2

Why VoIP

Synopsis

Voice over data networks, data over voice networks, networks are definitely coming together. This module explores this issue as well as why you might want to implement VoIP technology. To be fair, the downside of VoIP must also be explored. Finally, who and what is driving this technology forward? These are the issues that are covered in this module.

Lesson Index

A. Converging Networks
B. Benefits of VoIP
C. Issues with VoIP
D. Driving VoIP

Lesson Objectives

Upon completion of this section, students will:

- Appreciate that data and voice networks have been coming together for some time now. Will the final network of the future be a switched TCP/IP network?
- Understand the benefits of voice over IP as well as some of the challenges involved.
- Know who and what factors are driving the adoption of VoIP.

VoIP02
☑ A
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VoIP A,B,C,D
NextGen A,B

VoIP02.0105

Converging Networks

- **Voice converted to data for long distance transmission (T1s)**
- **ISDN supported voice, video and computer data**
- **The Internet is almost as extensive as the PSTN**
- **Packet switching TCP/IP based networks were not designed for voice**
- **With a little tweaking, the two networks can converge**

Data over voice networks

With the introduction of modems in the early 1960's, data could be transmitted over the public telephone system.

Voice over data networks

AT&T introduced the T services in 1962 as a means of increasing the capacity of their central inter office trunk lines. Originally designed to multiplex 24 voice circuits over a 4 wire cable, it now transmits any combination of voice, data and video. It wasn't until the early 1980's that T1 circuits became available for corporate clients.

ISDN

Integrated Services Digital Network (ISDN), developed in the late 1980's, was an attempt to provide services for voice, data and video traffic to small businesses as well as large corporations. And it did. ISDN was attractive to small business because the service included two connections (called 2B+D) over one telephone wire. You could have a telephone conversation, fax a document and cruise the Internet, as long as you used two out of the three, at the same time. The transmission rate was also attractive, 64 kbps at a time when modems were speedy at 24 kbps. ISDN's time has now passed, however, eclipsed by high speed access to the Internet.

The Internet

The Internet, and its precursor, ARPANET, languished for most of its history. From its inception in 1969 to the early

nineties, the Internet was mostly of interest to academics and the military. The introduction of the World Wide Web made the Internet of interest to everyone and since then, the growth of the Internet has put it nearly on par with the public system telephone network.

Now we are in the situation of having two parallel networks. Merging the two together makes some sense as long as all types of data can be serviced equitably. The analog voice network is actually a hybrid with a digital core and analog services only to the end user. On this basis, it makes sense to convert the last analog portions to digital. In addition, the preferred method of moving data is through packet switching instead of point-to-point.

When all analog sections of the voice network have been converted to digital and the data network has been completely converted to TCP/IP and packet switching, the networks will have truly converged.

Benefits of VoIP

- **Reduced long-distance costs**
- **More calls with less bandwidth**
- **More and better enhanced services**
- **Administration and maintenance savings**

Voice over IP can be a complex and expensive technology to install. What benefits can organizations see that would be an incentive to make a change to their well established telephone system?

Reduced long distance costs

Reducing long distance costs is always attractive but only realistic if those calls are being made to other locations of the same organization. Furthermore, the organization must have fixed rate, leased lines to those locations. If a long distance call enters the public telephone system, savings on that call cannot be realized.

Traditionally, leased lines to other locations were installed if the organization needed to move computer data between sites. By converting voice to data, voice could join the other data and be transmitted to other locations. As long as the voice did not increase the need for more bandwidth, and hence the leased line charges, long distance charges could be avoided. This concept is known as toll bypass.

VoIP provides the toll bypass benefit and, in fact, may use the same leased lines. Its natural to ask the question, "What is the difference between the two systems?" The answer is the packet. In order for IP to work, information is broken up

into discrete sections, called the "payload", and control information is added to it in the form of a "header". The resulting combination is called a "packet". An example of control information is the address of the destination. Why go to all this trouble? Because each packet is independent and when transmitted on a packet switching network will find its way to the destination. In other words, a fixed link does not have to be established between one computer and every other computer the first one needs to communicate with.

Data networks are just naturally packet based and by converting voice to packets, they can be managed along with the other data on the system.

If you already have toll bypass using leased lines, switching to VoIP on a managed IP backbone may not save a lot of money. However, better management and increased services may still make it a worthwhile exercise.

More Calls with Less Bandwidth

Traditional voice digitization techniques require 64 kbps (thousands of bits per second) to function properly. This rate is a function of the way voice is digitized using a technique known as Pulse Code Modulation (PCM). PCM provides pristine voice quality and is the hallmark against which other voice digitizing methods are measured. The 64 kbps rate is responsible for the way T1 lines operate. Each T1 line has 24 channels of 64 kbps each (each channel is referred to as DS0) and was originally devised to transmit 24 long distance calls simultaneously.

Today, state-of-the-art toll quality voice can be achieved at as low as 2 kbps, but is more typically provisioned at 8 kbps. Methods of generating digitized voice below 64 kbps PCM can use several techniques. One is data compression, but not all digitized voice below 64 kbps is produced by compressing 64 kbps PCM voice. And the 8 kbps digitized voice is typically only produced when someone is actually talking. Silence suppression is also a key component of many of these techniques. In other words, when there is a lull in the conversation, no packets are generated.

If each voice stream requires 8 kbps, than one DS0 service can carry 8 conversations instead of one, a clear saving.

More and better enhanced services

No one will replace a system with one that has less features. Therefore the VoIP system has to at least equal the traditional PBX when it comes to voice services. These include

the familiar ones such as call forwarding, call waiting, third-party calling (charging the call to a telephone other than the caller or the recipient), collect calling (charge reversal), caller identification, and so on.

VoIP also makes it easy to interact with services that are also data based such as e-mail and unified messaging as well as call centre applications.

These last examples fall into the category of Computer Telephony Integration (CTI). VoIP will further enhance CTI. This is especially true when the Internet and the World Wide Web are mixed in.

One intriguing new service applies to home workers. You can reach a worker who is at home by their extension number. When that worker is back in the office, their extension is still the same.

Administration and maintenance savings

Administration and maintenance savings fall into several categories.

- One cable system to maintain. Since the telephone system and the LAN use the same cable system, UTP cat5, only one system needs to be maintained.
- Administration can be centralized, probably within the IT group. Head count can be decreased.
- Moves, adds and changes are easier to make. If an employee moves to a different floor, just relocate her telephone. The DHCP based IP phone will instantly put the employee back on the telephone system. Her extension will stay the same.

Issues with VoIP

- **All your cabling eggs in one basket**
- **IT people not well versed in telephony technology**
- **May need to upgrade the system**
- **No power, no dial tone**
- **911**

Organizations may still be leery of VoIP for several reasons. They may wish to test out and play with the technology before committing to a full scale implementation.

One cable system

One of the benefits of VoIP, a single cable system to install and manage, can also be a weakness. If the network is down both your data and telephone systems are out of action.

IT is not telephony

Telephone systems normally have 5 9's (99.999%) uptime. Data networks can't say the same. To put this in perspective, 5 9's means that the system can be down only 5 minutes per year. IT personnel will need to take extra telephony training and be cautious around their networks. No more playing around with the server in the middle of the day. Data networks are also notorious for weak security and viruses. These will impact negatively on the telephone service.

Upgrade the system

Besides the telephone equipment itself, the network infrastructure will probably need to be upgraded. This may include upgrading the network cabling and devices such as hubs and switches to handle fast Ethernet. Routers will need to be upgraded to handle quality of service.

Power can't be interrupted

Analog telephone sets receive power over the telephone wire. This provides dial tone even when there is a power outage. In order to provide this same service, servers and other network devices need uninterruptible power supplies (UPS). IP telephone sets will need to rely on the building's protection from power outages or embrace Power over Ethernet.

911

Emergency services depend on being able to find someone who dials 911. This is not a problem with the PSTN since telephone numbers, including extension numbers in office buildings, are mapped to physical locations. IP telephones can easily be moved from location to location. When plugged in, they receive their IP configuration from a DHCP (Dynamic Host Configuration Protocol) server and they are back in service again. Some method must be found to map IP addresses to physical locations in order for Emergency services to respond quickly.

Driving VoIP

- **Users, individuals or organizations**
- **ISPs**
- **Manufacturers**

The VoIP technology will not be adopted unless there is a measurable benefit to stakeholders. The stakeholders are as follows.

Users

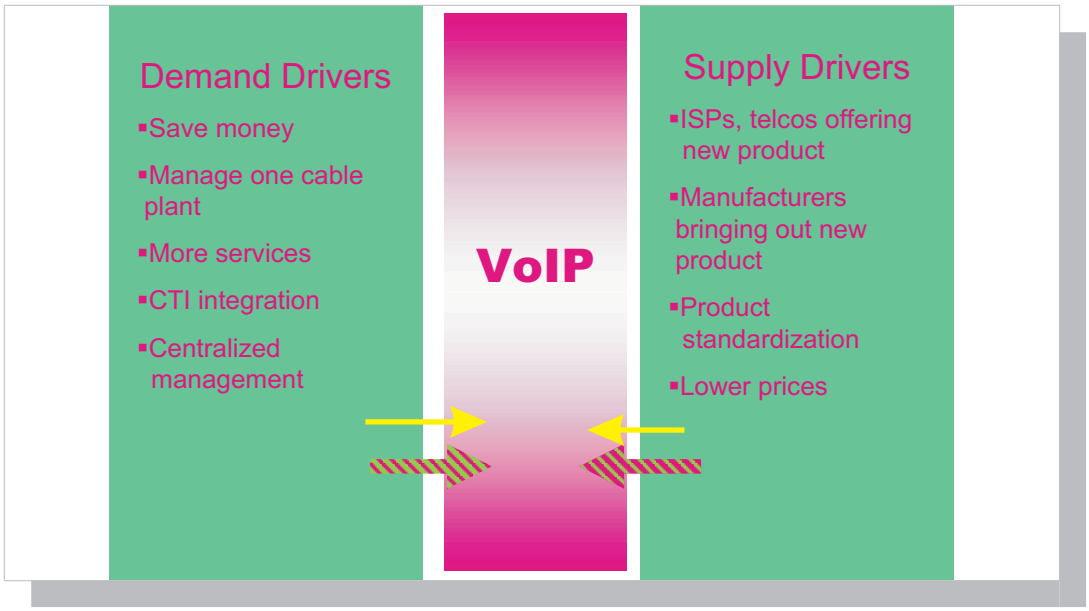
Users, either as individuals or organizations, need to see some benefits of VoIP. The benefits were discussed in the earlier section and include savings in telephone charges, savings in administration and maintenance costs and greater capabilities. What end users want is relatively well understood: high-quality voice, “always-on” dial tone, easy-to-use features, and new applications.

Service Providers

Service providers fall into two categories, those who only provide data services including access to the Internet (Internet Service Providers- ISPs) and those who provide analog voice service as well as data (telcos). The first group has a clear desire for the success of VoIP since it will increase the volume of data, hence revenue, plus steal business from the traditional telephone companies.

The second group is ambivalent about VoIP. On the one hand, as providers of data services, they will benefit from the increase in data traffic. On the other hand, as suppliers of the

Figure 8: Drivers for VoIP technology



analog service, their traditional revenue will decrease as VoIP becomes more popular.

The traditional telcos know that VoIP will become the standard technology for the telephone system, it is just a question of when. They all have plans to implement it and are trying to work it into their business plans.

Manufacturers

Manufacturers are looking for an opportunity to generate revenue. Whenever a new technology field opens up, there is an opportunity for startup companies to provide cutting edge products. This is the case with VoIP where startups were the first out with innovative products. Now that customers have shown an interest, established companies have followed with their own products. Companies that exist in the IP space, particularly Cisco, see VoIP as a brand new marketing opportunity. The companies that have traditionally supplied the telcos with their voice gear have a need to protect their installed base. Nortel, Lucent and Alcatel are as interested in upgrading PBXs and central office equipment to VoIP as they are in end-to-end VoIP. In some ways this last group is ambivalent about VoIP since their sales of traditional voice gear has plummeted while their sales of VoIP equipment has not increased enough to fill the vacuum.

Review:

This module looks at the reasons that VoIP is gaining in popularity and some of the issues involved in deploying it.

Section A: Converging networks
Voice and data networks traditionally have separate characteristics because they moved different kinds of data. Now voice is typically converted into digital form for transmission and the two networks have for all purposes become one. Being able manage a single network instead of two separate ones, excites many a network administrator.

Section B: Benefits of VoIP
This section examines some of the benefits touted for voice over IP including reduced long-distance costs, more calls with less bandwidth, more and better enhanced services and administration and maintenance savings.

Section C: Issues with VoIP
This section looks at some of the issues with a voice over IP deployment. These include putting all your cabling eggs in one basket, IT people not well versed in telephony technology, may need to upgrade the system, no power, no dial tone and 911 service.

Section D: Driving VoIP
This section looks at the drivers for this new technology including organizations and manufacturers.

Exercise 2-1: Quiz

Quiz: Why VoIP?

1. Why does VoIP have a problem with the 911 emergency service?

a) The 911 operator keeps the caller on the line which interferes with other people making telephone calls
b) IP telephone handsets are identified by IP address which is not mapped to a physical location
c) IP cannot guarantee that a call to 911 will get through
d) The emergency services in most cities have not upgraded to VoIP yet

2. Without compression, what is the normal bandwidth requires for one telephone conversation?

a) 2 kbps
b) 32 kbps
c) 64 kbps
d) 8 kbps

3. Why haven't data networks been considered suitable for telephone service in the past?

a) They use more expensive cable than telephone networks
b) Administrators of data networks are over qualified to run telephone networks
c) They have 5 9's uptime
d) They are prone to be infected by viruses

4. Which is not considered a benefit of VoIP?

a) Increase in the number of IT jobs
b) Unified management of data and telephone infrastructures
c) More calls with less bandwidth
d) Closer integration of computer and telephony applications

5. In order to maintain dial tone on a VoIP system,

a) You can implement power over Ethernet
b) You can use rechargeable batteries in the IP phone
c) You can put a UPS on the telephone
d) You plug the telephone into the computer