Demystifying Video

C-MUG

Steve Fala, Paul Smith

May 15, 2012

Agenda

- **History**

- **Applications**

- **Technology**

History

ANALOG TO DIGITAL

Video Timeline

Film Camera
1827

Recording Sound
1877

Bell Phone
1895

Motion Pictures
1895

The Talkie
1927

CRT
1927

Technicolor
1939

Going Mobile
1948
Going Cellular
1973

AT&T Videophone?
1964

Going Digital
1975

Digital Camera
1994
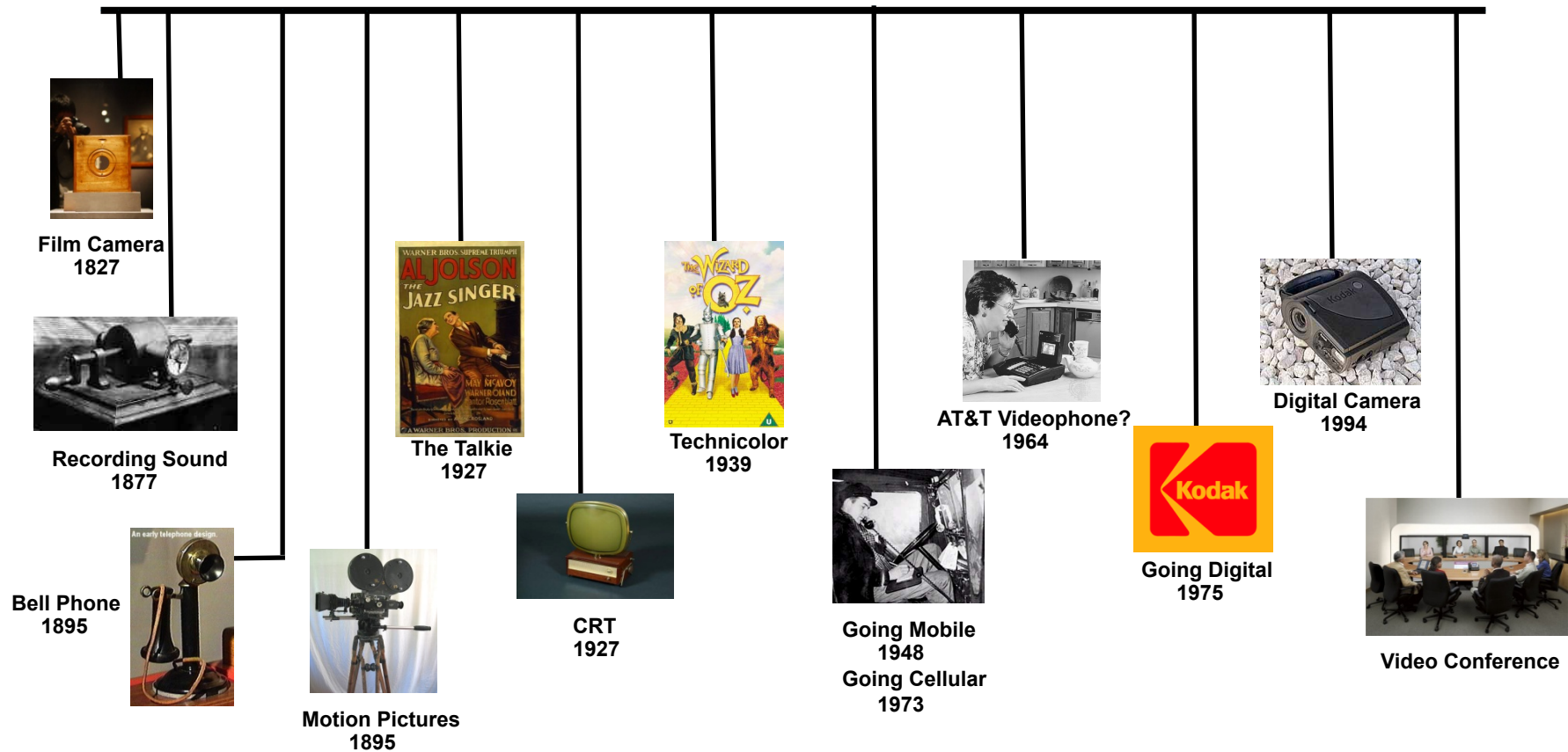
Video Conference

TRIVIA

What year was Microsoft NetMeeting introduced and on what Microsoft Operating system?
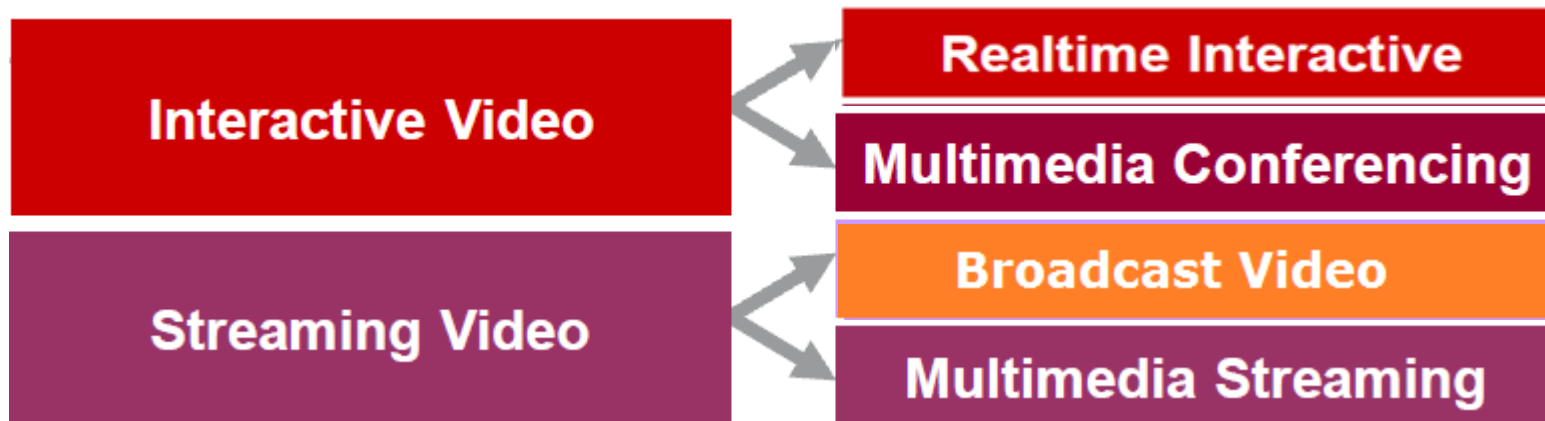
ANSWER

NetMeeting was VoIP and multi-point videoconferencing client that used the H.323 protocol for video and audio conferencing and was introduced in 1996 as part of Windows 95 – IE3

Chesapeake NETCRAFTSMEN

CISCO PARTNER
Gold Certified

Applications

VIDEO CONFERENCING AND MORE
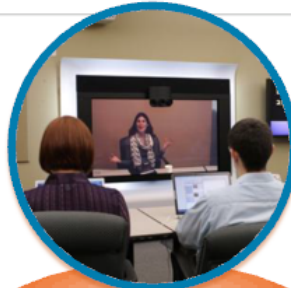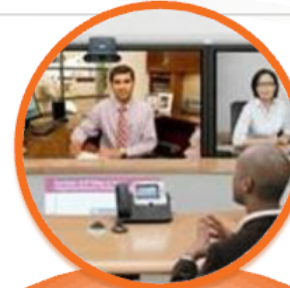
CMUG Video Focus

Video Applications

Meetings — Faster Decisions

Training / Education — Share Expertise

Broadcast Communications — Drive Change & Alignment

Safety and Security — Improve Protection

Events — Extend Reach

Customer / Patient Care — Expert-on-Demand

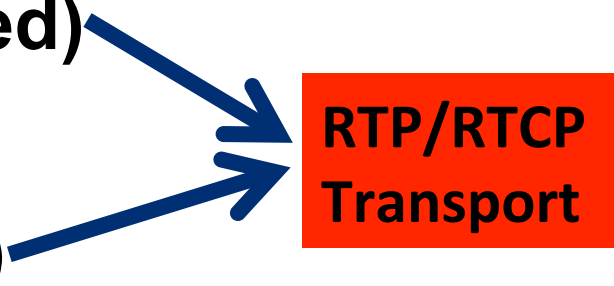**Advertising** — Personalize Ads

Technology

STANDARDS AND DEFINITIONS

Standards

- **Connecting Video (Signaling and Control)**

- **Encoding Video (Bandwidth and Resolution)**

- **Encryption**

- **NAT/Security**

- **Collaboration**

Connecting Video

- ## H.320 (Circuit Switched)
  - Nx64Kbps (Typically ISDN)

- ## H.323 (Packet Switched)
  - IP based networks

- ## SIP (Packet Switched)
  - IP based networks

- ## Skype (Proprietary)
  - Licensed Based : IP based networks

RTP/RTCP Transport

Standards

- ## H.323 (ITU – 1996)

  - Multiple standards (H.245, H.225, etc.)

  - Video Support built-in

  - Multipoint Control Unit (MCU) for Conferencing

  - Video Codecs (H.261, H.263, H.264)

  - Supported by most vendors

  - H.239 additional channel support

  - H.323 Annex Q – FECC for Video Conferences

Standards

- ## SIP (IETF – 2002 RFC3261)

  - ### Signaling and Control Protocol

  - ### Supports IM and Presence (SIMPLE)

  - ### Multivendor IP-PBX support

  - ### Uses URI destinations (i.e. **myname@cnc.net**)

  - ### Uses ITU Codecs

- ## BFCP (Uses SIP RFC4582)

  - ### Additional Content Channel Support

Device Types

- ## H.323
  - **Terminal**
  - **Gateway**
  - **Gatekeeper**
  - **Multipoint Control Unit**

- ## SIP
  - **User Agent**
  - **Redirect Server**
  - **Proxy Server**
  - **Registrar Server**

Standards

- **ITU Video Encoding Timeline**
    - **H.261 (1988)**
    - **H.262 (1994)**
    - **H.263v1 (1996)**
    - **H.263v2 (H.263+, 1998)**
    - **H.263v2 (H.263++, 2000)**
    - **H.264AVC (MPEG-4 Part 10, 2003)**
    - **H.264SVC (Annex G, 2007)**

Encoding Video

	Application	Bandwidth
MPEG-1	VHS	0.5 to 1.5Mbps
MPEG-2 (H.262)	DVD / HDTV	1.5 to 20Mbps
MPEG-4 P.2	Internet - TV	64Kbps to 4Mbps
MPEG-4 P.10	Internet - HDTV	500Kbps to 12Mbps
H.261	Video Conferencing	N x 64Kbps
H.263	Video Conferencing	32Kbps to 2Mbps
H.263+	Internet - TV	24 - 64Kbps
H.264 AVC (MPEG-4 P.10)	Internet - HDTV	500Kbps to 12Mbps
Microsoft	Internet - HDTV	128Kbps to 15Mbps

# H.264 Profiles

- Profiles define features used for encoding

| H.264 Advanced Video Coding - AVC	H.264 Scalable Video Coding - SVC
Approx 50% bandwidth savings versus H.263	Defined in Annex G of H.264; 3 new Profiles
MPEG-4 AVC is identical to H.264	Although it is a standard, signaling is not standardized in either H.323 or SIP
Interoperable video conferencing devices use a Baseline Profile	Has interesting capabilities because of multiple bit streams
There are 17 Profiles defined in the standard	Doesn't actually recover from packet loss – instead allows a lower quality video stream

H.264 Profiles

Baseline	Extended	Main	High
Video Conferencing	Enhancements on Baseline	Enhancements on Baseline	HD Performance
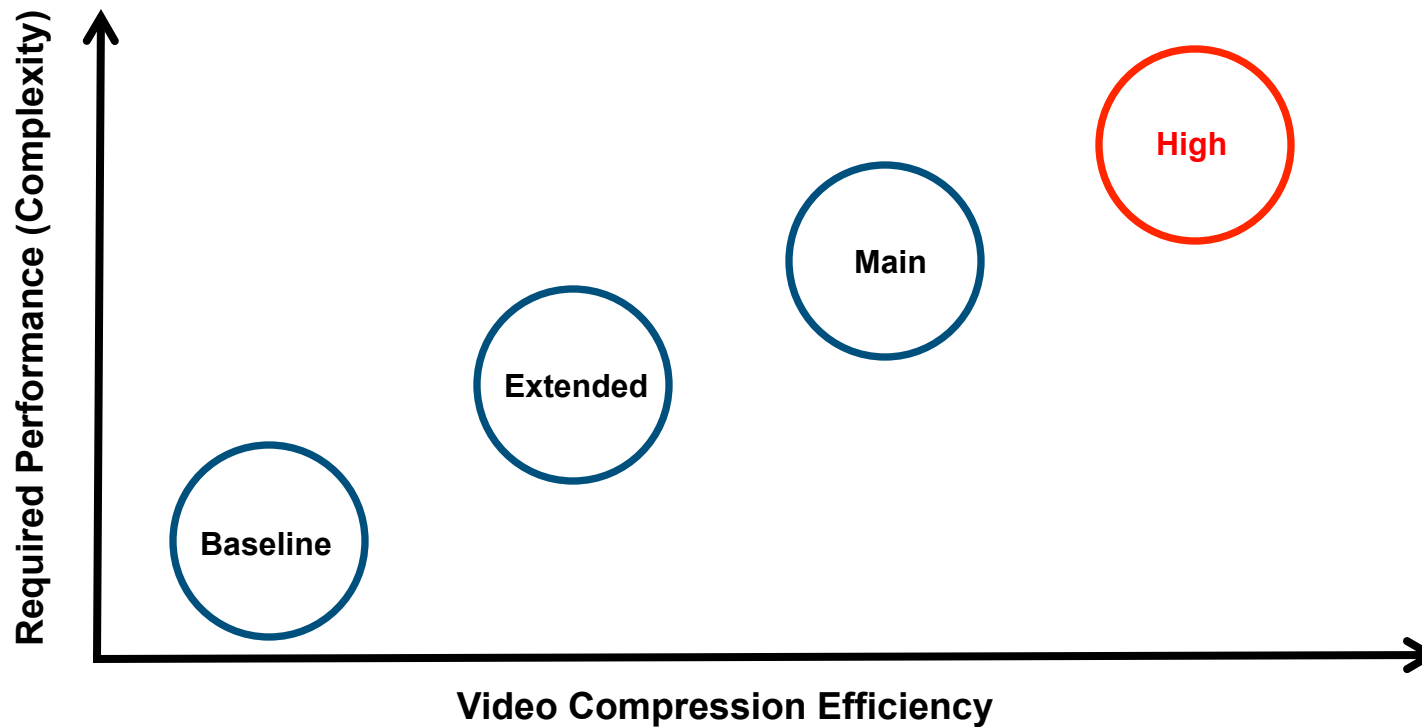
Frame

- An image (frame) is made of dots (pixels).
- A picture resolution is given by the number of pixels (i.e. Width x Height).
- The higher the number of pixels the higher the resolution, hence better picture quality.

720x480

720x576

1280x720

1920x1080
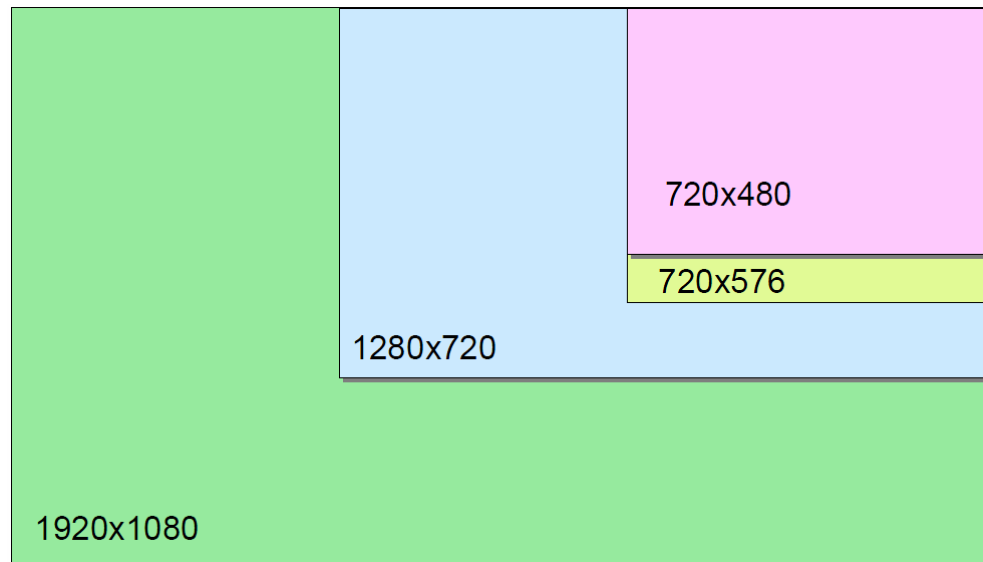
Common Intermediate Format (CIF)

Standard Video Resolution

- Video standard between NTSC and PAL
- Based on 30 fps.

Format	Video Resolution
QCIF	176 x 120
CIF (FCIF)	352 x 240
2CIF	704 x 240
4CIF	704 x 480
16CIF	1408 x 960

NTSC Resolutions

Common Intermediate Format (CIF)

Standard Video Resolution
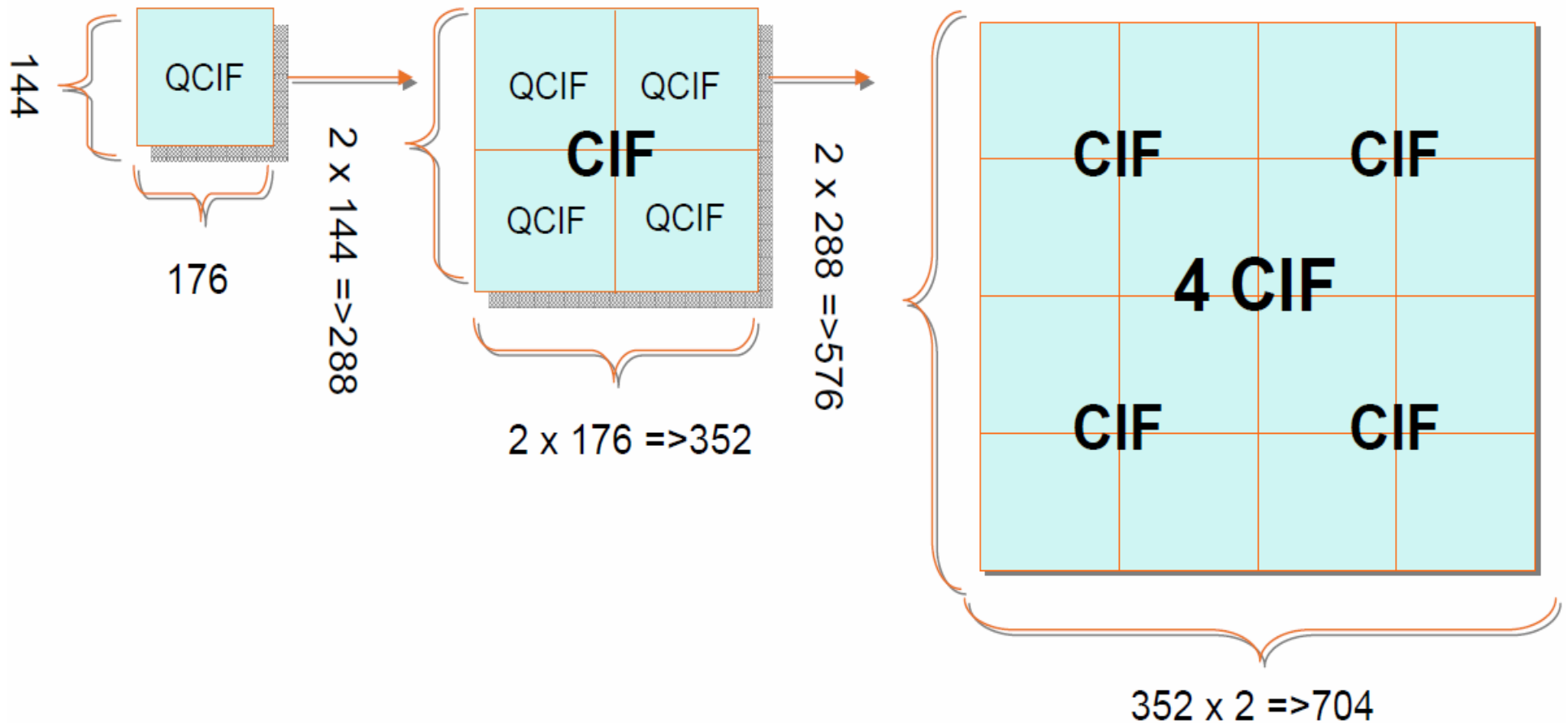
Interlaced

Interlaced Video

- NTSC & PAL are interlaced video
- In a video image, the dots (pixels) are not updated at the same time. The screen is drawn twice – odd fields first and than even fields.
- The frequency depends on the system
  - NTSC = 30 frames/sec = 60 fields/sec
  - PAL = 25 frames/sec = 50 fields/sec
- 1 frame = 2 Fields

upper field

lower field
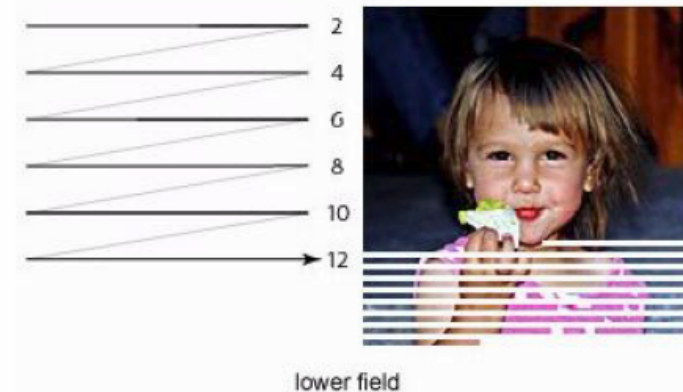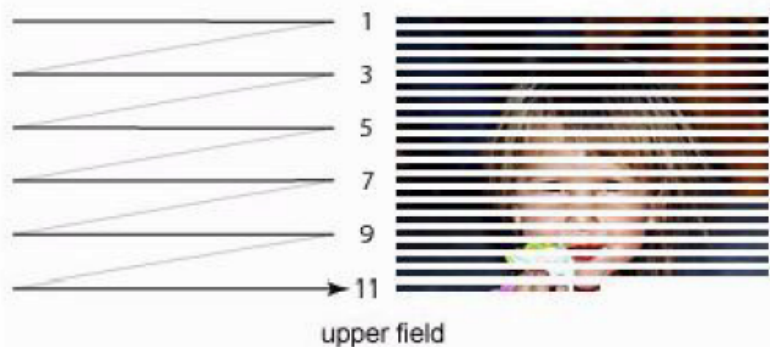
Scan (P vs I)

- **Same HD Resolution (1920 x 1080 pixels)**
- **Difference in recording and display**

  - Progressive (i.e. 1080p)
    - ✓Sharper for fast moving objects
  - Interlaced (i.e. 1080i)
    - ✓Less broadcast bandwidth
    - aka – half frames interspersed

Scan (P vs I)

- **1080**i is an HDTV standard referring to a signal with a resolution of up to **1080** by 1920 pixels. It is a 16:9 signal using interlaced build-up of the signal's lines

- **720**p is also an HDTV display standard referring to a signal with a resolution of up to **720** by 1280 pixels. It is a 16:9 signal using progressive build-up of the signal's lines

- **480**p is a SDTV display standard referring to a signal with a resolution of up to **480** by 720 pixels. It is a 4:3 signal using progressive build-up of the signal's lines

Aspect Ratios

By contrast, a **4:3** ratio allows only a 10 degree field of vision

4

3
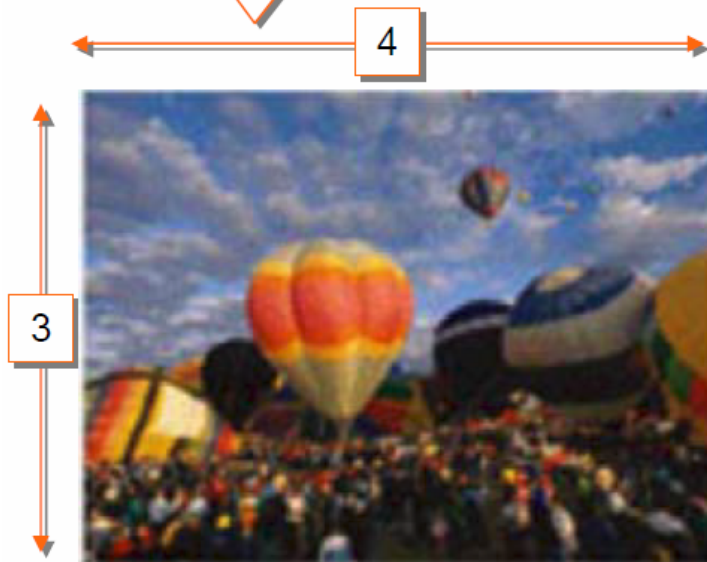
16:9 enables the human eye to take in more visual information, as our vision is optimized within a 30 degree field of vision

16

9

Additional Picture Area
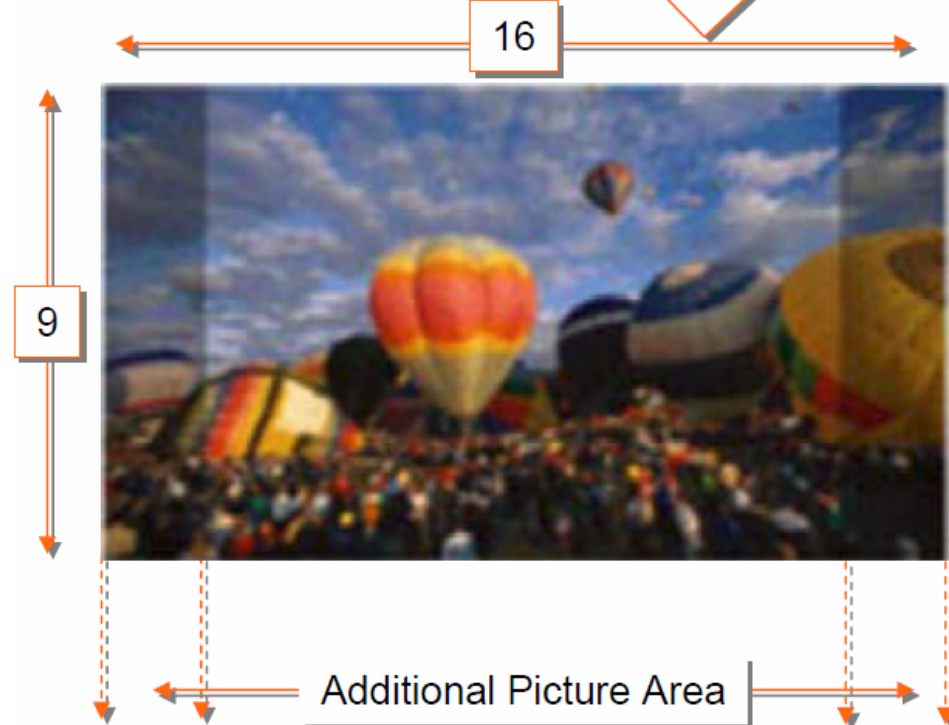
Audio Support (Lip Sync)

- ## G.711 (ulaw/alaw), G.722 (48/56/64Kbps)

  - ### Speech Codecs

- ## MPEG4 AAC-LD

  - ### Advanced Audio Coding – Low Delay

  - ### Capable of stereo signal

Network (Jitter/Delay)
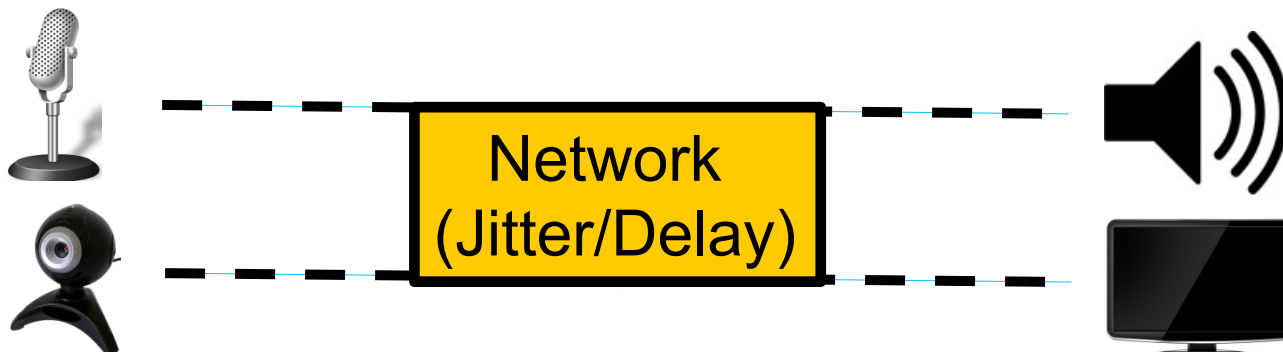
Wrap Up

QUESTIONS

Reference Information

APPENDIX

H.264 Profile Features

Values Specified

- **Chroma Format (YCC)**
- **Sample Depth**

Feature Use

- **Flexible Macro Block Ordering**
- **Arbitrary Slice Ordering**
- **Redundant Slices**
- **Data Partitioning**
- **SI & SP Slices**
- **Interlaced Coding**
- **B Slices**
- **CABAC Entropy Coding**
- **Quantization Scaling Matrices**
- **Separate Cb/Cr QP Control**
- **Monochrome**
- **Separate Color Plane Coding**
- **Predictive Lossless Coding**
- **8x8 – 4x4 transform adaptivity**
- **Film Grain Modeling**
- **Multiple Reference Frames**

H.323 Standards

- ## H.323

  - Call Multiplexing : H.225.0

  - Call Control : H.245

  - Multipoint : H.323, H.243

  - Video Codecs :H.261, H.263, H.264

  - Collaboration : T.120, H.239, H.323 Annex Q

  - Encryption : H.235

SD Television

- **NTSC (National Television System Committee)**
  - ✓ **Primarily US-Americas**
  - ✓ **60i or 30p fps**
  - ✓ **525 Scan Lines**

- **PAL (Phase Alternating Line)**
  - ✓ **Primarily EU**
  - ✓ **50i or 25p fps**
  - ✓ **625 Scan Lines**

- **SECAM (French have to be different)**

Chesapeake NETCRAFTSMEN

CISCO PARTNER
Gold Certified

H.264 Levels

- **Level 1, 1b, 1.1, 1.2, 1.3**

- **Level 2, 2.1, 2.2**

- **Level 3, 3.1, 3.2**

- **Level 4, 4.1, 4.2**

- **Level 5, 5.1, 5.2**

- **Level Specifications**

  - **Max Frame Size**

  - **Max Decoding Speed**

  - **Max Video Bit Rate**

Chesapeake NETCRAFTSMEN

CISCO PARTNER
Gold Certified

HD Formats

Format	Frames per second	Aspect Ratio
720p	24	16:9
720p	30	16:9
720p	60	16:9
1080i	30	16:9
1080p	24	16:9
1080p	30	16:9

Video Interfaces

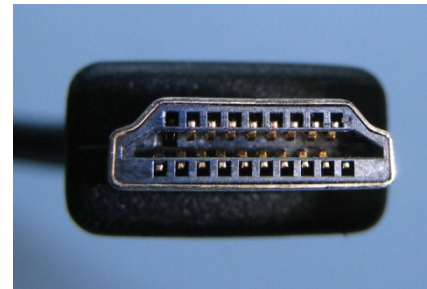VGA Plug/male

DVI Socket/female

S-Video Socket/female

HDMI Socket/female

SIP vs H.323 (P2P)

SIP

- Session Protocol
- Can use ITU Codecs
- URI Addressing
- SDP (CAPx)
- Servers
- DNS Dependent
- Less Interoperable
- HTTP like

H.323

- Calling Protocol
- Codecs Defined
- Multiple Addressing Types
- H.245 (CAPx)
- Gatekeepers
- GK Redundancy
- More Interoperable

CISCO FUTURES

- **CUCM 8.6 Video Enhancements**
  - **Telepresence MCU Conference Bridge**
  - **ISR2 Video Resources (Specific PVDMs required)**
  - **Additional Device Endpoints (EX, SX, MX, C-Series)**
  - **BFCP Support**

- **CUCM 9.0 Video Enhancements**
  - **<Top Secret>**

Chesapeake NETCRAFTSMEN

CISCO PARTNER
Gold Certified

Will Jabber be the new Skype?