The Joys and Tribulations of VoIP

When Henry Kaestner, co-founder and CEO of business communications solutions provider Bandwidth.com, chats up a potential customer about Voice over Internet Protocol (VoIP), the initial interest is usually cost savings. “ROI [return on investment] is real and very important,” Kaestner says.

Depending on the type of implementation, companies almost always save money — often substantial amounts — on their monthly telecommunications bill by eliminating toll charges. But VoIP experts contend that this cost savings, while the most obvious and quantifiable cost benefit, represents only one slice of the ROI pie. A converged data and voice network may allow some organizations to combine telecommunications and network functions, reducing costs in both departments. And one or two monthly bills could reduce workload and, ultimately, the monthly costs, because the accounting department doesn’t have to spend hours or days reconciling 500-page telephone company bills.

For some businesses, the most significant savings result from the fact that unlike traditional telephones, which are dependent on a physical location, VoIP phones can be accessed from anywhere within the network. So there’s no need to pay the telephone company hundreds of dollars an hour to install, move or delete jacks.

VoIP converts the voice signal from your telephone into a digital signal that travels over the Internet. According to Ian Kieninger, manager of voice and data products and services at CDW, the new features of VoIP mean more to end users, and even sometimes executives, than just the cost savings. “There are a lot of things you can do when voice communications run over the same network as other data that you can’t possibly do when the two functions are separate,” Kieninger says.

Depending on the equipment purchased and how the system is set up, users may be able to receive, send and forward voice mail the same way, and at the same time, they forward e-mails; they can use their notebooks anywhere on the network as a “soft phone;” and they can automatically store callers’ information in Microsoft Outlook or another contact management application. (These are just a few of the features; also note that many of the more advanced VoIP features are only available when a company invests in VoIP phones.)

For example, at the Pepsi-Cola Bottling Company of Hickory, N.C., receptionists can now monitor the availability and location of salespeople before forwarding incoming calls from customers. The system also allows employees to share voice mails between locations, enabling them to retrieve and leave messages from any phone in the enterprise. “Before implementing VoIP everything had to go through the receptionist, even when accessing voice mail remotely,” says Jim Bare, IT manager at Pepsi. “The receptionist was overburdened, and we don’t like keeping people on hold. VoIP streamlined our communications and made them more efficient.”

Is Your Network Ready?

VoIP technology is still new enough to be a hero-maker. On the other hand, if it results in cost overruns, degrades overall network performance or frustrates end users through confusing and unnecessary features, it might have the opposite effect.

Before technology professionals get too excited about VoIP, they have to go through a reality check. When voice communications travel over the network, it must be evaluated like any other high bandwidth data, such as streaming video or live teleconferencing. Any organization that ignores this fact does so at its peril, says Kieninger. “The most common way companies get into trouble when trying to move to VoIP is not having enough network capacity to support it.”

As a general rule, Kieninger says, if network equipment hasn’t been updated in the last ten years or so, you might have problems running VoIP. And you can assume that anything 15 to 20 years old will have to be completely replaced.
VoIP converts the voice signal from your telephone into a digital signal that travels over the Internet.
VoIP takes a heavy toll on bandwidth. However, says Bryan Cohen, senior solutions specialist at CDW, “VoIP in itself is very sensitive to network problems, so any deficiencies which the company had been able to live with when only transmitting traditional data may be fatal to VoIP systems.”

According to Cohen, there are three pain points of voice networks:

- **Delay** is an unacceptably long time for data to get from point to point. With e-mail, delays of seconds or even minutes are barely noticeable. “No one’s going to call you up and say they had a one-minute delay in receiving e-mail, but they’ll complain loudly about a 300-millisecond delay in voice traffic,” Cohen says.
- **Jitter** is uneven delay. Some packets come through in time; others come through with slight delay and still others with greater delay.
- **Packet loss** is problematic with voice communications because you can’t retransmit missed packets as you can with e-mail. Cohen says, “Say you’re saying the word ‘cat’ and the ‘at’ comes through before the ‘c’, you’ve changed the entire meaning of the word. What if that happens during an important sales presentation or negotiation?”

The best way to ensure high-quality voice reception is to assess the network early in the planning stages of a VoIP project. Cohen suggests placing monitors on the network to see how it performs during the busiest hours of the day, week or month. Some VoIP experts advise gathering a month’s worth of data in order to ensure you don’t miss any major peaks.

Next, look at the private branch exchange (PBX) logs to identify calling patterns, including peak calling periods. Once you’ve determined current unused network capacity and the maximum number of simultaneous telephone calls the network will have to support, VoIP analysts can tell you whether your network is sufficient.

**Making the Leap**

According to Cohen, when some companies are faced with upgrading a network, budget considerations impel them to put off their VoIP project, or switch gears and opt for a hosted solution. Others, especially those with badly outdated networks, find a potential VoIP project to be the impetus that pushes them to perform a long-needed upgrade.

For example, Pepsi-Cola’s network included a T1 line used partly for frame relay and partly for Internet connectivity. As the company grew, IT Manager Bare had found that the T1 line was insufficient to run backbone applications.

The company’s frame relay network had provided good service for many years, but posed programming challenges as the company grew and traffic flow increased. The network was bogged down by e-mails containing large files sent by users at remote sites. Too often employees experienced slowdowns while processing Web applications, such as consolidated billing, as well as such backbone applications as payroll, invoicing, inventory and sales reporting.

The company’s upgrade included a Multiprotocol Label Switching (MPLS) data network with failover redundancy from Sprint, an Avaya phone system with unified dial plan, Sprint and AT&T Internet T1 lines, and Cisco routers and switches. “We were looking to upgrade anyway, especially because we wanted to integrate our warehouses into the same network,” says Bare. “We were also looking at VoIP. Everything came together at the right time.”

In order to ensure a successful VoIP project, IT must understand the benefits and be able to separate them from hype; be cognizant of the potential stumbling blocks and ways to avoid them; and be aware of the available technology options in order to select the right one for the organization.

As with any technology, reminds Cohen, training is an essential part of the VoIP implementation. “There’s no benefit to adding functions if people don’t learn how to use them. And IT, network or communications departments have to be trained to troubleshoot problems.”

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**Basic IP telephony setup**

In a legacy phone system, individual phones are wired to the PBX (private branch exchange), which handles internal call switching and routes external calls to and from the PSTN (Public Switched Telephone Network). In a VoIP setup, the softswitch (software switch) connects to the PSTN and handles call control functions — relying on the IP network to deliver service — while the gateway translates voice data into packet data and vice versa.
Two Primary Architectures

While there are a large number of ways to implement a VoIP system, Bryan Cohen, senior solutions specialist at CDW, says that most fall into two broad categories.

**One** (PSTN)

The VoIP system communicates with the traditional PSTN (Public Switched Telephone Network) over a PRI (Primary Rate Interface) T1 or via CO (Central Office) trunks. Conversion from IP Voice to traditional voice is done on the VoIP system. According to Cohen, about 90 percent of the companies he works with use this method.

**Two** (SIP)

In the second architecture, the VoIP system uses SIP (Session Initiated Protocol, or Session Initiation Protocol) to communicate with the telephone company over IP. Conversion from IP Voice to traditional voice is done at the telephone company.

Cohen says the advantage of PSTN is that it provides a very reliable and stable connection with high call quality. SIP, on the other hand, provides a significant increase in density of circuit. In the same amount of bandwidth, companies can usually get three times the number of SIP traffic than PSTN, he estimates. A company that has at least two T1 PRIs may start to see a significant cost savings when using SIP, Cohen says.

While the VoIP to PSTN architecture is clearly the winner in terms of number of users, Cohen chalks this up to the fact that “most have not heard of SIP trunking yet or may be in existing contracts with their providers.” He expects over the next few months, SIP may become a much more popular architecture.

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