This special edition of the white paper includes updates of the community and member information.

Enhancing VoIP with Voice Peering

The Voice Peering Fabric is a service of Stealth Communications®.

White Paper - *Published July 2005 V.2006050101*

Abstract

From the invention of the telegraph to the emergence of the Internet, the world has evolved and reinvented itself over and again. Technology has always created efficiencies and opportunities. Despite skepticism from some, history shows that every time there was a change for the better, investors and the public realized and followed. The drive for a better life has invariably and inevitably shifted workforces and profits across different industries. Investments were made and revenues collected directly or indirectly with the evolution. The latest trend in the technology world is voice peering, whether between carriers, enterprises or anyone joining to form this new community.

The Voice Peering Fabric ("VPF") was launched in October 2003 to accelerate transmission of digitized voice traffic. Built as a distributed Layer 2 Ethernet network, the VPF has solved many of the uncertainties engineers have had about both security and quality of digitized voice traffic. The VPF is a large and secure private network that enables carriers and enterprises to trade minutes as well as to distribute and acquire access to different applications that are necessary or useful for efficient communications among branch offices and with national and international business clients and partners. It is a global interconnection mechanism, a unified transport infrastructure, and a private grid for voice and telephony communication.

This white paper is brought to you by the following members of the Voice Peering Community™

Introduction

Voice peering is a method for the exchange of digitized voice traffic. A typical example is a company with two branch offices, linked via a data connection. When a telephone call is made from one office to another office on this connection, the call transverses the data connection without interacting with the Public Switched Telephone Network (”PSTN”). The phone systems at both offices are configured to categorize and route calls internally. These telephone calls do not incur any incremental per minute charges. The only cost is the cost of the data connection itself. This method is often referred to as “toll bypass.”

For dealing with the outside world, large organizations and service providers often have complex designs involving multiple locations and multiple interfaces into the PSTN. Phone switches and systems usually require intelligent-routing capability such as Least Cost Routing (“LCR”) and Electronic Number Mapping (“ENUM”). LCR and ENUM are actual methods of voice peering. LCR allows a particular call to be routed to a particular connection based on cost, time-of-day and other parameters. ENUM simplifies the routing of a telephone call based on the database number look-up architecture.

Controlling costs in addition to ensuring quality and security on a voice network are similar to the challenges faced in managing a data network. In this information age, business processes have accelerated in all applications, not least in the demand for efficient communications. Voice over Internet Protocol (”VoIP”) is an important factor and a revolutionary technology supporting an organization’s ability to constantly reinvent itself. VoIP requires careful planning and engineering to ensure current network infrastructures are properly utilized and potential savings realized from the new implementation.

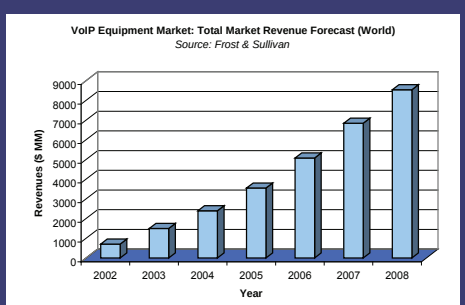
This paper discusses the value of voice peering through the use of the Voice Peering Fabric (”VPF”) coupled with VoIP implementations & deployment models for businesses with different backgrounds and needs. The paper will also provide a detailed introduction to the three major components of the VPF that enhance voice peering.

The Growth of VoIP

VoIP: It’s a method of transferring voice over an Internet Protocol (“IP”) network, which was originally referred as IP Telephony.

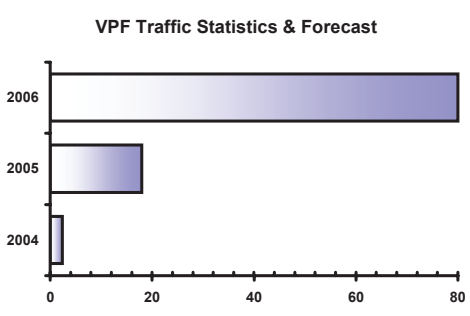
IP Telephony gained popularity when Yahoo, MSN, AOL and other messaging programs embedded voice-to-data conversion on their online chat programs. Since this implementation is over the public Internet on a desktop computer or handheld device, business entities are reluctant to employ these functions because of security and quality issues. Running VoIP over IP “VPN” (Virtual Private Network) or “MPLS” (Multiprotocol Label Switching) connections have somewhat resolved the security issue, but since some VPN sessions are over the public Internet, latency is difficult to control. Unless a physical dedicated connection is in place between branch offices, organizations with sensitive data such as those in the financial and healthcare industries may not deploy VoIP fully throughout their networks.

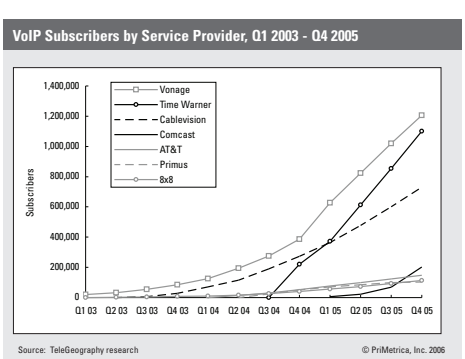
When Napster was launched, people were excited that digitization allowed them to download music for free. Similarly, VoIP (which does not have the copyright issues that have been so difficult in the music area) caught many people’s attention since it may significantly reduce expenses. The fact that VoIP is here to stay is proven by the growth of sales on VoIP technologies, as well as by the efforts of traditional telephone companies (like Verizon and SBC Communications) to offer their own VoIP products. The number of choices for VoIP phones, switches and gateways in the market seem to outnumber the choices for music gadgets. VoIP technology is important not only for cost reduction but also because it has enabled the world to communicate freely over PCs, mobile devices and IP phones and to break free of the limitations inherent in wireline, circuit communications that have changed little since the days of Alexander Graham Bell. With growing adoption of VoIP in Europe and Asia, more enterprises in North America have begun to deploy new IP PBX systems, IP gateways and IP phones within their businesses.

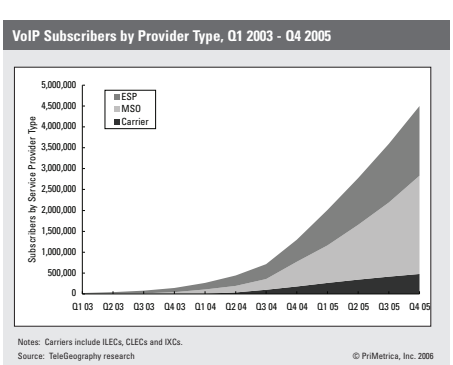


Stats on VoIP Growth

The growth of VoIP can also be seen through the exchange of minutes via the Voice Peering Fabric and acceptance of VoIP service in the consumer markets:







Defining Voice Peering

The Internet provides enterprises with improved communication, functionality and productivity with fewer resources. With the near total and universal adoption of the Internet, companies have taken steps to "localize traffic" to better control their internal communications and expenses. Given the means of keeping data traffic within a region, Internet service providers have long been "off-loading" Internet traffic at different "meet-points" around the world. In recent years, they have been able to establish more regional "meet-points" in ever smaller regions and to set-up "meet-points" for the private exchange of information among schools and universities. In the technology world, these "meet-points" are often referred to as "peering exchanges."

The same concept is being applied to voice communications. More importantly, separate direct connections are required for voice traffic due to the sensitivity of voice packets. Depending on the type of voice technology deployed by its members, today there are a few different methods of voice peering:

"TDM Peering": is typically a bilateral agreement between two carriers, to route telephone calls using "TDM" (Time-Division Multiplexing) technology, to and from the PSTN at a cost negotiated by the parties. This has been the traditional method and model in today's voice industry.

"Bilateral VoIP Peering": is the same as TDM Peering except instead of using TDM technology, calls are routed using VoIP technology. Major long distance carriers such as WorldCom, Sprint, and AT&T have been connecting using Bilateral VoIP Peering at different sites around the world to manage call volume and quality. In fact, billions of minutes are routed via VoIP for transport nationally and globally.

"Multilateral VoIP Peering": is a service within a peering exchange where all of its members agree to a set of rules for the exchange of VoIP traffic. It allows its members to send and receive telephone calls at no cost across the peering exchange.

In recent years, more VoIP networks have interconnected to exchange VoIP termination without tapping into the PSTN. Currently there are a few types of voice exchanges. Though these voice exchanges share a goal to localize traffic and bypass the PSTN -- they have their differences and limitations. Some voice exchanges connect their members by a voice switch and make their profit on commission fees; other voice exchanges are setup for the purpose of reselling voice terminations. Thus far, the VPF is the first to maintain a peering exchange that allows its members to trade minutes freely in an open marketplace while simplifying their business functions.

The Extended Value of Voice Peering

The role of the VPF is to build a community, of businesses and service providers for the exchange of telephony services. Rather than pursuing dedicated connections and spending resources searching for partners for particular types of routes of transport, a physical connection into VPF's distributed Ethernet fabric allows an organization to interact with hundreds of businesses and service providers located around the world.

The Voice Peering Community

Since our first user event held in late 2003, our community continues to grow at a rapid pace. New members and partners have brought with them more then products and services they offer. They have become part of the community where they share experience, knowledge and help businesses accelerate.

In our last two Voice Peering Forum held in New York and Miami, we had over three hundred industry professionals that met face-to-face, of which over a hundred of them joined us in both occasions. This business environment created an open marketplace that allowed buyers and sellers to come together – during which business deals were initiated and many were completed.

In addition to helping members of the community to connect with each other, we are on a continued mission to bring educational workshops to help our members on multiple aspects of their business.

VPF Members now include enterprises and service providers who are international PTT's, voice wholesalers, VoBB's to domestic ILEC's, CLEC's, and MSO's.

Partners to the VPF include Ethernet providers, carrier hotels, co-location operators, real estate owners, hardware & software companies and ASP providers.

VoIP is a new technology to many businesses. In the mist of technology convergence and net neutrality, we need direction and guidance. It is our privilege to work with the following publications, who have helped create awareness about Voice Peering and whose editorials have been comprehensive, informative and insightful.

FAT PIPE

IMS MAGAZINE IP MULTIMEDIA SUBSYSTEM

INTERNET TELEPHONY

NEW Telephony

PHONE+

SIP MAGAZINE

VOIP MAGAZINE

BUSINESS WEEKLY VoIP

xchange

VPF Minutes Market

Similar to stocks traded on financial market exchanges (NYSE, NASDAQ, etc.), voice traffic exchanged on a voice exchange is measured by minutes passed to each party, thus referred to as "minutes trading."

Traditional Minutes Trading, also known as Clearinghouses: The number and type of participants, the locations of the clearinghouses, rates and commission fees limit the growth and scale of minutes trading. Running long-haul circuits to a mutually agreed meet-point by the parties can be expensive and un-scalable. Connections via IP VPN over the public Internet are unsecured and low quality.

Minutes trading on the VPF is simple and secure. VPF PoP's (points of presence) are established at major fiber-dense connection points to meet businesses and service providers locally in their markets. Trading within the VPF Minutes Market provides its members:

- Direct access to multiple carriers;
- The ability to buy and sell origination (DID) and termination (DOD) services;
- The freedom to negotiate direct bilateral relationships;
- The choice of industry standard VoIP protocols and codec's;
- The opportunity to customize their LCR;
- The option of eliminating dedicated connections to each trading partner; and
- Access to VPF Minutes Market Request for Proposal ("RFP") Engine.

Featured VPF Members:

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DVVCom is a facilities based, VoIP Provider (located at 60 Hudson St. NY, NY) specializing in VoIP Origination / Termination (Domestic & International). We are also a Master Broker / VAR for multiple companies including: Bell South, ATT, Tier 1 / Tier 2 carriers, other RBOCs and many award winning equipment vendors. Our nationwide portfolio includes a full range of telecom products from analog lines to T-1, DS-3, OC, GigE connections, equipment, etc.

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Telecom New Zealand International is a provider of premium quality wholesale voice and data services, offering fixed line, mobile and cable MSO customers a range of services from quality voice termination, mobile roaming and wireless content distribution, signaling services to subsea capacity, delivered through a global softswitch-enabled IP network. The VPF is key to our 2006/2007 business plan, and will serve as both the interconnection medium to access new partners, as well as the vehicle upon which we deploy managed voice-related application services.

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XO Communications is a leading provider of national and local telecommunications services to businesses, large enterprises and telecommunications companies. XO offers a complete portfolio of services, including local and long distance voice, dedicated Internet access, private networking, data transport, and Web hosting services, as well as bundled voice and Internet solutions. XO provides these services over an advanced, national facilities-based IP network and serves more than 70 metropolitan markets across the U.S. For more information visit www.xo.com.

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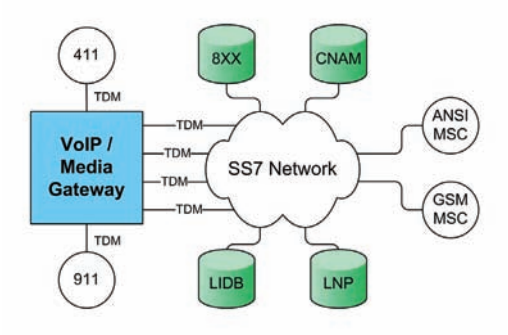
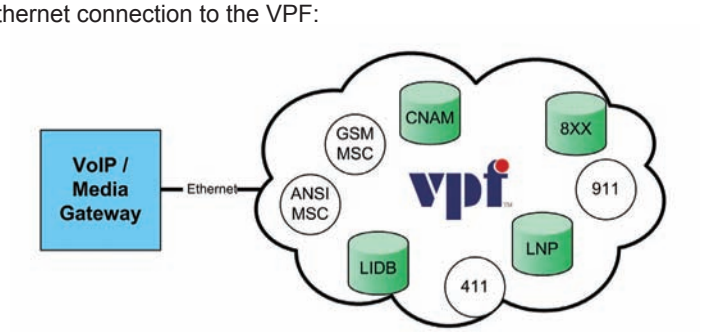
Waveleap Communications, LLC, founded in 2002, provides high quality VoIP origination and termination services to domestic and foreign carriers and enterprise customers. Our strategic partnerships combine the advantages of our IP network with the networks of multiple top IP and PSTN carriers to assure our customers of the best possible connectivity and quality. We also understand the difficulties facing new VoIP carriers and are glad to provide these companies with DIDs and other high quality services at reasonable rates.

Transition of SS7 to IP

Traditional method of accessing SS7 and other ASP applications through dedicated SS7/TDM circuits:



New method of accessing SS7 and other ASP applications via an Ethernet connection to the VPF:



Featured VPF ASP Partners:

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Transaction Network Services®

TNS is a provider of network services designed to meet the needs of carriers operating current generation IP networks or traditional circuit-switched networks. TNS offers SS7 services including ISUP, CNAM, 800 and LNP, VoIP/PSTN signaling mediation, VoIP peering and route discovery services, managed network services, and custom applications.

Terri Dory
Marketing, Next Generation Services
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VeriSign®

VeriSign, Inc. operates intelligent infrastructure services that enable and protect billions of interactions every day across the world's voice and data networks. VeriSign runs the world's largest private SS7 network, and offers a full spectrum of solutions for intelligent communications, commerce and content, such as connectivity and interoperability services, intelligent database services, ENUM directory services, and content and applications services. VeriSign is your single source - providing secure, fully-managed solutions - from nationwide number acquisition and activation to VoIP peering to fixed-mobile integration. Ask about services available via the VPF at VPF@verisign.com, or visit our website at www.VeriSign.com.

VPF ASP Market

During consultation with our members to simplify their VoIP businesses, we found that much of their time and effort was devoted to acquiring and accessing third-party applications to support call routing/setup functions. A handful of connections were installed to access different databases; some members have dedicated people or departments to ensure the accuracy of telephone data on each telephone number. After completing surveys with members and partners, it became apparent that Application Service Providers ("ASP") services are a vital component to the VoIP industry. With the FCC's ruling on E-911 in May 2005, the development for the VPF ASP Market became imperative to better service our members.

An ASP is an entity that operates applications, databases and gateway services that are telephony related. Databases and gateway examples include:

- Toll Free Gateway ("8XX") – Enables providers to route toll free numbers (800, 888, etc.)
- Directory Assistance ("411") Service
- 911 Gateway – Maps telephone number to physical address and routes telephone call to the nearest 911 / E911 center.
- Caller Name ("CNAM") – Displays first and last name of a calling party.
- Local Number Portability ("LNP") – Enables providers to move and route telephone numbers.
- System Signaling 7 ("SS7") – Ability for service providers to access the SS7 network over a VPF Ethernet connection using SIGTRAN protocol.

While many of the services offered in the VPF ASP Market are geared toward service providers, businesses themselves can also utilize services such as 411, 911 and CNAM services. Benefits of the VPF ASP Market include:

- *An open framework and marketplace for buyers and sellers;*
- *Direct bilateral relationship with the VPF ASP Partners;*
- *Direct and easy access to the ASP services over an existing VPF connection.*

The VPF has simplified and made available a marketplace for ASP's and their customers. Their integration removes a layer of complexity and expense that too often is little more than interfacing with legacy networks and technologies.

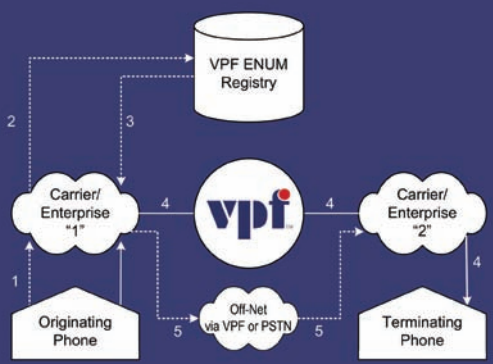
VPF ENUM Registry

ENUM: It is a network protocol that takes a telephone number and resolves it to an Internet address [URL], as a traditional Domain Name Server ("DNS") takes a URL (like www.google.com) and converts it into a numeric IP address. With ENUM, a telephone number is sent to the DNS server, which then replies back with the appropriate URL, if the URL/telephone number has been registered. This allows VoIP networks to send and receive telephone calls within the IP domain.

The VPF ENUM Registry is a multilateral peering enabling service that allows members to send and receive telephone calls to one another directly, free of charge across the VPF. It is toll bypass at its best.

Call volumes on the VPF ENUM Registry has been increasing. Launched in April 2004, the registry houses over 11 million unique telephone numbers, with no charge for the registration, lookup and calls. Current members of the VPF ENUM Registry include communities of universities, telecom companies and financial institutions. As the number of telephone numbers increases on this registry, more calls will be routed within the private networks.

VPF ENUM Registry Call Flow Diagram



The diagram above illustrates a call flow when using the VPF ENUM Registry.

1. User initiates phone call
2. Query sent to ENUM Registry
3. Routing information returned
4. If true, call established between the organizations through the VPF
5. If false, call sent to user's selected VoIP Carrier via the VPF Minutes Market or PSTN

Featured Technology Manufacturers:

Rick Gaulin
Director of Sales - IMG
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Cantata Technology's IMG 1010(tm) Integrated Media and Signaling Gateway offers service providers and enterprises unparalleled performance, reliability and flexibility to introduce services across fixed and mobile networks worldwide. The IMG 1010 supports wireline and wireless codecs which make it the ideal platform for transcoding in the next generation network. With its compact 1U package, integrated SS7 and flexible architecture, the IMG 1010 is a true carrier-grade VoIP gateway and/or VoIP transcoder that enables service providers to reduce costs while improving service quality.

Carrius Sales Department
T: +1-866-CARRIUS
E: sales@carriustech.com
www.carriustech.com

The Carrius *Compleat*™-200 Service Delivery Gateway (SDG) combines media gateway, and softswitch call control functions with powerful application control and signaling protocol translation, in a scalable platform. It supports interconnection of a full set of signaling protocols including SIP, H.323, ISDN-PRI, SS7, WIN, CAMEL, and CAS, and uses CCXML/VoiceXML, SIP, or the Carrius API to present applications with an abstracted network view. Through the SDG, service providers and solution developers can deliver services over a large collection of disparate networks.

Force10 Sales Department
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www.force10networks.com

Force10 Networks is the pioneer in high performance switching and routing. Based on a revolutionary system architecture that delivers best-in-class resiliency and massive scalability, Force10's TeraScale E-Series switch/routers deliver predictable application performance and latency, increase network availability, and reduce operating costs in VoIP networks. For additional information, please visit the company's website at www.force10networks.com.

NexTone Sales Department
T: +1-240-912-1300
E: sales@nextone.com
www.nextone.com

NexTone develops carrier-grade products for delivering scalable control of real-time IP services, such as Voice over IP (VoIP) and other digital media. NexTone's products and technology give IP networks a common way to exchange, monitor, secure, and bill for sessions flowing through them. Over 400 service providers and enterprises worldwide use NexTone's solutions to dramatically lower capital expenditures and deliver ongoing operational efficiencies such as reduced interconnect "turn-up" time and simplified network operations.

Andy Voss
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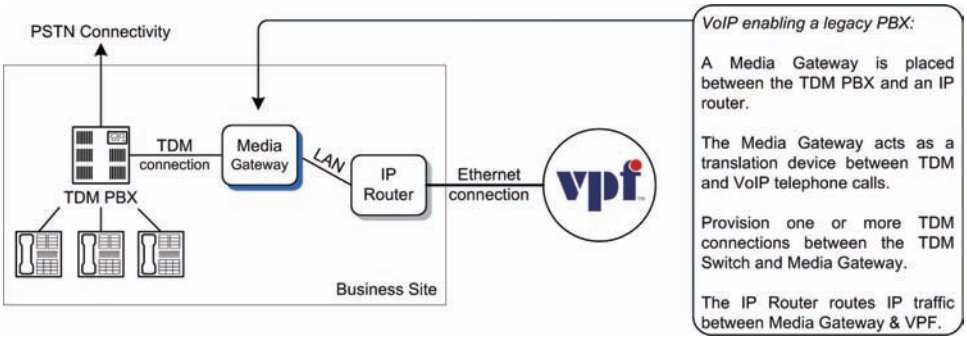
Sansay is the fastest-growing session controller company in the business. Sansay systems serve as a new generation of core infrastructure in high-demand VoIP call routing/switching applications. The Sansay VSX VoIP Session Controller brings VoIP carriers a new level of flexibility and control over their VoIP network through Sansay's advanced routing capability. Sansay's Least-Cost-Routing, ENUM and SIP/H323/MGCP interworking features can help reduce operating costs and increase profitability for organizations.

Large Businesses: Legacy PBX



VoIP enabling a legacy PBX:

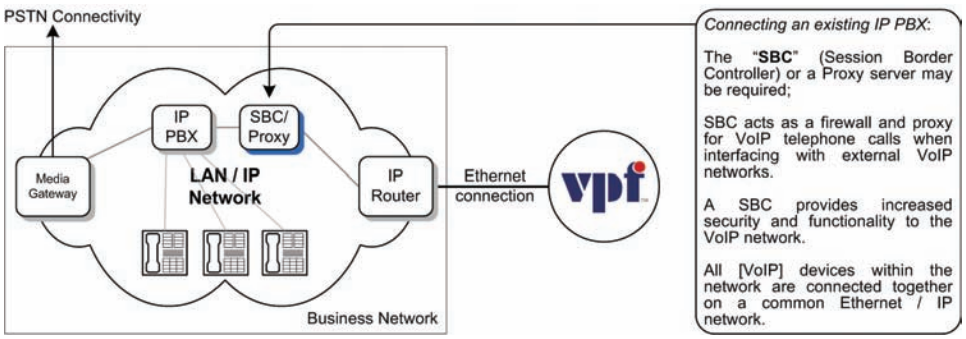
A Media Gateway is placed between the TDM PBX and an IP router.

The Media Gateway acts as a translation device between TDM and VoIP telephone calls.

Provision one or more TDM connections between the TDM Switch and Media Gateway.

The IP Router routes IP traffic between Media Gateway & VPF.

Large Businesses: IP PBX



Connecting an existing IP PBX:

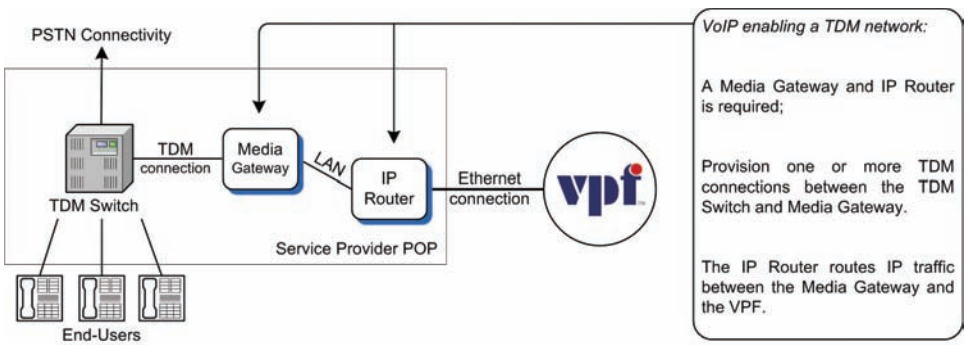
The "**SBC**" (Session Border Controller) or a Proxy server may be required;

SBC acts as a firewall and proxy for VoIP telephone calls when interfacing with external VoIP networks.

A SBC provides increased security and functionality to the VoIP network.

All [VoIP] devices within the network are connected together on a common Ethernet / IP network.

Service Providers: TDM only



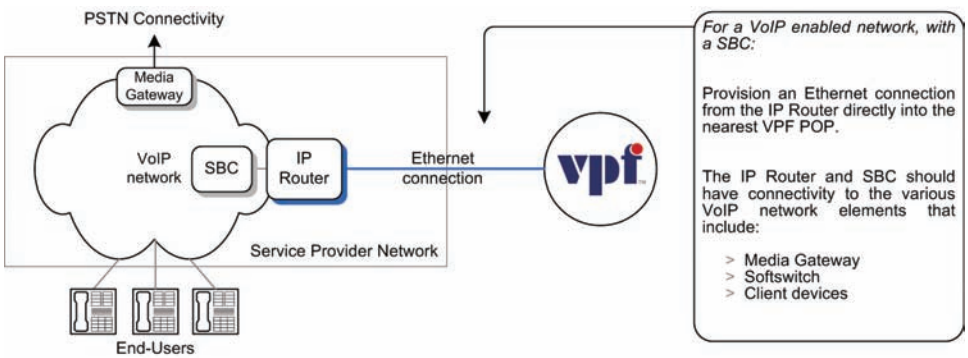
VoIP enabling a TDM network:

A Media Gateway and IP Router is required;

Provision one or more TDM connections between the TDM Switch and Media Gateway.

The IP Router routes IP traffic between the Media Gateway and the VPF.

Service Providers: VoIP enabled



For a VoIP enabled network, with a SBC:

Provision an Ethernet connection from the IP Router directly into the nearest VPF POP.

The IP Router and SBC should have connectivity to the various VoIP network elements that include:

- Media Gateway
- Softswitch
- Client devices

VPF Member Implementation Models

Since the VPF telephony marketplace introduces a new method for the exchange of minutes, members connect to us with minds open to the idea of trading minutes on terms that they negotiate easily and freely and the idea that they can now access applications on the same physical connection. The VPF simplifies both business plans and network configurations. To help our members and partners benefit, and to help others, the diagrams on the left are implementation models that map out a simple setup for each type of businesses connected to the VPF.

Did you know?

Utilizing a Media Gateway can protect existing infrastructure investments and enable you to exchange VoIP traffic immediately.

For most Enterprises, this solution allows them to realize savings between 50 to 90% and achieve an ROI within 3 months.

Service providers can now break free of the traditional footprints; this approach facilitates the reach into new market segments while controlling capital cost.

For more design tips and case studies, visit: www.thevpf.com

VPF Access Locations

The network reach of the VPF continues to expand. We are now accessible from most major carrier-hotels. In addition, the VPF Carrier Alliance extends the VPF to hundreds of buildings in various markets throughout North America and Europe. For a complete list of our ever-growing locations and partners, visit: www.thevpf.com.

- **New York City**
  60 Hudson Street - 9th Floor - tel^{X}
- **Atlanta**
  56 Marietta Street - 2nd Floor - tel^{X}
- **Boston**
  1 Summer Street - RCN
- **Chicago**
  600 South Federal Street - RCN
- **Miami**
  NAP of the Americas
- **Dallas**
  2323 Bryan Street - MMR - Digital Realty Trust
- **Los Angeles**
  1 Wilshire - 19th Floor - CRG West
- **San Jose**
  55 South Market Street - CRG West
- **St. Louis**
  Bandwidth Exchange Buildings
- **London, UK**
  Coriander Avenue - 1st Floor - Telehouse Europe

Featured Carrier-Hotel Operators:

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CRG WEST

An operating partner of The Carlyle Group, CRG West provides the telecommunications industry with a robust offering of colocation cabinets, cages, and fully conditioned private telecom suites in the world's richest Meet-Me Room environments. CRG West owns, operates, and provides all interconnection at the One Wilshire Building in Los Angeles, Market Post Tower in San Jose, and 1275 K Street in Washington, DC. The CRG West Any2 Packet Exchange provides Internet peering as a utility for One Wilshire and Market Post Tower tenants, and is also home to the Voice Peering Fabric.

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tel^{X}

tel^{X} is a premier operator of telecom "meet-me" network interconnection facilities. More than 250 networks physically converge within tel^{X}'s NYC facility, and more than 90 networks physically converge within its Atlanta facility. Known as a "marketplace" for network services, tel^{X} actively facilitates business opportunities between its carrier and enterprise customers. tel^{X} customers report higher revenue, greater profit margins, and lower costs from their tel^{X} based network operations. Internationally recognized for its facilities and services, tel^{X} continues to enjoy industry growth and success.

Summary

Literally, "One Connection to the World!"

The Internet has revolutionized business practices and enhanced the value of our lives. It is a tool that enables us to explore our interests and expand our dreams and imagination. The VPF is an evolution of the Internet's ability, via VoIP, to make voice communications faster, cheaper, and more comprehensive. Unlike the Internet, an organic community with no controls, the VPF has its implementation focused on security and quality.

The VPF has become the world's largest telephony marketplace. Working closely with its alliance partners, the VPF has expanded, and will continue to expand into businesses of different industries and markets. The growth of its VPF Minutes Market and VPF ENUM Registry over the last year has changed many businesses and benefited millions of users. With the recent introduction of the VPF ASP Market, the VPF provides an open architecture allowing third party applications to be developed and incorporated within the fabric - for instant accessibility to a global audience.

For information about the Voice Peering Fabric, visit the VPF web site at http://www.thevpf.com.

About the Author

Jinci Liu is co-founder and Managing Director of Stealth Communications. She is responsible for corporate strategy and business operations. Her functions at the company also include marketing and product development. She has a BS in Computer Science from Pace University and has been in the telecommunications and computer industry since 1995.

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