

High Definition: The Evolution of Video Conferencing

Abstract:

This white paper discusses high-definition (HD) and how it relates to the video conferencing industry today. HD video conferencing standards, requirements, resolutions and formats are defined. Additionally, the complete end-to-end HD experience in video conferencing is examined, as well as what is needed from a vendor and from the end user to ensure a complete HD experience. Readers of this HD video conferencing white paper will be well-informed and will be able to clearly determine what is needed to implement HD video conferencing in their organization.

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1. HD Television and HD Video Conferencing

High-definition TV (HDTV) is the newest set of video standards for high resolution television viewing. HDTV is broadcast one-way, transmitting video in one direction. High-definition video conferencing is two-way interactive communication where audio and video data are transmitted in real-time across a network. To achieve high-definition video conferencing, you must be communicating between HD capable devices.

Below is a list of the most common SD (Standard Definition) and HD resolutions.

Format	Frames/ Second	Pixels (H X V)	Aspect Ratio	Type
480p	24, 30, 60	345,600 (720 X 480)	4:3	SD
576p	24, 25, 50	414,720 (720 X 576)	4:3	SD
720p	24, 25, 30, 50, 60	921,600 (1280 X 720)	16:9	HD
1080i	25, 30	2,073,600 (1920 X 1080)	16:9	HD
1080p	24, 25, 30, 50, 60	2,073,600 (1920 X 1080)	16:9	HD

Higher number of pixels translate into finer resolution images which result in the display of sharper and clearer pictures. The refresh rate (frames/second) signifies the number of times a picture is updated on screen every second. Higher refresh rates result in better perceived motion handling as well as less flickering to the human eye.

The “i” and the “p” that follow the format designation have specific meanings. In the “i” or Interlaced Format, pictures are first drawn using the odd numbered resolution lines (1, 3, 5, etc.) followed by the even numbered lines (2, 4, 6, etc.). Thus, there are two fields (odd and even) drawn on the monitor for each frame. This scheme is referred to as interlaced video and commonly operates at rates of 50 or 60 fields per second. This odd/even drawing pattern is called *interlacing* (i), and was developed to improve picture quality without increasing transmission bandwidth (the data rate capacity of a given network connection). The *progressive scan* (p) format is an alternative to interlaced video that improves the overall picture quality. Progressive scanning treats the entire video image as one frame and does not suffer from the interlacing artifacts (jagged edges in pictures). In addition, progressive scanning provides motion handling that is as good as the interlaced format.



True High-definition standards have been defined by the ATSC (Advanced Television Systems Committee) as picture resolutions of 720p and 1080i/1080p. Resolutions other than these are not true high definition standards.

				1080p
1920 x 1080				720p
1280 x 720				
(Resolution)				
	15	24	30	(Frames per Second)

60

High-definition formats provide more visual information than any standard-definition format. There is an increased pixel count inherent in the high-definition formats which provides better picture quality and makes viewing images on larger screens clearer and easier to watch. In video conferencing, this enhances the overall viewing experience and eliminates meeting fatigue. Additionally, colors are more vibrant and realistic in HD; objects are sharper and motion is more fluid.

2. UltimateHD™ Defined

UltimateHD is more than just improved picture quality. UltimateHD encompasses every aspect of a complete high definition video conferencing experience, including voice, video, content sharing, network infrastructure, ease-of-use, and finally the service and support needed to create and maintain that experience.

UltimateHD Voice:

- Provides natural, free-flowing conversations with Acoustic Clarity
- Delivers the widest acoustical range for all types of media sharing with Wideband High Fidelity
- Allows for the clear separation of multiple voices during simultaneous speech with StereoSurround™
- Provides maximum flexibility in using single or multiple microphones, or audio mixers, all in stereo with Performance Audio I/O:

UltimateHD Video:

- Delivers the clearest, crispest images possible at 30-60 frames per second with a Performance HD Camera



- Shows the highest possible HD video quality using a standard-based video codec with minimum 720p at 30fps (720p starts at 24fps, but UltimateHD is 30-60fps) starting at bandwidths as low as 1 Mbits/s.
- Provides a fully backwards compatible system that allows you to maximize the number of people with whom you can communicate
- Gives the option of several HD cameras, HD DVD player, HD document camera and/or a PC for media and content sharing with Multiple HD peripheral support
- Enables secure and private conferencing with standard-based AES Encryption

UltimateHD Content Sharing:

- Allows for connecting several devices for sharing content during a video call with Multiple video and audio inputs/outputs
 - HD document cameras, HD DVD players, and PCs for HD video and audio files
- Delivers media and content in high resolution along with an HD video conference with HD Content Sharing
- Enables you to see both the person presenting and the content being shared while using H.239 Dual Stream

UltimateHD Infrastructure:

- Brings multiple people from different locations together in a single call with an HD Multipoint Conferencing Unit
- Reaches larger audiences and makes information readily available with an HD Recording, Archiving and Streaming server
- Ensures that HD video and audio devices are running optimally and are closely monitored with the right Management and Administration Tools
- Ensures the highest quality of service on any given network, taking into account network congestion, routers, firewalls, and other network devices with QoS

UltimateHD Service:

- Planned & Designed for optimal network and infrastructure performance, including future requirement and need planning
- Deployed & Integrated for delivering HD video and voice devices such that they integrate with the existing or planned network architecture
- Serviced & Maintained for ensuring the highest possible system reliability and performance
- Trained and optimized for true ROI, whereby the HD video and voice systems are used frequently and provide organizations with increased productivity

3. High Definition Video Conferencing Requirements



High-definition video conferencing requires that the person sending and the person receiving HD video, audio and content both have an HD system, HD camera and HD displays. In addition to having HD equipped endpoints, a critical consideration in achieving top-quality video conferencing is network bandwidth. A data transfer rate of 1Mbps is the minimum requirement for high-definition interactive video conferencing. For optimal results, data transfer rates between 1.5 to 2Mbps are recommended for “talking heads” video, while bandwidths of 2Mbps and higher are recommended to allow content sharing devices such as PC input, DVD’s or high-resolution document cameras. Quality of Service (QoS) for the network is a must to ensure consistent performance for the duration of video conferencing calls.

To capture high-resolution images, a camera that supports true high-definition (minimum 720p and 24fps) in the 16:9 format is required. Ideally, the camera should come from the same manufacturer as the video conferencing endpoint. This will ensure that the camera and endpoint have been optimized for providing the best end-to-end high-definition video conferencing experience.

High-definition video monitors (LCD, Plasma, or DLP) must also support a minimum of 720 horizontal lines of resolution. The monitors should offer connectors that enable optimal high-definition signals, such as DVI-I (Digital Video Interface) or component YPrPb. DVI cables longer than 5 meters could cause degraded or unpredictable video display. Purchasing high-definition monitors and endpoints with flexibility and correct connectivity eliminates this concern.

Correct monitor selection will also require matching the size of the room and the average distance participants will sit from the monitor. For large conference rooms where participants sit 10 to 15 feet from the monitor, a monitor that is at least 50 inches is recommended. The following table matches screen sizes and typical viewing distances.

Screen Size 16:9	Viewing Distance
30 in.	6.25 ft.
34 in.	7.0 ft.
42 in.	8.75 ft.
50 in.	10.4 ft.
57 in.	11.9 ft.
60 in.	12.5 ft.
65 in.	13.5 ft.

For high-definition multipoint video conferencing, where more than two parties plan to participate from different sites (endpoints), a high-definition Multipoint Control Unit (MCU) is required for bridging all of the calls together. Of course, the MCU must also support true high-definition (minimum 720p) and a sustained 30 frames per second, to



deliver the same quality experience provided in point-to-point calls. Purchasing an MCU from the same manufacturer as the video conferencing endpoints is highly recommended to ensure optimal end-to-end performance.

4. The Importance of Choosing the Right HD Vendor

Consistent with the adoption of other emerging technologies, customers moving to HD video conferencing are at risk of being swayed by video technology that may appear better than what they are experiencing today – but that isn't true high definition video conferencing. Some solutions may be less expensive than a true HD video conferencing codec and camera, so at first blush would appear to be a bargain, or at least "good enough."

The problem with this approach is two-fold. First, a video technology that isn't built using the defined standards for high-definition video conferencing may not be compatible with true HD video conferencing solutions. Therefore, while those solutions will be able to call other, like solutions, they will not be able to call outside of the organization to other customers, partners, or vendors that have implemented true standards-based HD video conferencing technology.

Secondly, video conferencing solutions that can provide increased resolution, but not HD resolution likely do not have the raw processing power to deliver true high definition video and voice. This further implies that any future improvements in technology will not be realized in these solutions, and customers deploying those non-standard HD solutions will not be able to take advantage of future features or standards that may arise in the world of HD video conferencing.

5. The Polycom Experience

Polycom addresses high definition voice and video conferencing from a holistic approach, including all aspects of UltimateHD to ensure the richest audio, clearest and sharpest video, most transparent technology and easiest to use interface, all enhanced by world-class service and support. Components of Polycom's solution include:

- HD Video Conferencing Codec (*available Q4 06*)
- HD Camera (*available Q4 06*)
- HD Multipoint Conferencing Unit: Polycom MGC (*available now*)
- HD Recording and Streaming Server: Polycom RSS 2000 (*available now*)
- HD Professional Services

While each part of the solution can be purchased separately, the combined solution allows your organization to leverage all the benefits of UltimateHD.

