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ZDNET.COM.AU SPECIAL REPORT

VoIP HANDBOOK

YOUR BUSINESS BUYING GUIDE

Business guide to implementing VoIP

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What exactly is Voice over IP? There are many definitions floating around, but the most basic one is that VoIP is a collection of technologies which allow you to hold voice communication over a TCP/IP-based network.

VoIP has actually been around for quite some time. Instant messaging and collaboration programs like Microsoft NetMeeting and MSN Messenger have offered the ability to transmit sound through the computer speaker/microphone jacks, allowing remote users to actually converse.

But VoIP is ultimately reliant on networking technologies, and as it's only in recent years that reliable, high-speed TCP/IP networking has become so prevalent and affordable, it was never really considered much more than a gimmick.

However, with home users on high-speed broadband, and companies able to outfit their buildings with high-speed cabling and switches capable of handling massive throughput, the potential of VoIP as a dedicated carrier of voice communications is being realised.

VoIP does suffer from a popular over-simplification of definition. Many people think that Internet + Voice = VoIP = Free communication. As with many over-simplifications, there's an element of truth there, but the reality is always more involved.

This guide is designed to help you come to grips with exactly what VoIP is, what it does, whether it's any good for your business, and how to go about implementing it if you decide it is.

Techno talk

First, some technical explanations to lay out an overview of what you're looking at.

PSTN, POTS and PBX

The traditional model for voice communications is the PSTN, or Public Switched Telephone Network. This is, essentially, the phone company -- its infrastructure, cables and so on. It handles your phone calls, and has its own range of technologies for ensuring that your call gets through properly.

Although this is a slight over-simplification, the basic model of the PSTN is a mainframe/terminal scenario. The switches and exchanges of the phone company provide all the features and functionality of your call service. Your telephone is just a dumb terminal, with barely any inbuilt features of its own. Even phones with funky buttons for call waiting, call forwarding and placing calls on hold are completely reliant on those features being supported at the switch. The switch provides everything to the phone (including its power), and every signal which comes from the phone, from the keys pressed to your voice, has to be managed and interpreted by the switch.

Every phone connection, therefore, has to connect directly to the switch. In low-density situations like a residential connection, the individual connections back to the switch are called lines. In situations where a greater number of phone connections are needed, like offices, it's expensive and impractical to connect multiple lines to the exchange so a PBX, or Private Branch Exchange, is used instead. This is a smaller switch mounted and installed in-house, with a line going back to the main exchange called a trunk. PBXs have the advantage that all internal calls do not have to route out of the PBX and back to the exchange, so the phone company is not involved and the calls are free.

However, the basic model still applied -- the PBX carries all the functionality and the phones are just dumb terminals.

The simplicity of the switch/terminal system has enabled voice communications to be reliably serviced over fairly dated infrastructure. A phone line connected to a house in the 1970s is still perfectly viable. However, it also means that any new features or upgrades have to be applied to the switch, and this often means new, dedicated and expensive hardware. This doesn't really impact home users (until the bill goes up with a new "Service Fee" attached), but when businesses wish to upgrade PBX functionality, dollars can quickly vanish.

VoIP vs IP Telephony

These two phrases do get bandied about a lot -- to the extent that sometimes they're interchangeable and sometimes meaningless. The definition that makes the most sense is this:

- Voice over IP describes the technology required to run voice communications over an IP network
- IP Telephony describes the features and capabilities open to you now that you are running VoIP

To be honest, the only thing which matters is that the definitions makes sense in the context in which it's being used, and that it's used consistently. This article will only be talking about VoIP, using the definition outlined above.

Networking and VoIP

The IP in VoIP stands for Internet Protocol, and it's the same IP as in TCP/IP, which has been the standard networking protocol for quite a few years. It's what most networks run on these days, from a small office environment to the Internet itself. Within IP are two more protocols -- UDP and TCP -- each performing separate functions.

TCP, or Transmission Control Protocol, has a number of inbuilt features like handshaking and error correction. It's the favoured carrier when reliability of communication is more important than pure volume.

TCP packets carry information about where they've come from and where they're going, and require that the remote receiver acknowledge each packet to ensure continued reliability, and carry self-protective information in case things go wrong. This reliability comes at the cost of size and efficiency -- TCP packets are larger than their UDP counterparts, which results in additional networking overhead. UDP, or User Datagram Protocol, has none of the error correction or self-checking of TCP, so is inherently less reliable. However, it has the advantage of being light-weight and speedy -- perfect for situations where volume of traffic and throughput is more important.

Most network communication makes use of either TCP or UDP, but VoIP makes use of both. The reliability and handshaking of TCP is used to establish a proper connection with the receiver, and then the voice component is broken down and transmitted over quick UDP packets to ensure smooth communication. TCP monitors the call, correcting for errors, and then handles the hang-up.

A key feature of networking and one of the reasons for its efficiency is that each end point on a network knows very little about all the other points -- the computer in my office neither knows nor cares about the existence of another computer two offices away. But -- and here's the cool thing - it knows how to find out. To talk on an IP-based network, all devices need three things (apart from a connection to the network):

1. An IP address, which is unique for at least as long as the device is connected
2. A subnet mask, to understand where its own address lies in the grand scheme of things
3. A default gateway, when attempting to connect to addresses not located in the local subnet

And that's basically it. Of course, for really seamless communication you need a few more things, like the address of a DNS server to resolve those odd IP addresses into understandable names (like www.google.com.au), but other than that, you can do quite a lot with just those three prerequisites.

The backend infrastructure of an IP network continues the concept in very much the same vein -- each point knows enough to forward traffic to the next logical point along the line, but no one device carries a working knowledge of the entire network. Additionally, all devices are adaptive learners. Network switches and routers carry dynamic information of the other devices directly connected to it -- change something and they will adjust that knowledge accordingly.

The wonderful advantage of this is that if a device fails, it's relatively easy to bypass it -- point the servers to another gateway and have them disseminate the information to the client machines, plug cables into another switch, rig up a temporary wireless connection, hang a cable from the ceiling -- anything. It all works.

And this is where the appeal of VoIP starts to take hold. A network is a dynamic, flexible environment, where communication and cross-communication is possible regardless of where you're plugged in. Upgrades are easy and are often done entirely in software -- no new hardware required, and telephony capabilities are much more dependent on the individual handsets. By comparison a telephone/switch voice network is static, inflexible and relies almost totally on the switching hardware for capability and capacity. If you want a new phone, you have to run a line straight back to the switch.

The business case for VoIP

Benefits of VoIP

Where exactly do the benefits of VoIP for businesses lie? Much depends on your current situation, current voice requirements and future plans. These scenarios aim to highlight the various considerations:

1) Moving to a brand new office

Go with VoIP. It's that simple. If you don't have any pre-existing infrastructure to worry about, fitting up a new office is the perfect opportunity to implement VoIP, regardless of your voice

requirements. Why? You'd have to fit out a network infrastructure anyway, no matter how basic. If you followed the traditional model of voice/network infrastructure, you'd have to cable everything up for network communications AND lay a separate run of cabling for voice communications. Not to mention the cost of either a dedicated line to the exchange, or a trunk line and local PBX. Consolidate and save.

2) Existing single office, low density, no PBX

This scenario fits the description of only the smallest of offices with perhaps only one incoming line, much like a residential connection. The benefits of VoIP here are not clear-cut. If you have an Internet connection, it would certainly be worth considering approaching the ISP to see what broadband VoIP deals they can offer. This would give you the flexibility to have multiple handsets on the one line or even a VoIP-capable mobile running off a wireless network. However the decision is more likely to be made on the grounds of functionality and consolidation rather than cost. The cost differential between traditional voice and VoIP is likely to be negligible.

3) Existing single office, local PBX, trunk to exchange

Are your current voice requirements being met? If so, stick with what you have for the time being until it's time to upgrade, and then future-proof your requirements by spending the money on VoIP. Until that time it's unlikely to be worth the cost. If you're not satisfied with the current system and were looking at upgrading anyway, VoIP is definitely a good move. You'll still need the trunk to the exchange for PSTN connection, but you'll get the internal benefits of running VoIP.

4) More than one office, local PBX at each, multiple trunks

This is a scenario where VoIP truly shines. Each office has a requirement for a local PBX to minimise costs and meet internal voice requirements and as already mentioned, even a VoIP-enabled system eventually requires access to the PSTN. But what you can do is leverage off each office's Internet connection to set up VPNs across the WAN links between each office, effectively making them part of the same network. Upgrade each office to VoIP, have one office hosting the trunk to the PSTN, and route all external calls through this one connection. Slash costs and make every employee's extension effectively internal (free!). Even as a starter, you could keep the analogue handsets but get rid of the trunks. Very, very cool.

Problems with VoIP

Before you get too excited about VoIP, it's worth taking a moment to consider what can go wrong. Although the beauty of VoIP is that it moves you from a rigid, centralised, hardware-based voice system to a decentralised and flexible one, this same selling point is also the source of many of VoIP's problems.

As soon as you move to a VoIP system, you're now running all your business communications over the network. This means that the bandwidth used to access databases, work files, e-mail and the Internet is now sharing the same space as your voice comms.

At this point, quality of service becomes paramount. The older phone system never had much of a problem with QoS, as each phone line was essentially a dedicated circuit -- next to no chance of interference. Now, the VoIP network packets are mixed in with everything else.

Network lags are common enough problems. Most of them don't cause much drama -- a file takes longer to copy, a Web page takes longer to load, a server share takes longer to browse. Most users simply take this in their stride, and it takes a severe lag or series of lags for complaints to be raised. However from personal experience, I can guarantee that users are far less understanding about phone problems. I think it's because computer communications like e-mail and IM are still regarded as inferior because they are impersonal -- no emotion or voice inflection, risk of misinterpretation and so on. Many people still rely on phone conversations as their primary means of communication, but even those who don't won't tolerate lags, echoing and drop-outs while they're on the phone. The PSTN has set a high standard of quality over the years, and VoIP has to at least match it.

So with network reliance paramount, you have to ensure that your infrastructure is up to the job of moving all that data around. In scenario number four, where VoIP replaces multiple trunk connections, routing and switching across the WAN has to be streamlined, which is even harder than optimising the internal network. And optimisation is the absolute key to VoIP. The vast majority of technical problems with VoIP relate to the supporting network infrastructure. Get it right first time and you can run anything -- get it wrong and it will become the bane of your existence.

Then there's the problem of power. As current handsets draw their power from the PBX, if the power goes out in an office, as long as there's power to the PBX then the phones are fine. IP switches don't natively supply power to devices plugged into them, so the options are to plug each handset into the local power circuit or purchase power over ethernet adaptors for each handset. Either way, adequate UPS backup is necessary to keep the phone system up in the event of localised power failure.

Regardless of the model you take though, there is still the inescapable fact that your voice needs are now tied to the network/Internet. If access to either one goes down, so too do voice communications.

Convergence

What is convergence? In the IT world, convergence happens when two existing but different technologies or systems gradually draw together until they become one single integrated system. When talking about VoIP, convergence happens when your voice communications are handled entirely by the network infrastructure. Most businesses looking at migrating to VoIP will not be able to achieve true convergence straight away. This is largely due to the prohibitive cost of performing a complete migration from traditional telephony to VoIP. Assuming that the network infrastructure is capable as-is of supporting VoIP and requires no further improvement, there is still the cost of replacing every phone point with a network point, and replacing every non-VoIP handset with a VoIP-capable one. It's a lot of money all at once, and most businesses will find themselves in a position of gradual migration, supporting both VoIP and non-VoIP users. This requires a different implementation approach -- more on that later.

Additionally, it's important to remember that VoIP is, to an extent, still reliant on the traditional phone network to connect to non-VoIP systems. At some point, the call will have to route through the PSTN to reach its destination, depending on who you're trying to contact and how.

Implementing VoIP

So you've done the analysis and decided that VoIP is the way forward. Where to start? What do you need?

Unfortunately there's no simple answer to this. VoIP solutions come in many shades and flavours. There are fully hosted solutions, partially hosted solutions, locally hosted solutions, true VoIP, partial VoIP, IP-capable PBX units, softPBX devices, VoIP servers, messaging gateways and the list just goes on and on. The best solution for one business is unlikely to suit the business next door. So, the best first step is to seek advice from industry experts -- VoIP solution providers and system integrators.

If you have a small business and your voice requirements are minimal, investigate what your ISP has to offer. Many ISPs are offering broadband-based VoIP solutions, and they're generally pretty good. See what features you'll receive, how the call costs compare to your current plan and whether you'd make savings over time. This way, you don't have to worry about implementing a local solution -- someone else takes care of everything.

For medium businesses and larger, the options are simply too varied to list comprehensively in one spot. Each vendor will offer you a different package, different solutions, different hardware, different software products, different features, hosting options and support agreements. As much as it sounds like a cop-out (and it feels like one too), there are simply too many companies, vendors and products to list them comprehensively in one place.

The best course of action is to approach a small number of VoIP integrators to get an overview from each one as to what is likely to be suitable for your business, and compare them. If they're any good, the proposals should be fairly close to each other, which makes it easy to discard any obviously inflated quotes. Start with your current voice carrier -- all major telcos in Australia now offer VoIP solutions for business.

However, you can start getting to grips with VoIP in the office by setting up a test environment and involving a few key users to test messaging functionality, service integration and hardware. You can easily set up a software-based PBX server for free, get hold of some handsets and softphone applications and start assessing their value. To assist you, we've included tables of VoIP handsets and server products, as well as a list of VoIP systems integrators to get you started. This list covers the majority of players in the VoIP market, and should help to give you a comparison of the various products out there.