

Internet telephony 18343

[Technology](#), [Internet](#)



Internet Protocol (IP) telephony is the ability to do what has been traditionally done over circuit switched phone lines (PSTN), but is done over an Internet Protocol (IP) network. It is the real time transmission of voice signals using IP over the public Internet or a private data (Intranet) IP network. The terms IP telephony and Internet telephony are often used interchangeably, but are fundamentally different in practice. Internet telephony implies two users each using a microphone and PCs equipped with sound cards sending voice signals over the public Internet. IP telephony implicitly has a larger scope and typically refers to voice, data and images sent using Internet protocols across a network using packet-switching technology rather than circuit switching.

IP telephony is typically implemented via gateway switches that serve as an interface between the PSTN and the IP network such as the Internet or a private intranet (see Figure 1.). It typically works in the following fashion: a user places a call by dialing a telephone number of the access gateway, which is a computer server that interfaces with the PSTN. The gateway that handles the incoming call prompts the caller to enter the phone number of the destination and in some cases, the personal identification number of the caller. The gateway uses this information to identify the destination gateway closest to the called party. The inbound gateway then transforms the digital/analog signal into a data packet and compresses the packet to be handed off and routed over an IP network. The gateway compresses the voice signal to reduce the amount of bandwidth required to reduce cost and reduce the delay impact from the network. The destination gateway accepts

IP phone packets from the Internet, converts them back into voice calls for transmission across the PSTN.

Figure 1 IP telephony process

The perceived technological advantages of IP telephony as an alternative to the current circuit switched services are based on primarily two major reasons. The first being it is packet switched technology and the second being it utilizes the protocol used to route Internet traffic. The resultant benefit implies that a) the network bandwidth is used efficiently; b) Voice transport would be less costly than circuit switching; and c) it permits the integration of many forms of communication over a common network.

IP telephony using packet switching technology as the underlying transport vehicle is inherently more efficient than the current circuit switched communications. Utilizing multiplexing and compression techniques carriers are able to utilize their network's capacity more efficiently. There is no requirement to tie up network resources if there is nothing to transmit. Conversely in a circuit switched environment requires a dedicated complete circuit for the duration of the communications session. Overall this implies a cheaper operational cost from a traffic transport perspective with the implication of a better return on investment.

Another cost advantage for IP telephony emanates from the underlying transport vehicle used to transport the packets of data. In a traditional circuit switched environment switches were utilized for the transport fabric, and in a packet switched environment routers/gateways are used as the switching

fabric. There is a tremendous cost advantage in using routers/gateways, the analogy compares using a \$50, 000 gateway versus a \$5, 000, 000 Central Office switch.

On the regulatory side artificial constructs have provided an impetus for niche players to enter the IP telephony market exploiting the different tariff structures, and the settlements process particularly in the international voice calling market. This perceived arbitrage is expected to have a very short window of opportunity as tariffs changes result in the lowering of rates worldwide and the settlement process gets restructured. On the US front the interim classification of ISP s as enhanced service providers by the FCC, thereby exempting them from paying access charges is providing an economic incentive for new entrants and the existing carriers to embrace this architecture.

The players in the IP telephony space in the US could be categorized as follows:

- 1) Service Providers.
- 2) Long Distance Carriers
- 3) Cable Industry

The service provider market is characterized by the Internet Telephony Service Providers (ITSP) focusing solely on IP telephony, but could include ISPs and call back companies expanding their service offers. Transport of the packetized data is done via the public Internet or the provider s own private

data network, or some combination of public and private. There is clear recognition that the tariff arbitrage and the avoidance of access and settlement charges will be short lived. As a consequence of this, the ITSPs are trying to grow their market share while investing into building network resources to provide future value- added services.

The long distance carriers have all embraced some form of Internet telephony offers, with AT&T and their recent majority share acquisition of Net2Phone clearly indicating that IP telephony has a role in telecommunications for the future. Confidence abounds that the traditional channels to sell their existing customers can be used to sell IP telephony. The concern about cannibalization of their embedded base appears to have waned, particularly in light of the inroads being made by the ITSPs. Concerns about quality of service are still present, but increasingly it appears that these technological problems can be addressed via the advancements in gateway hardware and the adoption of international standards.

Cable companies could be considered as possible players in the IP telephony space. This emergence is further clarified and at the same time blurred when one considers AT&T's positions as the largest cable provider in the US market. What we have now is the largest cable operator coupled with the premier long distance carrier having a majority shareholder position in the largest ITSP. Is this the definition of the next generation Telephone Company? This convergence among companies and technologies is further illustrated when we look at AOL and its planned merger Time Warner. In this

model we have the largest ISP linking up with a cable/media giant, thereby further establishing the case for convergence.

Cable Television Laboratories and its member companies are conducting a project called PacketCable?, aimed at identifying, qualifying, and supporting Internet-based voice and video projects over cable systems. PacketCable? is actually composed of a series of specifications aimed at facilitating real-time, multimedia packet-based services, using a DOCSIS-managed IP backbone as the foundation. As such, the overall scope of PacketCable? goes way beyond delivery of telephony. That said, however, delivery of voice over Internet Protocol (VoIP) is the focus of the first phase of PacketCable?. PacketCable is also designed to meet the needs of other IP-based services, such as real-time gaming, enhanced e-commerce and home automation and networking.

What these efforts by the existing market participants and the new entrants seem to illustrate is that IP is being viewed as the Holy Grail of communications, one common network delivering a myriad of current and future applications. With that said one must evaluate the size and scope of this market to ascertain its overall impact.

The IP telephony market projections vary, but what is indeed universally accepted is that there is an increasing trend for rapid growth in both minutes of use (MOU) and revenue. Voice traffic is increasingly being carried on IP networks. This trend is representative for both the consumer and business markets. Listed below are excerpts from various forecasting companies with their analysis of the IP telephony market size.

Forrester Research

According to Forrester Research (1997), by 2004, more than 4% of U. S. telco revenue, or over \$3 billion, will migrate to Internet telephony. Of that total, users will spend nearly \$2 billion on Internet telephony services and equipment, and pocket over \$1 billion in savings.

Forrester Research also reports that 42% of telecom managers expect to use the Internet for fax or voice by the end of the century.

U. S. Internet Telephony Spending and Savings (Billions)

1998 1999 2000 2001 2002 2003 2004

Total telco toll revenues \$57. 00 \$62. 00 \$62. 00 \$61. 00 \$60. 10 \$65. 30
\$72. 20

% diverted to I. T. 0. 10% 0. 40% 1. 00% 1. 60% 2. 60% 3. 50% 4. 70%

I. T. savings \$0. 02 \$0. 06 \$0. 21 \$0. 34 \$0. 56 \$0. 82 \$1. 09

Spending \$0. 03 \$0. 18 \$0. 40 \$0. 63 \$1. 03 \$1. 48 \$1. 97

Forrester Research, 1997

Frost & Sullivan

According to Frost & Sullivan (1997), in 1996, revenues for the total Internet telephony market reached \$19. 8 million. Revenues are expected to grow to \$1. 81 billion by the end of 2001 with a compound annual growth rate of 229%.

International Data Corp. (IDC)

Meanwhile, IDC estimates the market will grow to \$1.5 billion by the end of the century. This estimate is a linear projection based on a conservative assumption of 10 cents per minute on the average for domestic calls and 40 cents per minute for international.

Internet Telephony Forecast

Packet-Switched Revenues - Billions of Dollars

Voice Only

	1996	1997	1998	1999	2000	2001
International	\$0.04	\$0.13	\$0.38	\$0.60	\$1.10	\$1.60
Within U. S.	\$0.01	\$0.02	\$0.06	\$0.15	\$0.38	\$0.85
Total	\$0.05	\$0.15	\$0.44	\$0.75	\$1.48	\$2.45

IDC, 1997

IP Telephony Active Users and Minutes of Use (MoU)

Worldwide Internet Telephony Active Users, 1995-1999 (thousands)

	1995	1996	1997	1998	1999	1995-1999 CAGR %
Consumer	475	1,500	2,500	4,000	6,000	89
Business	25	500	2,500	6,000	10,000	347

Total 500 2, 000 5, 000 10, 000 16, 000 138

IDC, 1996

IDC/LINK

IDC/LINK (1996) forecasts that nearly 12.5 billion long distance minutes of use will be carried over packet-switched networks by the year 2001.

Although seemingly high, this figure will represent only 1% of all U. S. and international long distance traffic estimated to be carried over circuit-switched networks in 2001.

Worldwide Internet Telephony: Packet-Switched Forecast, 1996-2001
(Billions of MOUs)

	1996	1997	1998	1999	2000	2001	1996-2001 CAGR%
International	0.098	0.325	0.950	1.500	2.750	4.000	110.0
Within U. S.	0.066	0.175	0.550	1.500	3.750	8.500	164.2
Total	0.164	0.500	1.500	3.000	6.500	12.500	137.9
% of total US and international long distance traffic							
	0.03						
	0.08						
	0.2						
	0.32						

0. 59

0. 98

IDC, 1997

Probe Research

Probe Research estimates that Internet telephony will account for 6% of the total long distance market (measured in calling minutes) by the year 2000, and 34% by 2005. In the year 2000, 4% of the total long distance market will be traffic lost to Internet telephony, climbing to 22% in 2005. Roughly 35-40% of IP voice traffic will be additive to the network in the long run. Most residential traffic will be additive to the network, but most business traffic will be due to replacement of public circuit-switched traffic with IP voice. Annual voice-over-IP minutes for carriers will reach 32 billion by the year 2000; 173 billion by 2003; and 260 billion by 2005.

Minutes of use in the U. S. including international outbound, 1997-2002
(Billions of MOUs)

1997 1998 1999 2000 2001 2002

Internet Telephony 0. 64 3. 1 11. 4 32 69. 9 120

Total Telephony 410. 7 462. 3 511. 7 554. 6 601. 1 648. 5

Probe Research, 1997

Estimated Global Minutes Traveling on IP Telephony (Probe Research, July 1999)

Overall what is emerging is a significant opportunity for IP telephony service providers, with international, or cross border IP telephony services with the greatest market share.

IP telephony is generally treated as a data or value-added service (VAS), with very few license restrictions or conditions attached. In the US, the FCC has classified as the ISPs enhanced service providers . At present, Internet telephony providers benefit from the interconnect obligations of incumbent PSTN operators to which they connect at gateways, but are not themselves encumbered by corresponding interconnect obligations vis- -vis each other and new entrants. Internet providers link to each other via peering rather than interconnection arrangements, and are not subject to obligations of unbundling, cost orientation or non-discriminatory treatment. Moreover, there is no distinction between peering nationally and internationally, and the accounting settlement rate system does not apply for international Internet calls. This has allowed Internet telephony providers to differentiate themselves on the basis of price.

In most jurisdictions today, Internet telephony providers are not required to make any contributions towards the access deficits or universal service obligations of incumbent operators. In contrast, new operators who originate PSTN calls may have to make such contributions, which places them at a competitive disadvantage.

The digital nature of Internet traffic makes it impossible to distinguish voice from data. The inability to detect Internet calls makes it very difficult to give them equivalent treatment to PSTN traffic, even if that was the regulatory intent. The FCC's decision classifying ISPs as end-users has only served to delay the inevitable. When one looks at the comparison between the IP telephony and conventional telephony (see Figure 2), it is difficult to understand the FCC's rationale.

Figure 2 Internet vs. Conventional Telephony

In the future, the regulatory treatment of Internet telephony may be similar to that of voice, rather than data or enhanced services. This would put it on an equal footing to PSTN calls, and preclude regulatory arbitrage. However, it remains to be seen how effective this can be in practice.

As more and more communications service providers increase their use of IP telephony, one can somewhat envision a time when the current circuit switched network would be supplanted. This replacement is a long way off, and is to a large extent dependent on the developing of new applications that are supported on this network of networks. I see the coexistence of circuit switching and packet switching based networks. New services will be offered using IP as the underlying transport technology, particularly as the technological hurdles, quality of services, standardization, billing systems, and network management issues get resolved.

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