What is Videoconferencing?

Interactive point-to-point or multipoint communications involving audio, video and data collaboration
### Other Video Technologies

- **Broadcast**
  - One way
  - Scheduled
  - May be “live”
  - Many viewers

- **Video on Demand**
  - One way
  - On request
  - User-controlled
  - One viewer

### Videoconferencing Applications

<table>
<thead>
<tr>
<th>Application/Vertical Markets</th>
<th>Financial Services</th>
<th>Healthcare</th>
<th>Retail Services</th>
<th>Manufacturing</th>
<th>Education</th>
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Agenda

- Overview
- Videoconferencing Standards
- H.323 Architecture and Devices
- H.323 Videoconferencing in Operation
- Considerations for Deployment

Video Conferencing Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Interface</th>
<th>Technology</th>
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<tr>
<td>H.320</td>
<td>ISDN</td>
<td>Circuit</td>
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<tr>
<td>H.321</td>
<td>ATM</td>
<td>Circuit</td>
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<td>H.322</td>
<td>IsoEthernet</td>
<td>TDM</td>
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<tr>
<td>H.323</td>
<td>Ethernet</td>
<td>Packet</td>
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<tr>
<td>H.324</td>
<td>Analog</td>
<td>Circuit</td>
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International Telecommunication Union

Telecommunication Standardization Section of the ITU – ITU-T (formerly CCITT)

Series H: Audiovisual and Multimedia Systems
Video Conferencing Standards

Control
- H.225.0 - Call Control
- H.245 - System Control
- H.225.0 - Multiplexing

Media
- G.711, G.722, G.723.1, G.728 - Audio
- H.261, H.263 - Video
- T.120 - Data

H.323
- Q.931
- H.242
- H.221

H.320
- G.711, G.722, G.728
- H.261, H.263
- T.120

Audio Coding Standards

<table>
<thead>
<tr>
<th>Method</th>
<th>Source BW</th>
<th>Compress Ratio</th>
<th>Bandwidth Requirement</th>
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<tr>
<td>G.711</td>
<td>64 Kbps</td>
<td>None</td>
<td>64 Kbps</td>
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<td>G.722</td>
<td>224 Kbps</td>
<td>3.5–4.6 : 1</td>
<td>48–64 Kbps</td>
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<tr>
<td>G.723.1</td>
<td>64 Kbps</td>
<td>10 : 1</td>
<td>6.4 Kbps</td>
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<td>G.728</td>
<td>64 Kbps</td>
<td>4 : 1</td>
<td>16 Kbps</td>
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<td>MPEG</td>
<td>706 Kbps</td>
<td>3–11 : 1</td>
<td>64–256 Kbps</td>
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Video Compression Standards

<table>
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<tr>
<th>Coding Method</th>
<th>Compression Ratio</th>
<th>Bandwidth Requirement</th>
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<tbody>
<tr>
<td>H.261/H.263</td>
<td>20-100: 1</td>
<td>64 kbps-2 Mbps</td>
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<td></td>
<td>100:1</td>
<td>1-3 Mbps</td>
</tr>
<tr>
<td>MPEG-1</td>
<td>30–100: 1</td>
<td>4-16 Mbps</td>
</tr>
<tr>
<td>MPEG-2</td>
<td>7-27:1</td>
<td>10-26 Mbps</td>
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<tr>
<td>Motion JPEG</td>
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</table>

H.261/H.263 Video Coding

- Low bit rate compression
- Variety of picture sizes
  sub-QCIF, QCIF, CIF, QCIF, 4CIF
- Designed for constant bandwidth
- Target bandwidth of 64 kbps to 2 Mbps
Data Protocols for Multimedia Conferencing (T.120)

Session Control
Data Replication

T.120 Server

Multipoint file transfer
Multipoint communication service
Multipoint still image and annotation

Application sharing
White board
Collaboration

Agenda

• Overview
• Videoconferencing standards
• Videoconferencing elements
• How videoconferencing works
• Considerations for deployment
H.323 Architecture
Terminal

IP WAN

H.323 Group System

H.323 Desktop

H.323 Desktop

H.323 Desktop

H.323 Desktop

H.323 Desktop

H.323 Desktop

H.323 Desktop

IP Phone
H.323 Architecture

Terminal

- Provide real-time 2-way communication
- Video and data are optional
- Desktop systems
- Group/Room systems
H.323 Architecture
Gatekeeper

Gatekeeper is an optional component of H.323

**Required**
- Address translation
  - H.323 aliases or E.164 addresses to IP
- Admissions control
  - Authorizes LAN access based on call authorization, bandwidth, etc.
- Bandwidth management
  - Controls the number of terminals permitted to access a LAN

**Optional**
- Call control signaling
  - Gatekeeper completes call signaling with endpoints, or processes the call signaling itself
- Call authorization
  - Accepts or rejects calls from a terminal based on authorization
- Call management
  - Maintains a list of active calls
H.323 Architecture
Multipoint Control Unit (MCU)

IP WAN

H.323 MCU

H.323 Architecture
MCU

Audio Mixing
Video Image Control
Data Conference Control

Audio Mixer
Voice Activated
Continuous Presence

T.120
H.323 Architecture
MCU

Conference Request
Accept
Audio/Video Media Streams to Participants

Multipoint Controller
- Conference Control
  - entry/exit
  - resource location/allocation
  - call direction

Multipoint Processor
- Media Processing
  - audio mixing
  - active participant selection
  - video image generation

Multipoint Processor

H.323 Architecture
Gateway

IP WAN
Gateway
H.320 Room System
H.323/H.320 Gateway

H.320 Room System
H.320 MCU
H.320 Desktop
Analog Phone

ISDN
PSTN
H.323 Architecture Gateway

- Provides interoperability between video/audio and network standards
- Protocol conversion
  - Communications procedures
  - Transmission formats
- Audio/video format conversion
- Media transcoding (optional)
H.323 Architecture
Proxy

- Call relay agent – terminates and reinitiates (forwards) a call
- Transparent to any endpoint
- Implements QoS on behalf of endpoint
  - RSVP
  - IP Precedence
- Provides security
  - H.323 firewall
Proxy for QoS

QoS-Enabled WAN
(FR, ATM, Serial, Leased Line)

RSVP or IP Precedence

Proxy and Firewall

Public Internet

Proxy

H.323

H.323 Clients
Agenda

• Overview
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• H.323 Architecture and Devices
• H.323 Videoconferencing in Operation
• Considerations for Deployment

H.323 Videoconferencing in Operation

• Zones
• Point to Point Calls
• Multipoint Calls
• Gateway Calls
A zone is the collection of all terminals, gateways, and multipoint control units managed by one H.323 gatekeeper.

Gatekeeper zones are logical areas reflective of network topology, and provide administrative convenience.

Endpoint Registration

<table>
<thead>
<tr>
<th>Name</th>
<th>Phone Number (E.164 Address)</th>
<th>IP Address</th>
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</thead>
<tbody>
<tr>
<td>Tom</td>
<td>5111</td>
<td>182.72.38.70</td>
</tr>
<tr>
<td>Liz</td>
<td>5112</td>
<td>182.72.38.65</td>
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<tr>
<td>David</td>
<td>5113</td>
<td>182.72.39.40</td>
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<tr>
<td>Jennifer</td>
<td>5114</td>
<td>182.72.39.10</td>
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</table>
**Point to Point Calls**

- **Gatekeeper** grants permission for the call
- **Gatekeeper** translates names/numbers to IP addresses
- **Terminal** sets up the call

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**H.323 Signaling**

- **Admission Request**
- **Admission Confirm**
- **Setup**
- **Connect**
- **Capabilities Exchange**
- **Open Logical Channel**
- **Open Logical Channel Acknowledge**
- **RAS**
- **H.225 (Q.931)**
- **H.245**
- **RSVP (optional)**
- **Path**
- **Resv**
- **RTP Stream**
- **RTCP Stream**
- **Media**

- **H.323v1 (5/96)** — 7 or 8 Round Trips
- **H.323v2 (2/98)** — 2 Round Trips
Multipoint Calls

- Service Prefix determines conference type:
  - 72 = 128 kbps, 4 participants
  - 73 = 384 kbps, 4 participants
  - 74 = 768 kbps, 8 participants
- Dialing: Service Prefix + Conference ID
- Example: 73 12345

- MCU registers service prefixes with GK
- Call setup requests to GK recognize number as service request for MCU
- Calls directed to MCU
Scheduled vs. Ad-hoc Conferences

- Scheduled calls
  Identify users, locations and times in scheduling application
  Scheduling application commands MCU to start conference and dial participants
  Participants may call in if given conference ID

- Ad-hoc conferences
  Scheduled independent of MCU
  Service prefix defines MCU, minimum number of users and bandwidth
  Users determine conference ID
  Conference starts when first participant joins

Calls Through a Gateway: H.323 to H.320

- Service prefixes determine type of ISDN call:
  - 91 2 x 64 kbps
  - 92 128 kbps (bonded)
  - 93 256 kbps (bonded)
  - 94 384 kbps (bonded)

- Example:
  - 92 1 408 434-4174 (128 kbps)
  - 94 1 408 434-4174 (384 kbps)
**Calls Through a Gateway: H.323 to H.320**

- Gateway registers service prefixes with GK
- Call setup requests to GK recognize number as service request for gateway
- Calls directed to gateway
- Gateway opens connection to H.320 endpoint
- Endpoints negotiate capabilities through gateway

**Inbound Calls Through a Gateway**

- Gateway accepts ISDN call from H.320 endpoint
- Gateway determines H.323 address of call destination
- Gateway looks up IP address via GK
- Gateway initiates connection to H.323 endpoint
- Endpoints negotiate capabilities through gateway
Calls from H.320 to H.323: Gateway Call Routing Methods

- Interactive voice response
  Dial: 408-434-4100 – use keypad to enter ext.

- Direct inward dial/multiple subscriber number
  Dial: 408-434-4174 – transfers to terminal 4174

- TCS4 routing
  Dial: 408-434-4100#4174 – transfers to term. 4174

- Default extension maps to pre-defined number
  Dial: 408-434-4100 goes to “Operator”

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Considerations for Deployment

- Video and audio bandwidth
- Delay
- Network requirements for videoconferencing

Video and Audio Bandwidth

“The More the Better”

| Video          | 128 kbps – 15 FPS   |
|               | 384 kbps – 30 FPS   |
|               | Sharpness/motion recovery vs. Frame rate |
| Audio         | AM vs. FM           |
Video Data Requirements

Common Intermediate Format (CIF)
Picture

352 pixels x 288 lines
8 bits per color value \((Y, C_B, C_R)\)
30 frames/second
\(\approx 39\ Mbps\)

Video Quality

128 Kbits/Second
Video Quality

384 Kbits/Second

Video Quality

768 Kbits/Second
**Audio Codec Quality**

<table>
<thead>
<tr>
<th>Piece</th>
<th>G.728</th>
<th>G.722</th>
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<tbody>
<tr>
<td>Classical</td>
<td>🎵</td>
<td>🎵</td>
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<tr>
<td>Take Five</td>
<td>🎵</td>
<td>🎵</td>
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<td>🎵</td>
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<td>Stars &amp; Stripes</td>
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**What Does Videoconferencing Need From the Network**

- **Sufficient bandwidth**
  - Call bandwidth plus 10-20%
- **Low delay (jitter increases max. delay)**
  - Toll quality voice = 150 ms. end-to-end
  - Videoconferencing < 400 ms.
- **Low packet loss (avoid congestion)**
Summary

- Overview
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- H.323 Architecture and Devices
- H.323 Videoconferencing in Operation
- Considerations for Deployment

Related Sessions

- Designing and Deploying IP Videoconferencing (VVT-230)
- Deploying QoS for Voice and Video in IP Networks (VVT-213)
- Troubleshooting IP Videoconferencing (VVT-330)
Introduction to IP Videoconferencing Technologies

Session VVT-130

Please Complete Your Evaluation Form

Session VVT-130