IP-Telephony

Alexandre Weffort Thenorio - Data

1. Introduction

The purpose of this project is to describe how IP-telephony works and discuss what are the advantages and disadvantages compared to the common telephone system widely used nowadays. I also aim to point how IP-telephony is being used and how it can be improved in certain aspects.

2. What is it?

IP-Telephony is the method of routing voice through the internet or any other IP-based network by turning analog audio signals into transmissible digital data.
The data is transmitted through a packet-switched network instead of the traditional circuit-switched used in common telephone land lines.

3. Why IP-Telephony?

IP-telephony has many advantages over the circuit-switched telephone network. It costs much less to set up, easier to implements certain services, allows mobility among others. We discuss a few of them below.

3.1. *Advantages*

3.1.1. Cost

IP-Telephony costs much less then circuit-switched network, in general, because in some cases it uses an already existing network which is underutilized and the cost for setting up a packet-switched network is less than the cost to set up a circuit-switched network. Also the fact that it uses one network to transmit both voice and data takes the costs down. Some companies offer free Voice-IP (Referred as VoIP from now one) to Voice-IP calls.

3.1.2. Functionality and Mobility

Once implemented, IP-Telephony is easy to use. You can have services which, no matter where you are in the world you can take your IP-Phone with you and receive calls without having to change your phone number and make calls internationally for prices cheaper than using a normal land line. Subscriber of internet services such as *Skype*[1], and others will only need an internet connection, offered nowadays almost everywhere to be able to make and receive calls.
Another advantage is the fact that, recently, airline companies are offering internet connection in-flight thus allowing the user to make and receive calls while on air paying much cheaper than the airline company's own phone service (If even available).
Also, since VoIP is digital one can offer more services together with voice such as call redirection, video conversation, audio conference and others for affordable prices.

3.2. *Disadvantages*

3.2.1. Firewalls and TCP/IP

The internet consists of many small networks connected together and quite often those networks implement some sort of firewall, to block unwanted data coming through or illegal access from the outside world. This makes implementing VoIP more difficult in such networks.
Also since voice communication has to be implemented via UDP protocol (As TCP would not make it viable) it doesn't ensure in-order delivery of packages as some packages can get lost in the way causing latency and jitter. This can be fixed with services such as QOS (Quality of Service) where data can be prioritized but it is no a standard on the IP protocol so not all networks will be able to offer that.

3.2.2. Reliable*?*

Differently from normal land line phones which don't require extra power but are connected to the already set-up phone lines, VoIP requires equipment which depend on conventional power lines to function, therefore in case of a power failure one will not be able to use IP-Telephony. Also in the case of emergency numbers, due to the nature of the IP protocol, there is no easy way of knowing where exactly the user is which means that emergency number cannot be called through VoIP and still require the use of a common landline.

3.2.3. Security

Most VoIP services nowadays do not offer any sort of encryption making VoIP insecure and allowing other people to eavesdrop on conversations and use services that do not belong to them without being charged. Implementing encryption on VoIP is another problem as the more complex algorithms will lower the quality of the call and cause further latency, if not well planned.

4. Implementing VoIP

VoIP allows not only centralized architectures but also distributed ones which is where the advantage comes when compared to land line networks.
As VoIP grew many standards were created some of which will be briefly discussed here.
There are advantages and disadvantages with both architectures although distributed is favored nowadays due to its flexibility and compatibility with the internet.
Having many different architectures allow companies and service providers to choose what best suit their requirements, demands and price.
We briefly discuss 2 technologies used for distributed architectures below.

4.1. *Distributed architecture*

With the rapid growing of the internet, the distributed architectures tend to be favored due to the fact that the “ground” (The internet) is already there for the building of the system.

4.1.1. H.323

H.323 was originally created for multimedia application transport over local area networks but it is widely used nowadays for videoconferencing applications and it is still growing to meet VoIP demands.
It allows companies to build large scale networks, and supports network intelligence on either the endpoints or the gatekeepers.

4.1.2. SIP

SIP was designed as a multimedia protocol to take advantage of the already existing architecture of the internet used widely all over the world. It uses existent aspects of the internet (Such as URLs for addressing, Domain Name System (DNS) for service location, call routing over IP and others).

4.2. *Centralized Architectures*

Centralized architectures resemble the architecture used in the land line system (PSTN) and allow a bigger, scalable, network to be created with a central control. Centralized architectures will usually have dumb endpoints (By dumb, it is meant that they have limited or no native features). Centralized architectures are favored where less complex and/or wider systems are a requirement.

5. The Future

With VoIP and the internet growing rapidly it is difficult to know what the future holds. Many groups such as the *IETF*[2], the *ITU*[3] and others are trying to set standards for the protocols used on VoIP and it seems that, since there are already many protocols out there, most VoIP deployments will consist of a interconnection of many of them allowing features that would otherwise not be possible if just one or another protocol was used. It also allows a very flexible system with option for offering different services and maybe even different standards.

6. Conclusion

There is still some development to be done in the subject. There is still much confusion on what should be the best standard and what protocols should be used. Interconnection of protocols is not always as easy as it appears to be. Many of them still lack some features or have certain disadvantages that are difficult to be conquered.
Also fast internet (Broadband) or even VoIP services (For companies who can supply VoIP as a replacement for the normal phone line) is not widely deployed, many areas around the world still rely on the 56Kbps modems which, may work, but are far from being a replacement for a normal land line.
Security being another point, VoIP, still early in development, does not support much security at the moment and there is still much work to be done on how to safely secure a connection between to endpoints and at the same time provide good quality and no jitter or delay, not to mention that fact that, being a digital service, it facilitates 3rd party intrusion by network hackers and more experienced users. This, in part, can be solved by network/internet companies offering QOS (Quality of Service) but that also is still early in development and not widely spread.
As far as replacing the common land lines, VoIP opens up a whole new world of possibilities but being still early in development, it still needs a few years to grow and mature.

7. Bibliography

http://electronics.howstuffworks.com/ip-telephony3.htm
http://en.wikipedia.org/wiki/Voip
http://www.cisco.com/en/US/tech/tk652/tk701/technologies_white_paper09186a008009294d.shtml

8. Notes

[1] A proprietary peer-to-peer protocol used in the Skype application.

[2] The Internet Engineering Task Force which develops and promotes internet standards.

[3] The International Telecommunication Union, based on the United States of America set to coordinate global telecom networks and services.