Outline (Preliminary)

1. Introduction and Motivation

2. Digital Rights Management 3. Cryptographic Techniques 4. Electronic Payment Systems 5. Multimedia Content Description	Part I: Content-Oriented Base Technologies
6. Streaming Architectures 7. Multimedia Content Production and Management 8. Commercial Streaming Systems: An Overview 9. Web Radio and Web TV	Part II: Multimedia Distribution Services
10. Signaling Protocols for Multimedia Communication ~~IP Telephony~~ 11. Multimedia Conferencing	Part III: Conversational Multimedia Services

IP Telephony and H.323

- ITU-T H.323 series of recommendations (standards)
  - Used as a synonym for a large group of ITU-T standards
    - » H.235 (security), H.450 (suppplementary services), …, but also RTP, RTCP, …
  - Originally developed for videoconferencing, see next chapter
  - Works also with IP networks
  - Recent versions stress telephony applications (IP telephony)
- Definition of various gateways:
  - To PSTN/voice
  - To PSTN/fax
  - To PSTN/H.324 videophone
  - To GSM mobile phone
  - To private phone exchanges (“PBX”)
- Competition between H.323 and SIP about signalling for IP telephony (and multimedia conferencing, see later…)

11 Multimedia Conferencing

Literature:

James R. Wilcox: Videoconferencing, the whole picture, 3rd ed, CMP Media 2000

John Rhodes: Videoconferencing for the Real World, Focal Press 2001

Videoconferencing: Definition

- Videoconferencing:
  - The exchange of *digitized* video images and sounds between conference participants at two or more separate sites
  - Transferred images:
    - » Pictures of the participants
    - » Video clips, still pictures and other accompanying material in digitized form
  - Transferred sound:
    - » Discussions between meeting participants
    - » Sound from accompanying material (sound or video clips)
- Group-system videoconferencing: Joins two groups of people meeting in physically separate rooms
- Personal videoconferencing: Joins individual users (desktops, phones)
- Two sites *(point-to-point)* or more *(multi-point)*

History of Videoconferencing

- Bell Labs, 1920s: First videoconference between Washington and New York
- Bell Labs, 1940s: Videoconference research resumed
- Bell Labs, 1964: Picturephone.
  - Other pioneers, 1970s: NEC, British Telecom (1979)
- 1983: Compression of video signal to phone line bandwidth: Widcom project (DARPA)
- 1984: PictureTel, first software-based videoconferencing system (224 Kbps)
- 1994: Intel ProShare system (two ISDN B-channels)
- 1996: Standards H.323 and H.324, including H.263 compression
- 1996 until today: Trend to use IP data network technology instead of ISDN

System Type I: Picturephones

- Telephone sets enhanced by video display and small camera
- Available on the market already for significant time
  - E.g. for ISDN

Pictures: Aethra

System Type II: Desktop Systems

- Desktop videoconferencing systems
  - PC with small camera mounted above the monitor
  - “Picture phone” on PC basis
  - Optimal for *application sharing*
- Disadvantages:
  - Usable only by a person a time
  - Limited picture and sound quality
- Cost: 500 – 2000 € plus PC

- Pure software solutions:
  - Simple standard systems like Netmeeting, GnomeMeeting
  - Sophisticated specialized software with dedicated servers

Pictures: VCON, Polycom

System Type III: Set-Top Systems

- Small box containing camera, microphone, speakers, codec, network interface, …
  - To be put on top of TV set or monitor
- Simple, easy to use,targeted also to computer-illiterate users
- Disadvantage:
  - “Vendor lock-in”: Upgrades are often difficult
- Cost: 3000 – 9000 €

Picture: Aethra

System Type IV: Rollabout Systems

- Movable, medium-sized unit, often a rolling cabinet, containing
  - High-quality audio, video and telecommunication systems
  - One or two large monitors
  - Remotely controllable camera
- Optimal for small groups (three to six people)
- Cost: 3000 – 10.000 €

Pictures: Sony, Tandberg

System Type V: Room Systems

- Room custom-equipped for conferencing requirements
- Possibly many cameras and monitors
- Furniture well integrated with conferencing equipment (cameras, monitors)
- High-quality sound system
- Cost: 30.000 – 1.000.000 €

Video Conference Room Design

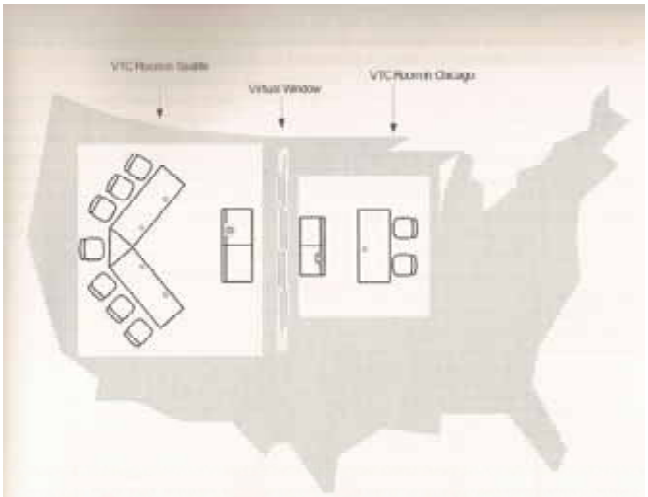

Figure 4-9 Two distant VTC rooms separated only by a virtual window.

Source:
Rhodes p. 79

Camera Control

- Far-end camera control:
  - Participant or operator in room A allowed to control camera in room B
  - Useful when untrained people in room B
  - Mainly for point-to-point conferences
- Camera presets:
  - Angles to view individual participants and other perspectives are pre-programmed before conference start
  - Camera can be moved with a single key press, e.g. to show a specific participant
- Follow-me function:
  - Camera movement automatically synchronized with room or speaker microphones
  - Camera snaps into position for current speaker

Copy-Stand Camera

- Typical accessory of videoconference rooms

Electronic Whiteboard

- Touch-sensitive whiteboard
  - To transmit life drawings over the network
- Technologies:
  - Front projection
  - Rear projection
  - LCD display
- Collaborative software solutions with or without video conference

Picture: Smart Technologies

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Application: PARC Media Spaces

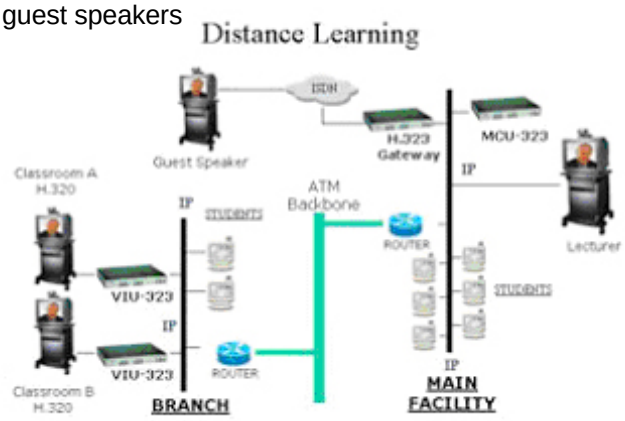
- Xerox PARC System Concepts Laboratory, mid 1980-s
  - Geographical split between Palo Alto/California and Portland/Oregon
  - To maintain a single group and explore technologies for collaborative work
- Offices and meeting rooms connected by audio/video links
  - Local panels to configure connection configuration
- Positive effects:
  - Awareness of remote situation (e.g. presence of people at remote site)
  - Enabling informal encounters across sites
- Problems:
  - Boundaries of personal and private space
  - Integration into daily work life
    - » Placement of communication devices
    - » Integration into work flow and daily routine

Application: Preventing Nuclear Destruction

- Videoconference technology helped to protect the world during the year 2000 date rollover
  - To avoid control problems of nuclear power stations
  - Videoconference link between
    - » Emergency Center of the U.S. Department of Energy (Washington)
    - » Situation and Crisis Center of MinAtom (Moscow)
  - Expert exchange: Experts of the remote side present locally
- T1 line (24 phone lines bandwidth), off-the-shelf video codecs, LCD projectors etc.
- Newly developed (UNIX-based) video transmission software

Application: Distance Learning

- Lectures transmitted to remote students
  - Training of staff in businesses
  - Home-learning
- Integration of remote guest speakers in meetings



Picture: Radvision

Application: Telemedicine

(According to Wilcox, p. 37)

- Remote consultation of medical specialists
  - Military health care for patients on remote bases
  - Health care services for prison inmates
  - Rapid emergency response
- Visiting nurses video-consulting with patients
  - Allows reduction of physical visits
- Additional data possibly transmitted:
  - Pictures: X-ray, tomography, …
  - Lab results
  - Current vital data

Application: Video Surveillance

- Remote surveillance is very similar to videoconferencing
  - Use of similar equipment and/or software
- Examples:
  - Security control of entrances, halls, …
  - Surveillance of public spaces (train stations etc)
  - Traffic control
  - Remote control of automatic bridges
- Bidirectional communication useful in some situations

11 Multimedia Conferencing

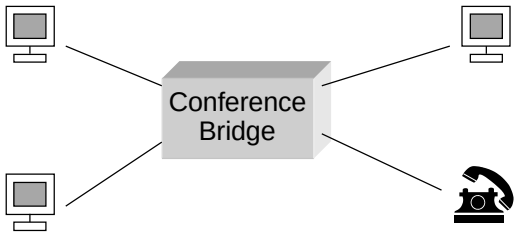
Literature:

Vineet Kumar, Markku Korpi, Senthil Sengodan: IP Telephony with H.323, Wiley 2001, Chapter 4 (“Multi-Point Conference”)

Types of Multi-Point Conferences

- Meet-Me Conference
- Ad-Hoc Conference
- Interactive-Broadcast Conference

Meet-Me Conference



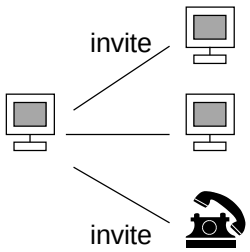
- Conference is pre-arranged
  - Time and address of bridge are known to participants
- Participants call the bridge to enter the conference
  - Bridge may also call out to participants
- Central conference bridge is a resource owned by a network or service provider
  - Mixes and distributes audio and video signals

Multi-Point Control Unit (MCU)

- Traditional name for conference bridges in telephone/ISDN networks
- Mixes the voice signals coming from participants
  - One consistent joint signal distributed to all partners
  - Partner may be silenced until sound level exceeds some threshold
- Determines the video signal to be sent to the participants (in case of audio/video conference)
  - Often, video source of participant with highest voice energy is chosen

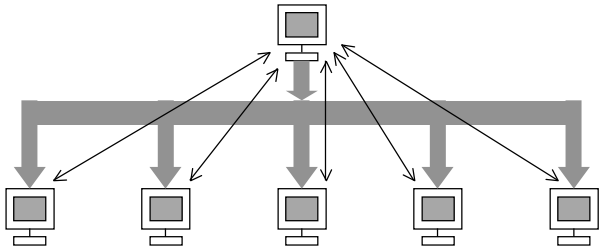
Ad-Hoc Conference

- Conference starts as a point-to-point conversation
- Grows to a multi-point conference when participants *invite* other people by calling their terminals
- Conference is usually not pre-arranged
- Example: Three-way call in ISDN/private telephone exchanges
  - A talks to B
  - A puts B *on hold*
  - A calls C
  - A joins B and C into a three-way call
- User originating the conference call must be able to provide the necessary bridge functionality
  - Bridge outside the public network, e.g. in a private network
  - Capacity limited (e.g. in number of participants)



Interactive-Broadcast Conference

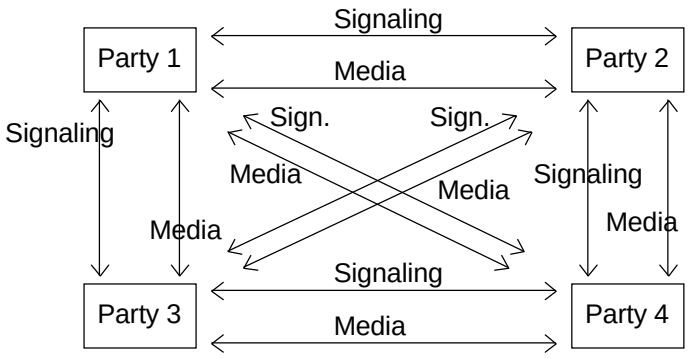
- Asymmetric conference
  - Master distributes media and signalling to many terminals
  - Terminals have a much simpler back channel to the master (e.g. just signalling or a plain text stream)
- Scales to thousands of terminals
- Typical applications: tele-teaching, business TV



Network Configurations for Multipoint Cfcs

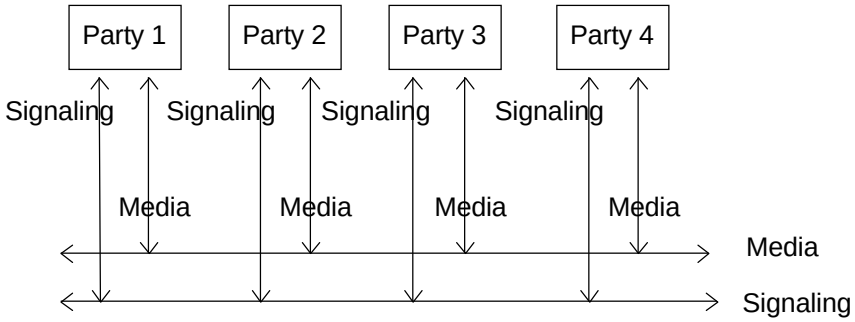
- Multi-Unicast
- Multicast
- Master-Slave

Multi-Unicast Network Configuration



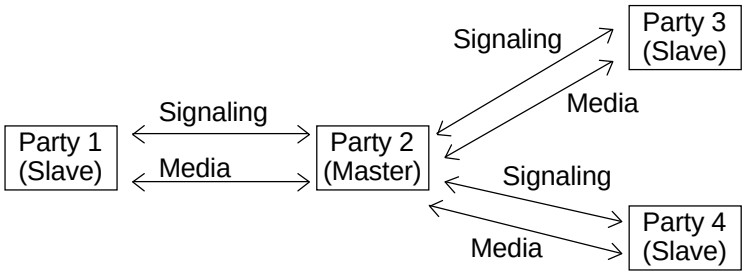
- Difficult to implement, no single point of failure, high bandwidth usage
- Suitable for ad-hoc conferences with low participant numbers

Multicast Network Configuration



- Uses multicast addresses
- Difficult to implement, no single point of failure, bandwidth-efficient
- Suitable for interactive broadcasts with high number of participants

Master-Slave Network Configuration



- Easy to implement, single point of failure, medium bandwidth-efficiency
- Suitable for meet-me and ad-hoc conferences of medium size
- *Note:* Hybrid forms may use different configurations for signaling and media!
  - H.323: Master-Slave signaling, master-slave or multicast media distribution

11 Multimedia Conferencing

Literature:

James R. Wilcox: Videoconferencing, the whole picture, 3rd ed, CMP Media 2000

H.32X Family

- H.323: ITU-T standard “Visual Telephone Terminals over Non-Guaranteed QoS Service LANs”
- Components:
  - Terminals: PCs, workstations, videophones (must support voice-data)
  - Gatekeeper: Access control, address administration
  - Gateway: E.g. interoperability between IP networks and ISDN
  - Multipoint controller: To support multi-point conferences
- H.324: ITU-T standard “Terminal for Low Bit-Rate Multimedia Communication”
  - Point-to-point audio and video over telephone lines
  - Comprises H.263 video compression

Audiographic Conferencing

- Document or data conferencing: collaboration on documents
- ITU-T standard T.120 (“Transmission Protocols for Multimedia Data”), 1996
  - Point-to-point and multi-point document conferencing
  - Main applications: shared whiteboard, multi-point file access
  - Additional applications: online chat, multi-party games, VR simulation
- Main features:
  - High resolution graphics transfer
  - Pointing
  - Annotation
- Also suitable with audio bridges

Conclusions…

- Advanced conferencing:
  - Virtual Collaborative Spaces
  - 2D or 3D, participants may be represented by *avatars*
  - Embedded into physical environment (Augmented Reality, Instrumented Rooms)
- Innovation Processes:
  - Uptake of applications into social life takes much longer time than pure technological innovation
  - Innovators often fail when introducing new technology & applications
  - Many small steps, sometimes new combinations of technologies, finally introduce the new ideas
    - » Example video telephony
- “When we stop talking about the technology, that’s when it will be here.” Norman Gaut