VoIP

Voice over Internet Protocol

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Why VoIP ?

- Using VoIP we can easily call anywhere in the world where internet connection is available.
- VoIP systems usually interface with the traditional public switched telephone network (PSTN) to allow transparent phone communications worldwide.
- This system has potential to change completely current phone system.

What is VoIP ?

- VoIP (Voice over Internet Protocol) is simply the transmission of voice traffic over IP-based networks (internet/intranet).
- VoIP is a method for taking an analog signal and turning them into digital data so that they can be transmitted over the internet.

What is VoIP ?

- Using VoIP we can turn a standard internet connection into a way to place free phone calls.
- It is also known as
  - IP telephony
  - Internet telephony
  - Voice over Broadband (VoBB)
  - Broadband phone

How traditional phone system works ?

- Before knowing How VoIP works, first let's understand how current system works.
- Current system works on **circuit switching** technology.
- When u dial a number you are connected to that number using existing **PSTN (Public Switched Telephone Network)**.
- The dedicated connection is being made between two phones, which is maintained for the duration of the call.

How VoIP works ?

- This is the simplest diagram which represents VoIP transmission.

- It's a three step process
  1. Source side Processing
  2. Transmission over Network
  3. Reconstruction at Receiver

How VoIP works ?

- Step 1: Source side Processing
  - ADC : An Analog voice signal is being converted into Digital signal using ADC.
  - Compression Technique: An compression algorithm is being applied on digitized signal. Data compression is a process whereby voice data is compressed to render it less bulky for transfer over network.
  - The compression used in VoIP is lossy compression, in which some of the elements of the audio stream is lost - we may loss some information.

How VoIP works ?

- Step 1: Source side Processing
  - But this loss does not much affect the quality because it discards the sound that cannot be heard by human ear which is useless to be transmitted.
  - Also silence is discarded.
  - For this compression we have different CODECs (coder - decoder).
  - Codec is simply an algorithm which is installed on server which have ATA or IP phone connected to it.
  - Compression software (called a codec) encodes the voice signals into digital data that it compresses into lighter packets that are then transported over the Internet

How VoIP works ?

- Step 1: Source side Processing

Common VoIP Codecs (Reference only)

Codec	Bandwidth/kbps	Comments
G.711	64	Delivers precise speech transmission. Very low processor requirements. Needs at least 128 kbps for two-way.
G.722	48/56/64	Adapts to varying compressions and bandwidth is conserved with network congestion.
G.723.1	5.3/6.3	High compression with high quality audio. Can use with dial-up. Lot of processor power.
G.726	16/24/32/40	An improved version of G.721 and G.723 (different from G.723.1)
G.729	8	Excellent bandwidth utilization. Error tolerant. License required.
GSM	13	High compression ratio. Free and available in many hardware and software platforms. Same encoding is used in GSM cell phones (improved versions are often used nowadays).
iLBC	15	Robust to packet loss. Free
Speex	2.15 / 44	Minimizes bandwidth usage by using variable bit rate.

Courtesy: http://voip.about.com/od/voipbasics/a/voipcodecs.htm

How VoIP works ?

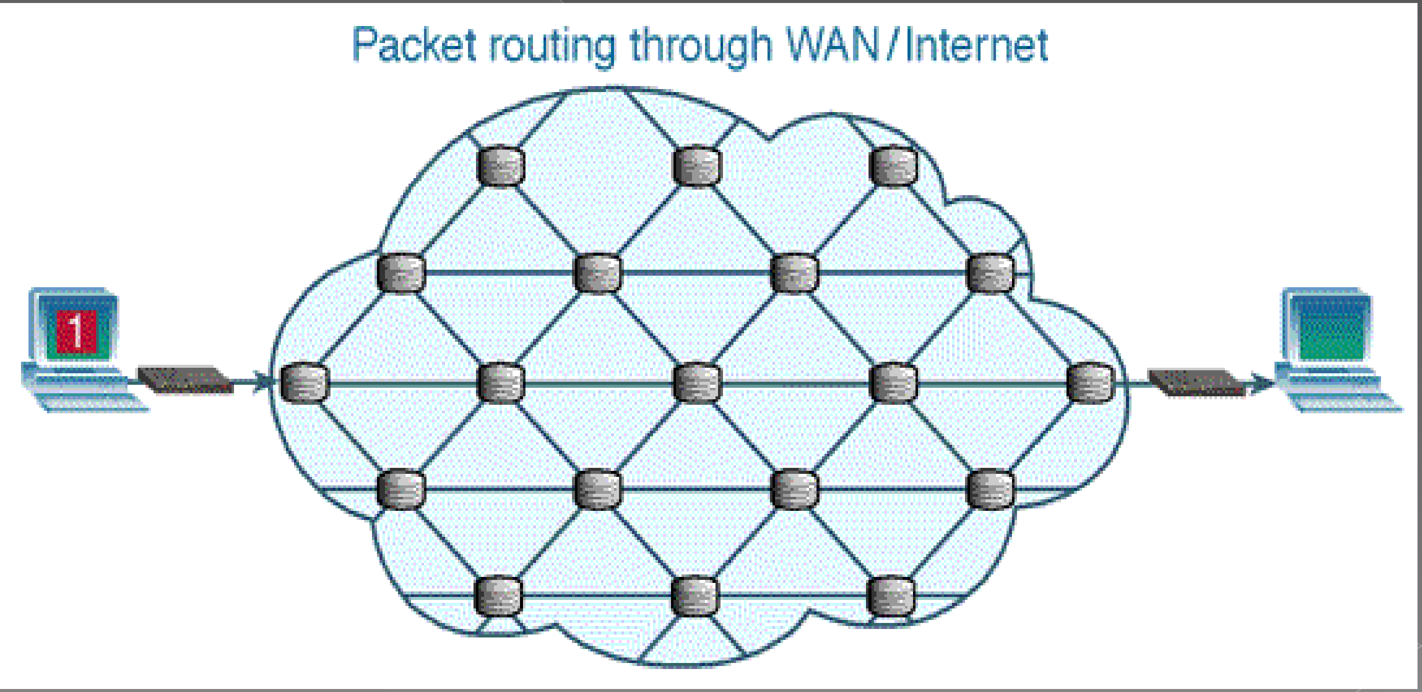
- Step 2 : Transmission over Network
  - Packet switching technology is being used for routing packets over internet.
  - Packet is one type of data record which contains the receiver's and sender's IP-address , data & packet number.

Header	**Sender's IP address** **Receiver's IP address** **Protocol** **Packet number**	**96 bits**
Payload	**Data**	**896 bits**
Trailer	**Data to show end of packet** **Error correction**	**32 bits**

Packet (1024 bits)

How VoIP works ?

- Step 2 : Transmission over Network



Packet Switching

Courtesy: http://www.teach-ict.com/technology_explained/packet_switching/packet_switching.html

How VoIP works ?

- Step 2 : Transmission over Network
  - Packet Switching

Advantages	Disadvantages
Efficient use of n/w	Latency-delay in packet routing
Multiple available path	Packet loss
Network scalability	Order less packet routing

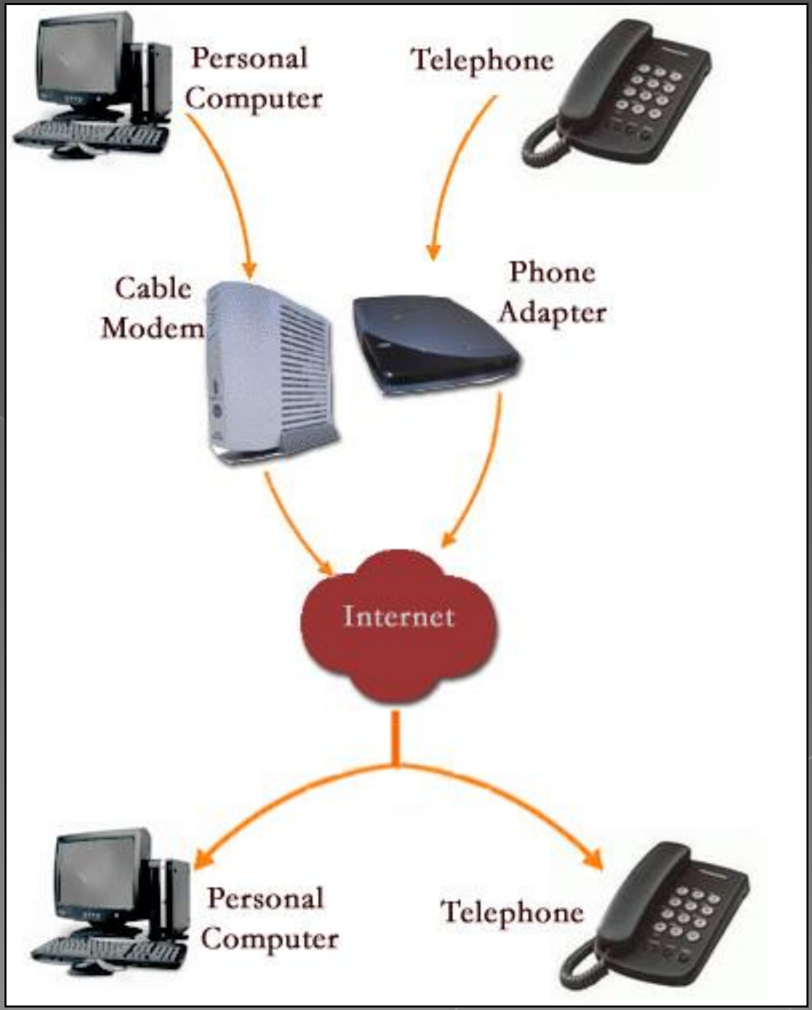
How VoIP works ?

- Step 3 : Reconstruction at Receiver
  - The packets received may be in random order.
  - To reorder them , one buffer is used in which the packets are stored and then they are sequentially ordered.
  - Then this packets are send to an D/A converter & lastly we get the analog o/p (voice) at receiving end.

Using VoIP

- For connecting to VoIP network, we have different methods.

1. Using your computer .
2. Using simple telephone with phone adapter.
3. Using VoIP telephone



Advantages

- Low cost
  - Because in IP-telephony only packets are send and received, while in traditional system the connection is made until end of call.
- Increased functionality
  - You can connect your phone from anywhere to network and receive your incoming calls.

Disadvantages

- VoIP is dependent on wall power.
  - If your power goes out the VoIP phone will not work. While current phone system works on phantom power.
- 911 - Emergency call
  - VoIP phone uses an IP – address as a phone number & we can find the geographical position using that IP – address.
  - To fix this, perhaps geographical information could somehow be integrated into the packets.

Disadvantages

- Latency
  - Latency is the time between the moment a voice packet is transmitted and the moment it reaches its destination.
  - This leads to delay & echo which is undesirable in voice communication.
- Jitter
  - Unfortunately, the delay is not always constant, and varies depending on network availability. This variation in delay is called jitter, which causes damage to voice quality.

Quality of Service(QoS)

- QoS depends on following factors
  - Type of internet connection
  - VoIP hardware
  - Codec : compression techniques used
  - Location of hardware
    - If your ATA is too close to your broadband router, you might experience voice quality problems.

References

- www.about.com
- www.howstuffworks.com
- www.wikipedia.com

Thank You

Questions ???