IP Phones Under $250: Value, Or Just Cheap?

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A new set of IP phones won't cause sticker shock, but VOIP's arrival doesn't overturn the old rule: You get what you pay for.

Delivering less expensive PBX systems—one of the great promises of IP telephony—means delivering less expensive phones. Phones are central to the economy of voice systems. An analogy we like to use—albeit slightly farfetched—is to compare voice systems to restaurants.

A swank, expensive restaurant might break even based on its food service, but the real money is made is at the bar. In this analogy, the PBXs are the food, and phones are the liquor. In the not-so-old days, a good salesperson would do what he or she had to do to sell the system, but the real reward came with the sale of the phones.

The advent of IP-based systems was supposed to end this kind of predation. The good news is that IP-based PBX phones are no more expensive than they ever were. The bad news is that, despite more vendor options than ever before, IP phones will not commoditize anytime soon.

In a Miercom survey conducted in November 2002, we queried respondents (which included 15 IP-PBX vendors) about their IP phone portfolios. Eleven percent of the 36 phones itemized list for $200 or less; just under 40 percent list below $300 (Figures 1 and 2). When we subtracted the anomalies (that is, the bargain-basement Mitel 5001 and the garishly expensive Siemens OptiPoint 600 Office and Avaya 4630), we found that the average U.S. list price was $363, and the median price is exactly $350. Like anything else, you can pay as much as you want for an IP phone, but based on this data, the price of IP phones falls well within the range that enterprise customers are accustomed to paying.

But there's a "gotcha" that the prices of IP phones don't reflect: License fees, which can drive up the cost of the endpoints significantly. Most IP-PBX vendors charge per-seat fees that range broadly from $15 to up to $350, with most of the prices we obtained coming in at $125–$150 per station. So, it's possible to wind up paying as much for license fees as for the phones.

While the IP-PBX vendors didn't invent software-licensing fees, they've elevated the concept to an art form by charging IP trunk-licensing fees. IP trunking allows networking of multiple PBXs over an IP WAN. Think of it as a "virtual tieline," to borrow a term from 3Com. The main difference is that a real T1 tieline carries signaling and voice occurring between two remote PBXs over a dedicated T1. A virtual tieline "carries" only PBX-to-PBX signaling over an IP network. Voice traffic occurs phone-to-phone directly, without PBX intervention.

Enterprises with multiple sites are saving money on tielines by replacing TDM-based systems with IP-PBXs and networking them over IP. Vendors are apparently taxing these savings by charging per-IP trunk fees ranging from $125 to $592 per trunk. It should be noted that the licensing fee information included herein, both for stations and trunks, was not derived from the survey, but anecdotally in conversations with product managers from over a half-dozen major vendors.

Testing Low-End Phones

What are customers in for when they decide they want to pay as little as possible for an IP phone? To find out, we invited IP-PBX vendors to submit their low-end IP phones for testing. Vendors could submit any IP phone in their portfolios that were under $250, and the "back-end" PBX of their choice. We decided not to include license fees in the pricing in order to invite maximum participation. Even so, only two vendors—Avaya and Cisco—accepted our invitation (Table 1, p. 31). A third, Citel Technologies, submitted a module that allows most Nortel digital phones to work with a 3Com PBX. More on that later.

■ **Avaya:** Avaya brought the 4602 IP Telephone, working with their S8100 Media Server. The 4602 pretty much comes as advertised—solid performance, good feature support, no frills, low price

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($195 list). Indeed, the 4602 was the most consistent performer of the three phones reviewed. It posted voice quality metrics that were well above business quality (that is, higher than a 4.0 score—Figure 3, p. 30). Most impressively, end-to-end latencies measured were exceptionally low for both conditions tested (Figure 4, p. 32).

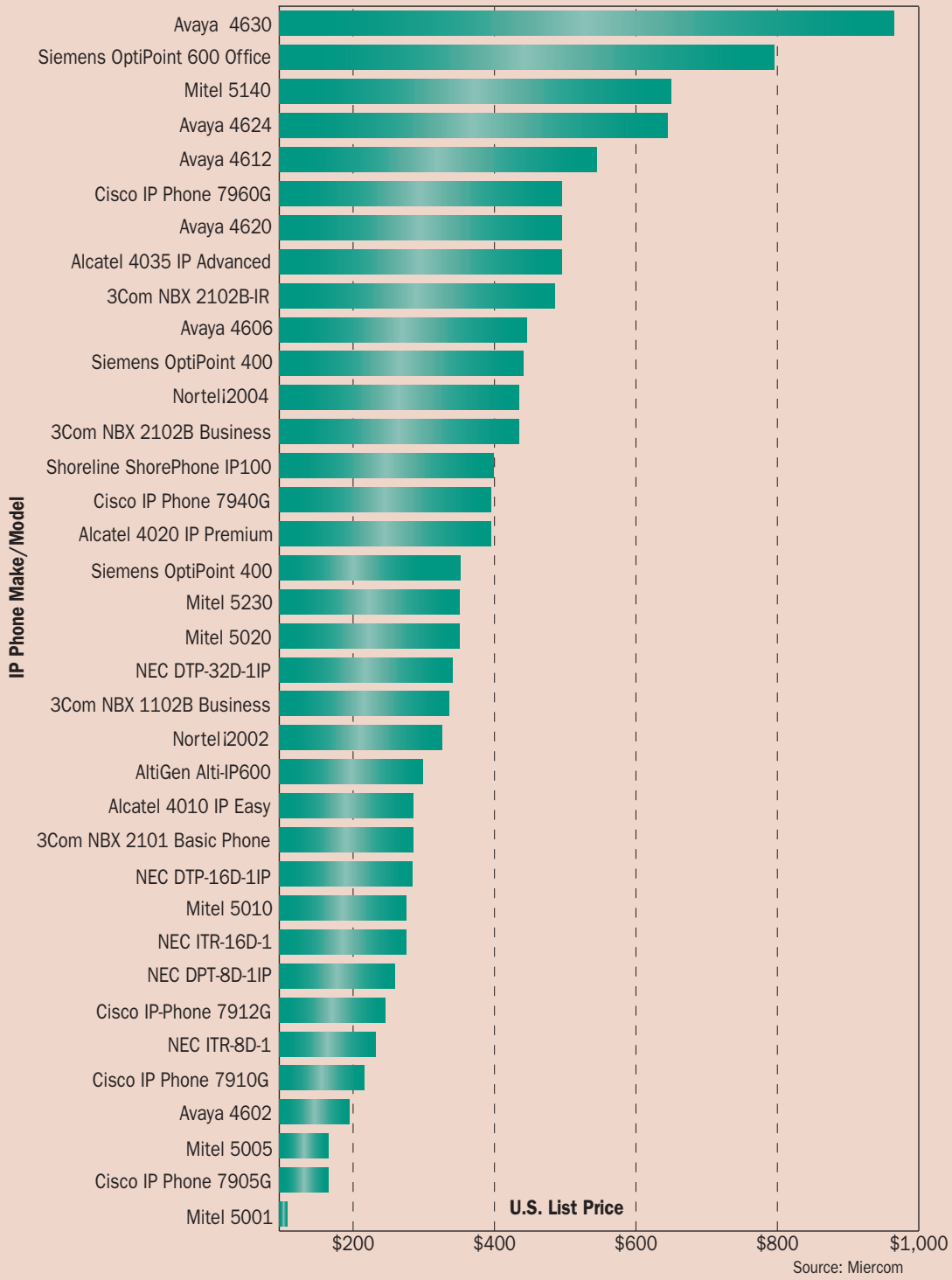
Feature access from the 4602 was also comparatively robust. Miercom engineers tested each phone for its support of 38 different station features. An itemized list of these features, along with descriptions, can be found on the Web at www.miercom.com. Among the phones tested, Avaya easily supported the highest number of features at 81 percent (Figure 5, p. 32).

Flexibility on Avaya IP phones has always been limited, in our experience, and the 4602 follows suit. Buttons are not user programmable, and the 4602 lacks "soft keys," requiring users to memorize or look up feature access codes to access certain features.

Soft keys are feature access buttons whose designations appear on the phone's display. This obviates the need for paper phone labels, fixed feature buttons, and feature access codes by allowing users to scroll to find the feature they need. Soft keys also enable other functionalities, such as multiple language selections for button designations and "dynamic" soft keys, or buttons that change designations "on the fly" depending upon what the user is doing.

Moreover, the 4602 only has one Ethernet port. This makes necessary a second Ethernet cable run from the cubicle—one for the PC, one for the phone. Many IP phones have two-port switches in the back, which allow phones to sit inline between the PC and the surrounding Ethernet network. The network link runs into one of the phone's jacks, the other connects directly to the PC. This is what

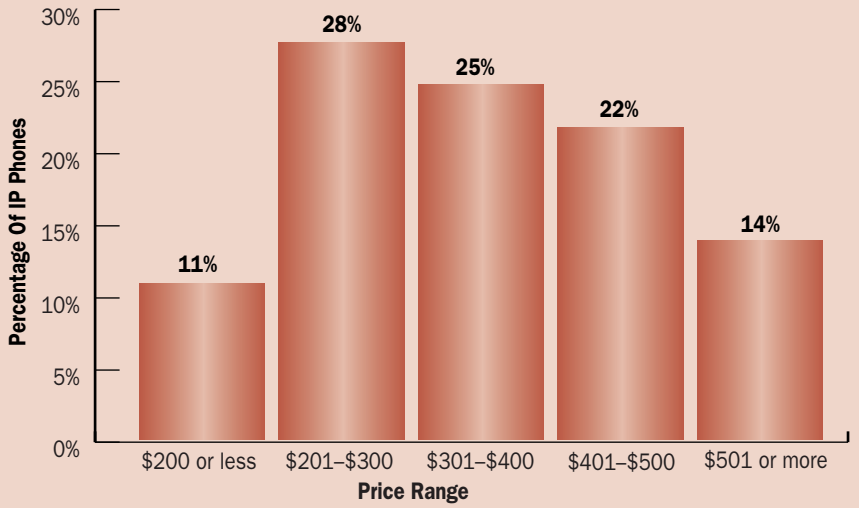
FIGURE 1 IP Phone Prices



Source: Miercom

Avaya's 4602 isn't pretty, but it covers the basics

FIGURE 2 Distribution Of IP Phone Prices



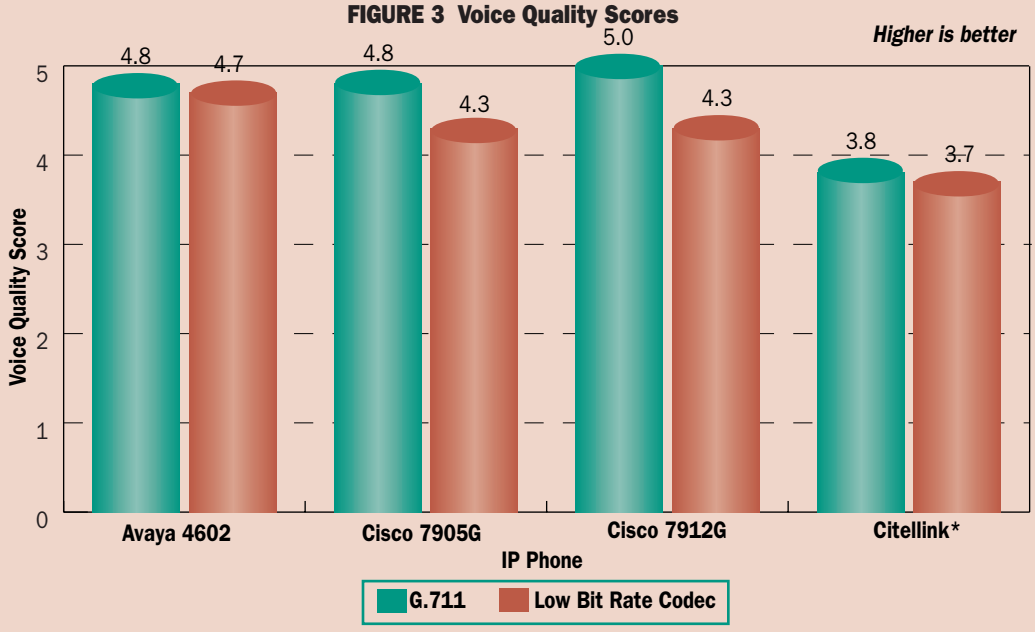
is meant by "one cable to the cubicle" installation, one of the great purported value-adds of voice over IP.

Overall, Avaya's design logic for the 4602 is coherent. The 4602 is not a "low-cal" high-end phone. It is not very impressive looking, and it offers none of the IP-enabled accoutrements usually associated with IP phones, like Web-enabled displays and PC application integration. But it covers the basics pretty well for a low price.

Cisco Systems: Cisco brought two low-end phones that were in beta at the time of testing—the 7905G and 7912G models, which were served by the Cisco CallManager. Cisco's onsite reps characterized the phones as identical, with the only difference being that the 7912G had a two-port switch on the back for "one wire to the cube" installations, while the 7905G did not. Cisco also stated that this was the only reason for the relatively broad price difference between the two—$245 for the 7912G; $165 for the 7905G.

For the most part, our testing corroborated that there's not much difference between the two. However, latencies on the 7912G were materially higher on its low-bit rate codec option than on the 7905G (100 milliseconds vs. 89 milliseconds, respectively). For both phones overall, latencies were on the high side. In our experience, the untrained ear can hear latencies that approach 120 milliseconds. While Cisco's metrics are acceptably below that limit, they don't allow for comfortable latency "budgets"—or the amount of delay that can be added by propagation or network conditions without users noticing. All calls on the

FIGURE 3 Voice Quality Scores



In all cases, tests were conducted on a flat local area network. Low bit-rate vocoders were tested with silence suppression enabled. *The Citellink IP Handset Gateway was tested using a Nortel M7310 digital phone on one end, and a 3Com NBX Business Phone at the other end.

Source: Miercom

TABLE 1 IP Phones Side-by-Side

	Avaya Inc. Basking Ridge,NJ (800) 784-6104 www.avaya.com	Cisco Systems Inc. San Jose, CA (408) 526-4000 www.cisco.com	
Product Name (version, release date)	Avaya 4602 IP-Telephone (ver. 1.61, Aug. 2002)	Cisco IP Phone 7905G (beta at time of test)	Cisco IP Phone 7912G (beta at time of test)
PBX System Tested With (version)	S8100 Media Server (ver. MV 1.2)	Cisco CallManager (ver. 3.3)	Cisco CallManager (ver. 3.3)
Call control protocol	H.323 v2	Proprietary SCCP	Proprietary SCCP
Feature delivery protocol	Proprietary CCMS	Proprietary SCCP	Proprietary SCCP
Other VOIP protocols supported	None	H.323 v2 SIP planned for 3Q03	None SIP planned for 3Q03
Codecs supported	G.711; G.729a	G.711; G.729a	G.711; G.729a
Silence Suppression support	Yes, for both codecs supported	Yes, for both codecs supported	Yes, for both codecs supported
QOS protocols supported at the phones	802.1 p/q, TOS, DiffServ, RSVP, UDP port range	802.1 p/q; TOS and DiffServ	802.1 p/q; TOS and DiffServ
U.S. List Price	$195	$165	$245
Display Size	2 X 24 characters	192 X 64 pixel XML interface	192 X 64 pixel XML interface
Dynamic "Soft" Key Support	No	Yes	Yes
Multiple Ethernet ports	No	No	Yes
Inline power support	Yes	Yes	Yes
Percentage of 38 basic features accessible via phone	81%	66%	66%
Speakerphone	No. One-way speaker only	No. One-way speaker only	No. One-way speaker only
Local call log	No	Yes	Yes
User directory access	No	Yes	Yes
Call duration monitor	No	Yes	Yes
Multiple line appearances	Yes, 2 lines	No	No

Cisco phones were business quality, particularly on the 7912G, where voice quality on uncompressed calls (G.711) was exceptional.

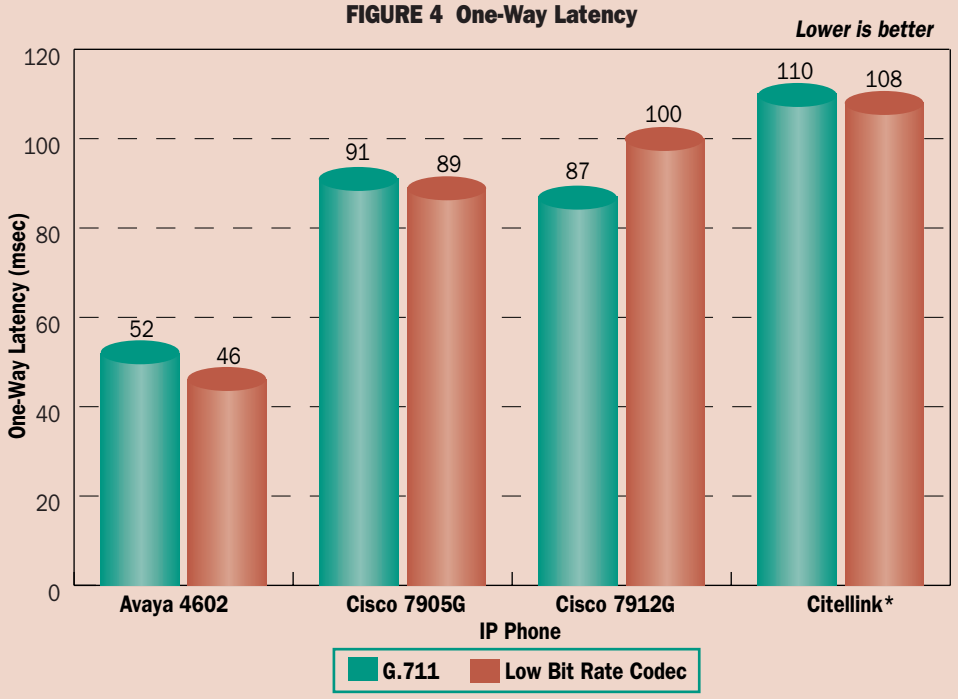
One thing the Cisco phones have maintained in their move down-market is their sex appeal. Cisco phones are well known for their large displays and their cool, gun-metal-and-gray colored good looks, and the 7905G/7912G models do not disappoint. As is the case with its higher-end 7940 and 7960 model phones, the displays on the 7905G/7912G phones are XML-programmable, though Cisco reps explained that they were "closed" and not currently open to third-party software development. As tested, Cisco's display enables features like local call logs, user directory access and call duration monitors, none of which are supported by the Avaya phone. Its "closed" status can eventually be changed with a software upgrade, however, allowing future extensibility of XML-based applications to these phones.

But the Cisco phones are top-heavy with the fancy stuff, and light on the basic station features. They each demonstrated support for only 66 percent of the features we required (Figure 5). Cisco has always been light on support for PBX station features, so we're not sure whether this is a statement about the phones or the Cisco CallManager.

Still, the Cisco phones deserve consideration for a couple of reasons. First, with the 7912G, Cisco managed to deliver a phone with a two-port, QOS enforcing switch on the back for under $250. Two Ethernet ports on a phone—particularly if they act as mini-Ethernet switches—seem to drive up the cost of an IP phone considerably. Second, there's considerable room to grow. The Avaya 4602 is a solid, inexpensive IP phone alternative. But with its static, alphanumeric, two-line display and fixed buttons, it is a relatively dumb phone, and designed to stay that way. The Cisco phones—with soft keys and large, XML-programmable displays—are smart and designed to get smarter (note that the 7905G/7912G phones were in beta when tested). Watching Cisco keep the price of the phones down as they get smarter will be an interesting spectator sport.

Citel gives customers some interesting options

FIGURE 4 One-Way Latency



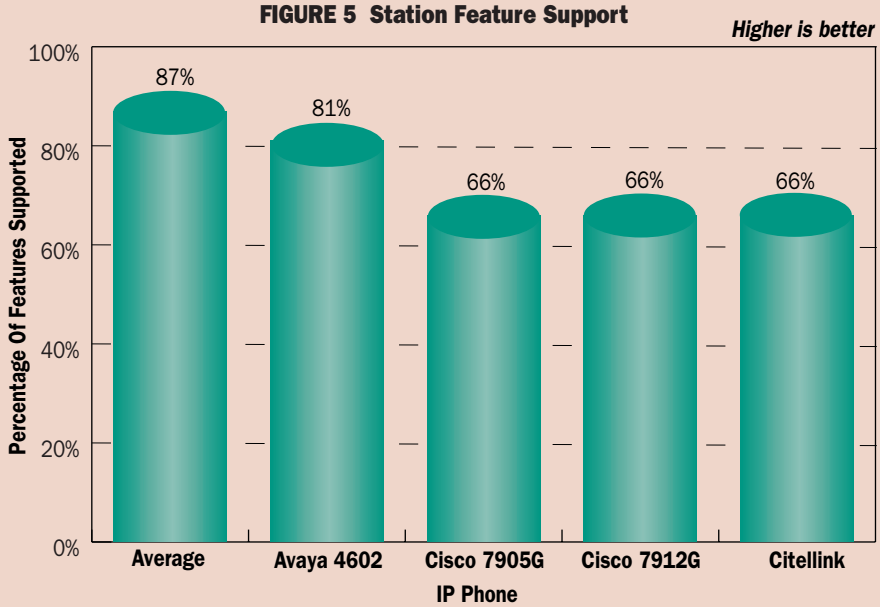
In all cases tests were conducted on a flat local area network. *The Citellink IP Handset Gateway was tested using a Nortel M7310 digital phone on one end, and a 3Com NBX Business Phone at the other end. Source: Miercom

A Different Approach

One intriguing approach to saving on the cost of phones is espoused by Citel Technologies of Nottingham, England. The Citellink IP Handset Gateway is a module that was designed for the 3Com NBX 100 multi-slot chassis, and it allows virtually any Nortel digital phone to function as a client on the 3Com system. An Amphenol connector on the Citel module connects the NBX box to a patch panel, where the Nortel sets are physically terminated. The Nortel digital phones appear as any other telephone does on 3Com's management interface.

This gives 3Com customers some options. If they are a Nortel shop wishing to transition to a 3Com solution, they get more mileage out of their existing investment in the phones, providing a migration path to an all-3Com solution. Or, they can buy a 3Com PBX and get Nortel phones from eBay or some other aftermarket source, where gaggles of Nortel digital phones can be had at bargain prices.

FIGURE 5 Station Feature Support



Figures represent the percentage of 38 station features tested that were supported by each phone station tested. A Nortel M7310 digital phone was used to test the Citellink product. The data point labeled."Average" represents the average number of features supported by phones tested for the January and February 2003 issues of *BCR*. Source: Miercom

While anything that smacks of a multi-vendor voice solution is exciting, the Citel product has some downsides, conceptually and technically. First, the $125 per-port price tag is a half-empty, half-full proposition. If you have Nortel phones, it's cheaper than throwing them out, and if you're buying second-hand Nortel phones, there also are some savings to be had. But in both cases, it also amounts to investing an additional $125 per line on yesterday's phones.

Second, this solution doesn't scale very well. Each Citellink blade can support a maximum of 16 digital phones per card, and the NBX 100 can support a maximum of 4 cards, or 64 maximum Nortel phones per NBX 100 chassis. The 3Com NBX 100 we tested with, according to 3Com, can support up to 200 3Com IP phones. You would need at least three NBX 100 chasses—give or take a few phones—to support the same number of Nortel phones.

Third, our testing showed that performance is an issue. To measure voice quality and latency, we used a Citellink-attached Nortel M7310 phone on one end and a 3Com IP phone on the other. Voice quality in both conditions was below par (3.8 for G.711 codecs, 3.7 using ADPCM with VAD enabled). Citel's latencies were high as well, with both metrics registering latencies higher than 100 milliseconds.

Out of curiosity, we measured latency between digital phones terminated on the same Citellink card. By the time a call originates at a digital phone, is encoded by the Citellink digital/IP gateway, routed by the 3Com NBX and then decoded for arrival at the destination digital set, the 144 millisecond latencies we saw are not surprising. Time constraints prohibited our ability to test voice quality on this type of digital phone-to-digital phone call, but with such high latencies, it would not have gone well.

Fourth and finally, support for our set of 38 PBX station features was weak at 66 percent, but, as with the Cisco phones, we're not sure that this necessarily reflects upon the Citel product. It stands to reason that a digital phone set retrofitted onto an all-IP system will lose some features, and a top-of-the-line 3Com SuperStack NBX 3 could deliver only 72 percent of the same feature set to its own native phones when tested last December and reported in the February 2003 issue of *BCR* (see pp. 28–41).

Conclusion

Though we only reviewed three IP phones that list for under $250, this comprises better than 40 percent of all IP phones so identified in our survey (Figure 1). That lends some authority to the following guidance with respect to low-cost IP phones.

First, expect fewer features. You knew before you started reading this article that IP-based PBXs deliver fewer station features than TDM-based systems. You get even fewer with low-end IP phones.

To get a read on just how many fewer, we borrowed once again from some IP-PBX testing we did in November and December 2002 (Figure 5). We went back to find the average percentage of PBX features supported by vendor phones that met two criteria: First, they had to be their top-of-the line IP phone, and second, the phones had to be designed to work specifically with their own PBX or family of PBX products (that is, no third-party phones). The phones that met those two criteria averaged support for 87 percent of the 38 PBX station features tested. By contrast, of the low-end solutions tested for this article, only Avaya's cracked 80 percent.

Also, if you buy these phones, do so recognizing that the state of the art won't reach your low-cost IP phone, however far it stretches. A case could be made for Cisco, which clearly has advanced feature extensibility for its down-market offerings. But these low-end phones don't even have two-way speakerphones, for instance, and software won't fix that.

Second, expect quality performance. If you hear poor voice quality on a low-end phone, it's a safe bet that the vendor has skimped on the phones' digital signal processors (DSPs) in an effort to preserve their margins. You should expect at least the performance we saw with the three phones discussed above, which, particularly in the case of the Avaya phone, was very good.

Third, don't expect IP phones to get much cheaper. At $100 list, the Mitel 5001 has hit rock bottom and started to dig. Conventional wisdom (read: cynicism) holds that phones cost pennies to make and dollars to buy, but this is not necessarily the case. Significant cost drivers like pricier DSPs (mainly because of the cost of codec licenses) and protocol stack licenses are new to the economics of making phones.

Citel Technologies presents a novel workaround, and the company is working to extend it to phones from Mitel Networks. But driving per-phone costs much below $100 can be achieved only when there's delivery on perhaps the greatest of VOIP's unfulfilled promises: Standards-based, multi-vendor voice systems. Don't hold your breath for that one□

The old adage is still true: You get what you pay for

Companies Mentioned In This Article
3Com (www.3com.com)
Avaya (www.avaya.com)
Citel Technologies (www.citel.com)
Cisco (www.cisco.com)
Mitel (www.mitel.com)
Nortel (www.nortelnetworks.com
Siemens (www.icn.siemens.com)