Distance Education with Internet2 Audio/Video Technology

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The construction industry has changed enormously over the last 20 years and so have the tools used to manage the delivery of today's construction projects. Students, as well as current industry professionals, are finding it necessary to master these new processes, particularly those that affect communication and the handling of information, or they will be left behind. Creating new courses and continuing education classes that address this issue is a major concern. Designing courses that fit today's busy schedules and allow students to attend classes in non-traditional ways is a primary challenge for construction educators. The curricula of university programs must be adjusted to meet these changing needs. New tools are now available to help make these changes possible. Simple, fast and portable technologies can now be used to economically implement audio/visual connections between remote sites. These technologies allow distance learning to be an integral part of the solution and to meet the current needs of the industry.

Key Words: Distance learning, Internet 2, graduate education, integrated services digital network (ISDN), bandwidth, internet protocol (IP), multipoint conferencing, mixed conferences, multipoint control units (MCU), video private network (VPN).

Introduction

Computer technology is an essential part of virtually every industry today, and the construction industry is no exception. Computer software for planning, scheduling, estimating, drafting, and accounting is rapidly becoming an industry standard. College graduates entering the workforce, as well as current industry personnel, must be proficient with computers to keep pace with ever-changing technology. Consequently, the construction industry is demanding that graduates have some background in computer applications for all phases of construction. It is becoming more common for the construction professional to return to college for this training, especially at the master's level. Due to time and geographic restraints, this is virtually impossible for many.

Construction educators must take the lead in promoting computer literacy in their curriculums, and continue to develop new courses, delivery styles and software applications through continued research activities. Assessing the current and future needs of the construction industry, educators from the University of Nebraska-Lincoln's (UNL) Department of Construction Management and educators from Colorado State University (CSU) believe the time has come to educate not only within the classroom setting, but also to advance technology through distance learning. This bold step has only recently become a reality with the latest Internet 2 audio/video technology and software that is currently available. Recognizing this, UNL's Department of Construction Management has already constructed a Distance Learning Computer Facility using this simple and portable technology.

Technology Background

Television has penetrated societies throughout the world as a non-interactive display device for combined video and audio signals. Interaction or video conferencing has been accomplished through expensive satellite feeds or through the integrated services digital network (ISDN), technologies that are affordable to only a minority of potential users. Even with these high-tech pieces of equipment, “interaction” can mean that one of the active parties benefits from the use of satellite audio and video feeds while the other party in the communication is restricted to telephone audio feed. Coming to the rescue is an affordable, impending convergence of three digital technologies -- namely the high bandwidth Internet2, computer equipment with very-high-definition screens and advanced internet protocol (IP) bridging.

Internet2 has the advanced capabilities of data communications but at lower costs. Internet2 is a high-performance network that uses an entirely different infrastructure than the public Internet. There are already more than 200 universities and scientific institutions, and more than 60 communications corporations in the Internet2 network.

Most of the institutions on the Internet2 network are connected via Abilene, a backbone that supports a throughput of 10 gigabits per second (see Figure 1). Abilene is an advanced backbone network that connects regional network aggregation points to support the work of Internet2 universities as they develop advanced Internet applications. The network has become the most advanced native Internet protocol backbone network available to universities. There are also several international networks that are connected to the Abilene's infrastructure, and as the project grows, more and more networks will be able to connect to the current framework. All of the original project's members are actively participating in the development and testing of new applications and Internet protocols.

Abilene is named after a railhead established in Abilene, Kansas during the 1860´s. In its time the ambitious railhead of the 1800's staked a claim on what was then the frontier of the United States; the Abilene Project establishes a foothold from which to explore and develop pioneering network technology. The links of last century's railway changed the way people worked and lived. The 21st Century’s electronic railway will likely do the same. (Abilene, 2003).

The group's emphasis is on research and collaboration, focusing on things such as video conferencing, multicasting, remote applications, and new protocols that take advantage of the many opportunities mega-bandwidth provides. The excitement is about the 10 Gbps worth of data-moving bandwidth.

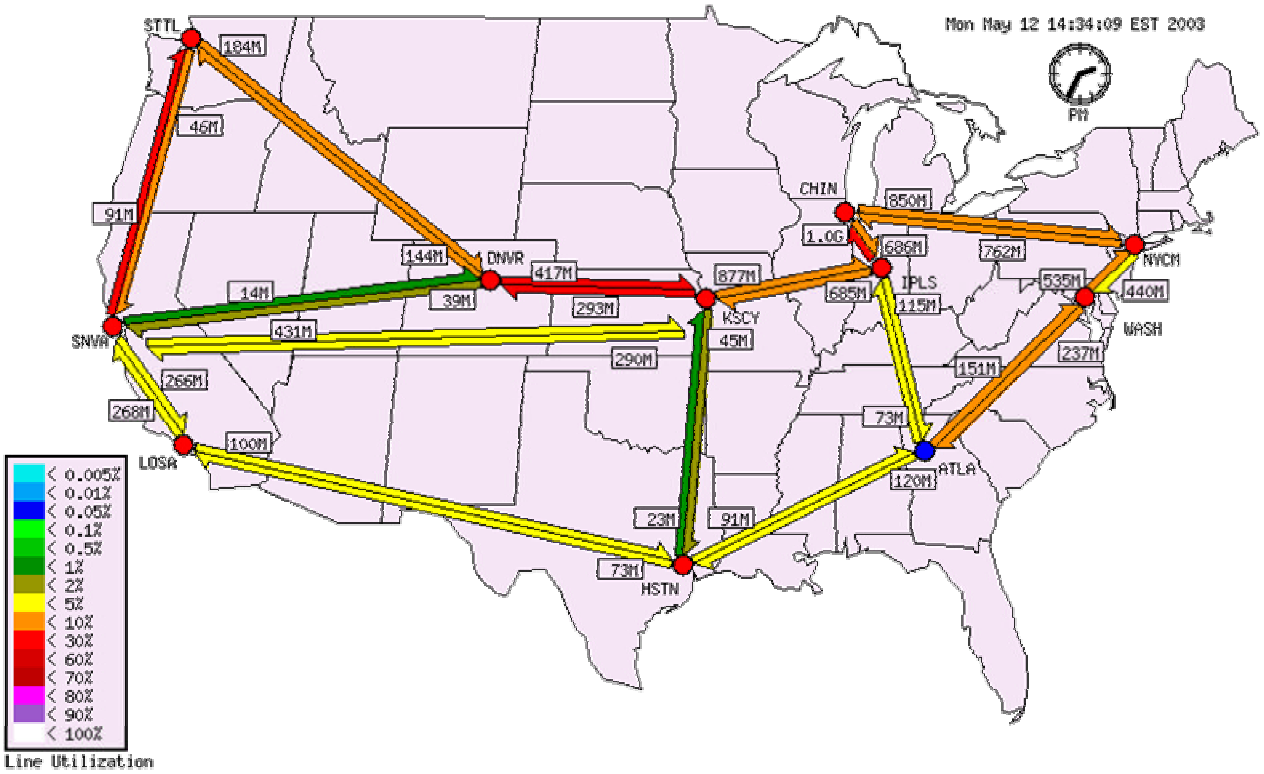

Figure 1: The 10 Gbps Abilene Backbone Network

The bandwidth for placing Internet2 - H.323 calls is based on the call-quality math of switched circuit networking. The math is based on the division of bandwidth into 64-Kbps increments or one DS0. A standard H.320 ISDN line is composed of two 64-Kbps DS0s for a total bandwidth of (2x64 Kbps) = 128 Kbps transmission. This does not include a signaling channel. Most businesses and educational video communications use 384 Kbps. Over ISDN, this requires six DS0s (or 6 x 64 Kbps – 384 Kbps) and requires an equivalent monthly expense of 6 separate telephone lines for a business or educational unit. The Internet2 H.323 counterpart requires a single line 100 Mbps Ethernet connection. (O'Neil, 2003). A speed/bandwidth comparison is given in Table 1.

With the breakthroughs in new multipoint conferencing systems and significant ease of use and performance enhancements in multipoint control units (MCU, also referred to as "bridges"), an IP real world voice and video system will detect industry standard firewalls and receive H.323, H.225 or H.245 signals with sufficient (and lower) bandwidth to accommodate rich media sessions. There is little to no network delay due to call set-up or maintenance. In addition, a video private network (VPN) with end firewalls has the ability to route calls, manage dozens of simultaneous sessions, and interoperate with many third-party H.323 entities and data networking devices. It is expandable and is comparable to telephone and data network services.

Table 1

Dialing Speed and Bandwidth Comparison of ISND and IP

Call Quality or Dialing Speed	Bandwidth Required over ISDN (H.320)	Bandwidth Required over IP (H.323)
128 Kbps	1 Basic Rate ISDN (BRI) line	153 Kbps
256 Kbps	2 BRI lines	307 Kbps
384 Kbps	3 BRI lines	460 Kbps
512 Kbps	4 BRI lines	614 Kbps
768 Kbps	Fractional TI or full Primary Rate ISDN (PRI) line	922 Kbps
1.5 Mbps	1 PRI line	1.843 Mbps
2.0 Mbps	Multiple PRI lines or E1 line (Europe)	2.4 Mbps

Usage Scenarios and Architecture

It is important to understand just how this type of technology affects the network administrator and the user of the service. The combination of MCUs and a gateway to provide multiple protocol intercommunications can offer the following usage scenarios for internal videoconferences over VPN tunnels.

- IP Point-to-Point Conferences – A single terminal calling another terminal or calls can be placed between any H.323 IP desktop and/or group system in a point-to-point conference using the VPN technologies.
- IP Multipoint Conferences – H.323 IP-based multipoint conferences to and from any desktop and/or group system may be placed with IP-based MCU products.
- IP & ISDN Mixed Conferences – IP & ISDN mixed point-to-point conferences may be placed to or from H.323 IP-based desktops and/or group systems using a protocol gateway.

The most common implementation is point-to-multipoint, using multiple protocols. This setup is ideal for Internet2 networking especially since the H.320 technology has slowed and moved toward the more dynamic and economical IP infrastructure. In deploying a video communications system, one must understand video communications infrastructure and network variables to evaluate terminals, gateways, MCUs, etc. An advanced complete learning solution was designed by UNL telecommunications staff in a "user-friendly" format that could be easily and economically integrated in the larger classroom. With multiple controls, cameras, microphones, and instructional tools, the best available solution was directed towards the Polycom® systems, due to their ability to take full advantage of distance learning technology at a reasonable price. The completed system allows complete interaction, from simple communication to sharing complex data and computer software (see Figure 2).

Polycom's® revolutionary unified conferencing system created a single platform that enables people to combine audio, video, and web conferencing in a single meeting over any type of network (see data specifications in Appendix A). The cost was extremely reasonable (compared

to ISDN systems), and the installation was flexible enough to accommodate the physical attributes of the classroom.

UNL has equipped a distance learning facility with 20 computer stations and tied them into a mainframe computer. The stations are strategically located to enable each student to have an unobstructed view of a large (7'x 8') centered projection screen and two left/right 56" Sony televisions located in the front of the classroom (see Figure 3). The heart of the system is an IP2 broadband audio/video system by Polycom®. The class lecture itself can be as sophisticated as the instructor wants it to be by utilizing computer software, PowerPoint® presentations, overhead projected materials, electronic white board, television/cable broadcast, or VCR/DVD programming. Students at UNL's end can manipulate the software at their individual stations while viewing the on-screen instruction. The screen image can be transmitted to multiple designated sites off campus such as contractors' offices, universities, technology centers and even wireless laptops where the interactive process of a live lecture can be offered.

Incorporating Internet2 Technology into Distance Learning

Rapid technological advances in communication are changing the traditional process for conducting business (Antevy, 1998; Emond, 1999; Hmelar, 2003; Orth, 2000; Schexnayder, Wiezel, & Seneviratne, 1999; Wacome, 2003). As a result, organization and documentation of information for the Internet environment requires special attention to how an audience will interact with the data (Tufte, 1990; Zaneldin, 2001). This applies not only to industry but also to any academic program development.

To be successful, one must understand the verbal and graphic operations of presentation that are currently conducive to distance learning. Many construction management programs across the United States are finally bringing distance education into reality. Some examples are:

- The collaboration between the University of Oklahoma and East Carolina University to develop an online delivery system for a design-build class. The team used a fire substation in Las Vegas, NV as the class project. Programming studies, site development studies , preliminary and final material research, code analysis, preliminary schematic designs, structural design, preliminary cost and scheduling, value engineering and final design development were all funneled into the class using Internet technology. They have plans to extend the course offering to students at Augsburg in Augsburg, Germany (Batie & Connell, 1999).

- In the Department of Civil Engineering and Construction at Bradley University, Peoria, in Illinois, they have developed a course using online learning tools to teach construction scheduling. Using tools ranging from scripting and programming languages to simple WYSIWYG (What-You-See-Is-What-You-Get), they have developed a new paradigm of "lecture-on-demand" as a part of the now recognized framework of Asynchronous Learning Networks (Nassar, 2001).

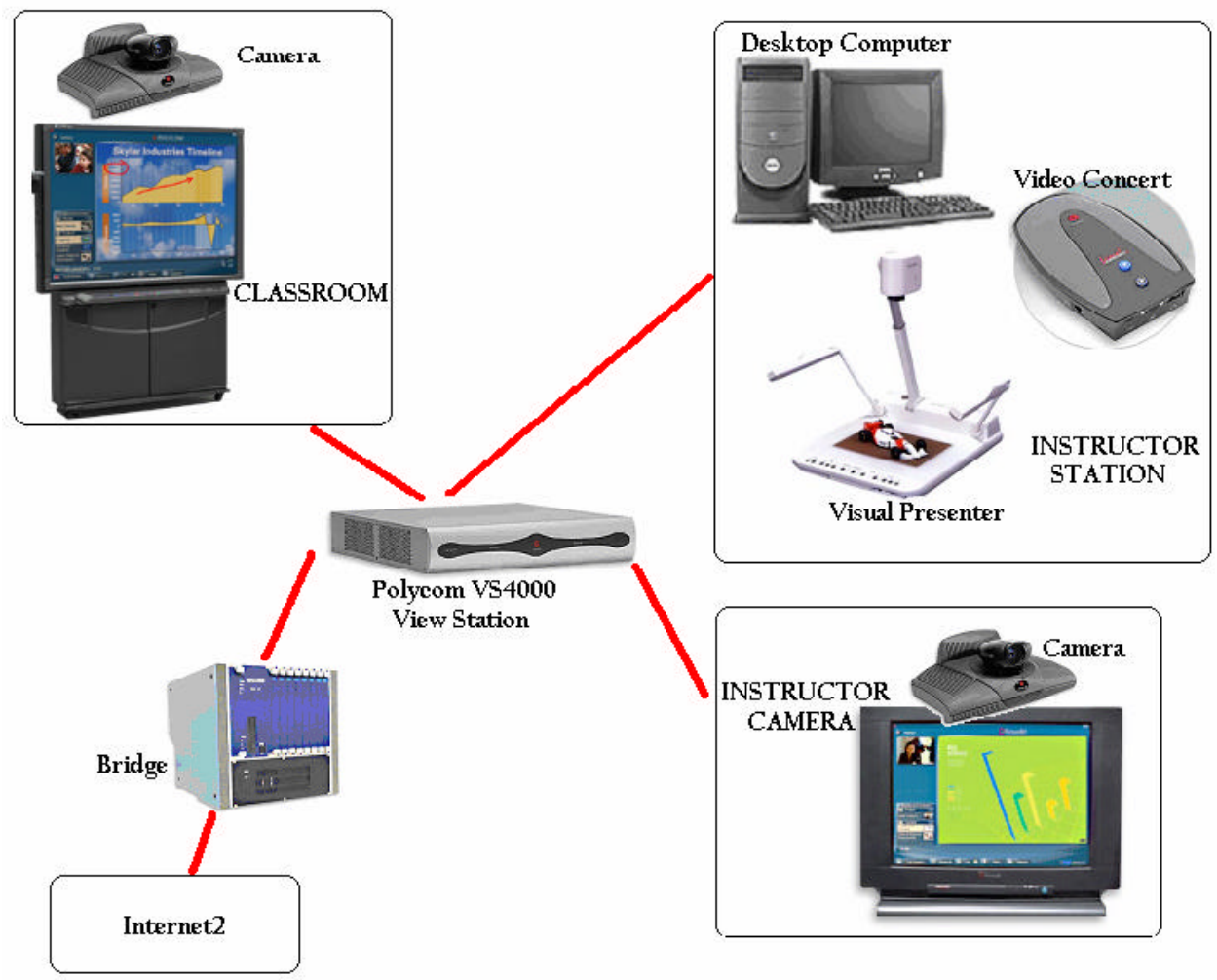

Figure 2: Real Time Video and Audio Solution for Internet2

Figure 3: Actual Classroom Configuration Using the Polycom® Solution

- There was a pedagogical cooperation between the University of North Florida and The American University using the new avenues of the World-Wide-Web technology through the Florida Engineering Education Delivery System (FEEDS). It is a system that was created to deliver academic programs to place-bound engineers throughout the state of

Florida. This statewide system is providing access to graduate- and undergraduate-level courses at corporate sites and cooperating university centers. Place-bound engineers have access to degree programs, courses and certificates (Malek, 2003).

- The University of Oklahoma in Norman Oklahoma is offering interactive online construction education experiences. They have developed a course that has an automated self-paced interactive format. It works by combining animation, video and audio to overcome or minimize the perception of a correspondence class. Overall results seem to capture the imagination of the student by reinforcing necessary concepts just as well as a "good" instructor would do in the traditional lecture format (Ryan & Kasturi, 2002).

- Classes are being taught successfully using UNL's distance learning facility within Lincoln-Omaha campuses and between colleges on the Lincoln campus. Collaboration of teaching have been successful with Harvard, Texas A&M, and Arizona State. Future plans are to extend this same type of graduate education into a 36-hour Master of Engineering in Construction program by fall 2004 with the collaborative efforts of UNL and CSU.

Discussion

Distance education is increasingly being delivered using combinations of the various tools previously mentioned. This forces an approach to teaching that requires breaking it into two constituent parts: instructor training and curriculum development.

Instructor Training

A review of the literature demonstrates that distance education through computer networking and related technologies is creating a paradigm shift in education away from the traditional teaching-learning transaction (Davison, 1996; Filipczak, 1995; Harasim, 1996; Kerka, 1996; Moore, 1995). The trend shows that the delivery of instruction is being shaped by microcomputers, the Internet, and the World Wide Web and that distance educators are facing enormous challenges (Kerka, 1996). These systems can be great, but caution is considered necessary. As noted by Williamson (2001), there needs to be real educational value beyond the use of technology. He discovered that most curriculums are written and presented in a teacher-centered format, not student-centered. Initially, most faculty members seem to view technology as just a simple aid to their existing teaching strategies. This attitude toward this new technology must, at a minimum, be expanded if not ultimately changed, in order to take advantage of this new teaching format.

There are an added number of issues that arise that are affiliated with the change in teaching and learning format by the use of distance education. The most frequently-mentioned issue is the need for faculty development (Davison, 1996; Filipczak, 1995; Thach & Murphy 1995; Warren, 1995). This is due to the fact that traditional lectures will not function in a distance education setting. If educators are not trained in facilitating greater student participation and interaction, the

end result would be a class that simply imitates familiar teaching situations and strategies, creating little student involvement at the far end (Davison 1996).

Thach and Murphy (1995) conducted a study of 100 distance educators that demonstrated a need for teaching development in distance education. They compiled a list of competencies that are needed to prepare the instructor for the distance-learning environment. These “top ten” competencies illustrated the dual importance of communication skills and technical skills as follows:

1. Interpersonal Communication
2. Planning Skills
3. Collaboration/Teamwork
4. English Proficiency
5. Writing Skills
6. Organizational Skills
7. Feedback Skills
8. Knowledge of Distance Education Field
9. Basic Technology Knowledge
10. Technology Access Knowledge

Curriculum Development

Course design is determined by the educator’s technological skill sets. Content and mode of delivery are key issues of the development of any distance class. However, it is important that instruction, no matter the skill set, is designed to promote continuous learning in an engaging format. Distance learning technology does not lend itself well to changing methodology once a class session has begun. With this in mind, there appears to be a need for distance teachers to stay with the "prepared script" by designing distance education courses with high levels of organization that can control the input and output of the learning environment. Moore and Thompson (1990), along with Williamson and Burt (2001), caution against the use of technology for technology's sake. They insist that decisions should be based on instructional needs and goals and then on professional and technical expertise.

There are four “teletechniques” that were first introduced by Parker and Monson (1980) and then described in more detail by Moore and Thompson (1990). These principles of instructional design are taken for granted in the traditional face-to-face lecture format but can become lost in distance education with disastrous results. The first is to keep students from becoming “dehumanized” by the distance technology. The instructors must maintain a rapport with their students by creating an atmosphere that fosters relationships. The second is participation as it relates to interaction among the students within the audio/video classroom. Multiple broadcast sites can be a challenge. The third is the message style in which the instructor creates strategies to generate student interest and appeal in the lecture or discussion. Finally, they identify the fourth principle as feedback. This is crucial for the instructor to determine the level of effectiveness of the distance learning process.

Conclusions

Distance education can now be delivered in an economical and "user-friendly" format. The distance communication gap has been bridged for the instructor and student; however, care must be taken not to inhibit classroom interactions and relationships. Instructors need to be reflective in their pedagogical principals and adjust their teaching style in a manner that is conducive to student learning. They need to be aware of the psychological, social, and technical obstacles that distant learners face. As for the distance students, logic would dictate that they will have to take more responsibility for their own learning. To be a successful learner, they will have to partner with the instructor to overcome the obstacles that are inherent to the distance-learning environment. The distant students must also overcome the intimidation of using the technology to interact with the class on a voluntary basis.

Trends indicate that in the future there will be an increase in the volume of students that enroll in distance learning programs as well as changes in the type of delivery systems that will be used. However, it needs to be noted that distance education is not, and will not be, for all teachers and students.

Recommendations

It is recommended that both UNL and CSU do an evaluation of resources that will allow them to determine the strategies in managing a simple "in-house" pilot project. This project would use one course for distance education at the departmental level (i.e. use the equipment in two separate and distinct classrooms with two groups of students). Using the information gathered from this initial project, both universities then could move toward the development of one trial graduate course to be taught between the universities.

Assessment can be made and lessons can be compiled for the development and employment of a larger-scale, 36-credit-hour graduate program. This development must address the mission, a needs assessment, goals and action plans, budgeting and evaluation of the program. To insure that the distance learning system develops in the most beneficial ways, it must be recognized as being consistent with and supportive of the culture and mission of all parts of the involved institutions. Management and administration of the program must also include the provision for evaluation which gives all of the stakeholders involved a method or methods by which they may determine if the goals and the mission of the distance master's program has been met. In addition, a reserve fund analysis is needed to determine service and update needs of the audio/visual system on both sites. These systems must be kept current in order to fully utilize the potential of these new and ever-changing technological advances.

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Appendix A

ViewStation 4000

ViewStation 4000 delivers near TV-quality video and superior audio to meet the most demanding video communications needs for custom conference rooms, auditoriums, boardrooms, and classrooms.

Highlights

Designed for customization and integration—The ultimate in performance, interfaces, and control for custom room integration

The industry leader–The most popular and widely deployed group video conferencing platform in the world

Superior video quality–With ITU standard, 60 fields per second, letterbox near TV-quality video, and Polycom Video Error Concealment (PVEC) designed to counter real-world network packet loss

Clear 360-degree, full duplex digital audio–With noise suppression, echo cancellation, and automatic gain control

Maximum call flexibility–Support MPPlus conferences with up to 14 video and audio sites through the embedded MCUs when cascading (10 sites on any mix of IP or ISDN, plus four regular telephone connections)

See presenter and live, high-resolution multimedia presentation–People+Content™ displays video of the presenter along with live, high-resolution XGA PC graphics and sound between ViewStation FX, ViewStation 4000, iPower™, and MGC bridges

Built-in automatic MPPlus presentation modes–Display modes automatically switch between presenter and continuous presence–like a live TV news show

Security you can trust–Independently verified and tested for secure use in corporate and classified environments. Polycom video conferencing and collaboration systems provide advanced technology specifically designed for video conferencing, including superior audio pickup with 360-degree microphone that enables meeting participants to be heard from anywhere in the room. Polycom's interface is easy to use, with on-screen graphics, and easy to navigate with color-coded remote controls. Going beyond face-to-face meetings, laptops can be quickly connected to Polycom video systems with dedicated devices that make sharing content as easy as pushing a button. These high-quality Polycom systems are all part of The Polycom Office.

High-quality video communications for The Polycom Office™

Technical specifications

ITU H.323 and H.320 compliant

- Cisco AAVID certified

The Polycom Office experience

- People+Content™ allows dual display of video and PC graphics
- Conference on Demand™ initiates unscheduled MGC calls from the endpoint
- Call Detail Records enables billing of calls and tracking with Global Management System
- Polycom Video Error Concealment (PVEC) for improved video quality on networks with packet loss
- Global Management System for centralized management
- Global Directory Server for live global address book
- PathNavigator for easier call placement and network cost optimization
- MGC Click &View integration for individual screen layouts

User interface

- User-friendly graphical user interface that is easy to read from a distance
- Handheld, ergonomic remote control
- Custom logo on home screen with speed dial numbers
- Web interface (Internet Explorer 5.5 & 6.0; Netscape Navigator 6.0 & 6.1)

Bandwidth

- Max Data Rate H.320: up to 2 Mbps
- Max Data Rate H.323: up to 2 Mbps

Video standards

- H.261, Annex D
- H.263+ Annexes: L, F, T, I, J, U, u
- H.263++ Annex D
- ITU 60 fields per second letterbox
- 1 x video out for projector up to 1024 x 768, 60 Hz
- 3 x 10/100 Ethernet hub

Other content input options

- pc Presents for Microsoft PowerPoint presentations from your desktop
- Polycom SNAP for high-resolution graphics capture of PC content

With integrated video, voice, data, and Web capabilities, The Polycom Office is the only solution that offers you an easy way to connect, conference, and collaborate any way you want. It's our commitment to making distance communications as natural and interactive

Video features
4 monitor support to simultaneously display full-screen video from up to 4 endpoints plus PC content on a separate XGA projector Automatic VCR recording of all endpoints based on the person who is talking Automatic Picture-in-Picture (PIP)

Video inputs (7 Inputs)
- 1 x MiniDin S-Video (main camera with PTZ control)
- 1 x MiniDin S-Video (document camera)
- 1 x MiniDin S-Video (second camera with PTZ control)
- 1 x RCA/Phono, composite (main camera)
- 1 x RCA/Phono, composite (document camera)
- 1 x RCA/Phono, composite (VCR)
- 1 x RCA/Phono, composite (second camera with PTZ control)

Video outputs (10 Outputs)
- 4 x MiniDin S-Video (Support for 4 independent monitors)
- 4 x RCA/Phono, composite (Support for 4 independent monitors)
- 1 x RCA/Phono, composite (VCR)
- 1 x XGA (projector)

Video formats
- NTSC, PAL, XGA, SVGA, VGA

Optional Polycom PowerCam external camera
- Ultra-quiet, ultra-fast Pan, Tilt, Zoom (PTZ)
- 65° Field of View
- Tilt Range: +/- 25° (up/down)
- Pan Range: +/- 100° (left/right)
- Total Field of View: 265°
- 12x Zoom; f-4.2 to 42mm
- F=1.85 to 2.9 mm
- Auto Focus
- Automatic White Balance
- 20 camera presets (10 local and 10 far end)
- Far end camera control

People+Content
- Dual images (transmits people and high resolution content simultaneously)
- Dual audio (transmits audio from room microphones and PC simultaneously)
- Available on IP and ISDN

Audio standards
- 7 kHz G.722, G.722.1
- 3.4 kHz with G.711, G.728Audio features
- Instant Adaptation Echo Cancellation
- Automatic Gain Control (AGC) – voice activated
- Automatic Noise Suppression (ANS)
- Built-in tonal speaker test
- Audio level meter
- Audio mixer
- Telephone POTS support
- Ability to talk over VCR audio

Digital tabletop microphone
- 360° voice pick-up, unidirectional performance
- Automatic room noise reduction
- Gated mixer built into microphone
- 3 hyper-cardiod microphones in each microphone pod
- Button on each microphone pod
- Includes 2 microphones pods
- Can be mounted to ceiling or walls

Audio inputs (4 inputs)
- RJ-9 to microphone (daisy chain up to 2 microphone pods)
- 2 x RCA / Phono line level (VCR)
- 1 x RCA / Phono line level (Mixer/Auxiliary)

Audio outputs (4 outputs)
- 2 x RCA / Phono line level (main audio)
- 2 x RCA / Phono line level (VCR)

Frame rates (point-to-point)
- 15 fps – 30 fps
- Intelligently selects frame rate for best video performance
- Near TV-quality letterbox 60/50 fields video for NTSC/PAL at 512 Kbps and above

Embedded MPPlus
- Supports mixed combinations of IP, ISDN, and analog telephone calls
- Supports IP telephones
- Supports normal analog telephones
- Automatic IP and ISDN downspeeding
- Dial-in and dial-out during MPPlus calls
- Continuous presence or voice switched
- Automatic MPPlus Presentation modes to automatically switch between presenter and continuous presence modes
- Chair control from endpoints or host system on IP
- Chair control from endpoints or host system on ISDN
- Embedded MPPlus for 5 sites (4 IP/ISDN sites + 1 POTS audio)
- Cascade up to 14 sites (10 IP/ISDN sites + 4 POTS

- Works from any endpoint with embedded MCU (not just host site)

Live people video resolution
- 4CIF (704 x 576)
- CIF (352 x 288)
- QCIF (176 x 144)

Live PC content resolution
- XGA (1024 x 768)
- SVGA (800 x 600)
- VGA (640 x 480)
- 4CIF or CIF for S-Video and composite inputs

Still image transfer
- CIF, 4CIF (H.261 Annex D), 16 CIF High resolution (H.263)

Optional Visual Concert™ FX
- Tabletop device (for audio and video input from PC or Macintosh)
- Input: up to 1280x1024, 60 Hz
- Output: up to 1024 x 768, 60 Hz
- 1 x audio input for PC
- 1 x video input for PC up to 1280 x 1024, 60 Hz
- Software upgradeable Inverse Multiplexer (IMUX)
- Auto SPID detection and configuration
- NATO standard KG-194/KIV-7 encryptor support with on-screen and address book dialing
- Polycom Global Address Book integrates with Active Directory/LDAP
- Automatic ISDN localization of calls
- Dial ISDN lines separately or simultaneously

Quality of service and experience - iPriority™
- Polycom Video Error Concealment (PVEC) for concealing packet loss
- IP Precedence (ToS)
- DiffServ DHCP (CoS)
- Dynamic bandwidth allocation
- Proactive network monitoring
- Packet and jitter control
- Network Address Translation (NAT) support
- Automatic NAT discovery
- Asymmetric speed control
- Fixed TCP/UDP port firewall support
- Lip synchronization
- Echo cancellation
- Echo suppression
- Auto gatekeeper discovery
- Automatic gateway dialing profiles
- Specify outbound call routing for gateway/ISDN
- Closed captioning and text chat support both in and out of calls

audio)
- Mixed network cascading
- Password protection for incoming calls
- Supports People+Content dual streams from any endpoint (not just host site)

Network features
- Automatic H.320/H.323 calling
- Downspeeding over IP and ISDN
- OneDial intelligent call management attempts call on preferred network (IP or ISDN) and automatically rolls over to secondary network if needed
- Maximum call length timer
- Live address book with Polycom Global Address Book automatically and quickly removes endpoints from directory if they are turned off

System management
- SNMP management
- Software upgrades via PC, IP, or in a ISDN video call
- Integrated Web server for remote management and Microsoft PowerPoint presentations
- Remote administrator video-only monitoring of room or calls from integrated Web server (enabled/disabled from endpoint for security)
- Built-in extensive Call Detail Records (CDR) that do not require separate external management system
- Account number validation at call initiation integrated with Polycom
- Global Management System for billing purposes
- Administrator configurable dialing speeds
- Complete support for The Polycom Office including:
- Polycom Global Management System
- Polycom Global Address Book
- Polycom OneDial
- Polycom PathNavigator

Other ITU supported standards
- H.221 communications
- Bonding, mode 1
- H.281 far-end camera control
- H.225, H.245
- Annex Q standard for FECC in H.323 calls

Data port
- RS-232 control port/data communications port (1200 baud to 115k baud asynchronous)
- API for custom integration with remote devices such as Crestron™ and AMX™ control systems

Electrical
- Auto-sensing power supply
- Operating voltage/power 90-260 VAC, 47-63 Hz/40

- Keypad audio confirmation – makes dialing easy

Security features
- Independently tested for endpoint security
- Enhanced integration for independently certified corporate and classified encryption devices
- Secure password authentication
- Unique factory default passwords
- Dial-in meeting password
- Do not disturb meeting feature for point-to-point
- Do not disturb meeting feature for MPPlus calls
- Select which menu screens to password protect
- SNMP security alerts for failed and successful password authentication attempts
- Option to disable remote interfaces (FTP, SNMP, Telnet, HTTP, Streaming)
- Option to disable mixed protocol MPPlus calls

Network interfaces supported
- 2 independent 10/100 Ethernet ports for IP (LAN, DSL, cable modem)
- Integrated Ethernet switch
- 1 x POTS for voice
- Optional Quad BRI (Basic Rate Interface)
- Optional PRI (Primary Rate Interface) T1/ E1
- Optional 2-port Serial Module (V.35/RS-530/RS-449 with RS-366 dialing)
- Optional wireless LAN support via Ethernet port

Ethernet connectivity
- TCP/IP, HTTP, DNS, WINS, SNMP, DHCP, ARP, FTP, Telnet
- T.120 interface for Microsoft Netmeeting
- Internal live video unicast or multicast stream to Apple Quicktime, Cisco IP/TV, etc.

Directory services
- 1000+ number local directory
- 10,000+ number global directory
- Unlimited MPPlus entries
- Live address book with Polycom Global Address Book as being there. Work faster, smarter, and better with the ViewStation 4000 and The Polycom Office.

Polycom ViewStation 4000 Specifications
- Polycom video conferencing and collaboration systems support Polycom network infrastructure and management systems. With the Polycom MGC, Polycom video systems can participate in large multipoint conferences. Polycom PathNavigator™, among many other features, enables easy dialing from Polycom video systems with OneDial™.
- And video systems can be centrally managed and controlled with Polycom Global Management

watts

Environmental specifications
- Operating temperature: 0 to 40° C
- Operating humidity: 10% to 85% R.H. noncondensing
- Nonoperating temperature: -40 to 70° C
- Nonoperating humidity (noncondensing): 10 to 90%

Physical characteristics
- Dimensions (W/H/D): 43.8 cm x 8.8 cm x 46.7 cm
- Base Unit Weight: 4.7 kg/10 lbs

Language support
- Chinese, English, French, German, Italian, Japanese, Norwegian, Portuguese, Spanish

Warranty
- Three-year parts and labor

System™, and the Global Address Book enables easy access to directory services. Polycom video conferencing and collaboration deliver high-quality video and integrated solutions for The Polycom Office.