Part IV

Conversational Multimedia Services
12 Multimedia Conferencing

12.1 Multimedia Conferencing: Service Definition and Equipment

12.2 Application Examples

12.3 Typology of Multi-Point Conferences

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

• Multimedia conferencing:
  – *Synchronous* exchange of *digitized* multimedia information between conference participants at *two or more* separate sites
  – Transferred images:
    » Pictures of the participants (still or live)
    » Video clips, still pictures and other accompanying material
    » Screen or window content
  – Transferred sound:
    » Discussions between meeting participants
    » Sound from accompanying material
• Group-system conferencing:
  Joins two groups of people meeting in physically separate rooms
• Personal conferencing:
  Joins individual users (desktops, phones)
• Two sites *(point-to-point)* or more *(multi-point)*
An Old Dream: Video Telephony

"Telephonoscope"
imaginary invention by Edison

George du Maurier
Punch
Dec 9th, 1878
An Old Dream: Video Conferencing in Movies

Metropolis, 1927

Star Trek, 1970s

2001: A Space Odyssey, 1968
Fritz Lang: Metropolis (1927)
Stanley Kubrick: 2001 – A Space Odyssey (1968)
Videophone Prototype 1955

Kay Labs, San Diego + Pacific T&T (Bell System)
History of Videoconferencing

• Bell Labs, 1920s: First videoconference between Washington and New York
• Bell Labs, 1964: Picturephone.
  – Other pioneers of the 1970s: NEC, British Telecom
• 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 2001: 500 – 2000 € plus PC
• Cost now: Very low (often built in)

• Pure software solutions:
  – Basic point-to-point:
    e.g. Ekiga, Apple FaceTime, Microsoft Skype
  – Sophisticated solutions with server/cloud support:
    e.g. Microsoft Lync Server (Skype for Business), 8x8.com

Pictures: VCON, Apple, LifeSize
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: LifeSize (Team 220)
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: 10.000 – 20.000 €

Pictures: LifeSize, Tandberg
System Type V: Room Systems

- Room custom-equipped for conferencing requirements
- Possibly many cameras and monitors
- Furniture integrated with conferencing equipment (cameras, monitors)
- High-quality sound system
- Cost: 30,000 – 1,000,000 €

www.omalleygc.com

HP Halo System
(www.telepresenceoptions.com)
Video Conference Room Design

Room 1 (Seattle)  Virtual Window  Room 2 (Chicago)

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

Source: Rhodes p. 79
System Type VI: Telepresence Systems

• Telepresence device
  – containing screen, camera, phone, speaker
  – Column-like form, screen/camera on eye height
• Remotely controlled robot wheels for free movement and spontaneous interaction
• Example: “beam” telepresence robot, cost 2014 ca. USD 16,000

www.suitabletech.com
Shoulder-Mounted Telepresence Avatars

"TEROOS"
Keio University, Japan
Interaction 2011
Source: diginfo.tv

"Polly"
FXPAL Labs, USA, 2014
Sven Kratz, Patrick Proppe
Source: fxpal.com
System Type VII: Handheld Systems

- Videoconferencing clients running on mobile devices
  - Smartphones
  - Tablets
  - E.g. Apps for iOS or Android
- Examples: Apple FaceTime, LifeSize UVC ClearSea client
- Cost: Very low cost + subscription (in some cases)
Document Camera

• Typical accessory of videoconference rooms

Source: Epson

Source: Qomohitevision/Wikimedia
Echo and Feedback

- Hands-free conference:
  - Feedback of own and foreign sound signals through loudspeaker into microphone
  - Various sources for delays
- Solutions: Cancellation in software, special microphones, headsets

Picture: Uni Erlangen
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Application: Xerox PARC

Media Spaces

• Xerox PARC, mid 1980-s
  – Link between Palo Alto/California and Portland/Oregon
  – “Always-on” audio/video links between offices and meeting rooms
  – Later (1990s): “Porthole” project linking PARC and EuroPARC

• 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
  – Time shifts

Pictures: Steve Harrison (people.cs.vt.edu/~srh/), billbuxton.com
Application: Preventing Nuclear Destruction

• Year 2000 rollover: Avoid control problems of nuclear power stations
  – Emergency Center of the U.S. Department of Energy (Washington)
  – Situation and Crisis Center of MinAtom (Moscow)
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
  - Specialist support during critical operations

- Visiting nurses video-consulting with patients
  - Allows reduction of physical visits

- Additional data:
  - Pictures: X-ray, tomography, …
  - Lab results
  - Current vital data
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Meet-Me Conference

• Conference is pre-arranged
  – Time and address of bridge are known to participants
• Participants enter the conference
  – Active call (authorization), or called by bridge
• Central conference bridge owned by a network or service provider
• Examples: Telephone conference, Cisco WebEx meetings, Microsoft Skype for Business
Ad-Hoc Conference

- Conference starts as a point-to-point conversation
- Participants *invite* other people by calling their terminals
- Conference is usually not pre-arranged
- Example: Three-way call in telephone exchanges
  - A talks to B
  - A puts B *on hold*
  - A calls C
  - A joins B and C into a three-way call
- Originating user must be able to provide bridge functionality
  - Bridge outside the public network, e.g. in a private network
  - Capacity limited (e.g. in number of participants)
- Example: Skype group calls
  - Up to 25 participants
Interactive-Broadcast Conference

• Asymmetric conference
  – Master distributes media and signaling to many terminals
  – Terminals have a much simpler back channel to the master (e.g. just signaling or a plain text stream)
• Scales to thousands of terminals
• Typical applications: tele-teaching, business TV
Full Mesh Network Configuration (P2P)

- Difficult to implement, no single point of failure, high bandwidth usage
- Suitable for ad-hoc conferences with low participant numbers
- Bad scalability
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
Star Network Configuration, Master-Slave Style

- 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
Star Network Configuration with MCU

- 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