Voice over IP Services

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Agenda

1) VOIP motivation
2) VOIP network architecture
3) Operator business challenges
4) Sustainable business models

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Why VoIP when ISDN/GSM works perfectly well?

Note: Voice still brings ca. 80% of operator revenues!

- Users are abandoning PSTN at an alarming rate. Voice goes mobile.
- Data traffic grows >30%/year, Voice ca. 5%. Data has bypassed Voice several years ago.
  - Internet in Finland: August +20%, double in 6 months.
  - Expect 1000 –fold increase in 5…10 years.
  - Due to Entertainment over IP.
- Cost of transmission goes down very fast: xDSL, SDH, WDM - it is difficult to take full benefit of this trend using circuit switching: only one voice sample can be switched at a time: 8 bit sample vs. e.g. 20 ms sample => 1 Gbit router is less expensive than 1 Gbit circuit switch. => must make use of packet switching = IP.
- Broadband is gaining critical mass. BB users can do VOIP with SKYPE without operators. PSTN calling requires a GW and time based charges.

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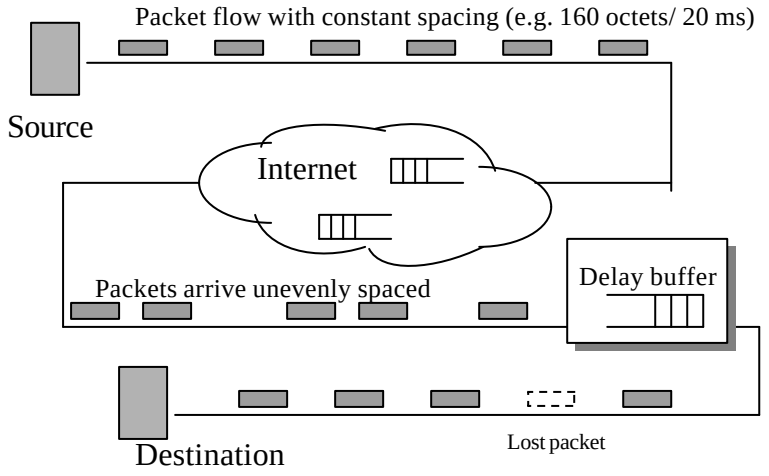
More reasons for IP centered convergence

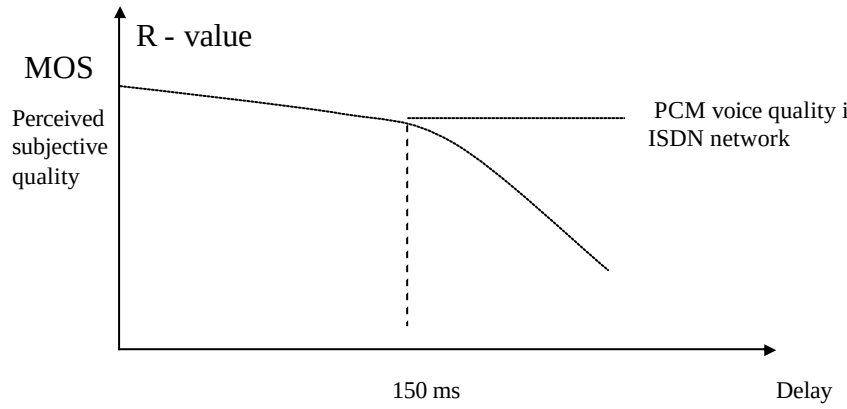
- More processing can be pushed to terminals -> consumer market economics
- All things become addressable --> wider variety of services become possible
- Open software environment --> More vendor competition, lower prices, faster introduction of new services
- Triple-Play: data+voice+TV from the same operator in one package = a compelling offering.
  - When Broadband reaches 50…70% penetration, it makes little sense to keep maintaining PSTN!
  - South-Korea has 70% BB penetration today!

Delay variance is compensated at reception by buffering

VOIP technology:



Voice quality starts to degrade, when one way end-to-end delay > 150ms



Quality can be measured e.g. based on the E-model or using MOS –measurements.
MOS - Mean Opinion Score.

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How is IP Telephony different from Circuit switched telephony?

Circuit Telephony

- Voice sample = 8 bits
- A- and μ-law PCM voice standard
- Reference connection gives network design guidelines => end-to-end delay is under control
- Wire-line telephones are dumb. Cellular phones are pretty smart
- Call control is tied to the voice path - IN is used to add service processing on the side.

IP Telephony

- Voice in 10…40 ms samples, Bits in a sample can be switched in parallel
- No single coding standard
- E2E delay is a big challenge
- Terminals are intelligent - consumer market economics
- Call control is separate from voice path - first find out whether parties want and can talk, if yes, set-up the voice path

Note: Using todays technology IP Telephony is not less expensive in replacement nor green field investments in Corporate networks! Nevertheless, VOIP is popular.

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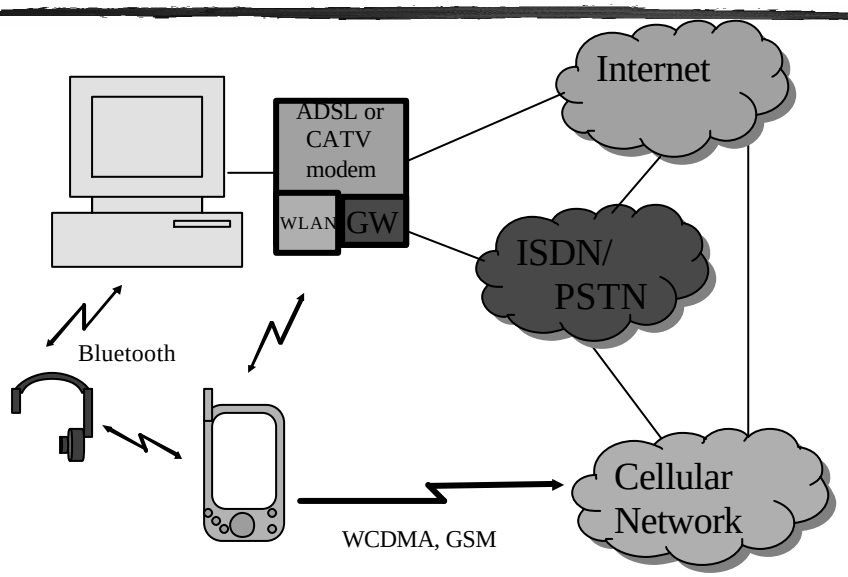
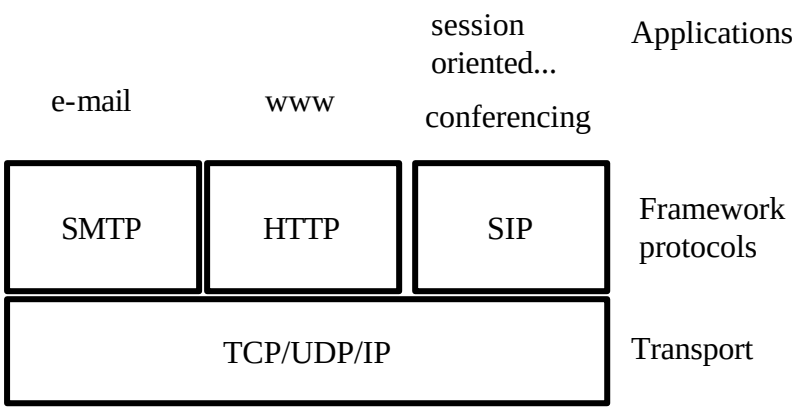
Why is QoS important?

- An interactive conversation (voice or multi-media) requires < 150 ms end-to-end delay. If delay is longer, voice quality is less than PSTN quality.
- If there is too much UDP traffic, it blocks TCP traffic. If there is too much TCP traffic, it blocks UDP (e.g. voice) traffic.
- Internet service is unfair. Sometimes a TCP session gets zero throughput while similar other sessions get a finite capacity.
- Capacity remains an issue in Interconnect points, in the access and in Wireless networks.

How to do it?



The emerging Internet Architecture



Information Economy

Normal Goods

- Law of supply and demand by Adam Smith – price is established on the market. Price can sustain a competitive business.
- Supply is finite.
- Goods available from many sources.

Applies to network services and content.

Information

- is non-depletable = supply is infinite.
- Creation may be costly.
- Marginal cost = price = zero.

→ Forget market economy. It does not help to create sustainable business. Instead try to gain a monopoly.

- Frequency licence
- Patent or copyright
- Hold the "truth" and keep it secret = MicroSoft model.

→ You can "tax" users!

- Alternative: Tie information with a physical good: a disc or a box or...

VOIP business challenges 1

- Voice is going wireless fast. Who needs wireline voice?
- To meet the challenge of mobile, PSTN operators are forced to compete by building Broadband.
  - With high BB penetration, who needs PSTN?
- Can wireline voice be a sustainable business on its own or is wireline VOIP just a feature of other IP applications such as games, e-business sites etc?

VOIP business challenges 2

- If A and B subscribers have each other's IP addresses, they can send media streams to each other – do not need their operator to know that this is media (QoS?).
  - In PSTN operator control is inbuilt in the technology
  - In Internet: the lack of operator control is inbuilt.
- If operators do not build VOIP services, users can do it themselves – the operator is reduced to a bit pipe carrier. In the Fall 2003 Skype appeared to prove this!
- VOIP kills PSTN – an important cash cow.

VOIP in Cellular Challenges

- VOIP can be provided in 3G by the IP Multimedia Subsystem (IMS) or
  Cellular operators can move their legacy MSC signaling to work over IP/MPLS networks – IP provides "virtual circuits".
- Maintaining control is a challenge for the operators like in wireline.
- Why would the operators **replace** a perfectly functioning existing Circuit based network into a less reliable and unproven IMS based VOIP?

Non-sustainable business models

- PSTN with time based charging is dead anyway. Mobile and Broadband are killing it.
- What the operators do not build in BB, users will.

→ Operators can not ”do nothing”.

- Best Effort service is a commodity. Marginal price is zero. Recovering sunk cost is unlikely.

Sustainable business?

- Raise entry barries: IP oligopoly networks through consolidation – 2...4 wireline providers.
- Drive cost down – to prevent users from doing their networking all by themselves.
- Add Features such as emergency calls.
- Links to Broadband and Mobile business models:
  - Triple Play service: data+voice+video from the same operator
  - Flat rate for IP calls, time based charging for PSTN and cellular connections.
  - Cheap rates and high QoS for cellular IW calls.

Conclusions

- VOIP is either a replacement of PSTN/ cellular voice service or an add-on feature to IP applications such as www, e-mail, etc
- For wireline Broadband Internet – VOIP is an additional service, part of e.g. the Triple Play package.
- For 3G VOIP comes with IMS, push-to-talk etc. Full replacement is = ?
- Best Effort service will never be a money maker – QoS is essential for adding value to the network.
- Cannibalization of PSTN is hard for the incumbent operators.