Video Conferencing

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Introduction
Videoconferencing – What Is It?

“Videoconferencing is a method of communicating between two or more locations where sound, vision and data signals are conveyed electronically to enable simultaneous interactive communication.”
Uses of Videoconferencing

Meetings: cost savings on travel, accommodation and staff time. Several sites can be linked together.

Data sharing: images from a PC, such as spreadsheets, PowerPoint illustrations etc. can be shared to enhance a presentation.

Teaching: access to remote expertise.

Remote diagnosis: in rural areas specialist medical help may not be on hand.

Trivia: German Reich Postzentralamt (Post Office) network set up in Berlin and several other cities from 1936 to 1940 is an example of one of the first videoconferencing systems. It consisted of two closed-circuit television systems connected via cable.
Hardware
Videoconferencing Components

• Cameras (to capture and send video from your local endpoint)
• Video displays (to display video received from remote endpoints)
• Microphones (to capture and send audio from your local endpoint)
• Speakers (to play audio received from remote endpoints)
In Addition, Three Additional Requirements:

- Codec - "compressor/de-compressor" - makes the audio/video data "small enough" to be practical for sending over expensive network connections. A compressor takes analog signals, compresses and digitizes them on the sending end. The decompressor converts them to video/audio at the remote location.

- The Supporting System and the Network Connection (IP protocol over internet, dial-up integrated services digital network (ISDN) over modified telephone lines).

- Suitable Location.
**Camera**

- small desktop camera (individual systems)
- Low end PC cameras are not capable of high resolution, susceptible to quality degradation due to poor lighting, psycho-visual effects, low refresh rate— all resulting in poor video signal transmitted over the network.
- Cheap cameras also have limited field of view—undesirable for large conferences and applications such as medical diagnostics
- High-quality camera that has remote control pan, tilt and zoom (PTZ) features in a room-sized system.  
  - Higher resolution and refresh rate
  - Better quality video
  - Calibration to fit environment
Audio

The human ear is able to modulate and extract salient information from audio data automatically. However, mics do not. Result, noisy communication and echo

Echo cancellation

- A fundamental feature of professional VC systems:
  - acoustic echo cancellation (AEC)

Echo - can be defined as the reflected source wave interference with new wave created by source.

AEC = algorithm which is able to detect when sounds or utterances reenter the audio input of the videoconferencing codec—identifies the frequency of noise signal (echoed signal with time delay) and subtracts it from audio signal
• Effects of No AEC
  - the remote party hearing their own voice coming back at them (usually significantly delayed)
  - strong reverberation, rendering the voice channel useless as it becomes hard to understand
  - howling created by feedback.

Echo cancellation is a processor-intensive task that usually works over a narrow range of sound delays.

(anyone tried using skype with speakers at full blast??)
Video Display

- TV, Display monitor
- LCD, Projector, Multiple projectors
- Touch screen interaction
- Video display needs to be of adequate resolution and needs to meet the need of the conferencing modality
Network
### IP vs. ISDN

<table>
<thead>
<tr>
<th>Traditional (ISDN H. 320)</th>
<th>Internet (IP H.323)</th>
</tr>
</thead>
<tbody>
<tr>
<td>User in special room; rare</td>
<td>Use anywhere; ubiquitous</td>
</tr>
<tr>
<td>Use ISDN telephone lines</td>
<td>Use internet</td>
</tr>
<tr>
<td>High maintenance cost</td>
<td>Low maintenance cost</td>
</tr>
<tr>
<td>High usage cost</td>
<td>No usage cost</td>
</tr>
<tr>
<td>Usage at plateau</td>
<td>Rapidly growing usage</td>
</tr>
<tr>
<td>Scheduled in advance</td>
<td>impromptu</td>
</tr>
<tr>
<td>Professional operator</td>
<td>Do-it yourself</td>
</tr>
<tr>
<td>Centralized control</td>
<td>Decentralized control</td>
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<tr>
<td>H.320 standard</td>
<td>H.323 standard</td>
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</table>
IP vs ISDN: Performance

**IP**
- Results can be variable due to VC data competing with other computing data
- Less expensive than ISDN

**ISDN**
- Guarantees connections at the selected quality
- More reliable
- Call charges are levied, therefore more expensive than IP
Codecs
Codecs

• **Important:** without it, the data size would remain large and would take a long time in transfer over network

• Hundreds available, which can make choosing the appropriate equipment difficult.

• Vary according to encoding techniques, supported bit rates, audio frequency spectrum, image resolution and frame rate.
Main challenge is interoperability: bottom line:
  - end users need to be running the same codecs
Video codecs H.261, H.263 and H.264 or MPEG-4 and the voice codecs G.711, G.729, G.723.1, G.726, G.722 and G.728
VC session requires connection initiation via same SIP (session initiation protocol), compatible voice codec, video codec
Videoconferencing Systems
Types of VC

Two kinds of VC systems:

• Dedicated -
  
  - encapsulates all required components into a piece of equipment (typically console with high quality RC video camera; controls pan, tilt and zoom (PTZ))
  
  - also contains all electrical interfaces (control computer, SW/HW codec, omnidirectional mics Monitor, speakers, and/or video projector all built in
Dedicated VC

Such devices vary in scale:

- Large: non-portable, expensive; used in large rooms and auditoriums
- Small: portable/non-portable; less expensive for smaller rooms
- Individual: portable; cameras, mic and speaker integrated into console
Desktop VC

Desktop

- Typically are add-ons to normal PCs to transform them into video conferencing devices. Most work with the H.323 standard. Conferences on such Setups known as “e-meetings”

- Could be as simple as Skype-like applications to desktops PCs with multiple cameras and noise cancellation mics incorporated

Most of these are two way connection; multi point connections are also available
Show Me The Money: Everything boils down to money.

- **Medium / Large Room Systems**
  - ViewStation FX - $8,000 –$10,000

- **Small Room Systems**
  - ViewStation H.323 - $4,000 - $6,000

- **Desktop Systems**
  - ViaVideo - $400

- **Web chat** – potentially free
Types of VC Communication
Point-to-point Conferences

- Point-to-point – A video-conference that connects two locations.
- Each site sees and hears the other sites at all times
Multi-point videoconferencing

Simultaneous videoconferencing among three or more remote points is possible by means of a Multi-point Control Unit (MCU).

**What is MCU?:**

It is a bridge that interconnects calls from several sources (in a similar way to the audio conference call).

There are MCU bridges for IP and ISDN-based videoconferencing.

**How does it work?**

All parties call the MCU unit, or the MCU unit can also call the parties which are going to participate, in sequence.
Characterizing MUC:

- There are MCUs which are pure software, and others which are a combination of hardware and software.
- Defined by number of simultaneous calls it can handle.
- Defined by its ability to conduct transposing of data rates and protocols.
- Characterized by features such as Continuous Presence, in which multiple parties can be seen onscreen at once.
Multipoint Conferences

- Multi-point conferencing can be effective although the scheduling, technical, and logistical dimensions of MCU conferences can be imposing.
Standards
H.323 – It’s Not a Disease

- Standard for interoperability in audio, video and data transmissions as well as Internet phone and voice-over-IP (VoIP)
- defines the protocols to provide audio-visual communication sessions on any packet network
- Enables videoconferencing without usage fees
- Requires special equipment
- But does not have QOS (quality of service)
Limitations of Videoconferencing

• If the “pipe” that carries the transmission among sites is not large enough, the one may observe “ghost images” when rapid movement occurs in “real time”

• If the system is not properly configured an audio “echo” effect may result.
Limitations of Videoconferencing

- The absence of QOS (Quality of Service) provides virtually no guarantee of a satisfying and successful experience.
- Though the technology is improving, a successful videoconference is dependent upon the connections and technologies at all of the participating sites, AND the network infrastructure.
- Security issues.
Videoconferencing Is Passé

Terminology

- Traditional videoconferencing was about audio-video communications to facilitate meetings without the burden of travel.
- *Visual collaboration* is much more; it is the combination of audio and video and data in both real-time and store-and-forward applications.
- It’s not just about meetings anymore.
Further Reading

http://c21video.com/standards.html
http://ezinearticles.com/?H323---The-Messenger-of-Video-Conferencing&id=4662999