HD IN HEALTHCARE

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Introduction

In a healthcare environment that is technology oriented, providers and patients are recognizing the benefits of video conferencing. With the constant pressure to increase the quality of patient care and the desire to provide new services, while at the same time controlling costs, healthcare providers are leveraging the power of video networks to link patients, specialists, and clinicians, thus extending the reach of healthcare. Patients seek lower out-of-pocket costs, less travel and shorter wait times as they receive medical care. Live digital video and high-speed network connections enable physicians to evaluate and diagnose illnesses in real-time, without the need for either the patient or physician to travel. Medical professionals also have the convenience of being able to obtain continuing medical education (CME), access certification programs, and train through video conferencing. Telemedicine systems bring medical expertise to patients and providers regardless of location. The use of telemedicine increases revenues for healthcare facilities by allowing hospitals to tap the expertise of individuals across the country or the globe. Patients get the care they need regardless of their location, and often faster and at a reduced cost.

The medical profession needs the highest quality voice, video, data sharing and transmission to deliver the clear pictures and sound required to accurately treat patients at a distance and better educate their staff. Reliability, quality, and security are critical factors to allow medical professionals using video conferencing to perform their daily jobs. The use of high definition (HD) video conferencing provides the superior video communications needed by medical professionals for interactive patient care, training, research, and expanding overall reach to the community. High definition video conferencing affords faster response times, greater reach, more accurate training and diagnosis, and a higher level of care, thus ensuring critical needs are met in a timely fashion.

The purpose of this document is to discuss high definition video conferencing and how it can enhance the healthcare experience.

HD Definition

High definition means high resolution or a large number of pixels for monitors. The original idea for high definition television came from film producers when they realized that people seated in the first rows of a wide-screen cinema enjoyed a greater level of participation in the action on the screen not possible with conventional (4 x 3 format) movies. Having the screen occupy a greater field of view, especially horizontally, significantly increases the sense of “being there”. This is why the individuals behind high definition television decided that an aspect ratio for the screen should be16 x 9.

With high definition technology the image resolution is three times better than standard television and over nine times better than traditional video conferencing. High definition video conferencing also provides cost effective, powerful new camera designs, spatial audio, and improved user interfaces.

Time has proven the effectiveness of video conferencing in healthcare. Physicians earn required CME credits using video conferencing, by linking interactively and in real time, with the leaders in their field, regardless of distance. Grand rounds, where physicians share their expertise and

comments about complex medical situations, are now done with regularly scheduled video conferences, thus allowing many more people to participate and learn from one another. Boards of specialty practitioners (i.e. cardiologist, psychologists, surgeons, etc.) collaborate through video conferencing to review individual cases. Patients are now reached remotely, using video conferencing, to be educated about their heath care options, learn about new treatments, and share experiences with other patients. Video conferencing allows for greater reach of message, since individuals may now obtain information when it is convenient for them. Video conferencing also allows for an increased number of participants and allows people who might never meet physically, yet who study or work together, to meet virtually – face-to-face over video. With video conferencing, and the instructional tools that are now used with it, all individuals who need information can get the information when it is easiest for them, on a delayed and real-time basis. Enhancing standard video conferencing with high definition only improves the benefits and increases the number of applications for which individuals can obtain medical information and be treated remotely. With the addition of high definition content sharing devices like PCs, DVDs, and high-resolution document cameras and devices, physicians and patients can now connect for training or diagnostic issues and be assured of the highest level of learning or care possible.

Standard Video Conferencing Compared To High Definition

To compare standard video conferencing to high definition video conferencing one needs to understand the differences in resolution, frame rates, display systems, bandwidth, audio quality, and camera designs.

Resolution

Standard video conferencing systems are limited to providing 352 x 288 lines of video resolution at 15 – 30 frames per second due to computing limitations of the systems. Newer advances in processor technology enable more powerful compression/decompression architectures that provide high definition video at a resolution of 1,280 x 720 lines of video resolution at 30 frames per second, which is over nine times better than the standard video quality achieved today.

Frame Rate & Format

Frame rate refers to the frames that are refreshed each second. Higher frame rates mean better motion handling and higher overall picture quality. Format refers to the number of lines of vertical and horizontal resolution displayed on the screen to make the picture sharp and clear. The higher the format, the clearer and sharper the picture. The “i” and the “p” after the format refer to how the lines of resolution are drawn. Pictures are first drawn on the odd numbered resolution lines. Then the same picture information is drawn in the even numbered lines. The odd/even drawing pattern is called *interlacing*, which was developed to conserve transmission bandwidth. The *progressive scan* format is an alternative to interlacing that improves picture quality on larger screens. In North America, all high definition television (HDTV) receivers are capable of decoding 18 separate scanning formats, including interlaced and progressive formats at various picture frame rates. Progressive scanning is the norm for computer displays. High definition video displays picture resolutions of 720p at frame rates of 24, 30 or 60, and 1080i/1080p at frame rates of 24 or 30.

Display Systems

A video conferencing system needs a display or projection device for maximizing visual output. Initially, video conferences were displayed on a TV set or a computer monitor. Today there are many more choices and often two or more displays are used for video conferencing. This could mean a display device for the medical staff or patient, a document camera, PCs, DVD content, specialty scopes for diagnosis, etc. When standards for high definition television were initially

discussed, the aim was to double the horizontal and vertical resolution and increase the viewing angle from 10 degrees to 30 degrees horizontally and 20 degrees vertically. This is done by going to a 16 x 9 wide screen, instead of a traditional 4 x 3 screen. Having the screen occupy a greater field of view significantly increases the sense of "being there". The viewer experiences an increased sense of reality and 3-dimensional depth in the picture, as soon as the viewing angle exceeds 20 degrees.

Users are amazed when they first experience the nuances of expression and gestures that are visible with high definition video conferencing. For healthcare purposes, the use of high definition video conferencing allows people to really SEE what they are viewing. Observation of patient care, surgery, life monitors, and x-ray films are examples of the content sources that will benefit from HD. Specialized educators in healthcare can provide continuing medical education at a distance by allowing physicians and nurses to participate in remote training sessions and truly experience all the nuances of patient care at the distant end.

Bandwidth

Bandwidth is defined as the capacity a telecommunications channel has to move information. Many of the standard video conferencing systems used today operate at bandwidths ranging from 128 Kbps to 768 Kbps. These ranges have historically been selected to minimize cost and because additional bandwidth was not always available. High definition video conferencing systems use a minimum of 1 Mbps of bandwidth to operate effectively, with bandwidth at 2 Mbps or better recommended to achieve premium audio and video quality and allow the use of additional high definition content sharing devices like PCs, DVDs, or high-resolution document cameras. In recent years, cost effective and plentiful bandwidth has become accessible to healthcare institutions, enterprises, educational institutions and the government.

Organizations using high definition video systems will also find the video better at any bandwidth (Cable TV quality at 384 Kbps, DVD quality at 512 Kbps, 2 times Cable TV quality at 768 Kbps, or 1 Mbps). This is important for organizations that might wish to run multiple video conferences at the same time, but cannot offer 1 Mbps to all of them. This is because HD video offers almost twice the horizontal and vertical resolution of traditional video systems which results in improved capture, process, and reproduction capabilities across the entire system.

Audio Quality

While often overlooked, high quality audio is critical to the success of any video conference for without good quality audio, the image appears to suffer; and with no audio at all we are left with silent pictures! High quality audio causes less meeting fatigue because noise is suppressed. There is a natural flow of conversation due to minimal latency. (Latency is a fancy word for waiting time.) Interaction is natural because gain control means you no longer have to scream into microphones. To ensure the highest quality audio, attention must be given to microphone placement, echo cancellation, audio balancing, tone adjustment, and audio pre and post processing. Proper audio quality allows participants to "talk over" one another, as they might during an in-person meeting, and simultaneous "side conversations" can also be heard. Regardless of all the good technology, successful audio quality is also dependent on room acoustics. If a room is not properly treated (i.e. sound absorption, ambient noise, distance and direction from microphones, and speaker placement) the quality of the audio equipment will be lost.

Camera Designs

In the past, high definition cameras have only been available for digital camcorders or the broadcast television market. Now that high definition is being used for video conferencing, firms are starting to develop software and technology to make high resolution cameras for high definition video conferencing. These cameras help ensure that optimal lighting in the room matches the individuals and the environment. New high definition cameras provide greater zoom flexibility, wider degrees of viewing angles, and larger panning radius. This equates to a wider view of the room and clearer pictures.

User Views of HD Video Conferencing in Healthcare

A survey of healthcare professionals, conducted as this white paper was written, indicated a wide range of applications and benefits for HD video conferencing in healthcare. Suggested applications, as presented by the respondents, include:

- Physician education, patient consultation, and evaluations,
- Telemedicine,
- Connecting surgical suites to other areas of the campus, including live surgery images sent to conference rooms and physician desktops,
- The use of HD for transport from the pathology lab to the surgical suites to allow surgeons to converse in real time with the pathologists and see what they are seeing,
- Clinical and educational services,
- Provider/patient consultation, dermatology care, cardio vascular store intervention, and remote emergency care.

The users feel there are many more potential applications for high definition video conferencing and as the technology is deployed and the benefits are discovered, the value of high definition video will result in everyone wanting HD video (healthcare administration, medical staff, telemedicine, and patients) to truly experience what is happening at a distant site with the clearest pictures and greatest clarity possible.

“HD is essential for accurate and precise diagnosis. Although dialog and sense of shared presence is important, being able to see the image in high definition is critical. The new Polycom HD codec provides equal endowment for people and content”, stated Dr. Stephen Papadopoulos, Director of Image Guided Surgery & Surgical Informatics at Barrow Neurological Institute.

Dr. Jonathan Tyman of Internet2 added, “Users are amazed when they first experience the nuances of expression and gesture that are visible in a high definition video conference. The full range of emotions comes through with the enhanced color depth and high-fidelity sound. This is astonishing to those numbed by years of communicating by telephone.”

What makes high definition video conferencing most attractive to these respondents is the a) increased sense of reality or of “being there”, b) the ability to have high definition content sharing, and c) the high definition video resolution.

Polycom® UltimateHD™

Given the breadth and depth of applications where video conferencing, and now HD video conferencing, can be used to provide value, Polycom brings to market a solution that addresses all of those applications. It is not enough to just provide an HD resolution and high frame rate. A true HD experience needs to take into consideration every aspect of the video meeting and provide an "UltimateHD" experience.

Polycom ® UltimateHD™ is a next generation architecture that enables the worlds most lifelike and engaging collaborative communication experience. Polycom's UltimateHD architecture is a long term strategy that conceptually describes the essential elements (HD voice, HD video, HD content sharing, HD infrastructure, HD services) and how they blend to enable remote meetings to be as engaging as face to face meetings, dramatically improving productivity and efficiency.

What does the UltimateHD architecture provide?

UltimateHD products and solutions based on this architecture will provide users the greatest visual, audio, and content detail in a multimedia collaborative meeting.

- **Enhances productivity, effectiveness , and efficiency** - an engaging life like experience with superior audio fidelity, video clarity, and detailed content that allow you to manage globally dispersed teams, speed time to market and build loyal relationships over distance
- **Facilitates a new class of Unified Collaboration applications**- applications that require the enhanced detail supported by UltimateHD where you used to have to be there are now possible remotely
- **Ensures a lifelike user experience everywhere**- consistent premium experience from mobile, desktop, and conference room
- **Enables the next generation of unified collaboration**- conferencing, broadcasting, streaming and archiving
- **Becomes the collaboration core of any unified communications strategy**- leverages and enhances incumbent infrastructure telephony and presence based systems
- **Provides unmatched flexibility**- Supports simultaneous On-Demand or scheduled HD collaborative meetings
- **Delivered without compromise only Polycom** - Can provide all of the essential elements with Best in class HD Voice, HD Video, HD Content, HD Infrastructure, HD Services

How is Polycom's UltimateHD architecture different from what competitors offer?

In order for customers to have a complete and consistent life-like collaborative communications experience everywhere, the technology must be approached from a strategic and holistic level. Unlike other solutions claiming high definition, which only focus on delivering the requisite video resolution, Polycom HD solutions adhere to the UltimateHD architecture enabling a complete high definition experience with every aspect of the meeting enhanced by UltimateHD architecture conformity: HD video as well as HD voice, HD multimedia content, HD bridging, HD recording/archiving/streaming, and supporting HD services.

What An Ultimate HD Healthcare System Will Look Like

To optimize the HD Healthcare experience, the following should be kept in mind:

1. *A data transfer rate of 1 Mbps is the minimum requirement* for high definition interactive video conferencing. For optimal results, data transfer rates at or about 2 Mbps are recommended. This provides incremental bandwidth for premium audio and additional content sharing devices such as PC input, DVD's, high-resolution document cameras, and various medical devices.
2. *Quality of Service (QoS) for the network is a must* to ensure consistent performance for the duration of the call. Current detractors for video conferencing are related to QOS issues – packet loss, video tiling, choppy audio, etc.
3. *High definition video conferencing requires that all endpoints be HD-compatible* in order for any of the video conference participants to take advantage of the high definition video experience. However, it is important to note that HD video makes every unit look better, even if not fully HD compliant.
4. To capture high-resolution images, *a camera that supports true high-definition (minimum 720p) 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.
5. *High-definition video monitors (LCD, Plasma, or DLP) must also support a minimum of 720p horizontal lines of resolution.* The monitors should offer connectors that enable optimal high-definition signals. Correct monitor selection will also require matching the size of the room and the average distance participants will sit from the monitor.
6. *A high-definition Multipoint Control Unit (MCU) is required for bridging all of the calls together*, when more than two parties plan to participate from different sites (endpoints). 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. Finally, the MCU should be standard-based (H.264) for interoperability and scalable to allow as many connections as required for multipoint calls.

Summary

High definition video conferencing ensures that medical professionals can service patients remotely, obtain continuing medical education, and run the day-to-day business of hospitals without any loss of quality or care. Because the technology is so good, physicians and other care givers are able to see symptoms clearly and patients are able to relate to these professionals often from the comfort of their own home. Now that all aspects of the communication (voice, video & content) are crystal clear and healthcare professionals can participate in training without physically being present, more professionals will be able to obtain continuing medical education at a distance and save time and money. Hospital administrators, especially those serving multiple locations, will have the luxury of accomplishing their jobs more effectively and efficiently by using HD video technology to interact with others as if in person, obtain detailed medical information, and not have to leave their primary office to travel from site-to-site for meetings. Knowledge transfer is critical for healthcare providers. Challenging problems include a shortage of skilled doctors and nurses, a potential for global outbreaks of new diseases, spiraling medical costs, and an aging

population. With the advent of high definition video conferencing technology healthcare providers now have a tool to make true, real-time, visual communications a reality now that the technology exists to SEE without being there.

UltimateHD from Polycom allows healthcare professionals to be more successful by providing improved voice, video and content sharing. Better voice quality allows sounds to be heard in noisy environments, handles dialect differences from multinational participants, and allows large groups to easily converse with multiple speakers. Better video means facial expressions can communicate as much or more than words, and primary cameras may be used to show in-room content, Grand Rounds, and telemedicine. Better content sharing means multiple cameras, full-motion HD DVD footage, PC interfaces, and connection of a variety of medical devices can result in enhanced viewing of all types of images. It is now easy to record, stream and archive video conferences and multimedia content, which broadens applications for conferencing and collaboration solutions.

The following chart provides a sample summary of how HD video conferencing can add value to healthcare administrators, telemedicine professionals, and for continuing medical education.

Healthcare Administrators	**Telemedicine**	**Continuing Medical Education**
Interface with administrators and staff at remote sites without leaving ones primary facility.	Have access to healthcare professionals across the country or the globe to obtain specialists when needed	Physician training toward continuing medical education credits without leaving ones local medical environment, thus saving time and travel costs which equates to more time on the job caring for patients.
Obtain training and expertise by interfacing remotely with other medical facilities, specialization boards, and experts who can offer information and education not available locally.	Increase the frequency of telesurgery to learn from other physicians and participate in patient care remotely..	Remotely educate patients prior to hospital procedures, post hospital stays, and as a way to maintain their health by providing medical updates for issues like diabetes, neonatal care, and heart disease.

About TRI

Telemanagement Resources International Inc. (TRI) is a 24 year old management consulting firm specializing in marketing, communications, and training with an emphasis on design, assessment, project management, promotions, and training for collaborative conferencing systems. More information about TRI can be obtained at www.TRIInc.com.

About S. Ann Earon

S. Ann Earon has been a researcher and consultant in multimedia communications for 24 years. She holds a Masters in instructional technology and educational administration from Northeastern University, and a Ph.D. from Boston College in business, speech & communications, and education. Dr. Earon currently chairs the Interactive Multimedia & Collaborative Communications Alliance (IMCCA), the non-profit industry association for conferencing & collaborative communications. She can be reached at AnnEaron@aol.com.

About Polycom

Founded in 1990, Polycom delivers end-to-end rich media collaborative applications for voice, video, data and the web from desktop and mobile personal systems to room systems to the network core. Our vision is to enable people to connect anytime, anyplace and with any device in a virtual experience as natural as being there. Polycom is the worldwide leader in market share for best in class group and personal video systems, video and voice collaboration infrastructures and conference phones. For more information, visit www.polycom.com