

Internet Telephone Service

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Every week it seems like a new technology somehow associated with the Internet is announced. We are continuously bombarded by advertisements for cable or DSL access to the Internet. Wi-Fi (wireless fidelity) access is no longer just for coffee shops. A BlackBerry is no longer an edible fruit but a pocket-size interactive Internet portal.

The latest Internet-related technology to be introduced into popular culture is the Internet telephone call. Bypass the traditional telephone company and pay only 3 cents per minute to call locally or anywhere in the country. Why be limited to your local area code? Choose any area code you want. Have your wire-line phone call follow you wherever you go. Are these advertised qualities real? Do they work reliably?

The simple answer is yes! But I don't think that I would bet the house on it—at least not just yet. Techies know this technology as VoIP (voice over Internet protocol). It is not a new technology, but it had to wait for other supporting technologies to mature. These supporting technologies have finally matured to the point where Internet telephone calls are almost ready for prime time. Let me repeat what I consider the operative word: *almost*.

VoIP has its roots in digital voice transmission technology. At least 30 years ago people recognized that it was more efficient to transmit information in digital form than it was to transmit the same information in analog form. Digital transmission was a more efficient means of transmitting data faster and with less power.

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The human voice is in the analog mode, and most wire-line telephones are analog devices. Once the analog telephone signal reaches the local central office, however, it is usually first converted into a digital signal and then transmitted, in digital form, to the destination central office. There it is converted back to analog form and sent to the destination telephone receiver. The connection between central offices is via a private, non-Internet, digital network.

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Modern cellphones work the same way except that the conversion between analog and digital modes takes place right in the cellphone itself. That way the efficiency of digital communications can also be exploited during the most difficult link, the wireless link between the phone and the cellphone tower. Again, all communication is carried out over a private, non-Internet, wire-based, and wireless digital network.

Early Internet hobbyists noticed the communications companies' move to digital networks. If telephone calls could be made reliably over a digital network, why not add a speaker and a microphone to a computer and hold voice conversations between similarly equipped computers over the Internet. The experiments were done and the result was less than satisfactory. The communication companies had embraced a digital transmission standard called Asynchronous Transfer Mode (ATM), which was optimized for the transmission of voice data. The digital transmission standard used by the Internet is Transmission Control Protocol/Internet Protocol (TCP/IP), which is optimized for the transmission of textual data, the major form of data at the time the Internet was invented.

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What began as a hobbyist idea ended up in a major research effort to transmit a digitized voice signal reliably and intelligibly over a public network based on the TCP/IP standard. The result was VoIP, the enabling technology for making a telephone call over the Internet.

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Here is how it works. Take a standard wire-line telephone and plug it into a special box provided by an Internet telephone call vendor and plugged into your cable modem or DSL line. The box is really a computer optimized to convert the analog signal from the attached phone into a digital signal for transmission over the Internet to the Internet call vendor's computer. The box has been assigned a fixed telephone number, including area code, so once it is attached to the Internet, it can relay its Internet loca-

tion to the call vendor's computer. It doesn't matter where the box is physically, as long as the call vendor's computer knows how to reach it. This is why the area code can be physically located anywhere.

If the phone number being called is a standard land-line or cellphone, the call vendor's computer redirects the digital voice signal via the Internet to a similar computer located nearest to the phone number being called. That computer converts the digital signal to analog and completes a call to the designated phone number, hopefully without incurring any long distance charges. If the phone number being called is associated with an Internet phone, the call vendor's computer redirects the digital voice signal to the box associated with that phone number. The receiving box converts the digital signal to analog, rings the connected wire-line phone, and the call is completed without any telephone company charges at all.

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So why isn't this Internet telephone service ready for prime time? VoIP technology is ready, but the problem is in the Internet connection between the central office and your home or office. Many institutions are using Internet telephone service already, and their employees don't realize it. The digital signals travel between the in-

stitution and the Internet call vendor by way of a dedicated high-bandwidth line, often via a 45-megabit copper or 155-megabit fiber-optic connection. This is not inexpensive, but there is much to be saved on local and long distance charges.

Most home and office locations are served by cable or DSL. Both have a reliability factor of 99 percent. This means that you could be without telephone service for 3.65 days each year. If you cannot get broadband cable service, you will need DSL; satellite is not good enough. The telephone company will not provide you with DSL unless you subscribe to its phone service.

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Internet telephone requires a source of AC power to run the interface box. If you lose power, you will also lose your telephone service. This is not a problem for institutions since they routinely have backup generators, and the additional power needed by the interface equipment is marginal compared with the electrical needs of the institution. This factor is causing many states to think about requiring subscribers to Internet telephone services to have an alternative means of communication—cellphone or standard wire-line telephone—before they can subscribe to an Internet telephone service. ■