



NetLink Technologies, Inc.
White Paper

VoIP for the Technically Challenged

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3589 Sagamore Parkway N.
Suite 240
Lafayette, Indiana
www.netlink-tech.com

Introduction...

Voice over Internet Protocol (VoIP) is not about “smoke and mirrors;” it’s not “hype.” Voice over Internet Protocol is NOT about transporting voice communications over the Internet... that would be too restricting. It’s about a protocol and a process of digitizing and sending voice telephone signals across ANY data network supporting the widely accepted TCP/IP Protocol, INCLUDING the Internet...and it’s here to stay.¹

Virtually all businesses, of any size can benefit from this technology, but some examination of operations and options is first needed to determine the extent to which individual companies might benefit. “Which supplier should I contact?” “Who can I find to advise me?” “Is a hosted or premises based solution a better alternative?” ... and then the tough questions... “What will it really cost?” “Is it consistent with my company’s ROI criteria?” “Will it save me money, in the long run?”

The popular belief is that VoIP means “free” long distance, and even local service. It does NOT mean that. It can, however, mean a reduction in charges associated with local and long distance service; an elimination of the expense associated with “on-net” calls (calls made between different branches over facilities connecting them); **but it will also mean that facilities enabling these services will most certainly have charges associated with them.**

But VoIP means much more than implementation of a technology designed to lower your telephone bill. VoIP also enables soft-benefits (those far more difficult to quantify) like improved employee productivity; it enhances the organization’s ability to collaborate with one another; with vendors, suppliers, and customers; it offers a means of reducing administrative and maintenance charges associated with multiple cabled networks; and provides us the potential of improved customer service, client retention, and increased market share.

Within the Largest Enterprises world wide, VoIP has readily been accepted. The technology is only now gaining momentum in the smaller business market segment. The purpose of this paper is to offer an SMB (Small-Mid-sized Business) perspective to the benefits and risks associated with VoIP; to generally address some alternatives, and to attempt to provide an initial foundation to those SMBs who might be beginning the discussion of VoIP for their ‘enterprise.’

The Benefits of VoIP...

Of principal importance to all businesses, large and small, is the ability to control (reduce, or at least contain) expenses that are controllable. VoIP offers us the ability to do exactly that. For

¹ It is estimated that during the calendar year 2008 VoIP sales will grow to \$7.1 billion; that nearly 80% of all new PBX installations will be VoIP, and compared to TDM technology... Info Tech Primary Research, *InfoTrack for Converged Communications*

many of us, that's all the justification we might need in order to launch an implementation of VoIP. For example, the suggestion that one might be able to control/reduce support and other administrative expenses by nearly 25% per year, as compared to other telecom technologies, is all the justification required. For large organizations, this could mean hundreds of thousands of dollars a year, but even for the smallest of companies, the ability to improve profits by an amount equal to 25% of associated payroll expenses, will tempt most.

Of course, savings can come in different forms; there's the potential to significantly reduce toll and local telephone charges; the savings associated with having to manage only a single network (voice and data) as opposed to two or more. There's the potential benefit of having a single provider to support both voice and data networking services; and the gigantic potential gain (relative) of being able to control the expense of human, technical resources, by controlling the payroll required to support both a voice and data network. In fact, outsourcing installation, maintenance and ongoing support of an SMB's Data Network, including integrated VoIP, will, in most cases, mean annual costs significantly less than those incurred through the recruitment and staffing of one's own technical support department.

In an environment where new offices are being built, the infrastructure required to support a converged voice and data network is reduced simply because there's no longer a reason to have a cabling infrastructure for voice, and a second for data, and perhaps a third for Video surveillance. All can, and do, travel along the same pairs of wire.

In environments where change is the rule, VoIP also reduces the cost and difficulty associated with traditional hardware, moves-add-changes and rearrangements. Many VoIP systems, whether premises based, or hosted, enable the client access to the software of the system making routine moves-adds-changes, simple and inexpensive.

A final cost savings benefit afforded by many/most/some is the capability of migrating from one technology (analog and digital telephony) to VoIP in incremental stages. That is, many providers of premises-based products (Avaya, Cisco, Nortel, others) provide a certain level of compatibility with older technologies, minimizing the need and risk of throwing everything out, and replacing it with new. In some cases, the migration can be made on a location by location, department by department, or other incremental basis enabling problems to be identified and corrected in a confined and cost-effective fashion.

So, what do we have to be afraid of...?

Voice Quality

We're a spoiled lot. Though most of us haven't been around for all of it, the telephone network is more than a hundred years old. It's had a century to refine and enhance every component of the Public Switched Network (PSTN), resulting in a product of incredibly high quality and reliability, and an end-user who is extraordinarily sensitive to quality and clarity of voice communications (or rather, sensitive to any deviation from what we have grown to expect).

A pervasive concern is a belief that the actual quality of voice carried over a VoIP network, actually sounds inferior to that of traditional telecommunications. Arguably, this may be the result of early Internet voice users who often tried to connect via unstable, unpredictable, low bandwidth internet connections. Many times the voice communication was degraded to the point of being worthless. The unfortunate reality is – in some locales – that these conditions can and do persist today, and should not be ignored.

By in large, however, these conditions have disappeared as the result of the increasingly available (and competitively priced) broadband internet access, AND with the entry of major carriers (AT&T, Verizon, Sprint, Covad, Qwest, and others) into the arena of VoIP Transport services.

A technical detour

The Title of this paper makes reference to the “technically challenged,” one of which is this author. I enthusiastically admit “blissful ignorance” when it comes to the details of circuit switching; as opposed to packet switching (the methodology by which data is transmitted across an IP Network). However, it’s necessary for us to take a minute to establish at least a minimum level of understanding of the two, in order to understand the possible Voice Quality risks of VoIP.

With Circuit switching, **a connection or dedicated path** is established between two devices which is **used for the duration of the message**. Information about **the nature of the connection** itself is **maintained by the network**. There are many types of connections, but the most common is one that is created on an as-needed basis.

The communication path is selected by the network from among many potential paths; is **established and maintained until terminated by the parties**; and ultimately gives us the ability to create communications between many separate devices. The most common example of a circuit switched network is the Public Switched Telephone Network (PSTN).

In a Packet switching network **no specific path is used for data transfer**. Instead, the message is **divided into smaller, well defined segments** called packets and sent over the network. Information regarding the routing of the message is left to intermediary hardware devices within the network (routers, switches, etc.)

As a result, **packets are often transported over different routes**, combined or fragmented, as may be required in order to get them from one point to another. **At the receiving end, data is read from the packets and reassembled** to form the original message.

Far more differences between these two switching methodologies exist, but the point that needs emphasis with regard to its impact on VoIP is that...

Voice communications carried over the PSTN enjoys the luxury of being carried, in an uninterrupted fashion, from one end of the circuit to the other. Data, including digitized voice, carried via a packet switched network, is broken into multiple parts, switched via multiple different routes, and then reassembled at its destination.

With that as our technical foundation, we now can introduce the qualities of Jitter, Delay, and Latency into our discussion of VoIP (qualities that exist to one extent or another within all Data networks).

- Jitter is the variation in the time between packets arriving at the destination, caused by network congestion, timing fluctuations, or route changes.
- Delay, on the other hand, is the amount of time it takes for a signal to be transferred across the path.
- Finally, Latency is a synonym for delay, and describes how much time it takes for a packet to get from one point to another.

As often as I've heard the terms, as often as I look at the definitions, I'm still not sure I understand the distinction between the three. But that's not important. What is is the knowledge that data transmitted over a packet switched network is subject to DELAYS, and worse, missed packets... and that these delays can be the result of factors beyond your control.

That being said, it becomes paramount to take steps to control factors WITHIN your control, including: an assessment of your data network's cabling infrastructure; and the evaluation of routers, switches, internet or other IP carrier services. Prior to implementation of a VoIP solution, careful attention should be paid to these factors, and a network assessment performed.

Security...

Another area for serious consideration – and frankly, an area far too often neglected by the smaller business client – is network security.

VoIP devices and software attach to a computer network in much the same way as other computer devices, servers, routers, printers, etc. **In fact, it may benefit us to think in terms that equate a VoIP telephone to a specialized computer** – one looking a lot like a telephone, and performing all of the same tasks. In this light, VoIP hardware and software must be treated with exactly the same degree of care in order to prevent unauthorized access, denial of services, asset high jacking, and worse.

The use of computer based soft-phones, and remote IP Telephone instruments connected to the network via VPNs (standard capabilities of VoIP), can also create vulnerabilities to malicious activity. By their very design, these services work by “punching” holes in firewalls and other

perimeter security devices. The VoIP devices then, should be encrypted; access controlled through multiple levels of passwords; and steps taken to limit the types of resources that are permitted to be used by the remote user (e.g. calling number restrictions, feature denial, etc.).

Other general suggestions for protecting voice traffic from security threats include: encryption of the voice stream itself; keeping an eye on the network through the use of intrusion detection and protection systems; firewalls installed and properly configured; and securing Windows based servers dedicated to advanced VoIP features as tightly as any other critical business function server.

The point is, if you do or don't have (shame on you) a security policy for your data network, VoIP will certainly add additional stress points...and should be factored into your discussions of deployment.

Network Outages...

The PSTN powers single line and Centrex® like services remotely by carrying a nominal current to power functions necessary to carry out telephone communications, even in the event of a commercial power outage. Likewise, traditional PBX services generally provide batteries or other backup, in addition to power failure stations, to further enhance the ability to carry on in light of a loss of power.

That is not the case for VoIP. IP networks are not powered. Therefore, VoIP requires a power source **within the structure of the network itself**. This, in and of itself, is not a problem and is generally accommodated by the use of what are referred to as Power over Ethernet (PoE) Switches. BUT, when commercial power is interrupted, these devices will be as well, and must be factored into your evaluation of VoIP.

Because of our critical reliance on business telecommunications, even the shortest interruption will not go un-noticed. Clients have reasonable expectations that they will be able to reach us and vice versa. Likewise, as we consider the move to VoIP we have the expectation that the system will perform at least as well as the system it is designed to replace. If a new VoIP system sits idle, the result of a poorly designed power plan, it becomes virtually worthless.

An Uninterruptable Power Supply continues to supply power to the VoIP system for a limited time until the main power can be restored, and is an obvious component of a well thought out power plan. Beyond this temporary solution, and depending on the degree of importance YOUR Company places on telecommunications, other devices (generators) could be considered.

We would strongly recommend that any discussion of backup power solutions also consider incorporation of surge suppression and load balancing in order to avoid power fluctuations which could adversely effect VoIP traffic.

Finally, provisions should be implemented to monitor your power infrastructure itself, at least temporarily/periodically, to mitigate any existing or emerging power issue themselves.

E 911...

Probably the most significant feature of 911 Service itself is the broadcast of the caller's physical location, especially in the event that the caller is unable to provide that information themselves. First trialed in Chicago in the mid 1970's, E911 has become a North American standard, now required by law.

In order to interface with networks operating with different protocols and technologies, a device referred to as a gateway is required. In order for VoIP to interface with PSTN, therefore, a gateway is required, and generally presents little problem. However, one of the bigger challenges facing VoIP is the interconnection with PSTN services like E911.

In fact, in earlier days, VoIP systems simply could not interconnect at all with the 911 network, and could not complete those calls. Given the potentially mobile, or nomadic characteristics of VoIP Softphones and other remote application end-points; combining it with the fact that not all broadband providers are created equal, you have a problem that must be sorted out before the implementation of VoIP in order to minimize obvious risks.

Currently there are two ways that a VoIP system (more accurately, VoIP Service Provider) can be connected to 911 Services...

With VoIP **Basic Emergency Calling**, the call is NOT routed to your local 911 Center on emergency lines. It is sent to a remote private call center or a NON emergency line without location information, and possibly without your callback number. There information that is received is compared to an offline database; information collected, and emergency action taken. This type of processing can often delay the emergency response.

Enhanced VoIP 911 Service is routed over a dedicated 911 network and arrives at the local 911 dispatching center with both the customer registered location and callback telephone number.

It is essential that you be aware of exactly which service you are acquiring.

Premises based or Hosted VoIP Solution...?

Choices are ample when it comes to the evaluation of VoIP products. Companies like Avaya, Cisco, Nortel, AT&T, Verizon, and many others, offer premise-based alternatives. Some of the same companies and many others like Covad, and Qwest offer hosted services for your consideration. But in the end, you have to make the decision. Both service options have their place, and neither is universally applicable to every business.

The choice is very similar to the decision making process individuals go through when deciding whether to buy or lease an automobile. With either option, in the end, you still get telephone service, equipment, software and feature capabilities; all with similar quality and reliability (at least from those with international reputations for quality and reliability). What is different?

1. With hosted solutions, you don't ordinarily own the equipment. In fact, most equipment is remotely located; you may only own telephones necessary to connect to the service. With a premises-based VoIP system, you purchase the equipment; it is installed and maintained at your location.

In either case, the feature capabilities reach across the network, without regard for geography or type of telephone, giving users access to the capabilities of the system. In most cases, you shouldn't care how, or where the capability comes from, you should care that it works as required.

2. Another difference...with a hosted solution, there is generally no up-front capital investment (often a very attractive feature for the SMB owner) beyond the purchase of telephone instruments... payments are made periodically and continual for the lifetime of the service. With VoIP that is premises-based, the initial capital costs can be significant, but usually can be spread over the expected lifetime of the system, making leasing too, an attractive option to the SMB owner.

So the financial benefit of the hosted option -- generally suggested by the hosting service provider -- doesn't appear to be as clear cut as one might first expect...but a comparison is strongly recommended.

3. Geography doesn't play as key a role in the hosted option as with the premises-based solution, because the hosting company can be located anywhere and still provide services. With a premise-based solution, it is prudent to select a system that has qualified/certified, local support, as well as the ability to call upon the manufacturer for additional support if needed.
4. For those seeking control, ownership provides it. But control also implies a learning curve. Owning means a significant commitment to installing, maintaining, and learning how to use the system to its fullest, in order to achieve the greatest benefit. Each of these considerations should be included in a determination of Total Cost of Ownership.
5. With either alternative, end-users can easily move, change, rearrange features, and reconnect to the network without incurring traditional service charges.

So if there's no clear cut financial advantage to either the hosted or premise-based solutions; if geography and location is only a small factor; if the questions of ownership vs. non-ownership contribute equally, what does matter? The answer is simple, quality.

What matters is the Manufacturer/Services Provider/Vendor's reputation for quality and performance; their track record for reliability, dependability and responsiveness; the richness of the feature set provided; the security of the system itself.

Other contributors...

As with auto leasing, if a company intends to keep its VoIP system "forever" then the decision to purchase may make more sense, especially if it has a high degree of "migrate- ability" to future system releases and provides adequate capability to grow and expand.

Regarding the issue of survivability, disaster control and recovery, in the event of a disaster or other interruption of service, survivability is optimized by insuring the capabilities/facilities are reasonably redundant. Calls need a means of being alternatively routed when the system goes down.

A significant advantage offered by the premises-based VoIP system is that it is end-user designed, and therefore gives the greater degree of control in the design of appropriate levels of disaster control and recovery.

But hosted systems are also very reliable if the disaster occurs at the client site. Calls generally can be re-routed to an alternative site in short order, and because IP Telephones can be connected anywhere there's an internet connection, service restored very quickly. However, should the disaster occur at the hosted provider site, it is a major issue, and one that needs to be carefully evaluated.

In the end, the selection of a hosted or premises-based VoIP solution comes down to individual choice:

If you want to OWN the VoIP solution, especially if you intend to own it for a very long time, the premises-based alternative will most likely be the less expensive alternative. If you intend to retain the system for a shorter period of time, a hosted alternative may suite you needs.

If you want a customized solution, then the premises-based solution, because it gives you ultimate design control, is your better choice. If you only require basic calling capabilities, and have no desire to customize the system, then hosted VoIP, with its standard feature packages, makes a great deal of sense.

The end...?

Not likely. VoIP is here to stay, and it's evolving. Those that refer to it as "black magic," "smoke and mirror," or "hype," simply don't understand the nature of data networks, and the extreme efficiencies they provide. Packet switching, in particular VoIP, is a proven technology—already extensively involved and evolved within the largest business organizations — that offers many significant benefits to the smaller business. Any organization considering the acquisition of a telecommunications system must include a discussion of VoIP in that process.

VoIP offers the potential of a rich range of benefits, from the reduction of recurring telephone line and long distance expense to "soft benefits" of improved employee productivity; enhanced collaboration between one another, vendors, suppliers, and customers; the reduction of administrative and maintenance charges associated with converged networking infrastructures; and the potential of improved customer service, client retention, and increased market share.

But there also may be consequences if a deployment of VoIP is done haphazardly, and without consideration for potential risks... and there are choices that need to be considered. This paper has tried to identify some direction, but certainly isn't detailed enough to provide a roadmap for every SMB considering VoIP.

What then should the SMB client do? Probably the best advice we could offer is to search out a trusted advisor. One that understands the technology itself; has significant experience across a broad range of voice and data applications and networks; one that isn't afraid to take the time to understand your business and the tools you use to support decision-making; one who is happy to discuss more than one alternative; one who can accurately represent the capabilities of more than a single provider.

But in the end, the responsibility of research, evaluation, and implementation is yours. You simply need to figure out what's right for you. With a complete understanding of your needs, and by getting complete answers to the right questions, you can take confidence in your ability to move you company to VoIP.

NetLink Technologies is a Microsoft Certified Solutions Provider – Partner, specializing in the design; installation; support and maintenance of Windows Networking solutions for the Small to Midsized Business client. In addition, they are both an Avaya Small Business Partner, as well as a Cisco Select Business Partner, with concentrations in the voice, voice over IP, and data communications needs of the Small Business Client.

NetLink Technologies also, through contractual arrangement, represents the services of more than 50 Carrier service products and services, including: AT&T, Verizon, Covad, Qwest, Sprint, and others.

They can be reached at (765) 742-2420, or via the internet at www.netlink-tech.com

The author is President of NetLink Technologies, Inc., and has more than thirty years experience with Telecommunications, Data Communications, Data Networking and Internet products and services. He may be reached via email at tbrown@nltech.com.
