CAUSES & CURE OF LATENCY IN THE INTERNET TELEPHONY

DR. OLUMIDE SUNDAY ADEWALE
Dept of Industrial Math & Computer Science
Federal University of Technology
AKURE, NIGERIA

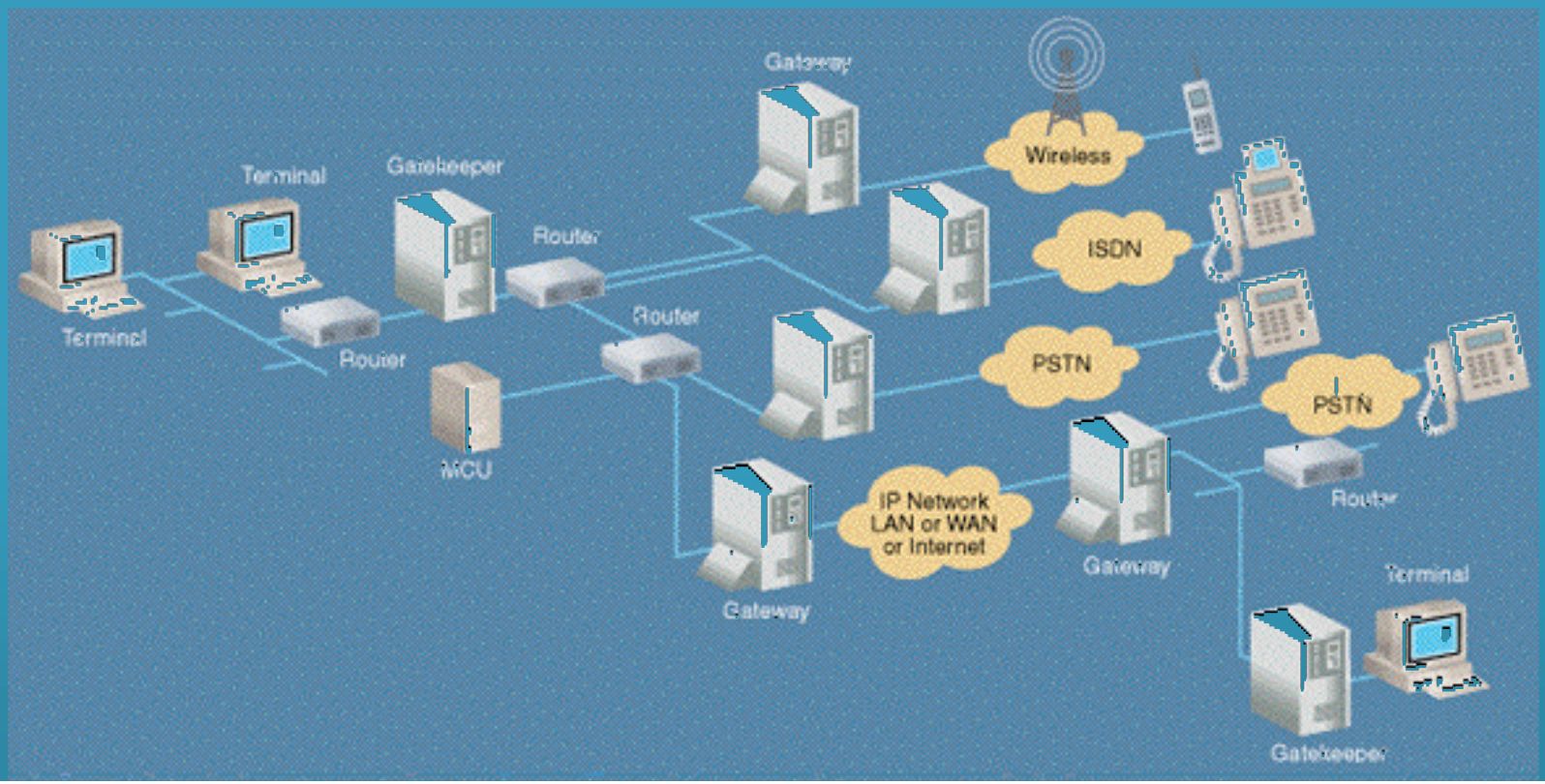
OUTLINE

- What is Internet Telephony?
- Typical Internet Telephony Components
- Internet Telephony Architecture
- Advantages
- Limitations/Barriers
- What is Latency?
- Causes of Latency
- Managing Latency
- Conclusion

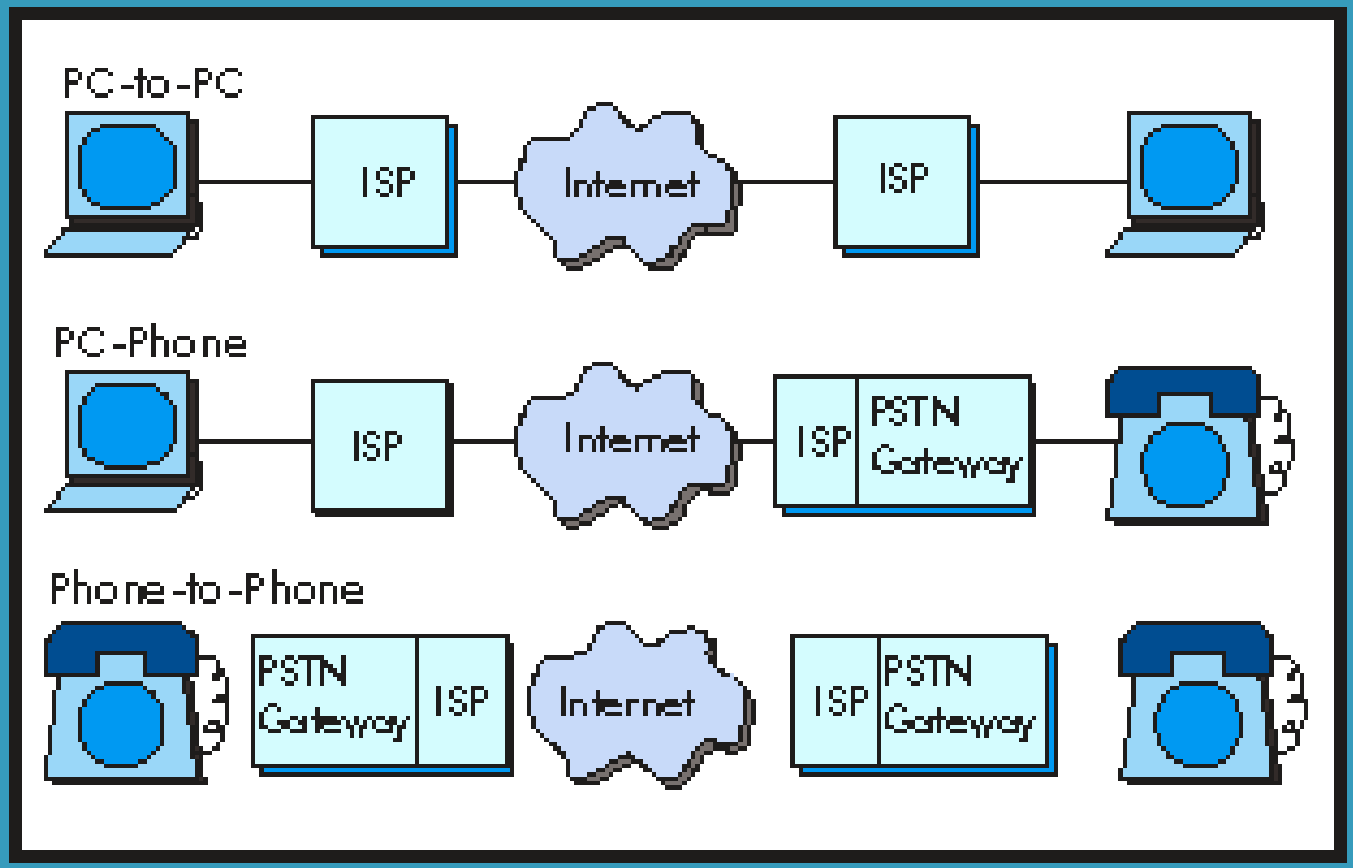
What is Internet Telephony?

Internet telephony is the transport of telephone calls over the Internet, no matter whether traditional telephony devices, multimedia personal computers or dedicated terminals take part in the calls and no matter whether the calls are entirely or only partially transmitted over the Internet.

Typical Internet Telephony Components



Internet telephony Architectures



Benefits

- The most significant benefit of Internet telephony and driver of its evolution is money saving and easy implementation
- Customers take advantage of flat Internet rating versus hierarchical rating and save some money while letting their long-distance call to be routed via Internet
- Deployment of new Internet telephony services requires significantly lower investment in terms of time and money than in the traditional PSTN environment
- Its software oriented nature will make it to be easily extended and integrated with other services and applications
- Internet telephony with an intranet enables users to save on long-distance bills between sites; they can make a point-to-point phone calls via gateway servers attached to the local area network.

Limitations/Barriers

- Standard
  - inter-operability between Internet telephony products and services
  - issues to be addressed are:
    - codec format
    - the transport protocol
    - directory services
- Quality
  - Clipping effects
  - Voice performance is measured by delay
  - Calls on the PSTN usually exhibit delay of 50 – 70 ms
  - This latency increases substantially on the Internet ranges from 500 ms
  - Human can tolerate about 250 ms

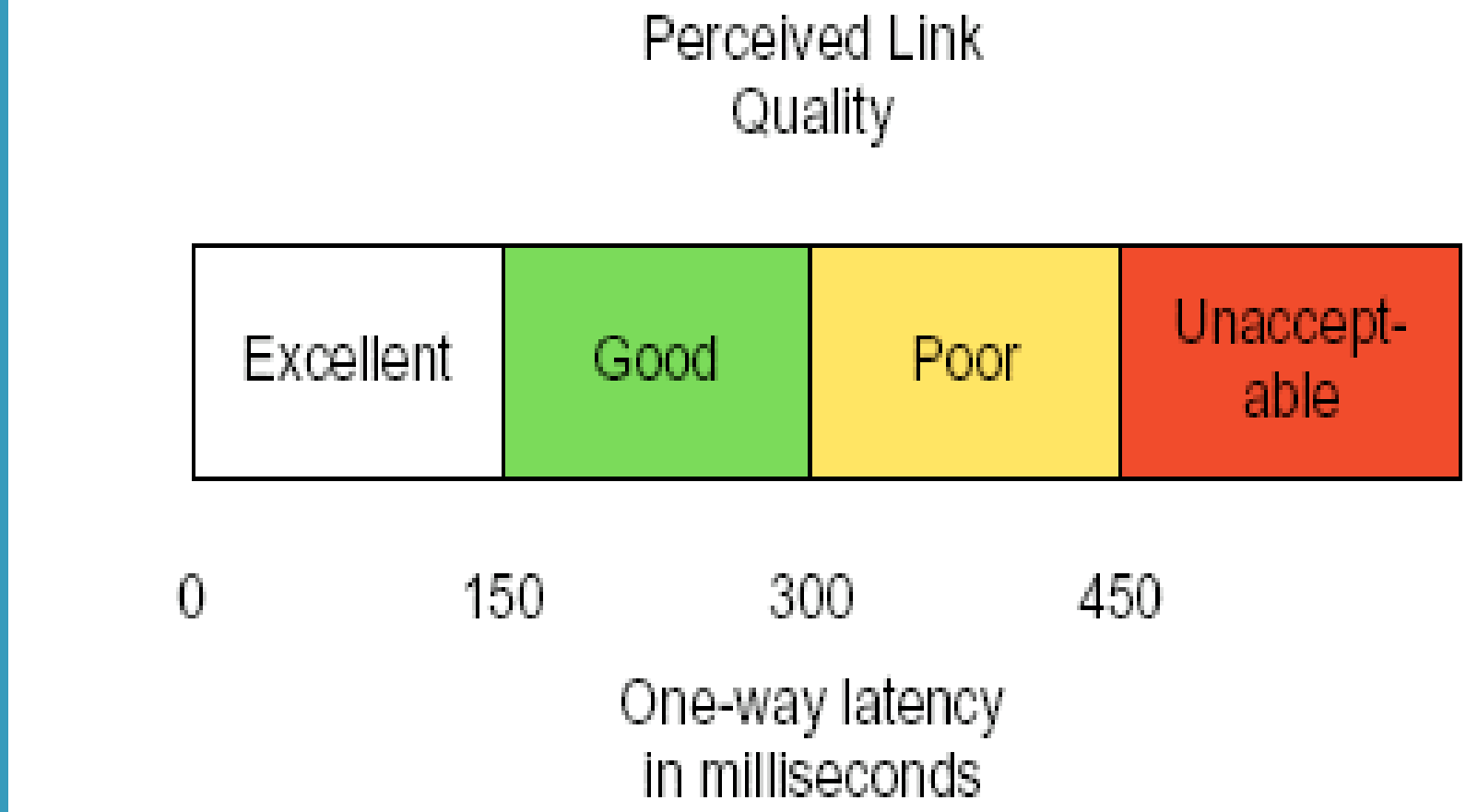
Limitations/Barriers Continued

- Capacity
  - Internet is an open network of many different ISP's networks
  - Bandwidth limitation
  - There is no way to get network bandwidth and latency guaranteed
  - Loss of packet affects the quality of voice
  - Traffic collision and congestion
  - Packets take different routes to destination
- Social Issues
- Phone-to-phone option using Internet telephony only possible where ISP has POP in the local area
- More digits to dial to get through (ISP, user account, user's password, and destination phone number)

What is Latency?

- Latency is the time delay incurred in speech by the Internet telephony system.
- Latency is typically measured in milliseconds from the moment that the speaker utters a word until the listener actually hears the word.
- This is termed as "mouth-to-ear" latency or the "one-way" latency that the users would realise when using the system.
- The round-trip latency is the sum of the two one-way latency figures that make up a telephone call. In the traditional PSTN, the round-trip latency for domestic calls is virtually always under 150 milliseconds. At these levels, the latency is not noticeable to most people.

Quality Perception versus Latency

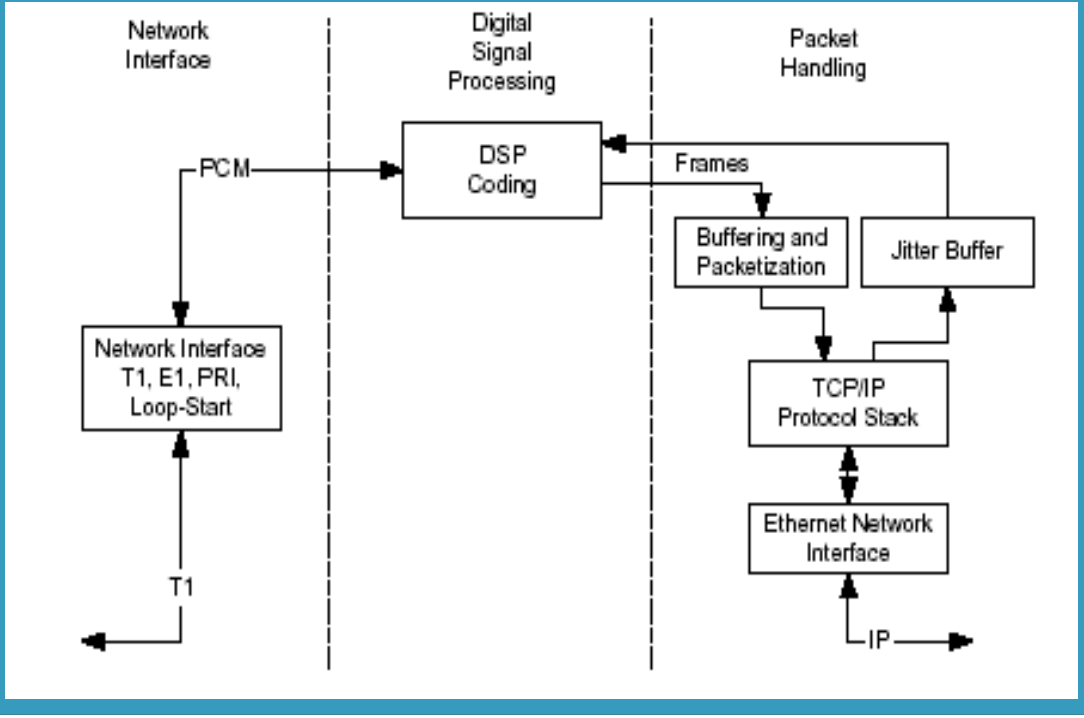


Causes of Latency

- Latency in an Internet telephony system is introduced by two primary sources.
- Some of the latency is incurred in the:
  - Internet telephony gateways at either end
  - IP network that connects the two gateways.

LATENCY CAUSED BY GATEWAY

- The following block diagram shows the high-level functions that occur in both gateway systems. The interface to the end-point telephone system is on the left side and the interface to the network is on the right side.



Latency Caused by Gateway Continued

- Network Interface Latency
- Digital Signal Processing Latency
- Framing Latency
- Processing Time
- Packet Handling Latency
- Buffering
- Packetisation
- Jitter Buffer Latency

Latency Caused By Network

Now that the Gateway has the voice data compressed and packetised, the data is passed to the Wide Area Network for transport to the far-end gateway. Passing data over the WAN introduces yet another set of potential latency additions that will affect the total latency.

- Media Access Latency
- Routing Latency
- Firewalls and Proxy Servers

Managing Internet Telephony Latency

Managing the latency in a deployed Internet telephony system is key to the success of the resulting service. Some key steps that can be taken to reduce and manage the latency are:

- Know the sources of latency in your system.
- Use routing equipment that supports prioritisation of selected ports or provides RSVP to guarantee a certain level of packet throughput.
- Ensure that your network has sufficient bandwidth to avoid congestion.
- Stay away from equipment and media that you do not have control over (the public Internet)
- If you use a network carrier, ask for a guaranteed route.
- Reduce packet overhead. If feasible, use piggybacking in your design to send multiple channels of voice data to the same destination. Efficient use of piggybacking can reduce total network traffic by over 50%, leaving more room for growth.

A Sample Latency Budget

Source	*Latency (in milliseconds)*
Network Interface	1 (1.54 Mbps T1)
Framing	30 (G.723.1)
Processing Time	10 (worst case)
Buffering	0 (no additional buffering)
Packetization	30 (two frames per packet)
Media Access Delay	10 (5 – 2msec hops)
Routing	50 (router dependent)
Jitter Buffering	30 msec (one buffer)
Total One-Way Latency	161 msec

Conclusion

- Internet telephony is a powerful and economical communication option that integrates both telephone networks and data networks together. The ability to use IP networks to carry traditional telephone traffic brings both challenges and opportunities to all the long-distance telephone service companies. Although a lot of difficulties exist, from the technological point of view to social issues, it is believed that it will bring a great change to communication field and bring a new huge market.
- This paper identifies two major primary sources that cause latency in the Internet telephony, and present means of managing the latency to maintain sufficient quality of service in Internet telephony.

THANK YOU