Executive Summary

Today every industry participant is engaged in some stage of transitioning services to IP, with each company’s IP investments gaining value as more service providers worldwide deploy their own all-IP capabilities. An increasing number of drivers push service providers to migrate to IP, both to achieve cost efficiencies in their business and enable them to bring new propositions and services to market.

As the global communications industry continues its gradual transition from a Time Division Multiplexing (TDM) to an internet protocol (IP) interconnect model, existing TDM interconnect revenues will steadily decline, increasing the cost of managing traditional voice switches. Service providers recognise that those switches are approaching the end of their operational life. TDM switches have already become obsolete for the management of new IP-based services such as enhanced voice and messaging and media-rich, content-based applications.

Though the equipment may appear to be fairly robust and reliable, it can actually account for a range of network fault issues as it ages. Vendors support some end-of-life legacy TDM equipment on a best-effort basis, often with little or no software support, and their strategy is to push the market towards IP solutions and technology.

Identifying legacy equipment clusters for removal or consolidation can help reduce on-going infrastructure costs and will invariably contribute to IP migration decisions.

The migration from legacy TDM to cheaper and more efficient IP-based voice is therefore inevitable, both at the retail and the wholesale level; many service providers now predict that they will have completed their migrations to IP within a decade or less. This fact, together with the continued consolidation of the voice market (particularly the international segment), the expectation that growth in revenues can only stem from IP-based services, the desire to realise the cost efficiencies associated with switching minutes over an all-IP infrastructure, and the need for scalability will all play key roles in the decision-making process.

However, since legacy TDM technology still serves the industry well, most service providers are moving to IP at a judicious pace. They are taking advantage of their sizeable investment in traditional voice by continuing to use it during this time of transition to IP. This means that deployed network solutions must provide interoperability between TDM and IP while enabling an easy transition to all-IP services.

Migration to IP brings the ability to effectively offer new services and bundle multiple services (“Unified Communications”) over established IP connections to meet the demands and diversity of customers, whether business or residential. Companies with all-IP networks provide commercially and technically sophisticated products and services with reduced time-to-market, better cost base, and simplified delivery infrastructures.

Voice-over-IP (VoIP) technology is not by any means restricted to the fixed-line sector of the telecommunications industry. Evidence in the market suggests there will also be a significant transition of voice-over-IP technology from fixed-line phones to the mobile world that will encourage global spending in the mobile VoIP space.

This transition is driven at the retail layer by smart devices like the iPhone, mobile operating systems like Google Android, and the emergence and wider availability of mobile VoIP clients such as Skype, Fring and Truephone. The ease of use of such services as well as the end users, particularly the youngsters in the market who have grown accustomed to using such services as part of their daily communications, accelerate this development.

Mobile operators are starting to realise that mobile services will be a key component of next generation IP-based communications driven by developments in 3G/HSDPA and Long Term Evolution (4G) networks. Many mobile operators now allow VoIP clients to operate over their 3G networks as part of their data packages. The enterprise sector, where business users’ mobile phones act as extensions of their office desk phones, is also driving this transition.

IP Interoperability enables services to be independent from the networks they are provided on, virtually separating the carriers and the service providers and allowing new entrants to compete aggressively over the top (OTT) against established players. New entrants take advantage of the internet protocol to create new communications services and brands with global reach and appeal, often achieving significant proximity to the end user to become services of choice. For example, a range of Apps Marketplaces offer cloud-based applications and an abundance of new capabilities that can be integrated with VoIP to deliver a true Unified Communications experience. These services may include contact- and calendar management and extend to video calling, security, conferencing, multimedia messaging and media-rich content.

In summary, the migration to an IP interconnect model will be gradual and the winners will be the companies that seek to validate the commercial model early in the transition process.

This will enable them to develop the know-how to connect with each other, deliver and receive services, and pay and get paid for doing it.

Shifting a proportion of a service provider’s traffic to IP yields learning about different functions, such as the consistent handling of IP-based services across providers and their networks.

Other functions include the structuring of IP Interoperability agreements and settlement processes, as well as performance metrics that may not be reminiscent of the TDM world.

Platforms such as IP Packet eXchange (IPX) provide the necessary commercial and technical framework for service providers to validate the model and develop the same level of fluency in IP as they have in TDM through carefully prescribed investments. Such platforms allow them to easily implement end-to-end IP interconnectivity “at scale” with minimum upfront fixed investment and to monetise the emerging IP interconnect model, providing options to:

- increase related revenue and EBITDA through a consolidation of interconnections, leading to reduced network costs
- reduce financial and operational risk
- enable high-quality connections end-to-end
- gain financial benefits from interconnecting IP-based voice with traditional voice
- create new strategies and sustainable business models that will equip telecom operators to compete more effectively against inherently internet-based competitors
- prepare for the interoperability requirements of future technology such as LTE (Long Term Evolution, 4G) and for an application-based user experience
- offer multiple services across one platform, saving on the previous “stove pipe” approach, which is hungry for network and maintenance resources

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Industry perspective

Adoption of end-to-end IP Interoperability for voice and data is expected to accelerate over the next two years, driven by the exponential growth in fixed broadband, 3G/HSDPA and LTE that will require significantly greater amounts of bandwidth as end users continue to take advantage of internet-based services and applications.

Rapid development of Session Initiation Protocol (SIP) standards, increased knowledge of IP Interoperability testing and deployment, and proliferation of Electronic Number Mapping System (ENUM) Interconnect Registries globally to enable end-to-end IP routing and termination all bring new sophistication to the ways service providers manage bandwidth and deliver services to end users.

For service providers to realise the financial benefits of the IP migration process, the first step in that process must be the efficient, secure and reliable interconnection between TDM and various VoIP implementations. They will need to maintain profitable interconnect relationships with a myriad of players, particularly those who have started to migrate to IP, and in turn gradually withdraw TDM switches from their networks.

Unlike the traditional voice segment, VoIP implementations do not all conform to a single standard and there are slight differences in interpretation of standards between the various vendors. Service providers will have to support both native IP and TDM to deliver carrier-grade voice to customers throughout every phase of network evolution. The IPX model enables true interoperability between service providers by eliminating difficulties related to different IP network and protocol implementations.

The growing emphasis on IP Interoperability across the telecommunications sector now requires solutions devised for both fixed and mobile operators to support existing and next generation communications services over converged IP interconnections.

Support for both native IP and TDM capabilities is leading to hybrid value propositions that combine essential services such as IP Packet eXchange (IPX) with other services like GPRS Roaming Exchange (GRX), mobile roaming signalling, messaging and video calling. All have to be delivered under one service wrap over converged IP interconnections, with global reach and a high level of interworking among the various service providers.

The level of IP Interoperability that a service provider can achieve with various fixed and mobile networks depends on the IP configurations and protocols it can support. This will invariably determine the cost efficiencies the service provider can achieve over the longer term as a result of implementing its IP Interoperability plans.

IPX platforms enable the IP strategy of fixed and mobile operators to include different access technologies; they address the requirement that these players have to “plug into” a single intelligent transport network platform, without alteration to their current network configurations, that supports any-to-any communications and is engineered for application, user and device optimisation, as in the illustration.
IPX – A critical strategic path for service providers

The global transition from the existing TDM interconnect model to the new IP interconnect model is inevitable given the level of investment being made in the deployment of SIP-based end-point services and the pace at which IP-based products are becoming available. There is a valid debate regarding “when” or “how fast” the full transition to IP will occur but there is no question “whether” it will happen. In this environment, services such as IPX provide the ideal framework for service providers to move forward along the critical strategic path of IP Interoperability while significantly limiting financial risk.

IPX offers a flexible and interoperable solution that allows interconnection between various kinds of service providers irrespective of their IP network configurations and protocol choices; it lets them inter-work via a single platform to collect and terminate premium-quality voice traffic and data services. Features of such a proposition include:

- high levels of interoperability between SIP/IP and C7/TDM networks
- guaranteed simultaneous management of voice and IP data transmission
- quality, minimising protocol conversion and trans-coding to reduce noise, delay, etc
- security with guaranteed standards
- a number of physical ways to connect to an IPX provider: internet, network access point (NAP) and/or remote point of presence (PoP), as well as direct connections
- cost-efficient migration of older TDM bilateral interconnections to IP using a single IP inter-working hub, i.e., one connection enables multiple bilateral relationships

IPX Framework: Best Practice inter-working of networks and services

The illustration demonstrates how an IPX platform addresses the need of service providers for reliable interoperability and helps them overcome the challenges of network configuration and service inter-working. The platform also accommodates the continuing refinement of industry standards and best practice with regards to IP-to-IP and IP-to-TDM Interoperability.

Such a platform fosters new business models and greater network efficiencies whilst allowing service providers to migrate their existing TDM relationships to IP according to their own timeframes and their own return-on-investment projections. An IPX takes into account the end-user services that telecom operators launch and maintain, enabling them to respond to changing customer demands without compromise to existing service functionality and quality.

In essence, IPX should be seen as a global platform providing any-to-any communications over a single converged infrastructure for voice, video and data communications.

By enabling interconnected parties to leverage their respective strengths in IP communications and benefit from a comprehensive commercial and technical solution for high-quality, reduced-cost interconnection, management and billing of IP traffic, IPX provides the necessary platform for all-IP relationships to flourish.
IPX Framework - Collection and termination of premium-quality voice and data services between mobile networks and between fixed and mobile networks

In the illustration, IPX enables support for multiple services on a single IP-based interconnect, underpinned by widely-accepted IP operating principles. It ensures consistent handling of these services across the interconnected service providers and networks. This enables service providers to achieve the quality required on a provider and inter-provider basis to support IP convergence and new applications. In essence IPX:

• provides an interoperability hub that connects service providers and supports several flavours of inter-working, i.e., TDM to IP, IP to IP and IP to TDM
• enables interoperability for critical capabilities and features such as signalling, messaging, voice, mobile data, video and future IP-based services
• uses IP-based infrastructures and standards to maximise quality of service
• provides codec negotiation between disparate signalling technologies and different coding configurations to ensure end-to-end connectivity
• aligns with Global Systems for Mobile Communications Association (GSMA) connection models (transport, service transport, service hub), as well as i3 Forum specifications, amongst others

On behalf of service providers, an IPX network collects and terminates their premium IP voice traffic and mobile data services, anywhere in the world.
IPX Framework: One connection, multiple bilateral relationships in voice and data

In an industry as interconnected — figuratively and literally — as telecommunications, no single carrier, or even single group of carriers, can take full advantage of IP evolution without widespread cooperation and support.

The illustration of the IPX Bilateral Interconnect Model shows IPX as a neutral, fully-managed IP transit hub for the interconnection, management and billing of voice and non-voice IP communications between service providers. It enables these players to maintain historical and strategic bilateral interconnects whilst avoiding the cost and complexity of moving their commercial relationships to IP. It provides the commercial and technical framework that enables service providers to trial and launch new services – for example, High Definition Voice, Mobile Video Calling and Messaging over IP – in partnership with trusted parties. As a result of the close cooperation between the parties over the IPX platform, new charging models may also emerge, e.g., a move toward bandwidth rather than per-minute charging.

In such an IPX Bilateral Interconnect Model, settlement may be left to the interconnected parties as part of their commercial relationships, with the IPX platform providing the necessary reporting structures and applicable IPX transit fees. Cascade payment methods may also be implemented, with the IPX platform managing settlements between the interconnected parties.

The IPX Bilateral Interconnect Model allows service providers to connect, deliver and receive services, pay and get paid for providing services.

Not only does an IPX platform apply the rigour that has come to be the norm for existing inter-provider TDM infrastructures, making them the model for establishing inter-provider IP Interoperability. It also offers the tools for a collaborative framework where guidance and strategies for worldwide IP adoption and interconnections among service providers can be developed.
IPX – Competitive advantages of migration

A service provider’s migration to IP should demonstrate the following potential competitive advantages of a next generation IP interconnect model:

**Reduced infrastructure cost**

Over time, the cost of adding IP bandwidth and session capacity on a session border controller will be less than the cost of deploying additional boxes of TDM trunks and gateway ports, accelerating the return on investment for the IP-based business case.

However, since many service providers already have large TDM infrastructures deployed in the market, depending upon growth rates, there will be no direct near-term cost savings associated with deploying new SIP/IP interconnect capacity.

Several factors may contribute to an earlier validation of IP cost efficiencies, such as the predictable operational and capital expenditures that a choice of IP protocol can deliver, as per the BT case study shown above (Cumulative cost efficiencies – Switching of voice minutes over IP versus TDM) and the requirement to make the greatest use possible of already-deployed next generation networks (NGN).

Moving a proportion of premium voice to IP platforms also serves to confirm whether the service provider’s choice of IP implementation effectively guarantees advanced call features such as Caller Line Identification and international roaming, and whether quality will be consistent across networks.

Providers competing at the retail level with converged voice and data offerings will need to more rapidly use single and integrated IP platforms for the delivery of such services to reduce cost and improve margins.

Competitive advantage will therefore be determined by players’ inclination to gradually invest in IP-based communications in response to their portfolio-enhancement and cost-management drivers. Carefully thought-out strategies for using dedicated IP connections for both voice and data, investing towards IP migration and embracing IPX platforms for traffic management and delivery globally will put many players at a long-term advantage over those who choose to wait.

**Higher-quality services**

Many of the end-user communications services being deployed in the market today are based on intelligent SIP end-point devices. Enterprise IP-PBXs are a prime example. Industry estimates show that nearly half of all enterprise end-points today are SIP end-points, not C7/TDM end-points.

Other good examples are the penetration and popularity of smartphones like Apple’s iPhone, BlackBerry’s Storm and Google’s Android, which contribute to the very fast global transition from voice-only handsets to IP-based phones. This development is driven by demand for mobile multimedia services, mobile email, internet browsing and Web 2.0 applications, as well as handset technology advancements and faster 3G networks.

The persistently hybrid environment which exists today, with both IP and TDM-based networks co-existing globally and regionally, makes it difficult to deliver end-to-end IP services without SIP-TDM-SIP signalling mediation and trans-coding activities. This lowers quality levels and creates a poor customer experience.

The opportunity exists for service providers to differentiate themselves through implementing IP interconnect solutions that allow a call to originate as SIP, transit their networks in native SIP and terminate as SIP at the destination. The result will be higher call quality than in existing C7/TDM services and provide numerous options to combine VoIP with value-added services such as making and receiving calls anywhere, click-to-call, transcoding voice messages to text (email, SMS), event notifications, speech to text, IP call forwarding to PSTN, Skype, Google Voice, etc.

The early implementations of SIP/IP interconnect solutions designed around the use of the public internet as a transport mechanism failed to deliver on the promise of higher-quality services, and they are missing many of the features taken for granted in the TDM world. But this early failure will not undermine the future of SIP/IP interconnect services. Higher-quality interconnects will define the leaders in this new model who will compete based on service differentiators, end-user experience and price mechanisms.

**Summary**

IP Interoperability brings ease of use to multiple services, delivering economies of scale and efficiencies to the service provider business. IPX architectures can reduce the number of commercial bilateral and roaming agreements needed for interconnection, thereby delivering further savings.

The migration from C7/TDM interconnect to SIP/IP interconnect will be gradual and the winners will be the companies that start now to develop the same level of fluency in IP that they have on TDM. Carefully prescribed investments in IP technology and utilisation of IPX platforms are a sensible option to overcome the technical and commercial challenges of IP Interoperability.

The rapid advancements in IP technology, increased availability of SIP-enabled devices, global broadband penetration rates and exponential mobile data growth driven by end-user demand will all contribute to the migration to IP, particularly as legacy C7/TDM network equipment becomes increasingly obsolete and costly to maintain. More conservative approaches to spending on IP-based voice infrastructures will result in a continued hybrid TDM-IP environment for some time, but services such as IPX will increasingly support the consolidation of legacy networks. This will open up many possibilities for feature-rich IP communications and new business models over converged IP connections for multiple applications (voice, video and data).
About BT Global Telecom Markets

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About the author

Rodrigo Donazzolo has over 10 years experience in the telecoms sector and a track record of building commercial relationships with telecom operators across the globe to accelerate the implementation and availability of IP-based communications services.

As head of IP Interoperability for BT Global Telecom Markets (GTM) Asia Pacific, he specialises in IP Voice Solutions, working with telecom operators to develop collaborative roadmaps that underpin the deployment and management of interoperable IP networks and services.

Previously, as head of IP Interoperability at BT Wholesale, he was responsible for IP interconnect relationships with telecom operators, delivering solutions for the inter-working, management and billing of IP traffic. He also owned the implementation of value added services in support of the roll-out of BT’s Global IP Exchange Service, including federated VoIP and ENUM implementations.

He was the director of the Fixed-Mobile Convergence Alliance (FMCA), a global forum for telecom operators representing 850 million subscribers worldwide and facilitating joint commercial programmes towards the sales of convergent communications to residential and enterprise sectors.

In BT’s corporate division, Rodrigo was responsible for designing ICT-centric offerings aimed at enterprise customers in the UK and Western Europe.