Multimedia im Netz
Online Multimedia

Wintersemester 2014/2015

Part IV

Conversational Multimedia Services

Outline (New)

* = Nicht für Nebenfach !

1. Introduction and Motivation

Part I: Web Technologies for Interactive MM

2. Interactive Web Applications
3. Web Paradigms and Interactivity *
4. Web Programming with Java *
5. Communities, the Web, and Multimedia

Part II: Content-Oriented Base Technologies

6. Digital Rights: Definition and Management
7. Cryptographic Techniques
8. Multimedia Content Description

Part III: Multimedia Distribution Services

9. Electronic Books and Magazines
10. Multimedia Content Management and Distribution
11. Web Radio, Web TV and IPTV

Part IV: Conversational Multimedia Services

12. Multimedia Conferencing
13. Signaling Protocols for Multimedia Communication *

14. Visions and Outlook

12 Multimedia Conferencing

Literature:

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

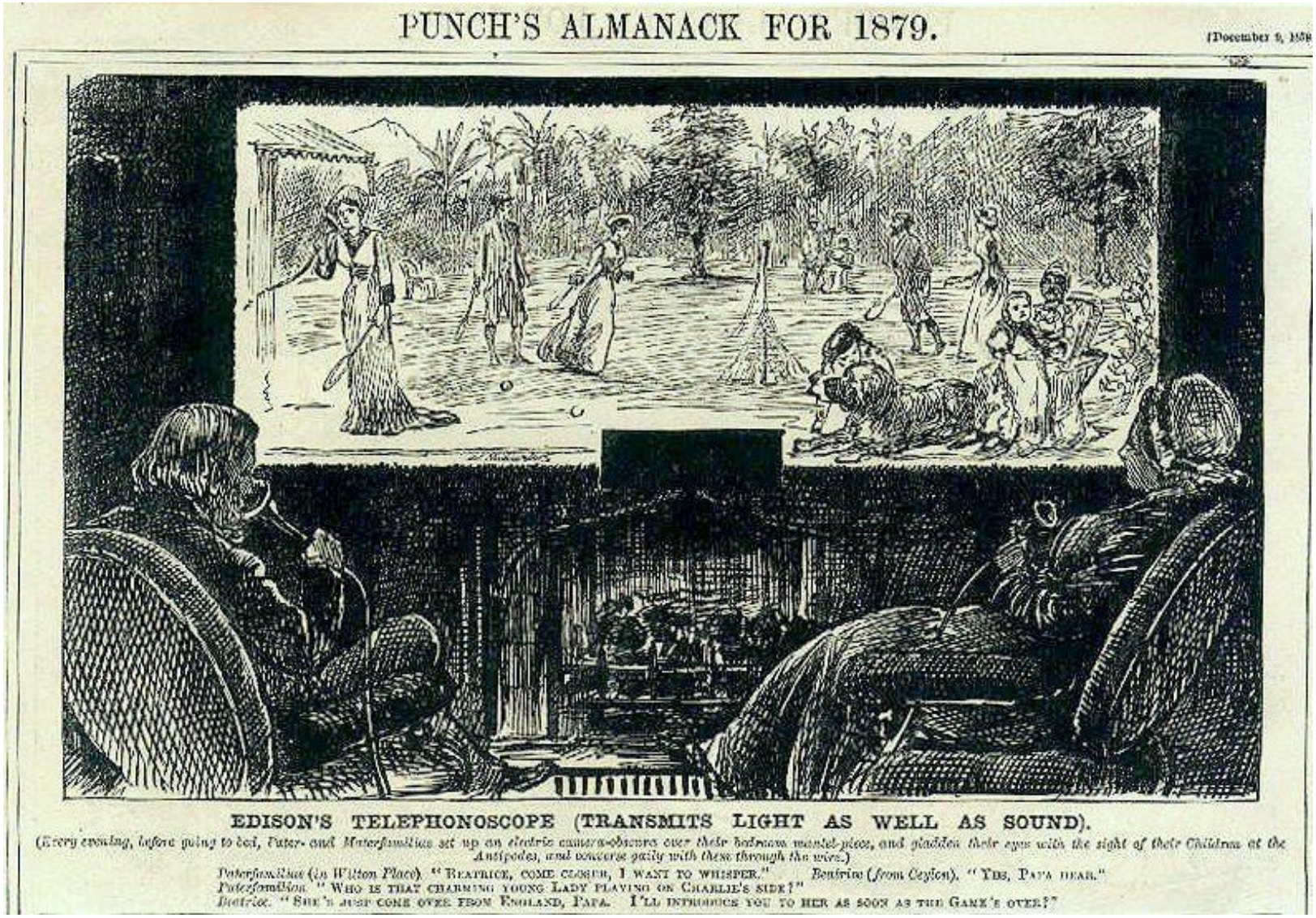
John Rhodes: Videoconferencing for the Real World,
Focal Press 2001

Scott Firestone et al.: Voice and Video Conferencing Fundamentals,
Cisco Press 2007

Videoconferencing: Definition

- Multimedia conferencing:
  - *Synchronous* exchange of *digitized* multimedia information between conference participants at *two or more* separate sites
  - Transferred images:
    - » Pictures of the participants
    - » Video clips, still pictures and other accompanying material
    - » Screen or window content
  - Transferred sound:
    - » Discussions between meeting participants
    - » Sound from accompanying material
- 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)*

An Old Dream: Video Telephony


PUNCH'S ALMANACK FOR 1879.

EDISON'S TELEPHONOSCOPE (TRANSMITS LIGHT AS WELL AS SOUND).

(Every evening, before going to bed, Pater- and Materfamilias set up an electric camera-obscura over their bedroom mantel-piece, and gladden their eyes with the sight of their Children at the Antipodes, and converse gaily with these through the wire.)

Paterfamilias (in Wilton Place). "BEATRICE, COME CLOSER, I WANT TO WHISPER." *Beatrice (from Ceylon).* "YES, PAPA DEAR."
Paterfamilias. "WHO IS THAT CHARMING YOUNG LADY PLAYING ON CHARLIE'S SIDE?"
Beatrice. "SHE'S JUST COME OVER FROM ENGLAND, PAPA. I'LL INTRODUCE YOU TO HER AS SOON AS THE GAME'S OVER?"

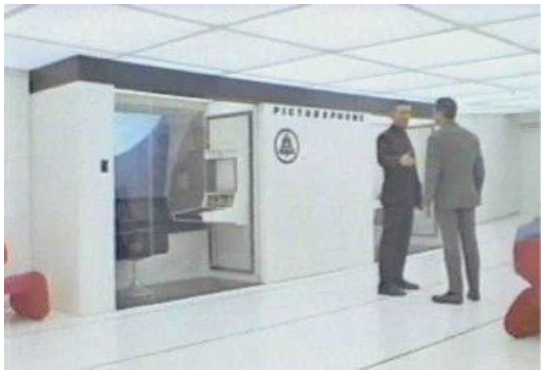
"Telephonoscope"
–
imaginary invention
by Edison

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)

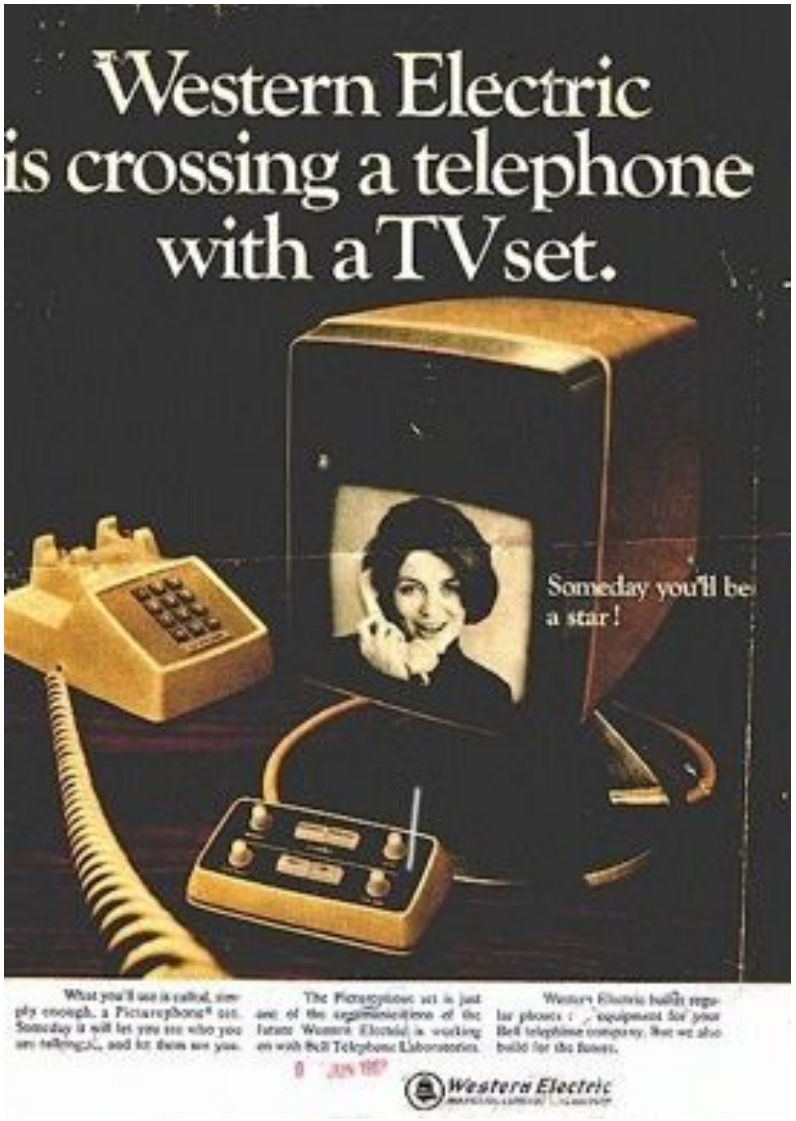
History of Videoconferencing

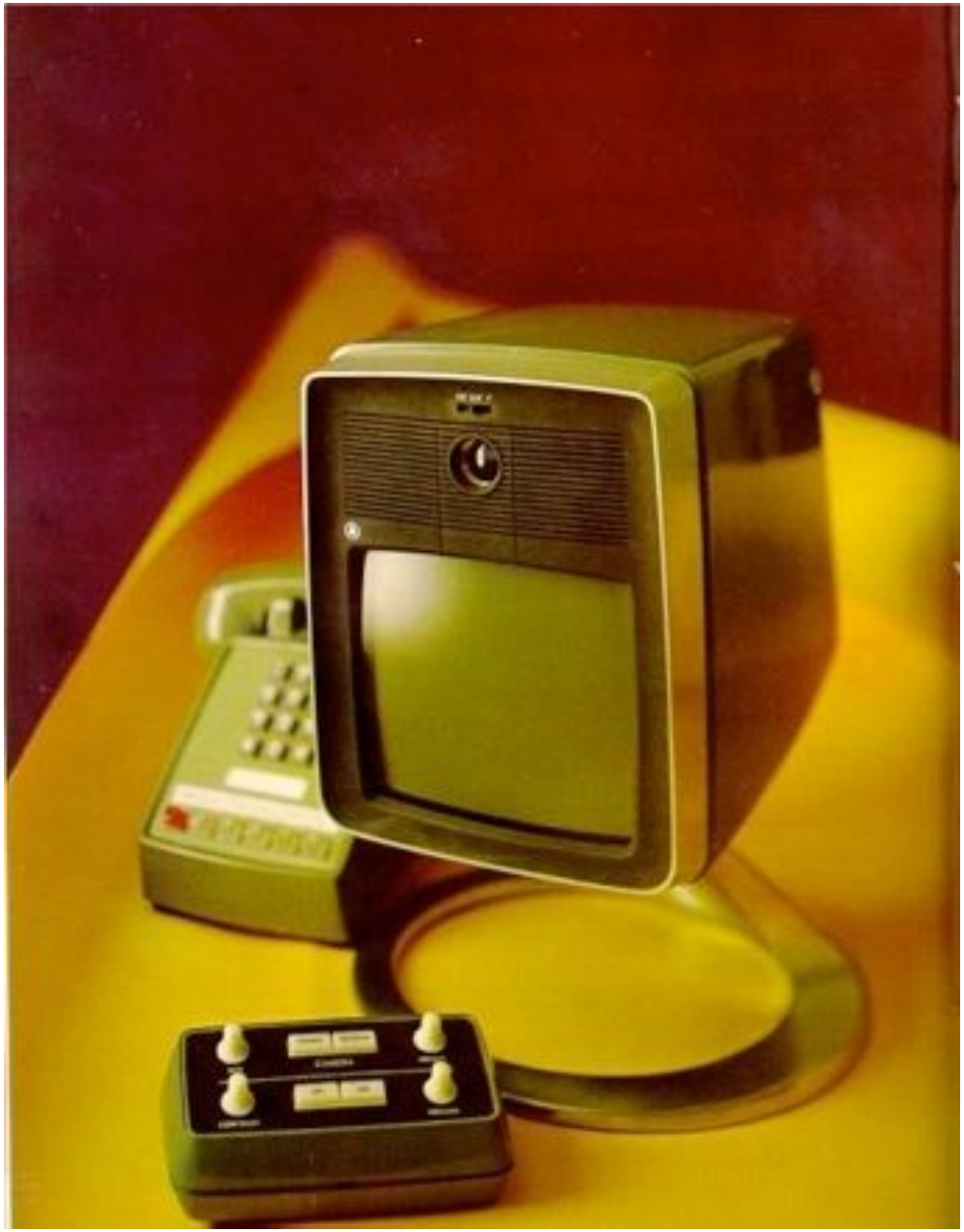
- Bell Labs, 1920s: First videoconference between Washington and New York
- Bell Labs, 1940s: Videoconference research resumed
- Bell Labs, 1964: Picturephone.
  - Other pioneers, 1970s: NEC, British Telecom (1979)
- 1983: Compression of video signal to phone line bandwidth: Widcom project (DARPA)
- 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

vintageadbrowser.com

Picturephone Mod 1 (Bell Labs, 1969)

http://www.uni-due.de/kowi/gal_picturephone.shtml





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:
  - Simple standard systems like Ekiga, Apple FaceTime, Microsoft Skype
  - Sophisticated specialized software with dedicated servers/online service (e.g. Microsoft Office LifeMeeting)

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

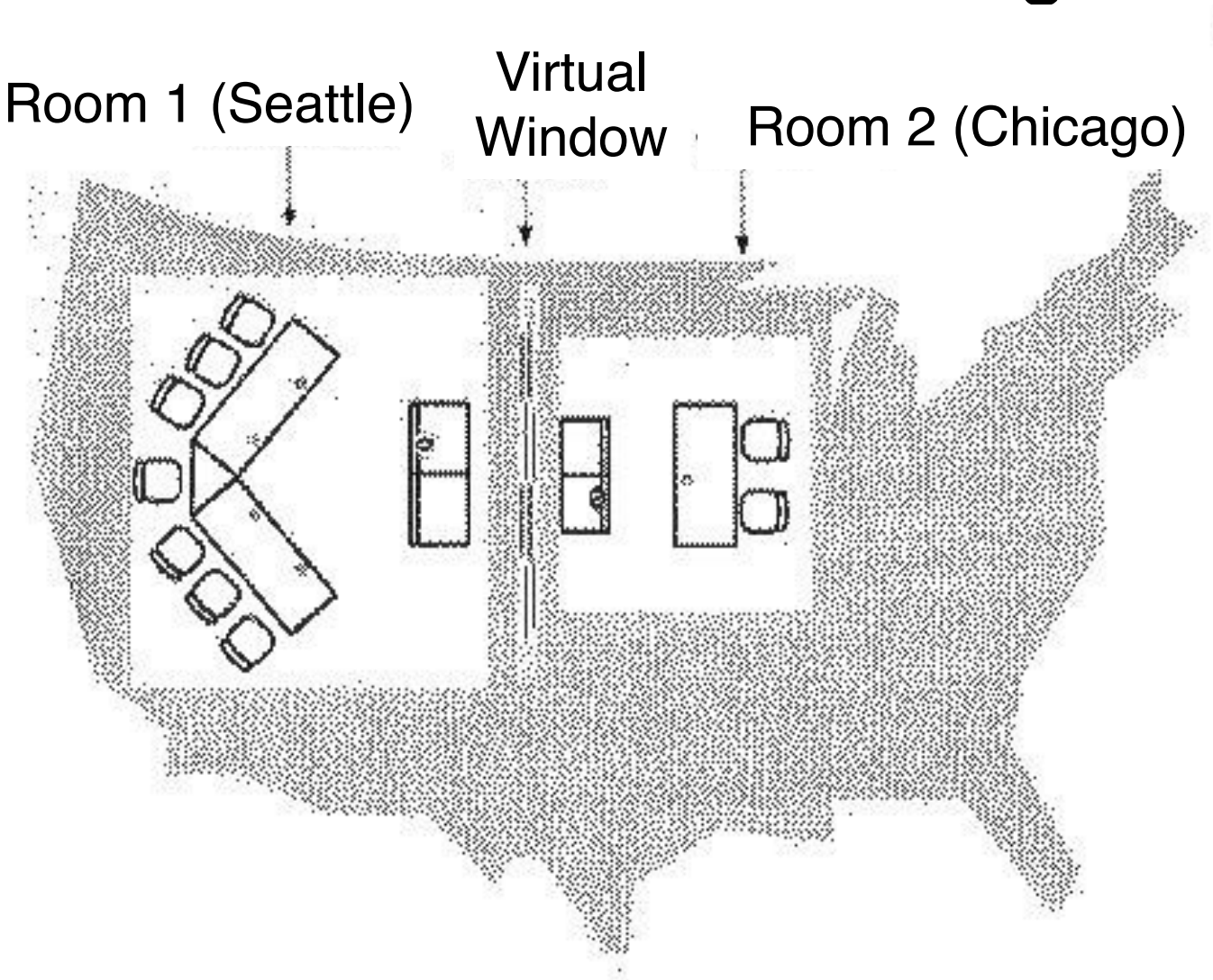


Figure 4-9 Two distant VTC rooms separated only by a virtual window.

Source:
Rhodes p. 79

System Type VI: Telepresence Systems

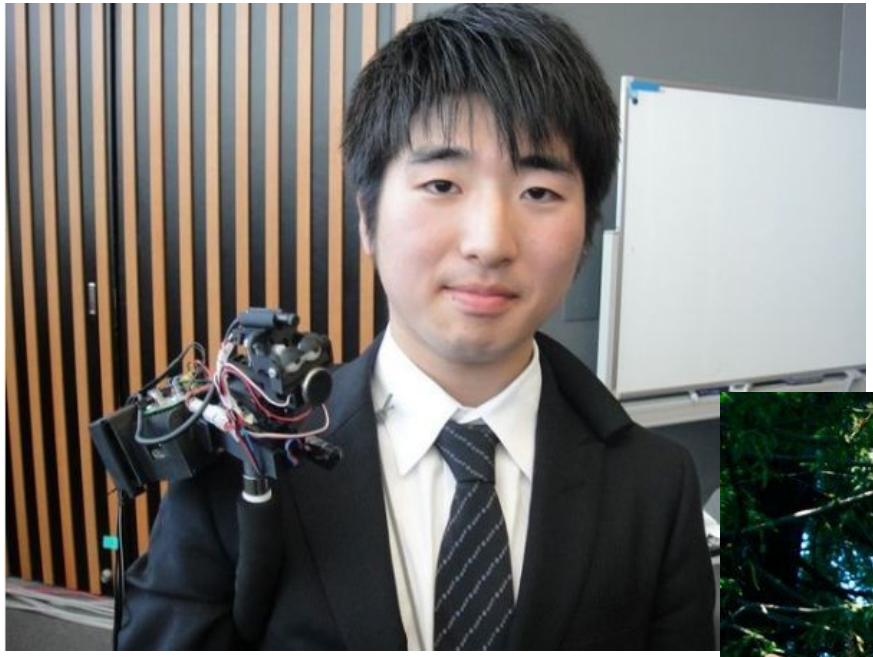
- Telepresence device
  - containing screen, camera, phone, speaker
  - Column-like form, screen/camera on eye height
- Remotely controlled robot wheels for free movem interaction
- Example: “beam” telepresence robot, cost 2014 ca. USD 16.000

www.suitabletech.com

Advertisement Video for Telepresence Robot

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)

Pictures: Apple/LifeSize

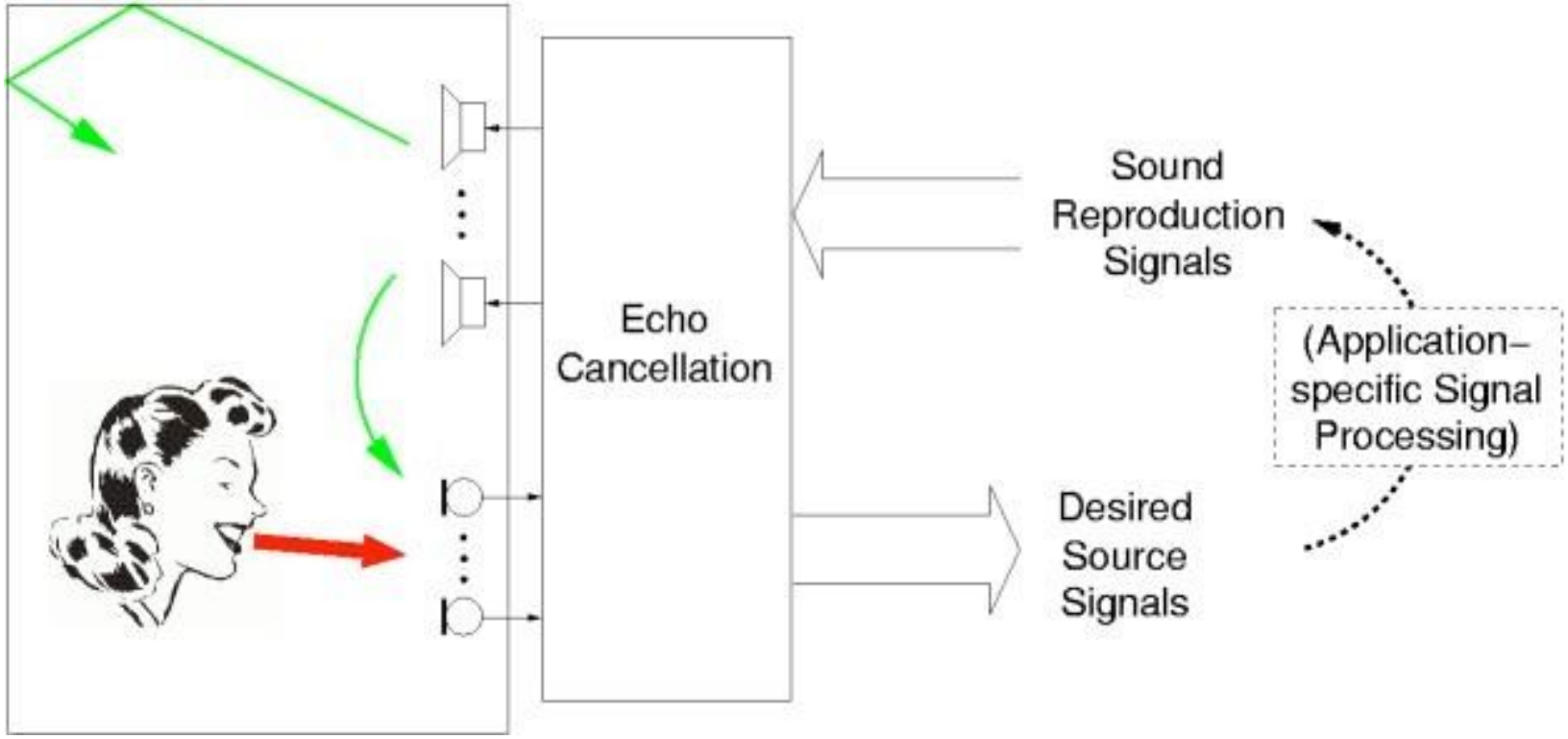
Camera Control

- 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
  - Standards exist (e.g. H.281/H.224 and H.323 V 5 Appendix Q, 2003)
- Camera presets:
  - Angles to view individual participants and other perspectives are pre-programmed before conference starts
  - 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

Echo and Feedback



Picture:
Uni Erlangen

- 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

Videoconferencing as Cloud Service

- Cloud resources:
  - Hardware (conference bridges)
  - Codecs (transcoding)
  - Directory services
- Simple clients
- No proprietary server needed
- Service paid per use

Polycom CloudAXIS

Pictures: 8x8.com, Polycom

12 Multimedia Conferencing

12.1 Multimedia Conferencing:
Service Definition and Equipment

12.2 Application Examples

12.3 Typology of Multi-Point Conferences

Literature:

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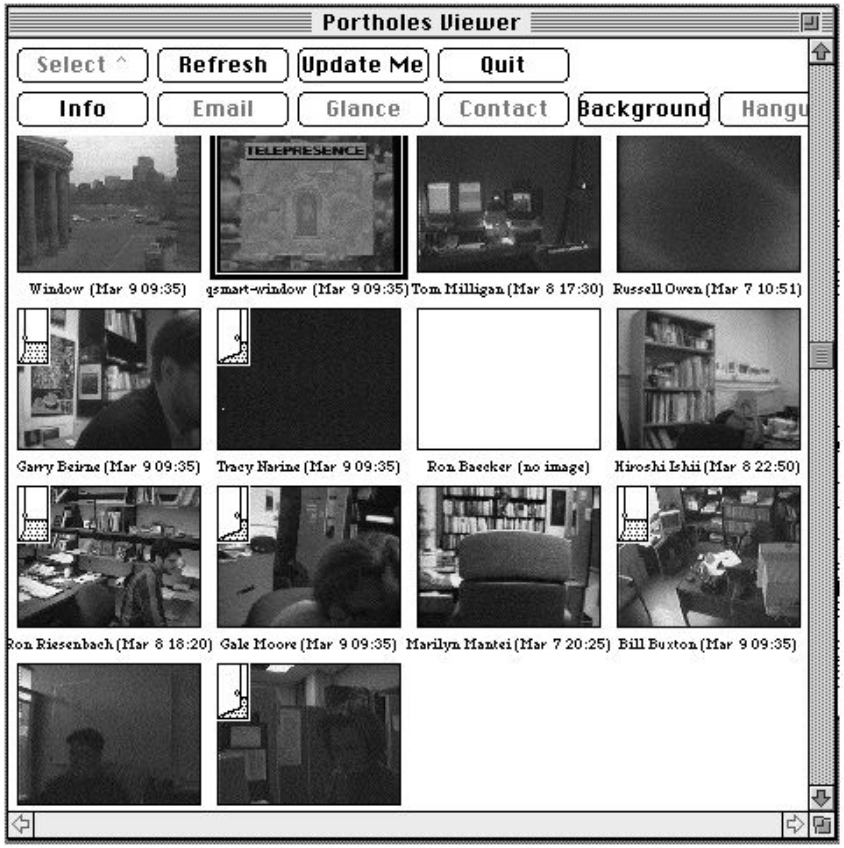
John Rhodes: Videoconferencing for the Real World,
Focal Press 2001

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

- 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

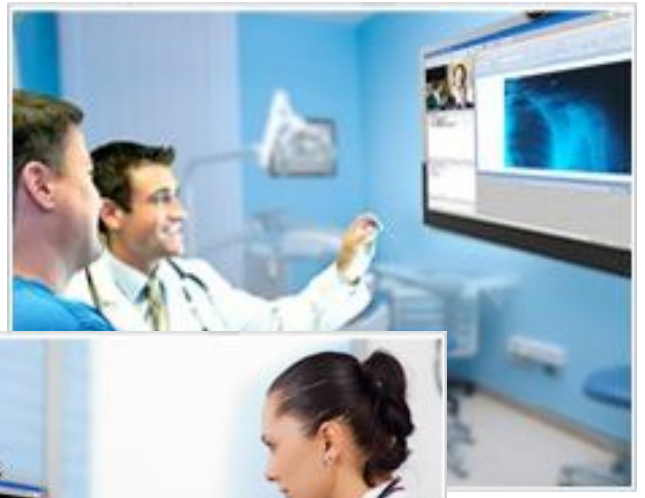
- Lectures transmitted to remote students
  - Training of staff in businesses
  - Home-learning
- Integration of remote guest speakers in meetings

www.sllboces.org

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



Pictures: Radvision

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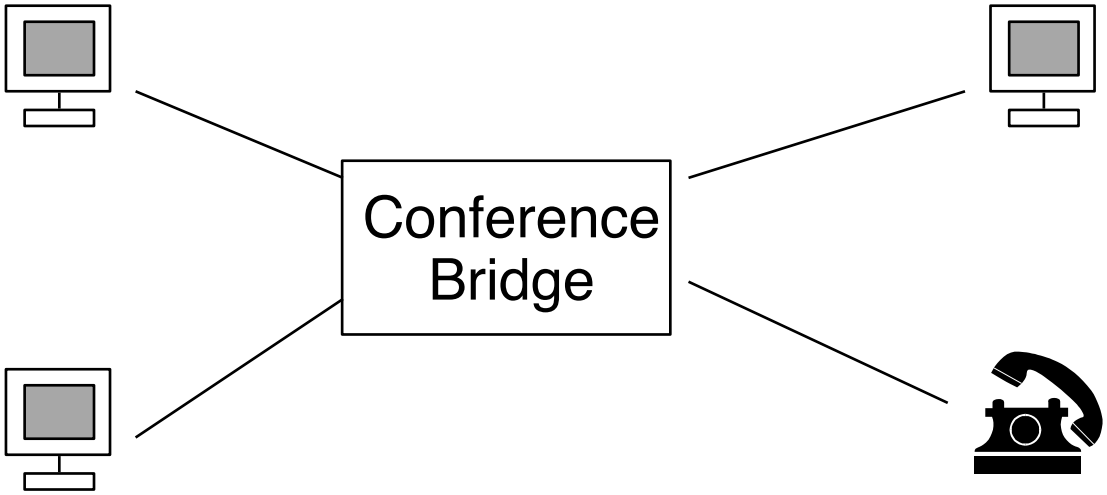
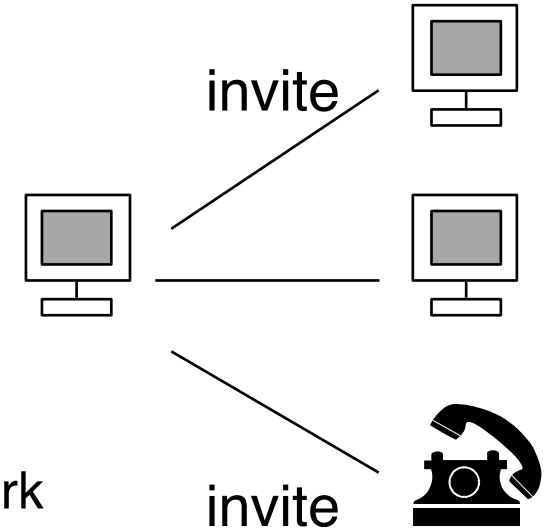
Meet-Me Conference



- 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
- Examples: Telephone conference services, Skype conference call

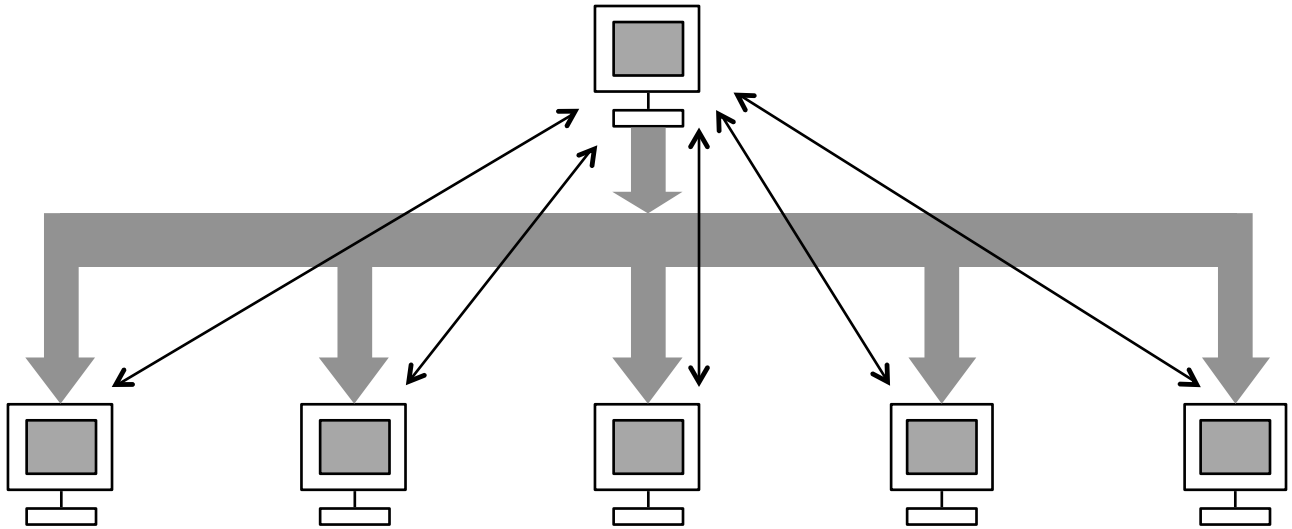
Ad-Hoc Conference

- 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 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
- 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)

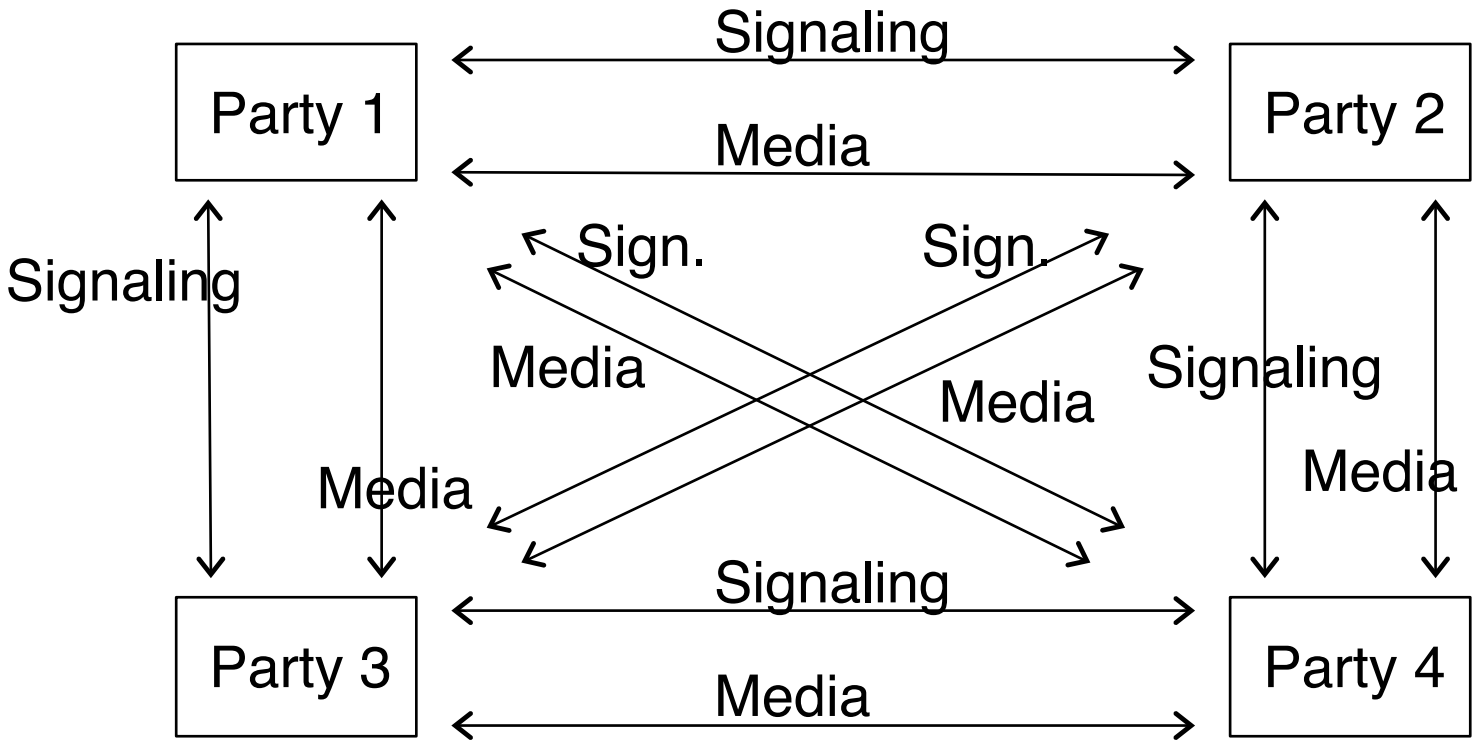


Interactive-Broadcast Conference

- 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

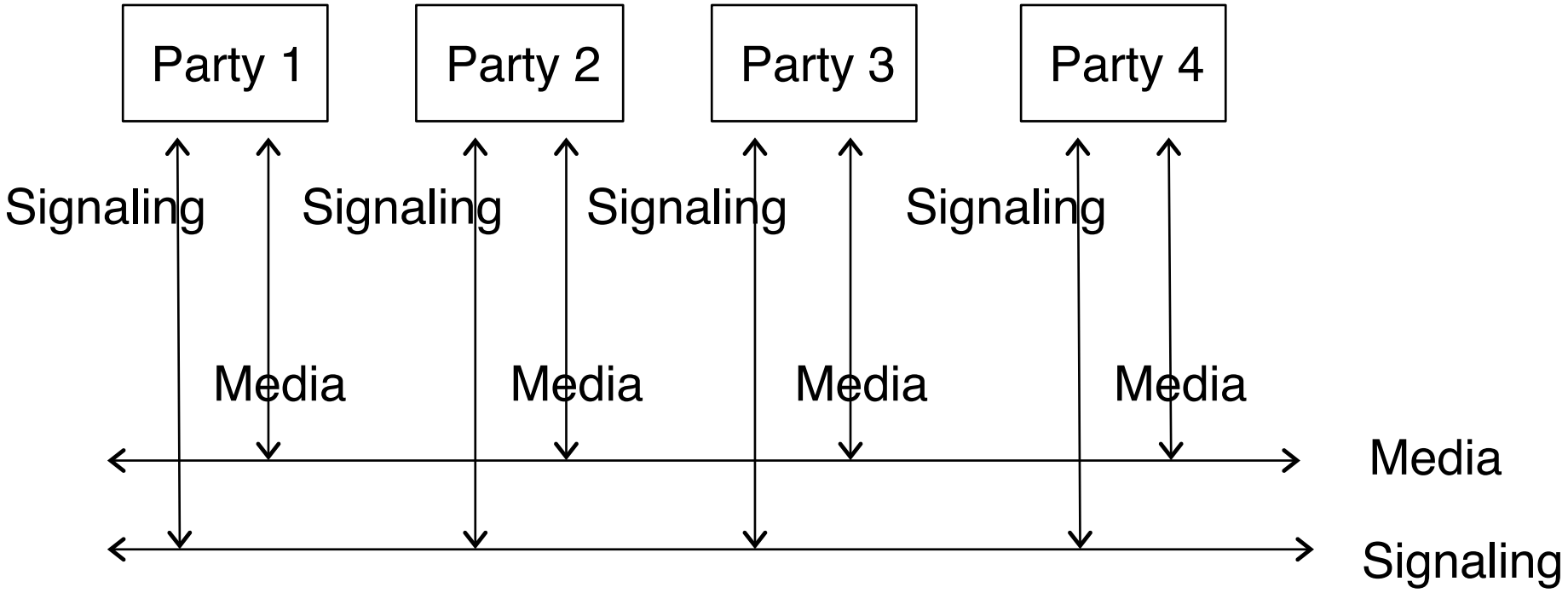


Multi-Unicast Network Configuration (P2P)



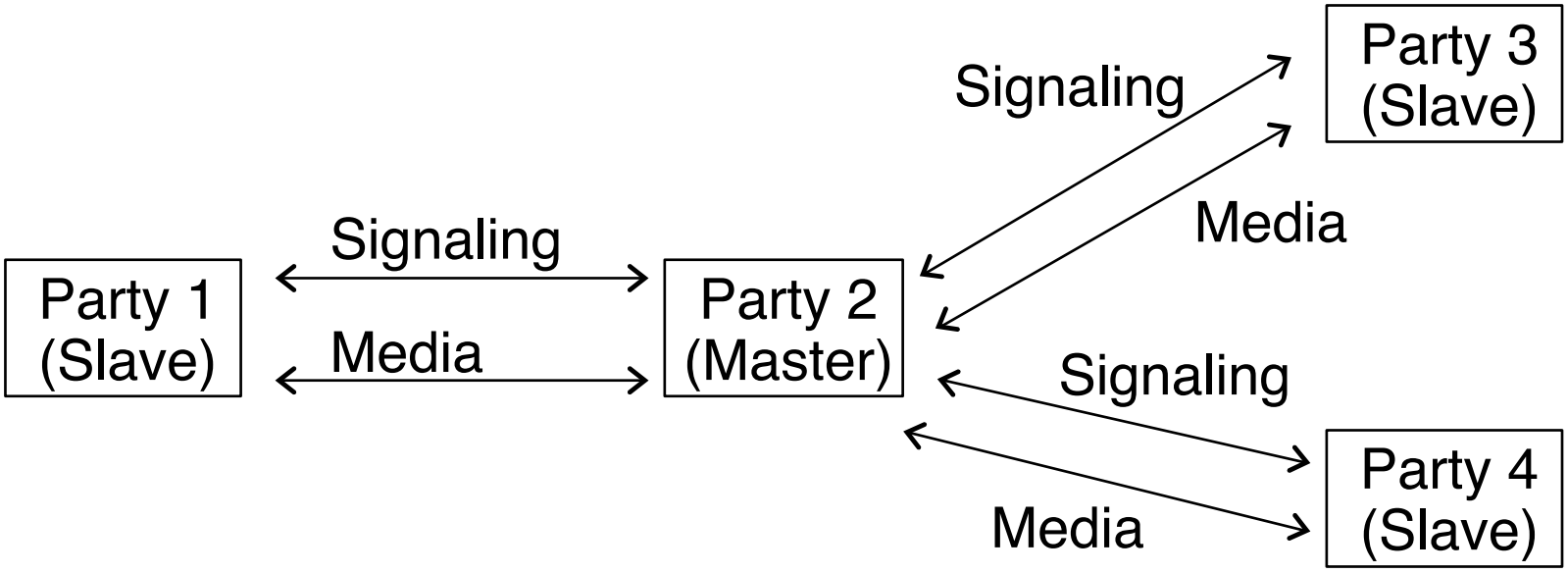
- Difficult to implement, no single point of failure, high bandwidth usage
- Suitable for ad-hoc conferences with low participant numbers
- Bad scalability

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

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