Synchrounous communications in eHealth: videoconferencing

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Broadband Communications and Distributed Systems

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- Introduction to eHealth
- Communication main principles
- Packet switiching tecnologies
- Networks

  The Internet

  Basics

  Fixed networks

  Wireless networks

  Concepts: bandwidth, latency, jitter, QoS, loss, WWW

- An example: vitam vodeoconferencing system

Telehealth

The use of electronic communications and information technologies to provide or support clinical health care, patient and professional health-related education, public health and health administration at a distance

To exchange information to support medical decision making
- Access to Medical Records
- Literature search
- Improving decision support (AI, data mining, …)
- Remote monitoring
- Consultation and Conferencing

eHealth:environment and constraints

- Technical:
  - Network infrastructure
  - Specialized devices

- Legal:
  - Licensure
  - Credentialing
  - Privileging
  - Liability (responsibility)
  - Security - assure data integrity,   confidentiality and availability:
  - Privacy - the claim of individuals, groups or institutions to determine for themselves when how and to what extent information about them is to be communicated

- Financial:
  - Start-up Costs
  - Reimbursement
  - Long Term Financial Sustainability

- Clinical implementation:
  - Re-engineering Practice
  - Clinical Acceptance

Types of eHealth.Technical point of view

eHealth is practiced on the basis of two concepts: real time () and store-and-forward and Home).

- **Synchronous (**Real time) Health requires the presence of both parties at the **same time** and a communications link between them that allows a realtime interaction
  - It could be as simple as a telephone call or as complex as robotic surgery.
- **Asynchronous (**Store-and-forward) Health involves acquiring medical data (like medical images, biosignals etc) and then transmitting this data to a doctor or medical specialist at a convenient time for assessment offline
  - It does not require the presence of both parties at the same time. Dermatology (cf: teledermatology), radiology, and pathology are common specialties that are conducive to asynchronous telemedicine

What makes (tecnically) eHealth possible?

Computer technology

– digital imaging

– videoconferencing

– remote monitoring

Networking and telecommunications

– Local networks

– Access networks :

☐ ADSL

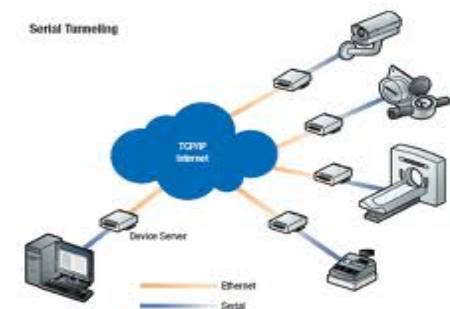☐ Passive Optical Networks

☐ Wireless
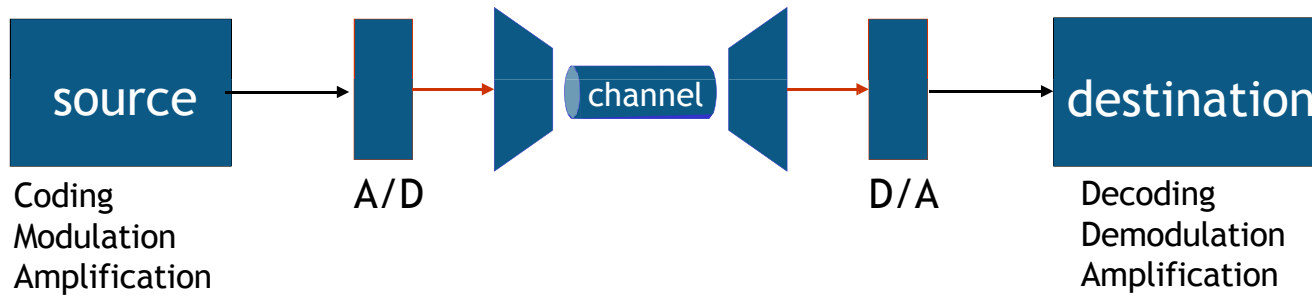
– Internet

Contents

Networks

    Basics

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    Wireless networks

    Concepts: bandwidth, latency, jitter, QoS, loss, WWW

Networks - Basics
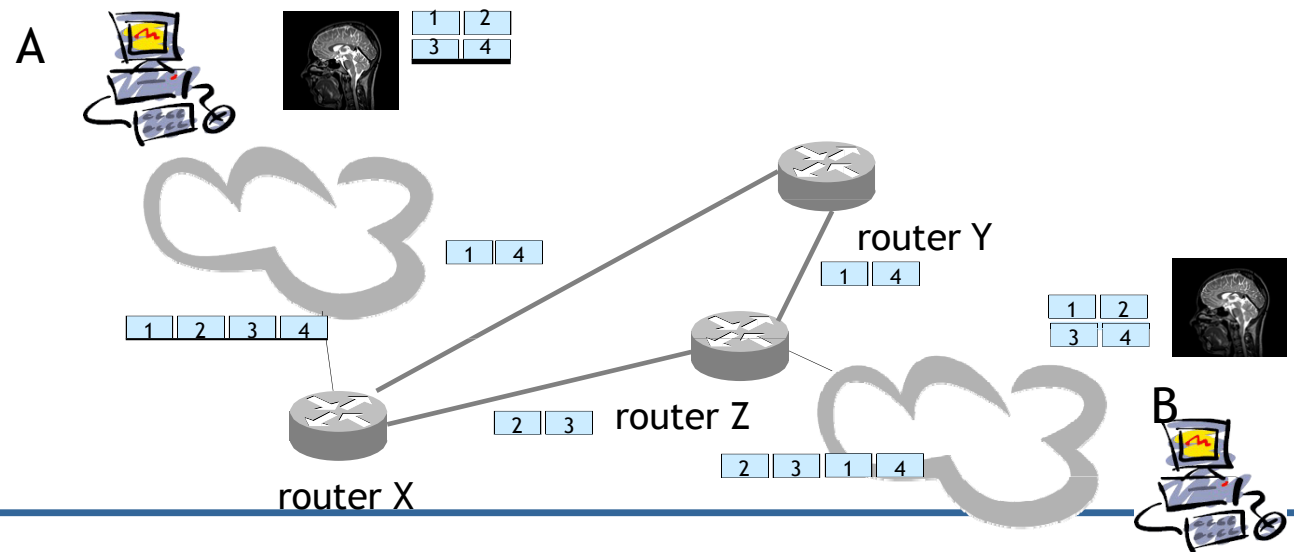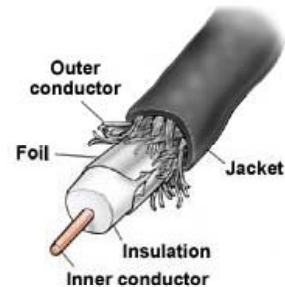

source

A/D

channel

D/A

destination

Coding
Modulation
Amplification

Decoding
Demodulation
Amplification

Communication Channel

Networking

A

router Y

router Z

router X

B

Networks – Fixed networks

Common cable types
Coaxial

Outer conductor

Foil

Jacket

Insulation

Inner conductor

Copper twisted pair

Optical fiber

Cladding (n_2)

Bound Rays

Core (n_1)

Cladding (n_2)

n_1 = Core Refractive Index
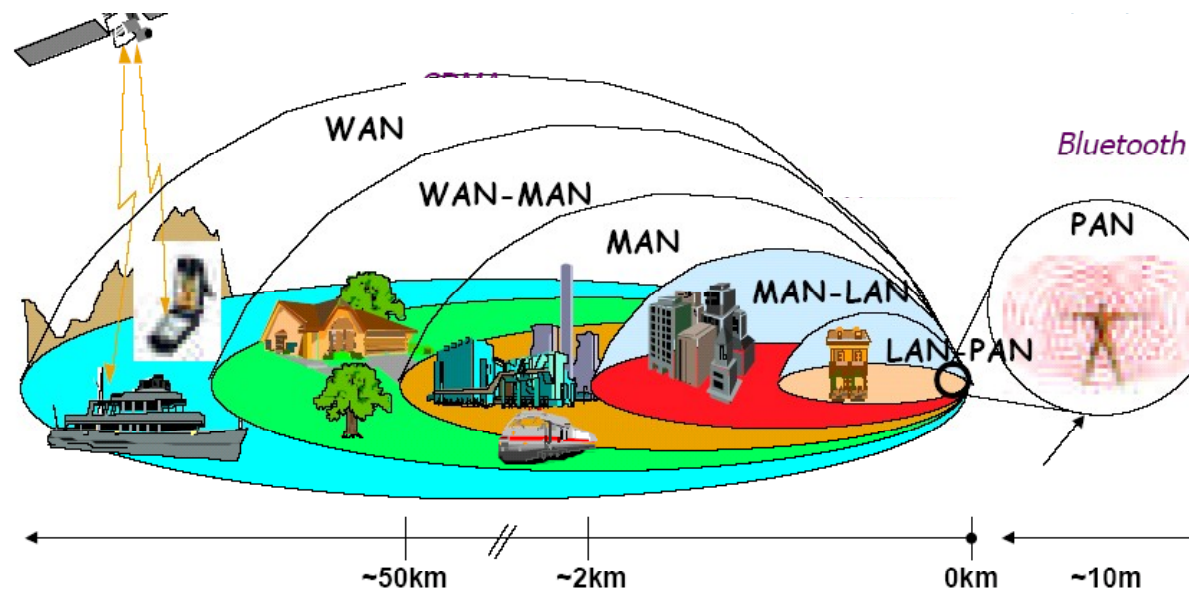n_2 = Cladding Refractive Index
$n_1 > n_2$
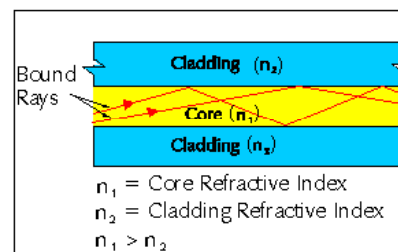
step index, multimode fiber

Networks – Basics - Wireless

Networks - Concepts

Bandwidth

measure of available or consumed data communication resources expressed in **bits/secon**d (bps) or multiples of it: Kilobits/s (Kbps), Megabits/s (Mbps), etc.

Latency (delay): time from the source sending a packet to the destination receiving it

Satellite TV football match vs radio

Jitter: variability of the packet latency

Packet Loss: some packets of data travelling across a computer network fail to reach their destination

Common in Internet

Real-time interactive constraints

Latency:

250ms (round-trip): voice users will notice it

>250ms (round-trip): callers start talking over each other

>500ms (round-trip): phone calls are no longer practical

Typical Internet: 150-200 ms Satellite: 500-700ms

Loss:

retransmission is not suitable (requires additional time)

Jitter:

delayed packets over acceptable time frame are discarded

Loss and high jitter → faltering speech, image artifacts

Networks - Concepts

Loss effects in videoconferencing

http://www.youtube.com/watch?v=tZWjOr0oh0A

Latency effects in videoconferencing

You see the images / hear sound some time after it has been sent

Broadband Communications and Distributed Systems
University of Girona
http://vitam.es

Secure videoconferencing designed for eHealth

vitam® solution

Usability

Simple asymmetric interface (w. moderator)
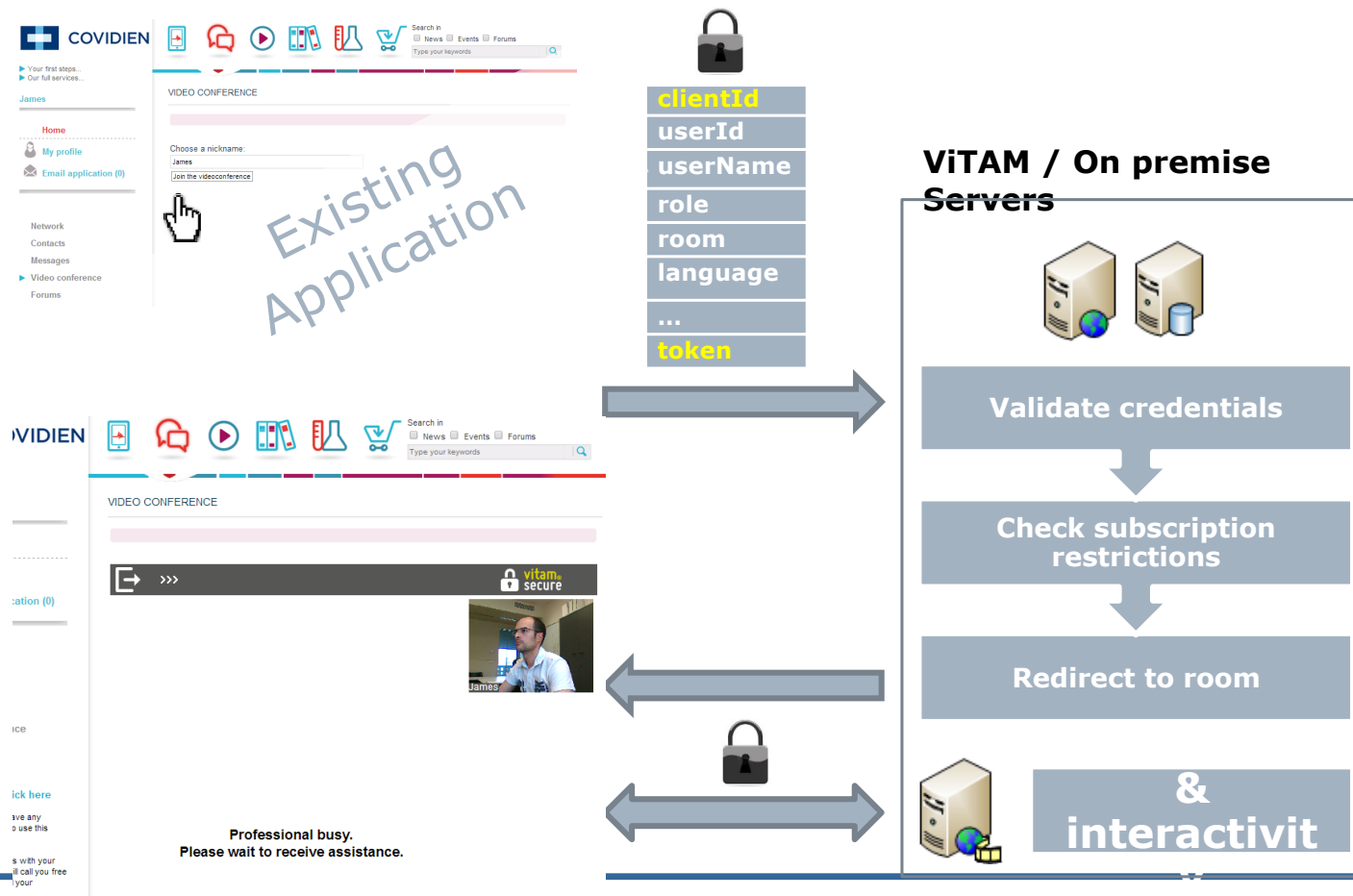
1 to 1 and multivideoconferencing
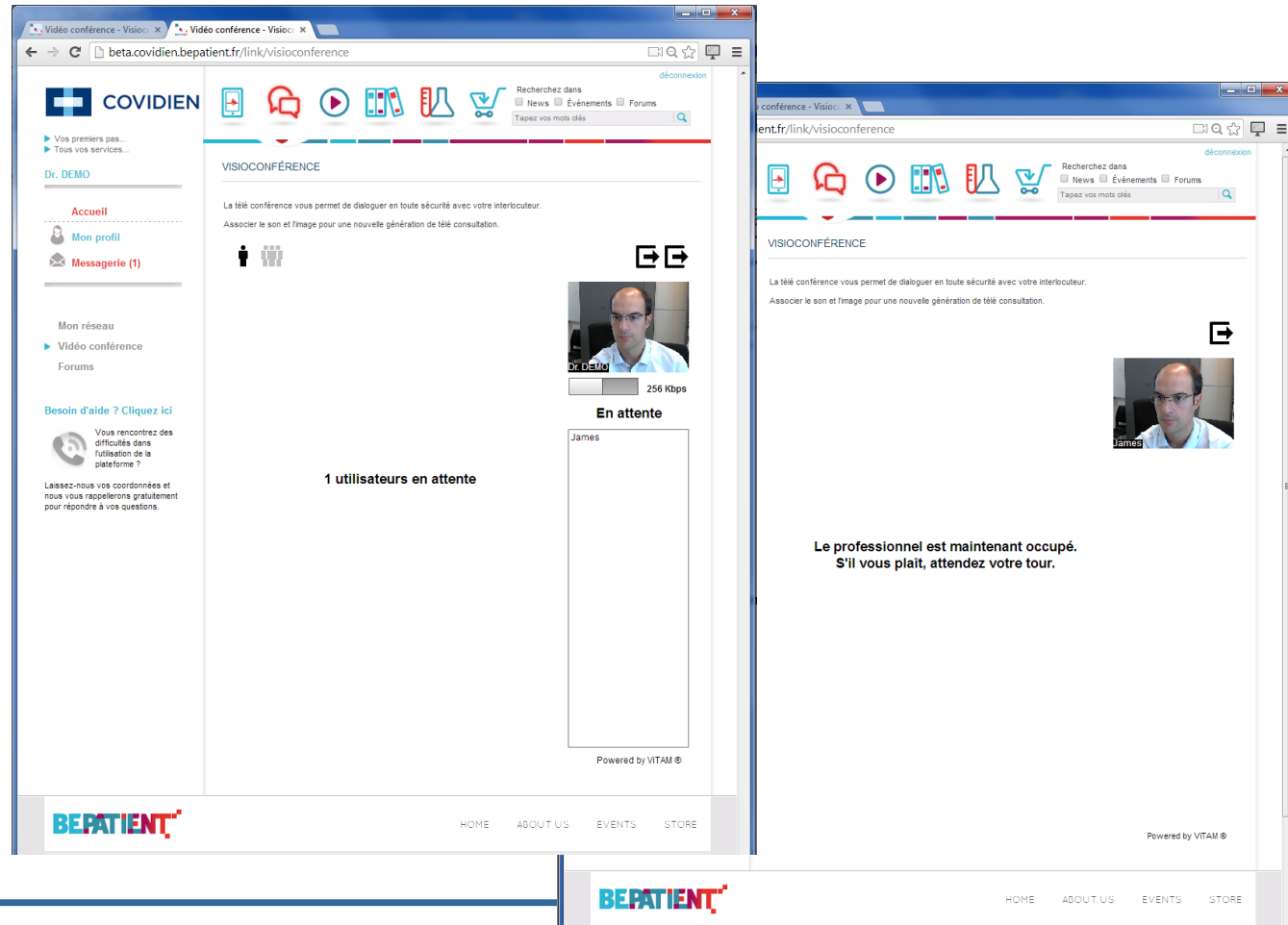
Integration

API (app and web)

Security

Encryption

Authentication

On-premise installation (optional)

Integration Use Case
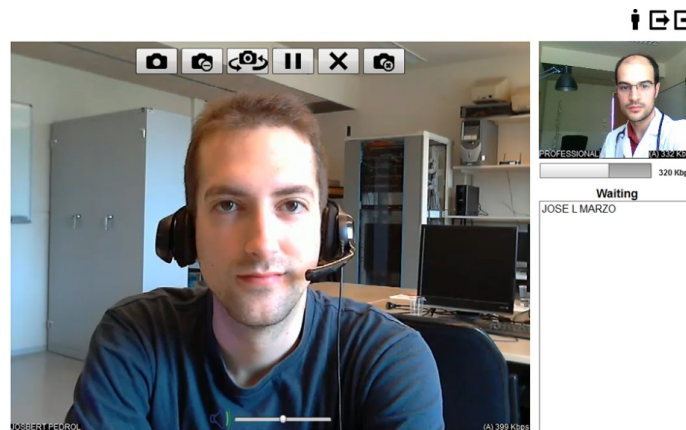
Integration Example (embedding)

Security Highlights

- Centralised communication
  - Either on vitam or on-premise servers
- SSL-based streaming protocol
  - RTMPS is an open protocol using SSL encryption
- PKI-based authentication
  - external applications make user of a public/private key pair to generate a temporal authentication token
- Decoupled end user authentication
  - vitam does not authenticate end users
- Anonymous
  - vitam does not know any private data from end users but the nick name.
  - the nick name is not stored in the vitam servers (logs only contain the user id assigned by the calling application)
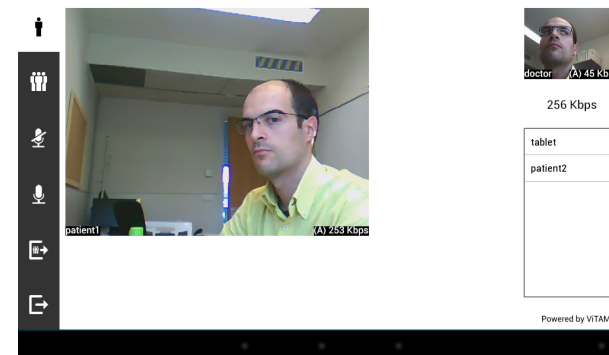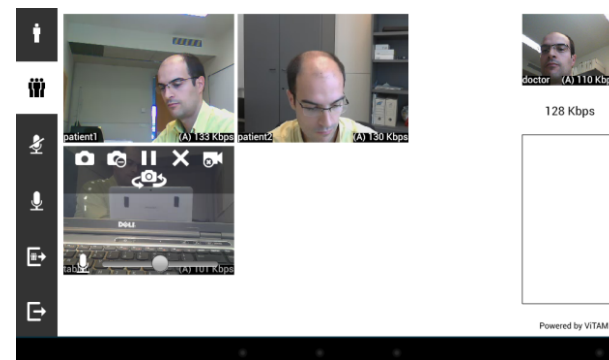
Interfaces

1 a 1 (web)

1 to 1 (tablet)

Multiconferencing (web)

Multiconferencing (tablet)

Uses

- eHealth
  - Teleconsultation with waiting room
  - Call Centre
  - Home Hospitalisation
  - Remote Monitoring
  - Group Sessions
  - Interprofessionales sessions