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Industry 1**Internet Telephony Jumps off the Wires**[\(pdf\)](#) [print](#) [ve](#)**Sixto Ortiz Jr.**

After years of unfulfilled hype, a growing number of service providers have been offering Internet telephony, in which voice data from phone calls is broken up into packets and sent across the Internet. In response, more individuals and companies have begun using the technology.

As Figure 1 shows, a recent report by the Yankee Group, a market research firm, predicts the US consumer Internet telephony market will explode from 130,000 subscribers at the end of 2003 to 17.5 million subscribers in 2008.

Now, providers are offering wireless Internet telephony, which adds convenience by letting users make Internet calls from their mobile phones via IEEE 802.11 (Wi-Fi) wireless LAN and third-generation (3G) cellular technologies.

With wireless-phone usage outstripping wired-phone usage, this represents a potentially huge market for developers, explained Mareca Hatler, research director with ON World, a wireless-technology consultancy.

As is the case with its wired Internet telephony, wireless Internet telephony is less expensive than regular mobile telephony because carriers can use the existing Internet, rather than build a new infrastructure, to route calls. In addition, Internet telephony is not subject to the regulation and fees that governments impose on traditional telephony.

Using the Internet enables wireless telephony to offer good reception indoors:

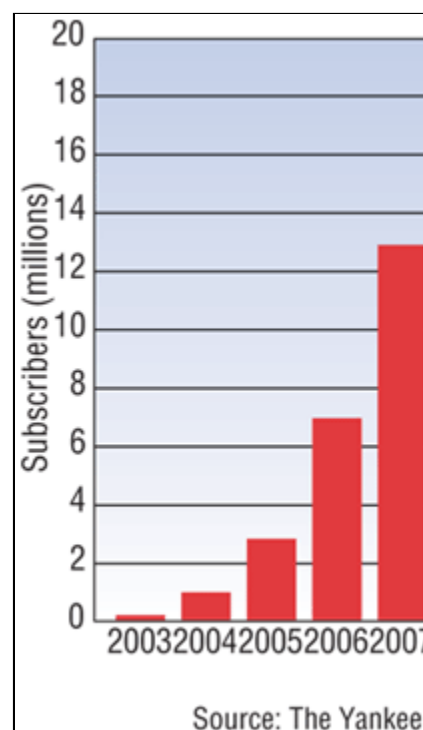


Figure 1. The Yankee Group, a market research firm, predicts rapid growth in the US consumer Internet telephony market.

is not always the case with traditional cellular service.

However, despite rosy marketplace-growth projections, Internet telephony faces several important concerns, particularly power usage, security, and quality of (QoS).

WIRELESS INTERNET TELEPHONY

In many ways, wireless Internet telephony is an adaptation of traditional wireline telephony, as the "[Internet Telephony 101](#)" sidebar explains.

Wireless IP telephony works primarily with Wi-Fi, which it uses to access the Internet. However, many Internet calls do not travel only over Wi-Fi networks. For example, a call from a user on a Wi-Fi network to someone using a traditional wireline telephone at some point will be routed over the traditional wired or cellular phone network.

Some systems provide wireless service only via Wi-Fi. For example, Spectralink's system connects its Master Control Unit to Wi-Fi base stations on one end and a traditional analog or digital PBX on the other, thereby eliminating the need for a separate service.

However, several companies, including Motorola, are developing phones that use cellular technology for the parts of calls that travel over cellular networks and Wi-Fi for those parts that travel over the Internet.

Wi-Fi

In Wi-Fi Internet telephony, vendors equip a mobile handset with an IEEE 802.11 radio. The phones, when within range of a Wi-Fi access point, use IEEE 802.11 to connect to the Internet, over which they can then transmit voice traffic.

There are several Wi-Fi standards. IEEE 802.11b, the first popular Wi-Fi standard, has a theoretical maximum data rate of 11 Mbits per second using the 2.4-GHz frequency band. IEEE 802.11a has a theoretical maximum rate of 54 Mbps using the 5-GHz band. IEEE 802.11g offers a faster speed and compatibility with the large installed base of IEEE 802.11b systems because it also uses the 2.4-GHz band.

Wi-Fi works with telephony by providing a wireless channel to the Internet. A Wi-Fi router converts voice and other data into radio signals that can be transmitted wirelessly. Internet-connected receivers then convert the radio signals into conventional network traffic that can be transmitted via the Internet or another network.

There is a growing number of Wi-Fi-enabled networks and IEEE 802.11 phone manufacturers such as Cisco Systems and Symbol Technologies, said Allen N. Rosen, principal analyst for wireless technology with In-Stat/MDR, a market research firm.

Companies such as Agere Systems, Broadcom, and Texas Instruments (TI) are beginning to release Wi-Fi-based Internet telephony chips, which have embedded functionality formerly provided by both software and hardware, said Allen.

For example, TI's TNETV1600 system-on-chip platform consists of a voice-over-IP application processor, an IEEE 802.11b and IEEE 802.11g media-access-control

baseband processor, and a radio transceiver.

Originally, Wi-Fi worked only within a wireless LAN. In recent years, though, individuals and companies have established Wi-Fi hot spots, which are nodes provide laptops, cellular phones, and other mobile devices within the technological range of 100 meters indoors and 400 meters outdoors with Internet connectivity. Many hot spots are close to one another, which gives cellular-phone users wireless Internet access.

In-Stat/MDR predicts that sales of business-class Wi-Fi-based Internet phones will increase about 120 percent from 2003 to this year, while the Wi-Fi Internet phone market will grow from \$16.5 million in 2002 to \$500 million by 2007.

3G cellular

Verizon is building a \$1 billion wireless broadband network that's fast enough to enable high-quality Internet telephony and cellular service. The network's 1xEV-DO (single-carrier radio transmission technology) carries Internet voice traffic at speeds of up to 144 Kbps. Its evolution-data-optimized (EV-DO) technology carries data at a theoretical maximum rate of 2.4 Mbps and an average real-world rate of about 1 Mbps.

Verizon's BroadbandAccess system is available in about 20 US metropolitan areas.

In the future, evolution-data-and-voice (EV-DV) cellular technology will combine 1xEV-DO and 1xRTT and thus could carry telephony traffic at 3 to 5 Mbps.

Meanwhile, TI and other manufacturers have recently developed or are developing Internet telephony chips for cellular systems.

Wi-Fi and cellular work together

Some equipment vendors are working on ways to better enable Wi-Fi and cellular technologies to work together in Internet telephony. This would let callers switch seamlessly between the two technologies, passing, for example, from one office's Wi-Fi network to a user's cellular infrastructure and then to another office's Wi-Fi network.

ON World's Hatler said Internet telephony that works with both Wi-Fi and cellular would be useful for the many stores, warehouses, hospitals, and other organizations that use or plan to use both technologies for various purposes. This creates a potential market for dual-use Internet phones.

Kineto Wireless has developed an IP-network controller that an organization could install between an IP network and its cellular or PBX system. Users could then connect Wi-Fi access points to their IP networks. This would extend the wireless telephony services to the Internet.

If cellular users are indoors and near a Wi-Fi access point, their phone's software would sense the stronger, more reliable Wi-Fi signal. The software would then tell the controller to route incoming calls over the Internet, via the access point, to the handset's IEEE 802.11 equipment.

No commercial dual Wi-Fi/cellular phones exist yet, In-Stat/MDR's Nogueira notes.

although manufacturers Motorola, Nokia, and Samsung are testing new mod with a single chip that would provide the dual functionality.

According to a recent In-Stat/MDR report, combination Wi-Fi/cellular handse begin significant adoption in 2007 or 2008, as Wi-Fi chips continue to become smaller, less expensive, and more power efficient. Company analyst Norm B predicted the number of Wi-Fi/cellular handsets used globally will grow from million in 2005 to more than 100 million in 2008.

However, ON World's Hatler said, many cellular service providers may not w cooperate out of fear they will lose revenue to Wi-Fi carriers.

LocustWorld and mesh networks

Wireless broadband vendor LocustWorld's freely downloadable MeshAP softw configures a group of wireless access points into a coherent mesh network. E device on a mesh network acts as a node and receives and transmits its own while acting as a router for other devices. Intelligence in each device lets it c an efficient network and adjust for problems, such as unavailable nodes.

LocustWorld also sells MeshBoxes, small appliances that run MeshAP and act mesh-network nodes and routers.

The company has added hardware and software support for the Session Initi Protocol to its mesh-networking equipment.

The Internet Engineering Task Force introduced SIP as a signaling protocol tl simplifies and allows interoperability in interactive online multimedia session: including those involving Internet telephony, for which the protocol initiates i setup, routing, authentication, and other services.

SIP support thus turns the company's MeshBoxes into wireless Internet telep switches.

LocustWorld director Richard Lander said the company's Internet telephony s works with wireless and wired IP networks and can interoperate with cellular technology.

Skype and P2P wireless Internet telephony

Skype for Pocket PC, available as a free download, is a peer-to-peer (P2P) w Internet telephony technology that works with Wi-Fi-enabled PDAs running M Pocket PC operating system. Callers can connect with users running Skype's applications, including those for traditional Internet telephony. They can also the SkypeOut service for calls to people who don't use Skype.

Skype for Pocket PC uses proprietary P2P software to intelligently route calls between users' PDAs without using a centralized device. This differs from mc Internet telephony applications, which require routers or other centralized ne devices to connect to both IP and traditional cellular or wired networks.

Because the client handles most of the complex computation and routing tas needs more processing power—at least 400 MHz—than most PDAs have, acc

Skype spokesperson Dan Twigg.

INTERNET TELEPHONY CONCERNS

Despite its promise, wireless Internet telephony raises several important concerns. For example, the relatively new Wi-Fi Internet phones can be quite expensive. However, Noguee noted, prices are dropping.

Also, Wi-Fi Internet phones use considerable power for their radio transmissions and requires bigger phones to accommodate more or larger batteries at a time when demand is for smaller phones.

Security

As with any wireless technology, Internet telephony raises security concerns. For example, authentication approaches, which determine whether people trying to access a system are who they say they are, must be improved and standardized. Noguee. Without standardization, competing technologies from vendors could cause system incompatibilities.

Meanwhile, wireless security itself is only now overcoming some early problems. Users complained that the Wired Equivalent Privacy Protocol, used in early Wi-Fi applications, was not strong enough. The industry has since evolved to Wi-Fi Protected Access and now WPA2, based on the IEEE 802.11i wireless security standard, which uses the new Advanced Encryption Standard.

Regardless, wireless Internet telephony security will require the exchange of additional information between senders and receivers and thus slow data transmissions, which will affect voice quality, explained ON World's Hatler.

Quality of service

QoS is a key issue for Internet telephony. IP networks must prioritize telephony because, unlike other data traffic with which it shares the Internet, voice data must be transmitted in real time. If not, voice quality degrades and latency becomes a problem.

Currently, several approaches, mostly proprietary, provide some QoS for Internet telephony.

According to Noguee, the proposed IEEE 802.11e standard would provide a way to address Wi-Fi-based QoS. The standard, currently under consideration, would accomplish this by prioritizing packets based on traffic type, enabling access to schedule resources based on transmission rates and latencies, and otherwise improving bandwidth efficiency.

According to an In-Stat/MDR survey, many businesses are looking into Wi-Fi Internet telephony. The survey of business Internet telephony users found that 11 percent of respondents are already working with the wireless technology, and 21 percent are considering implementing it.

Currently, the biggest Internet telephony opportunities are in businesses such as healthcare, education, retail warehousing and distribution, and manufacturing.

already have established Wi-Fi networks over which they could run Internet telephony, explained In-Stat/MDR's Bogen.

The real commercial value, ON World's Hatler added, will come when wireless Internet phones can integrate with PBX systems and thus become more useful companies.

However, she added, the usefulness of voice over Wi-Fi technology will depend on continued growth of the wireless LAN infrastructure—including access points, gateways, routers, and clients such as laptops, PDAs, and phones—in the enterprises and residences.

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From the **December 2004** issue of **Computer**

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