Introduction

Telecommunication has become an ever more critical part of the business environment. The evolution of voice solutions for the enterprise has evolved to include IP- the predominant protocol for all data and video communications. Many of the configurations and applications of Voice over IP (VoIP) are explored in this article.

Voice over IP (VoIP) has come a long way, improving call control and quality immensely since its infancy. Session Initiation Protocol (SIP) has defined a signaling standard, resilient to the passage of time. Maturity of this technology has created a revolutionary ripple effect, setting ubiquitous adoption of IP Voice in motion. Metro Ethernet is going to be a big part of making that movement a reality.

Comparing POTS and VoIP – Two people enter, one person leaves.

There are some distinct differences between analog voice (POTS – Plain Old Telephone Service) and using Voice over IP. Let's take a minute to review them and you should be able to see how VoIP has quickly become the superior form of technology.

POTS

With a strong history dating back to the 19th century, access to the Public Switched Telephone Network (PSTN) though POTS has proven to be an instrumental part of our society. Long gone are the days of talking over two cans and a string! As a circuit switched technology, there are some benefits with POTS. When you pick up the phone, your telephone conversation is created with a dedicated path through the PSTN. This enables a connection as long as circuits are available. The network was also designed to maintain a stable, high quality level of voice quality and because of its long history, POTS is available pretty much anywhere.

Although we are now in the age of fiber optics and wireless service delivery, POTS is still based on the copper medium. The core network has been upgraded to a fiber-based infrastructure, but copper pairs are still being used to deliver voice services to the home and business. One POTS line means the ability to have one call or conversation at a time, but today's businesses demand a better way to communicate. Time Division Multiplexing (TDM) has made copper more efficient but not scalable enough in the long term. Technology continues to evolve and copper facilities are not able to keep up with demand.

VOICE OVER IP

Voice over IP is the solution to POTS limited capability and growth potential. It was developed using the strengths of POTS and the PSTN as we know it today.   The dominant standards-based signaling protocol, Session Initiation Protocol (SIP) is similar to the signaling used in the PSTN (SS7), as it is also responsible for setup, management and teardown of IP voice calls.   Real-time Transport Protocol (RTP) is a UDP based method of transporting voice from caller to call recipient. Voice quality of IP calls is modeled after the clarity and consistency found with POTS, made possible by using high quality codecs that are effectively sampling and compressing audio.

VoIP is a very flexible technology with a massive amount of potential. There are fewer infrastructure concerns, as IP can run over multiple physical mediums, including copper, fiber or even collective forms of wireless technology. As long as you can route IP traffic, you can do the same with VoIP. It is Internet Service Provider agnostic as well, which means you can technically utilize any internet connection to place calls across the PSTN. There is no limit on your call capacity as long as the IP-PBX and network bandwidth can support it. In many cases, restrictions and surcharges on long distance calling are minimized or eliminated with IP to IP calls that never traverse the PSTN.

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Moving Forward – Consider All Factors Involved

Now that you know a bit about VoIP, ask yourself: Is my business ready to take on the transition? It will have to be at some point – the tidal wave of telecom evolution is proving that conversion is unavoidable.

A successful VoIP implementation is ultimately contingent on the user experience.   Avoiding dropped calls, maintaining high quality audio, enabling easy inter-office calling and maintaining usability and feature set is crucial. As you can see, there are many factors that should be considered. Here are some topics and questions to ask yourself that will give you a place to start and help you make smart decisions.

REVIEW CURRENT SOLUTION

When it comes to voice, what is working for your company? Step back and take a holistic look at how the current phone system complements your business; specifically how it is utilized and what the critical functions are. VoIP can give you all sorts of features, but ultimately a satisfying user experience is paramount. Find out what people like and dislike about how the current phone system works now and you will have an idea of what to look for in something new. Some important things to look for here are receptionist needs, executive management requirements and current inbound/outbound call flow.

PHYSICAL NETWORK AND SWITCHING

Cat5e or better in the walls? Gig-E or 10/100 LAN? Most IP phones have a built in switch (2 ports) so you can have both a computer and phone connected through the same wall jack (aka "daisy chain"). This is most often practiced when limited wall jacks are available. If you are running a Gig-E LAN and choose to daisy chain your workstations through IP phones with 10/100 ports, you are limiting your workstations to 10/100 port speed.

You will also need switches that can support 802.1q VLAN tagging and 802.1p for prioritization.

POWER OVER ETHERNET

Are your switches able to provide Power over Ethernet (PoE)? Utilizing PoE for capable phones is a nice way of conserving space as it eliminates the need for big fat AC power adapters. If you are looking to purchase new switches, this is a good time to consider those that are PoE capable. If you aren't PoE-ready, AC powered PoE injectors are an option, but should be kept in the MDF/IDF to maintain that space saving benefit.

MULTIPLE LOCATIONS

Do you have more than one office? If there are multiple offices as part of this equation, you should also review inter-office communication. The ability to extension dial between locations is sometimes overlooked. If you choose a system that cannot transport voice over a Metro E or VPN network, you are looking at more trunks/lines being tied up by these calls.

REMOTE USERS

Are there field personnel that work from smaller satellite offices or other types of remote locations? Teleworkers can also impact call capacity. If a remote worker has to dial in to the PBX just like an off network caller would, they are also tying up call trunks/lines. It is worth having a phone system that allows for IP and/or VPN connectivity, giving remote workers the ability to access the system as if they were on site and make more efficient use of resources at the same time.

LOCALLY MANAGED OR HOSTED PBX?

The locally managed (or premise based PBX) is a phone system managed within your own organization, either by a staffed telecom administrator or outsourced IT consultant. This is a great solution for mid-size to larger organizations because of the scalability and control over

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provisioning, features, handsets and ingress/egress call processing. Today's IP-PBX's can be collocated in a data center or remote location for a Hosted PBX like feel and some added business continuity and disaster recovery. Most IP-PBXs can use traditional ISDN PRI or SIP trunking.

Hosted PBX is a product powered by a cloud-based software phone switch (or soft switch). This is a desired solution for small and mid-size businesses and any business with multiple locations because of the provider managed provisioning and maintenance of the phone system. Many useful features and functionality are available to unite the desktop, mobile and telephone experience.

Disaster recovery capability of the Hosted PBX is possible because of its cloud-based nature. Ingress call flow (auto attendants, hunt groups), voicemail, and mobility features are processed server-side, so if your connection to the PSTN goes down or all call paths are full, there is minimal impact and business continuity is maintained.

CAPEX VS OPEX INVESTMENT

From a financial perspective, the locally managed IP-PBX requires more initial capital expense due to purchasing all the hardware required, licensing and support contracts. However, the ability to use PRI or SIP trunks to reach the PSTN translates into a more favorable cost per user for larger organizations, which means lower operating expenses in the long run. There are many well-known managed hardware vendors and thanks to the open source movement, many available Asterisk variants that can actually reduce your initial capital expenditure costs even further.

The initial capital investment with Hosted PBX is low, as you are only paying for IP handsets which usually come with some sort of warranty and repair managed by your provider. There may be an IP gateway, but there is no phone switch that needs to be purchased and most often no one-time licensing fee to activate features. The financial impact with Hosted PBX is in actuality an operating expense.

You are ultimately paying for hardware management, virtualization of your phone system, maintenance and transport to the PSTN. This can translate into a lower upfront cost and predictable costs per user.

Note: Be aware of Hosted PBX providers that require proprietary handsets. At some point you may consider changing providers, or liquidating the IP phones you have to make room for upgrades. Resale value of a proprietary handset is very low primarily due to the narrow options for use. Choose IP phones that embrace the SIP signaling standard, have adjustable configurations and thus versatility in choice of provider. Consider handsets with High Definition voice, as they provide better call clarity, a new standard of IP voice.

CHOOSING A SERVICE PROVIDER

There are some core considerations when looking at a service provider for your VoIP solution.

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Service Provider Checklist

✓ *Reputation - How long in the VoIP game?*
✓ *Network Infrastructure*
✓ *Choice: Hosted, Trunks or a mixture of both?*
✓ *How call quality is maintained*
✓ *Value vs Price – Cheap isn't always good.*
✓ *Total Cost of Ownership Analysis*
✓ *Local, Long Distance and International Rates*
✓ *Equipment Requirements*
✓ *Implementation Process – How long?*
✓ *Tech Support – Call and test responsiveness!*
✓ *Post Sale - Move/Add/Change/Deletes*

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Call quality control is the most important. VoIP is a packet switched technology and is dependent on access to the Internet or your provider network. Voice quality and stability are directly affected by poor network performance such as packet loss,

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jitter and round-trip delay. These symptoms cause dropped calls, low quality audio and loss of in or outbound audio which makes provider choice very important. You should make sure the provider can control call quality.

Although a low price is attractive and may make a transition easier, it isn't always true that the rock bottom cost option will be best in the long run. Look at value of the provider as a whole and ask about network infrastructure and ownership, reputation with VoIP and other business products, how the implementation/installation process works and other things like equipment requirements and package options.

Take a look at the service provider checklist for some other important topics. The best providers will be able to answer all of these questions easily and with a favorable response.

Metro Ethernet and VoIP - Let Our Powers Combine!

A Metro Ethernet Network is designed to address your own infrastructure needs and supercharge your VoIP deployment strategy. Long range Ethernet connectivity between offices gives you the same level of control over voice/data prioritization (using 802.1p) as you have locally with superior service levels ensuring call quality. Metro Ethernet networks can help enhance business continuity, performance and stability for both a localized IP-PBX and hosted PBX services.

METRO ETHERNET (METRO E)

A Metro Ethernet Network can be loosely defined as a regional extension of your Ethernet based Local Area Network (LAN). Its primary purpose is to connect geographically separate sites as if they were offices located in the same building. This means traversal of the the public internet for inter-office communication is no longer required. Running hard drives or tape backups from your office to a data center or data storage provider will become a thing of the past. Because this type of

service is Ethernet based, you will also have flexibility in the choice of equipment and freedom to configure the network as you see fit.

Flexibility from the equipment perspective is born from the Ethernet nature of Metro E. Just about any piece of networking equipment has at least one Ethernet interface. Contrary to SONET or DS3 customer edge devices, special interfaces are not required and therefore create a drastic reduction of required real estate (as low as 1RU) in the MDF/Telco Room. Making space available will not only free up room, but can also translate to savings on cooling and energy spent on networking equipment that is no longer there.

Metro E can be delivered over various types of infrastructure, from wireline (copper and fiber) to wireless, but the most resilient architecture is an end to end fiber implementation. As photonic technology evolves, fiber reveals nearly unlimited potential. Wireless service delivery is also becoming more prevalent, as stable long range options and multi-gig development progresses. However, wireless service (think of 4G LTE as an example) is ultimately dependent on a wireline network for transport; most often of which is based on the fiber medium.

NETWORK DESIGN

If the network is not designed properly, VoIP will be plagued by call quality and completion issues, as described earlier. So, the question is whether or not to design around complete network divergence, or converge wherever possible.

The legacy service delivery archetype is based on complete divergence: one connection type for voice and one for data. Diverged VoIP services are modeled the same way, with separate network connections used to prevent voice and data traffic from competing with each other. Converging voice and data over a single network connection is a better option from a financial perspective, but the risk of bandwidth contention is still there.

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Metro Ethernet allows for a diverged solution over converged infrastructure. A Metro Ethernet provider that can offer managed CoS can enable diverged voice and data VLANs over a single Ethernet Virtual Circuit (EVC). This facilitates complete availability of bandwidth for both voice and data. The problem with managed CoS is the management piece; usually limited by the amount of CoS offered. An EVC with a single VLAN and a high SLA empowers the network administrator with the ability to use more traffic classes than the service provider offers.

ENERGIZE THE IP-PBX

Inter-office calling with premised based voice has historically meant installation of a phone switch (PBX) at each site. A PBX that can utilize IP on the LAN side can use the Metro E network to transport voice traffic between offices. This saves call capacity, since inter-office calls behave like intra-office calls and do not tie up PRI/SIP trunks. It also means that less equipment is required, because there really only has to be one core phone switch for the entire network to use. For offices that are spread among multiple calling areas, the network can be utilized for least-cost routing to minimize long distance charges or even redundancy through a backup PBX at a second site. Data Center collocation of the PBX itself is also an option, which
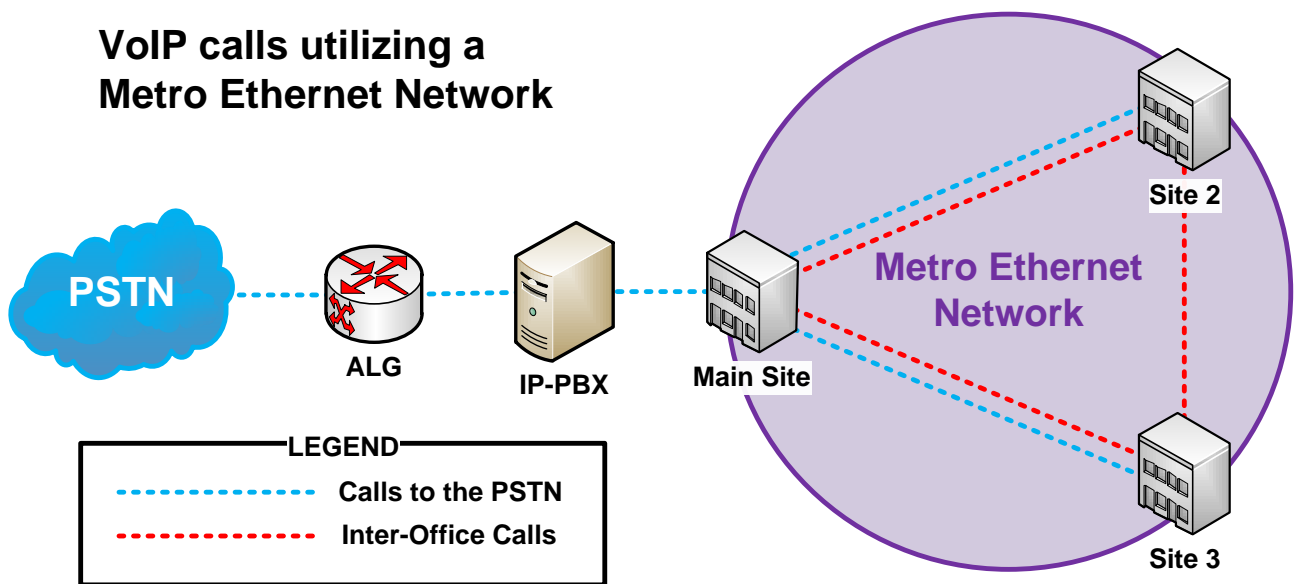
enables business continuity and disaster recovery as well as giving you the feel of a cloud based phone system.

ENHANCE THE HOSTED PBX

With a Hosted PBX, connectivity to the Internet is a common requirement. In order to govern call quality and capacity, an Application Layer Gateway (ALG) is installed at the top level of the network. The purpose of this device is to govern Quality of Service (QoS) using Traffic Shaping, Call Admission Control and CoS prioritization. So for a multi-site solution, an ALG would be required at every site.

Metro Ethernet Networks turn the tables a bit. Inter-office calls do not have to traverse the public Internet and prioritization can be controlled by the network administrator. There really only has to be one ALG for the entire network, as all offices can be configured to route through it. Disaster recovery and business continuity are accomplished by enabling data center collocation of the ALG (as mentioned in the IP-PBX section). In a multi provider situation, where the VoIP service provider is a different company, Metro E can also be used as an out-of-band network for inter-office calling and routes to backup ALGs.

VoIP calls utilizing a Metro Ethernet Network

PSTN — ALG — IP-PBX — Main Site — Metro Ethernet Network — Site 2, Site 3

LEGEND
- - - - - Calls to the PSTN
- - - - - Inter-Office Calls

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Conclusion

VoIP is a solution to the fading technology problem known as analog voice.   It carries most of the world's voice traffic today. A vast majority of advanced services we can now appreciate as business customers are enabled using VoIP, such as voicemail to email, click to dial, find-me-follow-me, web based PBX administration and the like.

Before VoIP, the ability to make telephone calls required a hard line to the PSTN. Networking was only used to transmit data. With VoIP, telephone calls can be made pretty much anywhere an Internet connection is available and today, the business world is utilizing Virtual Private Networking or extending their LAN with Metro Ethernet for better inter-office communication. Fiber based Metro Ethernet networks are scalable, resilient and built to meet the needs of demanding networking applications, which makes transition to a VoIP enabled networking environment simpler and much more efficient.

Combined, VoIP and Metro Ethernet complement each other very well, and together are creating a new future for business telecommunications. Find a solid Metro Ethernet service provider, review all options for implementing VoIP across the enterprise, make informed network design decisions, and you can really leverage the benefits here and become part of that future.

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