

High Definition (HD) Technology and its Impact
on Videoconferencing

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High Definition (HD) Technology and its Impact on Videoconferencing

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Introduction

The videoconferencing industry is currently crossing the chasm with a new realm of innovative collaborative tools. Adoption of videoconferencing has encountered many hurdles stemming from interoperability. Proprietary software and incompatibility between vendors' equipment often produced inadequate end user experience, resulting in nominal adoption. Interoperability between various vendor solutions has considerably improved in recent years although some concerns still remain. However, this has not resolved the impediments to adoption of videoconferencing as a critical business communication tool.

Advancements to enhance the end users audio and visual experience during a meeting are currently a focus for many videoconferencing hardware vendors. Many believe utilizing HD technology will enable end users to accept videoconferencing, therefore increasing adoption and utilization. This may be true in some vertical markets and specific applications, however, as with all new technologies, HD has positive and negative factors, which will determine adoption.

HD—What is it and how does it work?

High definition television (HDTV) is an innovative set of standards for television and the quality in which it is seen. This is the first change to the television format since color replaced black and white television. The generally agreed upon definition of high-definition television is roughly twice the vertical and horizontal picture resolution of analog, which essentially makes the picture twice as sharp. HDTV also has a screen ratio of 16:9 as compared with most of the present day TV screens, which have a screen ratio of 4:3.

HDTV image resolution shows greater details than analog television. MPEG-2 has been used as the HDTV compression codec in earlier markets. MPEG-2 is a high bit rate digital video broadcasting (DVB) codec industry standard for over ten years. MPEG-2 requires a minimum of 2 Mbps of bandwidth. The prerequisite for high bandwidth for many corporations has been cost prohibitive.

While MPEG-2 is a hardware-based technology, MPEG-4 offers a software approach to compress and decompress video. Therefore, MPEG-4 does not require the expensive encoding and decoding hardware that MPEG-2 requires, and employs economical solutions using industry-based processing systems servers, and set-top boxes.

MPEG-4 Simple Profile and Advanced Simple Profile were developed for streaming video over Internet connections. H.264/MPEG-4 advanced video coding (AVC) addresses the needs for greater compression while maintaining broadcast quality, enabling, for instance, less bandwidth-consuming HDTV broadcasting or interactive services such as video on demand (VOD).

Today's Current Video Compression—H.264

H.264 is a compression digital video codec standard. This standard is similar to ISO MPEG-4 part 10, and is also known as AVC, for advanced video coding. H.264 contains features allowing it to compress video more effectively and to provide more flexibility over different networks. Overall, H.264 performs much better than other standards. H.264 is more efficient than MPEG-2, providing the same quality with only half of the bit rate or even less. H.264 has provided new opportunities and considerably reduced operating and deployment costs when compared to MPEG-2. H.264 standard is benefiting the entire industry for the following reasons:

- It compresses video more efficiently
- More content and value-added interactive services embedded in video streams enhance customers' value perception
- H.264/AVC is also part of the third generation partnership project (3GPP) specifications. With the use of joint technologies, user datagram protocol (UDP) or transmission control protocol/Internet protocol (TCP/IP) and H.264, there is a common ground for greater interaction between home and mobile devices

The H.264 protocol improves video resolution quality in the H.323 protocol suite by encoding and transmitting two interlaced fields for each frame. That is 30 frames per second and 60 fields per second (instead of only 30 fields per second of H.263). This process enables to present decoded video that is more fluid and lifelike. The result of this enhancement is a substantially higher resolution quality that approaches or matches MPEG-2 quality at a 64% lower bandwidth cost.

H.264 also handles the encoding of the pixel blocks more efficiently than H.263, practically eliminating the tiling or pixilation seen on videoconferences today when there is a "scene" change or a lot of motion.

Issues for End Users

Over the last 10 years, the videoconferencing market was released of proprietary issues with development of industry standards. Most, if not all, vendors have adopted these standards as a common denominator to collectively encourage growth for the overall market. As a result, vendors continue to enhance the total videoconferencing experience for the end user resulting in continued growth. However it is still falling short of critical mass adoption.

Audio and video are basic components to videoconferencing. Improvements to these two elements from both a hardware and software perspective will deliver a greater overall experience for the end user.

The HD component is the latest technological addition to the overall videoconferencing market. HD on its own offers a higher quality visual experience, which is a key element in videoconferencing. In addition to video, audio is an integral piece of the puzzle. High fidelity audio along with HD has the potential to create a richer videoconferencing experience for the end user.

The benefits of HDTV from a viewer's perspective are:

- Enhanced realism from improved pictures because of higher bit rates cost effectively
- Improved audio using high fidelity
- A 30-degree viewing angle matching the human visual field better as compared to 10 degrees for standard-definition television in 4:3 format.

The Bandwidth Hurdle

Business quality videoconferencing typically runs at a rate of 384 Kbps over Internet Protocol (IP) or Integrated Systems Digital Network (ISDN). An organization's network resources predictably determine the amount of bandwidth used during a videoconference session. The basic theory is the higher the bandwidth the better the resolution and overall quality of the videoconference call. Quality is also based on other factors such as video and audio algorithms internal to the codec.

As organizations climb over the cusp from ISDN to IP, the availability of network resources becomes a part of the greater internal network infrastructure. In this environment, audio, data and video applications perform simultaneously on one network platform. This usually entails controlling the amount of bandwidth allocated per videoconference session. End users are often unaware they may have an option to run their videoconferences at higher band-widths thus, poor experiences have left them with the perception that the technology is not viable as a business communication tool.

The bandwidth requirement for HD videoconferencing may be one of the barriers to entry for many organizations. In order to utilize the H.264 compression algorithm and gain the highest level of quality that HD offers, endusers require 1 Mbps of bandwidth for each codec endpoint. Hence, using HD and H.264 compression at lower bandwidths will noticeably increase the quality of the call.

Issues for Videoconferencing Hardware and Software Vendors

How is HDTV Different?

The National Television Standards Committee (NTSC) analog TV screen in the U.S. has 525 scan lines, with 480 actually visible. The usual TV has an effective picture resolution of about 210,000 pixels. In the highest resolution digital TV formats, each picture contains about 2 million pixels. The result is about 10 times more picture detail on the HDTV screen.

To deal with HDTV's new standards videoconferencing vendors will need to develop some new components such as cameras and sound equipment. In addition, software will need to be interoperable with all vendors. The aspect ratio (width to height) of digital TV is 16:9 (1.78:1), which is closer to the ratios used in theatrical movies, typically 1.85:1 or 2.35:1. Currently compression standards crop the full picture of the film down to 4:3, eliminating part of every scene in the process or letterbox it to present the full picture only on the middle part of the screen, with black bars above and below it. With a 16:9 screen, it doesn't remove so much from the original picture and letterboxing and will not block out so much of the screen.

Benefits of HD Technology for Videoconferencing

With these inherent features of HD, the visual aspect of the videoconference offers a crisp and clear picture where often pixilation and NTSC produce images either too light or too dark and due to compression and decompression of the signal can often result in a bit of a fuzzy picture. Graphics and data sharing has often been a challenge to view on a NTSC and even a VGA data monitors. HD can help overcome this hurdle and enable end users to view documents and graphics while in a videoconference. The benefits are:

- Wider images
- Much more detailed pictures
- 5.1 channel CD-quality Dolby Digital (AC-3) surround sound
- The ability to send data directly to a screen or to a PC as a download (The actual HDTV transmission is based on a 19.3-Mbps digital data stream.)

As with any video component the higher the quality used as an input the better the result at the output. The HD camera is currently utilized in the broadcast market as the HDTV begins to permeate the global market. Many broadcasters and cable companies offer various stations in HD for those who have both the HD monitor as well as the encoder/decoder.

Videoconferencing equipment vendors are taking various approaches to HD videoconferencing. Some have developed HD endpoints including a camera to offer a full HD videoconferencing solution. Others are upgrading their infrastructure and endpoints with software to handle the compression but to date have not released the hardware upgrades. The market should see most videoconferencing vendors with an HD hardware offering by mid 2006.

Vendors in the Market

LifeSize

LifeSize has developed a product suite designed specifically for the HD videoconferencing market. Engineering and manufacturing a proprietary HD camera to be exclusively used with their systems, LifeSize is the first videoconferencing vendor to offer a complete HD videoconferencing endpoint solution.

LifeSize's product suite includes:

- LifeSize Room™—High definition video communications system for meeting rooms
- LifeSize Phone™—High definition audio conference phones
- LifeSize Exec™—High definition video communications system for executive desktops
- LifeSize Networker™—All-in-one gateway for IP and ISDN network integration
- LifeSize Control™—All-in-one video communications management software

Polycom

Polycom announced HD capabilities in their infrastructure product in 2005. Enabled through software, Polycom is delivering HD videoconferencing on their MGC bridges and has announced availability of a software HD option for its VSX 8000 system. The VSX 8000 HD upgrade will include all the necessary hardware, software, cables and instructions on upgrading their VSX 8000. This upgrade offers standards-based technology enabling the systems to work with other standards-based HD endpoints and HD video bridges. HD video calls will be available starting at bandwidths of 1 Mbps and higher and deliver 1280x720 resolution at 30 frames per second. The VSX 8000 HD upgrade will also include improved audio, video and content sharing functionality, while continuing to maintain existing software capabilities and hardware.

Tandberg

Tandberg's MXP product line is HD-ready and the software upgrade will be available in Q1-2006. In order to offer an end-to-end solution, Tandberg will also be adding the HD software upgrade to their carrier-class MPS bridge in Q1-2006.

HD Videoconferencing Applications

Initially, the bandwidth required to reach full HD quality may be a barrier to entry for some. At lower bandwidths the quality is presumably better and may be an impetus for organizations to implement HD videoconferencing for certain applications where the benefits will make a significant impact.

T e l e m e d i c i n e

The medical field has adopted videoconferencing as a collaborative diagnostic tool with great results. The ability to visually communicate over distances has enabled many rural hospitals and clinics lacking specialists to provide medical services to patients without the need to travel great distances to be seen. Diagnostic medical equipment such as X-rays and various scans are often a part of the examination. The ability to view these images clearly and with crisp details is vital. HD technology offers higher resolution and can be used as an effective tool to advance the use of videoconferencing in the telemedicine vertical.

H i g h e r E d u c a t i o n

Another vertical successfully adopting videoconferencing is higher education. Bandwidth consideration has not been an issue in many cases due to many universities implementing Internet2.

Internet2 is a consortium being led by over 200 universities working in partnership with industry and government to develop and deploy advanced network applications and technologies, accelerating the creation of tomorrow's Internet. Internet2 is recreating the partnership among academia, industry and government that fostered today's Internet in its infancy.

C o r p o r a t e

Over the last few years many enterprises that have implemented videoconferencing have upgraded their visual display to plasma screens as one way to improve the visual component of the meeting experience. Many of these screens are HD-capable. HD videoconferencing has the capability to increase the usage of videoconferencing by offering a higher quality experience.

Verticals within the corporate segment such as manufacturing, retail, and engineering will also be able to take advantage of the clarity provided by HD videoconferencing during the design and developmental stages of product development. End users have historically been reluctant to use traditional videoconferencing to complete production processes due to inadequate visual clarity required to make decisions. HD has the potential for end users to find the value of using videoconferencing to help them be more efficient and effective.

G o v e r n m e n t

Many government institutions use videoconferencing as a critical communication tool. HD will offer a higher quality experience resulting in improved confidence in operations and timely decision making.

C o n c l u s i o n a n d R e c o m m e n d a t i o n s

High-definition videoconferencing offers higher resolution at 1280 x 720 and has the potential to tackle many of the concerns of the preceding generation of videoconferencing technology. An inadequate visual experience and mediocre sound quality created discontent among many end users leading to slow adoption. Many end users state they have been disappointed with quality of traditional videoconferencing and would be interested in evaluating current advancements to determine if the benefits outweigh the costs of upgrading.

One of the early plagues in the videoconferencing market was each vendor utilizing propriety algorithms, which caused interoperability issues impeding growth. In order for HD to materialize as the next generation technology in this market, all vendors will need to develop a non-proprietary solution.

A combination of concurrent technological innovations makes it possible to bring high-definition video and audio to videoconferencing today. With rapid growth in IP network deployments, limited bandwidth is no longer an issue. Additionally, with the proliferation of new video advancements such as H.264, bandwidth can be used more efficiently and cost-effectively.