

Multimedia in IP

General Concepts

IP dominance in communications

Circuit switched systems

- Products based on TDM still give the major profits in industry
- They are getting close to the cost and efficiency limits
- Obsolete...
- Conversation (voice services) is critical

Packet switched systems

- Services based on IP will be dominant (SIP, VoiceXML)
- New distributed characteristics between gateways and media servers
- Conversation (voice services) is still a critical aspect

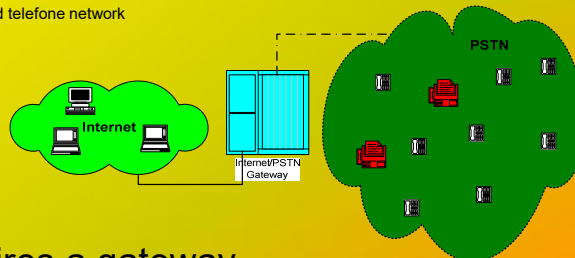
→
Migration is evolutionary: there is interoperability⁸



universidade
de aveiro

Multimedia in IP: a substitute for POTS? Interoperability!

POTS – Plain old telephone service
PSTN – Public switched telephone network



- Requires a gateway
 - What type of service translation?
 - What facilities are being provided?
 - What facilities to provide?
 - What can be provided (and how), taking into account the telecommunications environment?
- Currently VoIP is the default in many enterprises
 - And still connect to the phone network

9



universidade
de aveiro

POTS interoperation

- Interoperation of PSTN services with data networks (e.g., the establishment of a voice call between a phone based on internet and a traditional phone)
- Interoperation of data services with PSTN networks (e.g., paging/calling a user after an email reception)
- New services simultaneously based in PSTN and Internet facilities (eg, WEB-based helpdesk, capable of sending documentation through fax)

Although IP networks dominates now, there were many years of joint co-existence of both networks, which becomes a legacy

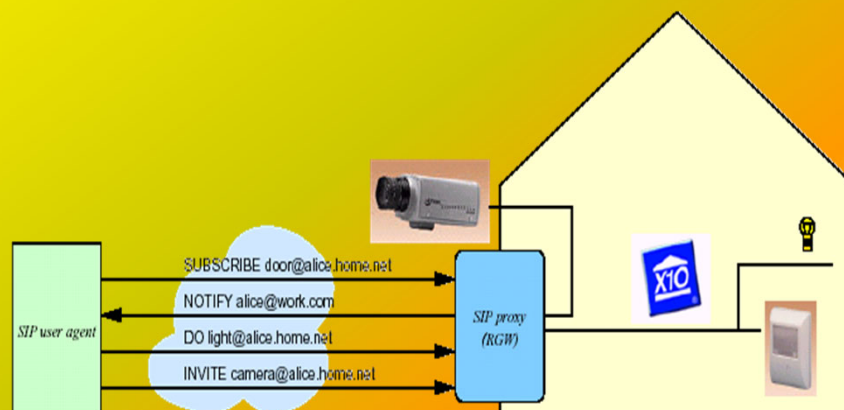
10

Multimedia in IP

- Many algorithms/applications supporting voice/video above IP
 - Vivo, ShockWave, AAC, MPEG-4, H.323, H264, RealAudio, etc...
- As long as some QoS exists in the network, an explosion of these applications is ever expected
 - Even without explicit QoS, multimedia took over the Internet
 - End points coding became much more adaptive
- IETF centered transport standardization:
 - Specially focused in the control of teleconference sessions and network protocols
 - Cooperates now with ITU-T
 - Has complete proposals to all audio/video communication aspects

12

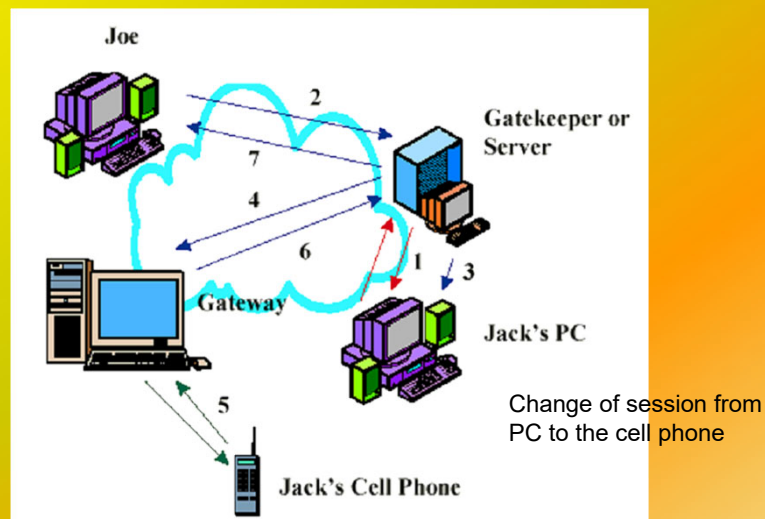
Example MultimediaIP in users: “Surveillance”



X.10 – home automation protocol.

13

Example: “Follow me”



Source:
IETF doc

14

Concepts and Protocols Voice over IP

More than multimedia streaming...

Learning outcomes

- Understand the scope of VoIP models
- Describe RTP operation
- Understand the SIP and H.323 protocols
- Describe architectures for interconnecting POTS and the Internet.

17

Data plane and control plane

- Data plane: determines data packet behavior
 - Packet forwarding (e.g. inside a router)
 - Packet differentiation (e.g., ACLs)
 - Link scheduling
 - Multimedia **transport** (e.g. the codec)
- Control plane: controls the state of network elements
 - Route selection (e.g. routing protocols)
 - RSVP, capability signaling, etc.
 - Multimedia **signaling** (e.g. the ringing tone)

In advanced architectures, these two planes often impact different functional units (boxes)

Data+control

- Multimedia is associated to the notion of “session”
 - Requires both data (multimedia) and control information
 - E.g. voice is data, and #busy signal” is control
- In-band signaling
 - Sending of metadata and/or control information in the same “channel” than the data
- Out-band signaling
 - There is a dedicated “channel” created for the transmission of metadata and/or control

19

What is signaling?

- **Signalling** is the process of interaction between network nodes to process calls
 - Signalling is for call **control**
 - Origin and destination nodes have to agree on the call establishment and its parameters
 - Network nodes have to prepare their resources/links for the calls
 - have to obtain information of the call initiation and its parameters
 - Servers for charging
- SS7 is the signalling system used in PSTN
 - There are others, and are being used... (ISDN)
- For PSTN, ISDN and SS7 are the more advanced systems
- Signalling also has to exist in the data world....
 - SIP, Megaco, H.323, ATM UNI, etc.

20

What is VoIP?

- VoIP is not a protocol!
 - VoIP is a set of protocols and equipments that allow coding, transport and routing of audio calls (multimedia) through IP networks
 - Both data (media) and signaling have to be tackled
 - Audio streams are coded in digital environment and encapsulated in IP for transport in the network.
- Examples of VoIP inclusion (required interoperation)
 - PSTN → VoIP → PSTN
 - VoIP Native → PSTN
 - VoIP Native → VoIP Native

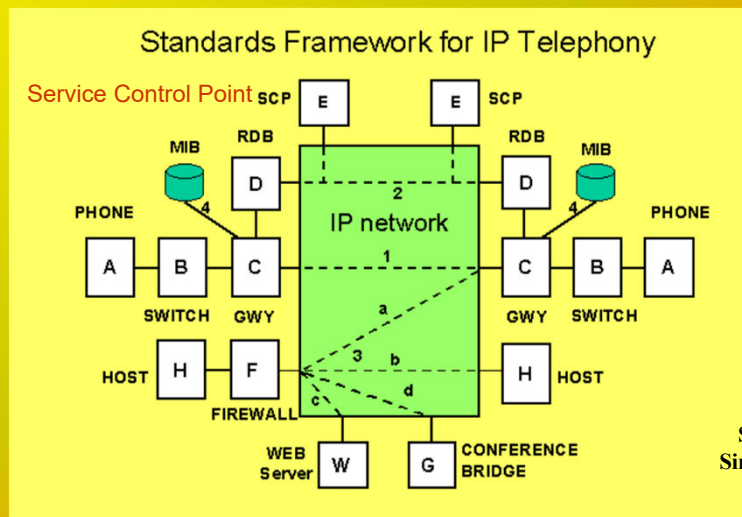
21

VoIP advantages

- Cost reduction
 - Do not need to pay for PSTN circuits for call transport (user side) / consolidate infrastructure (provider side)
 - Bandwidth reduction
 - Distributed nature of VoIP
 - Operation costs reduction – voice and data traffic both in the same network
- ‘Open’ standards and interoperability between operators
 - Does not depend on proprietary solutions
- Integration of voice and data networks
 - Considered as ‘just another IP application’
 - Two major approaches: ITU-T (early on) and IETF (current)
 - As long as the quality is similar to the PSTN network, companies can easily invest in new services and applications

22

Voice over IP Framework



23

Most challenges are associated with control plane.

Different levels of VoIP problem

1. The transport level
 - How to transport multimedia information. Covers also content, but we mostly talk about RTP (and associated protocols)
2. The session control
 - How to signal a VoIP session. Covers also application protocols, but we talk mostly about SIP and H.323
3. The gateway control
 - How to signal interface entities between Internet and POTS. We address mostly Megaco

24

Some Standards and protocols

- **Signalling** *(mostly inside IETF)*
 - SS7 to IP (SIGTRAN)
 - Transport of voice signalling over Internet
 - SIP, Megaco, MGCP, H.323, etc.
 - PINT (PSTN and Internet Interworking)
 - Mechanisms for the Internet to use POTS services (e.g click-to-dial, click-to-fax-back)
- **Media** *(some standards outside IETF)*
 - Real Time Protocol (RTP)
 - Echo cancelation
 - Voice coding (G.7xx)
- Major developments are in the call control field (or signalling)
 - **Web streaming has taken over these standards, embedding all complexity in a “transparent service”**

25

Example IPTEL protocols: SIP, RTP



- **Session Initiation Protocol - SIP**
 - **Contacts “office.com” to talk with “bob”**
 - **Locate Bob’s phone and connect**
 - **Bob gets the ringing phone**
- **Real time Transport Protocol - RTP**
 - **Packet sending and reception**

27