, enabling them to stay more tightly connected to the enterprise. IP also delivers user-defined capabilities that can be set up on users’ desktops, including IP-based voicemail, email, voice integration, and “Find Me, Follow Me,” a feature that allows remote workers to have their calls follow them wherever they go. Finally, enterprises can use IP to deploy productivity applications that make remote workers more effective and integrate management tools that enable supervisors to better support and evaluate those workers.
- **Enhanced customer service** – Through the integration of voice, data and multimedia, IP allows companies to provide consumers with more consistent experiences across all communication channels. For example, a retail chain store can use IP to regularly route multiple local phone numbers to a single contact center so that consumers receive the same service, regardless of where they are geographically located.
- **Rapid increase in capacity** – IP enables an enterprise to quickly augment capacity on its network. Companies can dynamically re-allocate existing bandwidth from data to voice to accommodate increases in call volume, a process that is not possible with traditional TDM voice circuits.

IP-based systems are extremely flexible and can be easily modified as requirements and technologies develop over time. They work with legacy TDM facilities, and enable a number of features and applications not available with TDM. For example, using extension mobility, a user can log into any IP phone and make or receive calls using their own extension. The phone adapts to the user's profile, giving the user access to speed dials, service links, and other user-specific properties. Unified messaging is another application, which enables users to access a single interface for all incoming voice, fax, and email messages. And presence management enables users to locate other users and determine the best possible method to reach them at any particular moment – via phone, e-mail, instant messenger, short message service (SMS), or video.

Feature capabilities are one of the greatest drivers for the migration to IP – and the basis for many business cases. IP allows the enterprise to control many of the advanced features that were traditionally handled externally and charged at a premium.

Feature	Description	TDM	VoIP
Take-back-and-transfer	A call going to a customer is "taken back" by the carrier and sent to a new destination.	Limited feature with poor standard support based on customer requirements. Usually has a per-call charge.	Re-Invite, Refer and RFC 2833 are all standard SIP protocols controlled by the enterprise VoIP feature server. Standard toll-free rates apply.
2-B-channel transfer Attended transfers Unattended transfers 3-way transfers	A protocol that allows the carrier to join or transfer a line, and relieves the customer switch of bridging the calls.	Usually only available via a Class 5 switch and rarely available on the long-distance (LD) Class 4 switch.	Re-invite, which is a standard SIP protocol, will indicate a new destination for a call. Standard toll-free rates apply.
Disaster recovery	The trunks are either busy or are not answering, and the traffic moves to a new destination that is connected to a new switch.	Requires a configuration on the Advanced Intelligent Network (AIN) platform. Usually a recurring monthly charge billed on a per-number basis.	The network can support multiple IP end-points to automatically move traffic among endpoints via Primary, Secondary, etc., Round Robin and Percentage Allocation. Traffic is moved via a new IP address, and does not consume idle network capacity.
Intelligent call routing	Usually employed as a contact center application that moves the destination of a call based on an enterprise's IVR or automatic call distributor (ACD).	An enhanced feature that requires signaling telemetry between the carrier and enterprise to get routing instructions. Usually billed on a per-call basis.	Supported via SIP 302 redirect. Exclusively controlled by the enterprise's equipment. An inherent VoIP feature with no charges aside from standard toll charges.
Voice Virtual Private Network (VPN)	A private dialing plan that allows an enterprise to dial between remote locations.	A premium service that requires a direct connection into the carrier switch. Billed at a premium costs by the call or by the minute.	Most VoIP feature servers allow the enterprise to build a private dialing plan independent of carrier connections, and send traffic among enterprise destinations via the public or private IP network. No per-minute charges apply; the only cost is that of the already established IP network connections.
Computer Telephony Integration (CTI)	This application looks at customer's telephone numbers and then reference a back-end database to determine call treatment.	Usually a proprietary application supported by the TDM vendor's equipment.	The baseline protocol of the application is IP, so it allows for the development of a number of open source applications, either in-house or by third parties.

Building Up and Bridging Out

To experience a seamless migration from TDM to IP, an enterprise must embark on a methodical and deliberate network evolution. The VoIP elements should initially be a “wedge” or a complement to the traditional private branch exchange (PBX) services. That said, there is no need for an enterprise to eliminate its previous architecture for a VoIP migration. Rather, the enterprise should view VoIP as an ongoing process with one extremely critical initial action – to ensure that the basic infrastructure is in place to build up and bridge out the existing network. This requires two primary elements.

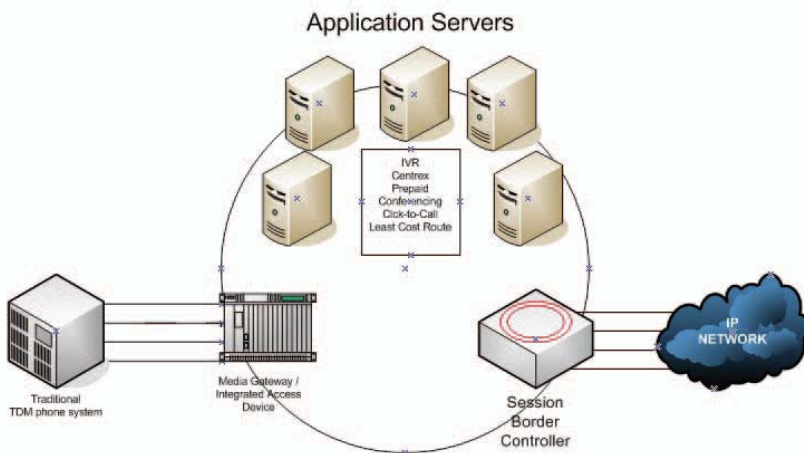
Media Gateway/Integrated Access Device – Serves as the mediator between PSTN-based technologies such as Primary Rate Interface (PRI), Signaling System 7 (SS7), and touchtone; and VoIP-based protocols, such as H.323 and SIP. These TDM to IP capabilities help bridge traditionally-based technologies with an enterprise’s emerging IP-based network and developing applications.

Session Border Controller (SBC) – Works as a demarcation point between the network and the VoIP service provider. An SBC can help manage a multitude of different network applications, including VoIP and upcoming IP Multimedia Subsystem (IMS) applications. It serves the following purposes:

- Monitors service quality
- Protects from Denial of Service (DoS) or SIP attacks, like a firewall
- Controls access via a control lists of trusted IP addresses
- Acts as a signaling and media edge for all VoIP services in and out of the network
- Allows for Network Address Translation (NAT) at traversal; places VoIP elements in the enterprise’s network on a private IP network
- Hides network topology
- Monitors and controls bandwidth

When an enterprise deploys a proprietary or hybrid IP-PBX (private branch exchange) some of this equipment must be “transcoded” to SIP to reach a VoIP service provider.

Deploying application servers, which are implemented based on the specific services required by the enterprise, is as easy as adding a Web server to a router. Currently there are widely available VoIP applications that support Centrex Voice, Conferencing, Prepaid Voice, and Interactive Voice Response, among others. However, because SIP-based VoIP is open source in nature, companies can easily use application servers to design and build their own applications that meet their particular needs.



The development or use of VoIP-related platforms will most likely fall into the long-term strategy of any enterprise.

Logical Configuration for an Enterprise VoIP Network

Five Steps to a Smooth Migration

As mentioned earlier, migrating from TDM to IP doesn't have to be a difficult process. Like other large-scale projects of this nature, enterprises must engage in thoughtful discovery activities and short-term and long-term planning to help ensure a cost-effective and seamless transition. By following five basic steps, enterprises can upgrade their networks from pedestrian to prodigious without incurring interruptions or displacing their existing equipment.

1. Assess the Network

Companies should always conduct a complete network assessment prior to implementing an IP telephony solution. These tests are extremely important as they enable an enterprise to evaluate its data network for a Multiprotocol Label Switching (MPLS) deployment, and to determine if it is robust enough to handle current and projected voice and data traffic needs. The network assessment, which also allows the enterprise to evaluate the impact of changes in calling patterns and voice server configuration, provides companies with the details they need to budget for previously unforeseen but necessary network improvements. This type of evaluation is best supported by equipment vendors.

Enterprises should also work with their equipment providers to ensure that back-end systems are attached to the current TDM system and develop a plan to incrementally migrate these systems to IP. Back-end systems, which include reporting, fraud and billing systems, among others, are sometimes proprietarily tied to a vendor's TDM system. If this is the case, it may be most cost-effective for enterprises to replace them with open-source systems during the migration.

2. Create a Cross-Functional Team

Because VoIP involves the convergence of telephony and data networks, its implementation spans the enterprise and requires cooperation from various groups, including those associated with telecommunications and networking functions. Key members of these groups should be asked to participate on a project team, with the express purpose of gaining an understanding of the overriding business objectives, and defining enterprise, human and technological requirements.

3. Identify the Appropriate Human and Capital Resources

As with other technologies, effectively deploying IP requires a specific knowledge set and a certain level of experience. Companies must take the time to accurately assess the resources that are available in-house and identify the external expertise they need to secure. Successful IP deployments require certain skills, and migrations run smoothly when enterprises work with equipment vendors and network providers that have the ability to deliver the best components and the highest level of consultative expertise.

These same providers can give companies guidance throughout the process, delivering insight into the most effective way to proceed and providing information about what to anticipate at different points throughout the project.

Do I need to upgrade my LAN?

Upgrades to the LAN are no different than any updates that are needed due to the development of new applications, such as the implementation of XML for web applications and databases, or the move from 10baseT to 100baseT.

LAN bandwidth requirements and bridging should be regularly re-evaluated. LAN upgrades should be familiar to most companies, and with the ever-increasing use of bandwidth-intensive web and video applications, companies should expect many more LAN upgrades on the horizon.

4. Select the Right Network Service Provider

A solid, experienced service provider is critical to a successful IP migration. To ensure quality of service and scalability, an enterprise must understand the role that MPLS plays in a potential partner's network and how the network service provider routes IP traffic. Enterprises should focus on carriers that offer the following capabilities:

- A converged network infrastructure
- A solid TDM background
- Experience in scaling a VoIP network
- VoIP as an integrated part of the data infrastructure and not an "experiment" next to their traditional switching
- Monitoring systems that recognize issues unique only to VoIP networks, such as Jitter and Latency.

The reach and scale of the service provider's network is also important, as a nationwide footprint allows enterprises to route their VoIP calls over a single network from origination to termination so that they can realize a higher level of QoS. Finally, equipment and service providers should support an enterprise's plans to leverage its new IP system without abandoning existing assets. The speed of the migration will be based on the desired timeframe for return on investment.

5. Develop a Detailed Migration Plan and Stick to It

Once an enterprise has determined and selected its partners, the parties should work in tandem to create a full-fledged business plan for IP deployment. The plan should identify expected technological, financial, and business costs and savings, and outline anticipated timeframes for completion of specific tasks as well as the overall project, among other items.

It is imperative that the enterprise continue to provide its customers with uninterrupted service as it migrates from TDM to IP. The enterprise can do this by ensuring TDM and IP interconnection, transitioning in phases in order to eliminate the margin of error and enable for phased-in service, and selecting technologies and protocols that best suit its network as it evolves.

Evolution, Not Revolution

Migrating from TDM to IP is a gradual evolution of the network. Due to age and wear and tear, enterprises will soon need to start replacing legacy equipment and networks. In addition, equipment vendors are beginning to phase out the support of certain TDM components. Companies must determine whether to spend their limited budgets replacing components and maintaining their legacy networks, or implementing IP-based solutions.

IP is not just about deploying a new network; it's about creating and implementing a telecommunications strategy that will carry the business well into the future. The right strategy can lay the foundation for scalability and growth, and help improve the bottom line by providing flexibility, reducing costs, and increasing efficiencies. And, employing the right strategy means choosing the right partners – partners like Level 3 Communications that can supply the infrastructure, services and expertise that help enterprises quickly and reliably deploy VoIP capabilities in their telecommunications-intensive environments.

The Level 3 Position

Level 3 operates one of the largest Internet backbones in the world and one of the world's largest Softswitch platforms, carrying more than 12 billion minutes of IP-based voice calls every month and reaching 85 percent of all U.S. households. In addition, our high-quality, expanded on-net footprint is trunked to every tandem in the United States.

Our voice termination services ensure that businesses experience high-quality nationwide and international call termination without having to own, manage or maintain their own networks. And, our E-911 Direct service delivers one of the greatest coverage areas available from a single network provider with network connectivity to Public Service Answering Points (PSAPs), reaching more than 83 percent of all U.S. households.

While Level 3's infrastructure and services greatly differentiate us from our competition, so does our extensive knowledge. We have a solid history of building network solutions that are based on customer needs, and a significant amount of experience managing TDM-to-VoIP migrations while helping businesses continue to operate efficiently throughout the process. In fact, we have integrated our own TDM and VoIP networks to enable us to provide our customers with innovative solutions that increase their productivity, drive incremental revenue and reduce their expenses without compromising quality.

Having built the first international, continuously upgradeable network optimized for IP technology, we are widely known and well-respected for our culture of technology innovation and leadership. Our solid reputation has enabled us to develop solid partnerships with respected equipment and software companies, giving us the ability to continue to deliver proven, comprehensive and cost-effective solutions to meet our customers' needs. Enterprises can use these offerings to gain efficiencies, shorten installation times, and ultimately achieve faster returns on their investments. And, Level 3's proven ongoing support services can help our customers ensure that their technology continues to offer returns year after year.

The fact is that a network and the applications that ride on that network can vastly differentiate an enterprise from its competition. Deploying a well-architected, flexible and cost-effective network today can prepare an enterprise for a successful tomorrow.