When is HD not HD?

Summary

High-definition (HD) in video conferencing used to require dedicated encoding/decoding hardware and boardroom-to-boardroom connections in products such as Polycom, Tandberg and Lifesize. As personal computers have increased in processing power, HD in desktop-to-desktop video conferencing is a reality, using ordinary hardware and an Internet or local network connection.

But not all desktop video conferencing products claiming HD are created equal, and this confuses buyers. If HD-quality is important in your organization's online meetings, you need to understand what you must (and must not) put in place in order to deliver it. Otherwise, you'll need to answer your conference participants when they ask, "Why is the image so grainy?

What is HD?

Current HD standards are:

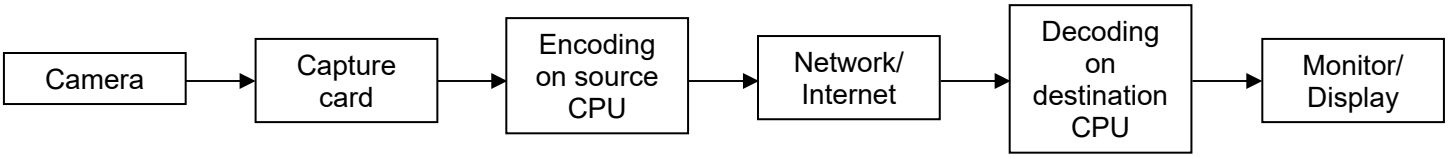
- 720 progressive scan lines at 60 frames per second and 16:9 aspect ratio, or
- 1080 interlaced encoding at 50 fields (25 frames) per second and 16:9 aspect ratio.

HD video does not break down or appear pixilated when magnified on the destination display. True HD preserves these standards and this playback quality from the source image in the camera to the destination display.

HD in Video Conferencing

Most traditional video conferencing systems use expensive cameras along with dedicated hardware and connections to support HD. But as prices for high-end cameras and displays have dropped, Web conferencing has become an attractive, cost-effective alternative to expensive video conferencing systems. Web-based video conferencing is playing a growing role in boardroom meetings, company all-hands gatherings and telemedicine applications.

The problem lies in getting true HD quality out of low-end equipment. Even with the general improvements in cameras, processors, displays and network bandwidth, delivering HD through desktop products is not as simple as plugging in new devices, as shown in this diagram:



Each link in this chain presents a potential source of latency or loss, and some Web conferencing products enhance the video to compensate for the lower resolution or fewer frames per second introduced by their approach to HD. But if the quality of hardware used is inadequate, or if any link in this chain does not support HD, then the resulting video cannot be HD.

The Camera

The camera must capture video at the resolution and frame rate desired for the destination display. In the context of business-to-business (B2B) video conferencing, "HD" generally refers to 720 (1280 x 720 pixels) or better.

HD: Conference room cameras and HD cameras use high-quality lenses and electronics to generate video natively in high definition.

Not HD: Some USB-based Web cameras can capture and move enough pixels for 1280 x 720 resolution, but because they are not generally designed for HD, they sacrifice frames per second and thus do not meet the true HD specification. The advent of USB 3.0-ready cameras may change this (see below).

For true HD, look for:

- Conference room camera or HD camera
- Web camera that supports USB 3.0 (eventually)

Nefsis supports the resolution and frame rate of conference room cameras and HD cameras all the way from image source to destination display. See "HD Video Capture" on http://www.nefsis.com/Best-Video-Conferencing-Software/hd-video-conferencing.html for more details.

The Capture Card

The image from the HD camera is captured and encoded using H.264. The data is then relayed to all users in the conference. This extremely compute-intensive work requires processing power.

HD: Conference room cameras and HD cameras perform the work on dedicated hardware in the PC. They connect via HDMI cable or BNC connector to a capture card running an HD codec (encoder/decoder) on its own chipset. The card then sends the image into memory across a high-speed PCI or PCI Express bus.

Not HD: Most Web conferencing products try to emulate the hardware function in software running on the CPU. Rather than use a capture card, Web cameras send the HD signal into memory over USB to a software driver specific to the camera, then use a software-based codec running on the CPU to convert the image. This saves the cost of the capture card, but software emulation on the CPU is slower than dedicated hardware and does not duplicate the quality of true HD. As a result, these products take shortcuts, such as capturing a smaller original image and stretching it, or reducing the frame rate. The image size at destination may be 1280 x 720, but the quality of HD is missing.

Eventually HD: USB 3.0 promises theoretical speeds of up to 5.4Gbps, which will suffice to move data from a Web camera into memory at rates that will keep up with HD codecs. As USB3.0-ready Web cameras come to market, conference room cameras and HD cameras will continue to distinguish themselves with higher-quality optics and features like pan-tilt-zoom rather than their dedicated hardware.

For true HD, look for:

- Cameras that use dedicated hardware (PCI/PCI Express) in the source computer
- HDMI or BNC connection to the computer

Nefsis preserves the resolution and frame rate of the image generated by the camera, whether the image comes from dedicated hardware or from software emulation.

Encoding on Source CPU, Decoding on Destination CPU

Video conferencing software takes the HD video at the source CPU and encodes it for transmission over the network. At the destination CPU, it decodes the video and hands it off for display. While this task does not

require specialized hardware, it is a function that benefits if the software can take full advantage of multi-core CPUs, MMX/SSE extensions, parallel processing and symmetric multi-processing (SMP).

HD: Boardroom-type video conferencing products include dedicated hardware for encoding and decoding HD at both ends; the technology is built into them.

Not HD: Web conferencing products can handle low-resolution video, but without the technology to accommodate the HD video produced by video conferencing cameras, their performance is lower and the resulting image is not – cannot be – true HD, as video conference participants will quickly notice.

For true HD, look for video conferencing software that takes advantage of multiple cores and CPUs, as well as their extensions, when available.

> ***Nefsis takes the HD video stream, intelligently distributes the work of encoding and decoding it among CPU cores and extensions, and processes it without any modification or latency.***

The Network

As the video goes from the source computer over the network to the destination computer(s), compression and network throughput come into play.

HD: The encoded HD video stream is too large to send over most networks efficiently. Video conferencing products compress the stream intelligently by comparing each frame to the previous one and sending only the bits that have changed. Also, properly handling HD requires network speeds of at least 1Mbps; otherwise, the network becomes a bottleneck. Wi-fi and broadband connections may not suffice.

Not HD: Most Web conferencing products rely on standard video codecs, which can result in too much data for the network transport layer. Thus, the network becomes a gating factor in delivering the HD signal from source to destination.

For true HD, look for:

- variable bit encoding to compress the video stream intelligently before sending it to the network
- 1-4 Mbps of sustained network speed

Destination Monitor/Display

Filling up a 47-inch, wall-mounted monitor in a conference room with high-quality video is more demanding than filling up ¼ of a screen in a 15.6" monitor. Also, displaying a high-definition, 1920 x 1080 video is more demanding than displaying nine low-resolution, 640 x 360 videos.

HD: An HD image that has been preserved from camera to destination display will allow for full resizing to original resolution with no pixilation or compromise in frame rate.

Not HD: An image captured by a USB Web camera may be satisfactory in a small window on the destination display. It's possible to resize the window to 720 or 1080, but degradation will be apparent: pixilation, choppy motion, jagged lines.

For true HD look for:

- monitors that meet or exceed 720, such as WXGA (1280 x 800) and SXGA (1280x1024)
- monitors that are a superset of 1080, such as WUXGA (1290x1200). A WUXGA monitor can display HD video and still have room for desktop features like the system tray and other application controls.

Conclusion

As applications for video conferencing continue to proliferate, and as Web conferencing software brings online meetings within the reach and budget of more organizations, the opportunity for HD in these meetings will grow. Still, there is more to introducing HD than simply purchasing a camera which claims to support it.

On the long chain between source camera and destination display, every software and hardware link must preserve the integrity of the HD image. Otherwise, the resulting image may suffice in low resolutions and frame rates but will disappoint at true HD size.