



CHAPTER 1

Cisco TelePresence Solution Overview

The Cisco TelePresence suite of virtual meeting solutions consists of the products and capabilities described in the following sections.

Cisco TelePresence System 3000

The Cisco TelePresence System 3000 (CTS-3000) is designed for business meetings, with up to six participants per room. It consists of:

- Three 65" high definition plasma displays
- Three high definition cameras
- Three wide band microphones and speakers
- A lighting shroud integrated around a purpose built meeting room table

Customers must furnish their own chairs. A Cisco 7975G IP phone is used to launch, control, and end the meeting.

Figure 1-1 Cisco TelePresence System 3000

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Participants are displayed life size with two participants per screen/table segment and multi-channel, discrete, full-duplex audio with echo cancellation per channel that appears to emanate from the person speaking. The unique table design also provides power and Ethernet ports in each table leg, so users do not have to hunt for power and network connections during the meeting. A projector is integrated under the middle section of the table for convenient viewing of PC graphics on the panel below the plasma displays. An optional WolfVision® document camera (not shown) may be installed in the ceiling so that objects and documents placed on the table surface may be viewed as well.

The CTS-3000 is represented by the icon in [Figure 1-2](#).

Figure 1-2 CTS-3000 Icon

Cisco TelePresence System 3200

The Cisco TelePresence System 3200 (CTS-3200) is designed for large group and cross-functional team meetings of up to 18 participants per room. It consists of:

- Three 65" high definition plasma displays
- Three high definition cameras
- Nine wide band microphones and three speakers
- A lighting shroud integrated around a purpose built meeting room table

Customers must furnish their own chairs. A Cisco 7975G IP phone is used to launch, control, and end the meeting.

Figure 1-3 Cisco TelePresence System 3200



The CTS-3200 extends the CTS-3000 by adding a second row of seating which includes a purpose built meeting room table and six additional wide band microphones. The CTS-3200 also provides an option for supporting up to three additional additional graphics displays for convenient viewing of PC graphics via an HDMI splitter.

The CTS-3200 is represented by the same icon as the CTS-3000 shown in [Figure 1-2](#).

Cisco TelePresence System 1000

The Cisco TelePresence System 1000 (CTS-1000) is designed for small group meetings and one-on-one conversations, seating up to two participants per room. It consists of:

- One 65" high definition plasma display
- One high definition camera
- One wide band microphone and speaker
- A lighting shroud integrated over the display

The customer must furnish their own meeting room table and chairs. A Cisco IP phone is used to launch, control, and end the meeting.

Figure 1-4 Cisco TelePresence System 1000



Participants are displayed life size with two participants per screen/table segment and full-duplex audio with echo cancellation that appears to emanate from the person speaking. An optional NEC® LCD display (not shown) may be installed on the table or on the wall for convenient viewing of PC graphics. An optional WolfVision® document camera (not shown) may be installed on the table so that objects and documents placed on the table surface may be viewed as well.

The CTS-1000 is represented by the icon in [Figure 1-5](#).

Figure 1-5 CTS-1000 Icon



Cisco TelePresence System 500

The Cisco TelePresence System 500 (CTS-500) is designed with a smaller form factor and streamlined footprint to fit easily into private offices or public locations. It consists of an integrated 37" display, camera, microphone, speakers, and lighting suitable for private offices.

Figure 1-6 Cisco TelePresence System 500



The CTS 500 delivers the same superior video and audio quality as the rest of the Cisco TelePresence portfolio: 1080p video, wide-band audio, one-button-to-push call initiation, multipoint capabilities, scheduling through existing groupware applications, ad hoc calling support, and interoperability with traditional, standards-based videoconferencing systems. It is available in three configurations:

- Free-standing pedestal
- Wall mount
- Table top

The CTS-500 is represented by the icon in [Figure 1-7](#).

Figure 1-7 CTS-500 Icon



Cisco TelePresence Codecs

One of the goals of Cisco TelePresence is to hide the technology from the user so that participants experience the meeting, not the technology. Hidden underneath the plasma displays of the CTS-3200, CTS-3000, and CTS-1000 solutions are the Cisco TelePresence codecs. The CTS-3000 and CTS-3200 consist of one primary codec and two secondary codecs. The CTS-1000 and CTS-500 consist of a single primary codec. An additional optional codec is available as an upgrade for high-speed (30 frames per second) auxiliary video input.

Figure 1-8 Cisco TelePresence Codec



The codec is the engine which drives the entire Cisco TelePresence solution. All displays, cameras, microphones, and speakers connect to it and it communicates with the network and handles all audio and video processing. The codec runs a highly-integrated version of the Linux operating system on an embedded Compact Flash module and is managed via Secure Shell (SSH) and Hyper-Text Transfer Protocol over Secure Sockets Layer (HTTPs). These codecs make the Cisco TelePresence solutions an integrated part of Cisco Unified Communications by leveraging established techniques for network automation and Quality of Service (QoS), such as:

- Cisco Discovery Protocol (CDP) and 802.1Q for discovery and assignment to the appropriate Virtual LAN (VLAN).
- 802.1p and Differentiated Services Code Point (DSCP) for QoS.
- Automated provisioning of configuration and firmware from Cisco Unified Communications Manager.
- Session Initiation Protocol (SIP) for all call signaling communications.

From an administrator's perspective, the entire Cisco TelePresence virtual meeting room appears as a single SIP endpoint on Cisco Unified Communications Manager. It is managed using tools and methodologies that are similar to those used for Cisco Unified IP Phones.

The Cisco TelePresence Codec is represented by the icon in [Figure 1-9](#).

Figure 1-9 Cisco TelePresence Codec Icon



Industry-Leading Audio and Video Support

Cisco TelePresence utilizes industry-leading 1080p high-definition video resolution and 48kHz wide-band spatial audio. 720p high-definition is also supported for sites with restricted bandwidth availability.

Video Resolutions and Compression Formats

The Cisco TelePresence displays and cameras natively support 1080p resolution and utilize digital media interfaces to connect to the Cisco TelePresence codecs. This ensures the integrity of the video signal from end to end by eliminating the need for any digital/analog conversion.

Inside the Cisco TelePresence codecs an onboard array of Digital Signal Processors (DSPs) encode the digital video signal from the cameras into Real-Time Transport Protocol (RTP) packets using the H.264 encoding and compression standard. The Cisco TelePresence codecs can encode the video from the cameras at 1080p or 720p.

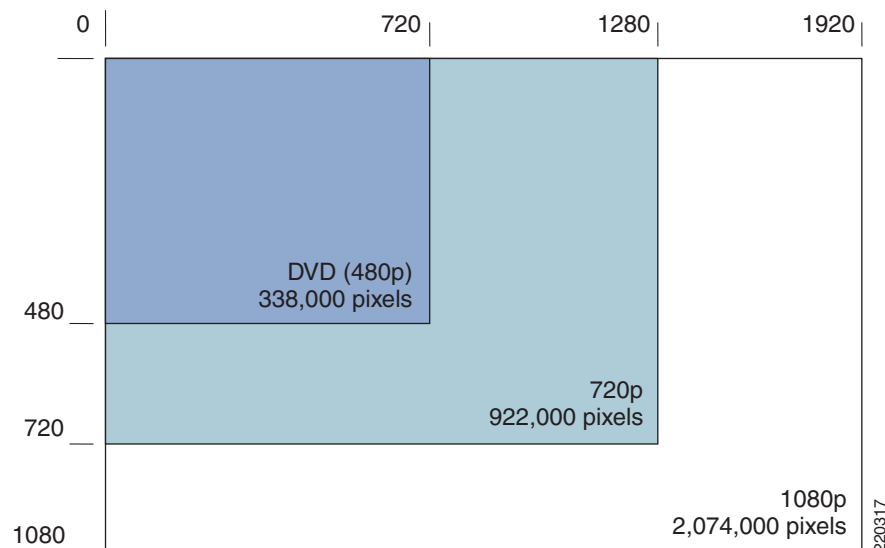
The quality of the video enjoyed by the meeting participants is a function of three variables:

- Resolution (i.e., number of pixels within the image)
- Frame rate (how often those pixels are re-drawn on the display)
- Degree of compression applied to the original video signal

Resolution

1080p provides the highest quality video image currently available on the market, supplying a resolution of 1920 x 1080 and 2,074,000 pixels per frame. 720p provides a resolution of 1280 x 720 and 922,000 pixels per frame. Compared with today's DVD standard video (480p) with a resolution of 720 x 480 and 338,000 pixels per frame, you can see the dramatic increase in resolution and pixel count. [Figure 1-10](#) illustrates the difference between these three resolutions.

Figure 1-10 Video Resolutions



Frame Rate

The frame rate of the displayed video directly corresponds to how motion within the video is perceived by the participants. To maintain excellent motion handling, the Cisco TelePresence System encodes video from the cameras at 30 frames per second (30fps or 30Hz). In addition, the codec video output signal to the plasma displays utilizes progressive-scan technology in order to eliminate any unpleasant visual artifacts that sometimes result from interlaced scan technology.

Compression

Note that 1080p video uncompressed is approximately 1.5 Gbps. The Cisco TelePresence Codecs must take this native video received from the cameras and compress it to a more feasible bandwidth value in as little time as possible. As mentioned above, they achieve this by utilizing an array of DSPs to compress the original 1.5 Gbps video from each camera down to under 4 Mbps (per camera), representing a compression ratio of over 99%, and they achieve this in under 90ms. To provide maximum flexibility, the customer is provided with some amount of control over how much compression is applied. For each of the two resolution formats supported (1080p and 720p), the Cisco TelePresence System supports three quality levels. Each quality level is really a function of the degree of compression applied, and has a corresponding bandwidth value. For simplicity, these three levels are referred to as “good,” “better,” and “best.” The “best” quality level has the least amount of compression applied and therefore requires the most bandwidth, while the “good” quality level has the most amount of compression applied and requires the least amount of bandwidth.

Taking the three variables described above—resolution, frame rate, and the degree of compression applied—[Table 1-1](#) illustrates the different quality settings supported by the Cisco TelePresence System and the requisite bandwidth required for each quality setting.

Table 1-1 Resolution, Quality, and Bandwidth Settings Supported (Video Only)

Resolution	1080p			720p		
	Best	Better	Good	Best	Better	Good
Quality Level						
Frame Rate	30	30	30	30	30	30
Bandwidth Required	4Mbps	3.5Mbps	3Mbps	2.25Mbps	1.5Mbps	1Mbps

These bandwidth values apply per camera. Therefore, a CTS-3000 which has three cameras and three displays, running at 1080p resolution at the “best” quality level, requires 12Mbps of video bandwidth, whereas a CTS-1000 requires 4Mbps of video bandwidth. These bandwidth values do not include the audio channels, the auxiliary video channel for displaying PC graphics and document camera images, or network layer overhead. Therefore, a more complete bandwidth table is [Table 4-1](#).

Audio Resolution and Compression Formats

The Cisco TelePresence System utilizes advanced microphone, speaker, and audio encoding technologies to preserve the quality and directionality of the audio so that it appears to emanate from the location of the person speaking at the same volume as it would be heard if that person were actually sitting across the table from you. Specifically, wideband spatial audio and multi-channel, full-duplex sound provides excellent voice projection and helps enable multiple simultaneous conversations, just like what typically occurs during an in-person meeting. Specially designed microphones eliminate sound interference.

The quality of the audio enjoyed by the meeting participants is a function of three variables:

- Frequency spectrum and decibel levels captured by the microphones
- Spatiality (i.e., directionality) of the audio
- Degree of compression applied to the original audio signal

Frequency Spectrum

The Cisco TelePresence microphones are designed to capture a 48kHz frequency spectrum of audio in a directional pattern that focuses on the people sitting directly in front of it and are geared to the decibel levels of human speech. Filters are designed into the microphones to eliminate interference from GSM and GPRS cellular signals and to eliminate certain frequencies generated by machinery such as the fans found in laptop computers and Heating, Ventilation, and Air Conditioning (HVAC) systems. Echo cancellation technology is built into the Cisco TelePresence Codec to eliminate cross-talk and double-talk.

The Cisco TelePresence speakers are designed to reproduce the same rich frequency spectrum and decibel level of human speech.

Spatiality

To preserve the spatiality (i.e., directional perception) of the audio, the CTS-3000 employs three individual microphones placed at specific locations of the virtual table, along with three individual speakers located under each display. The CTS-3200 preserves spatiality of the audio by adding another six individual microphones placed at specific locations on the table for the second row of participants.

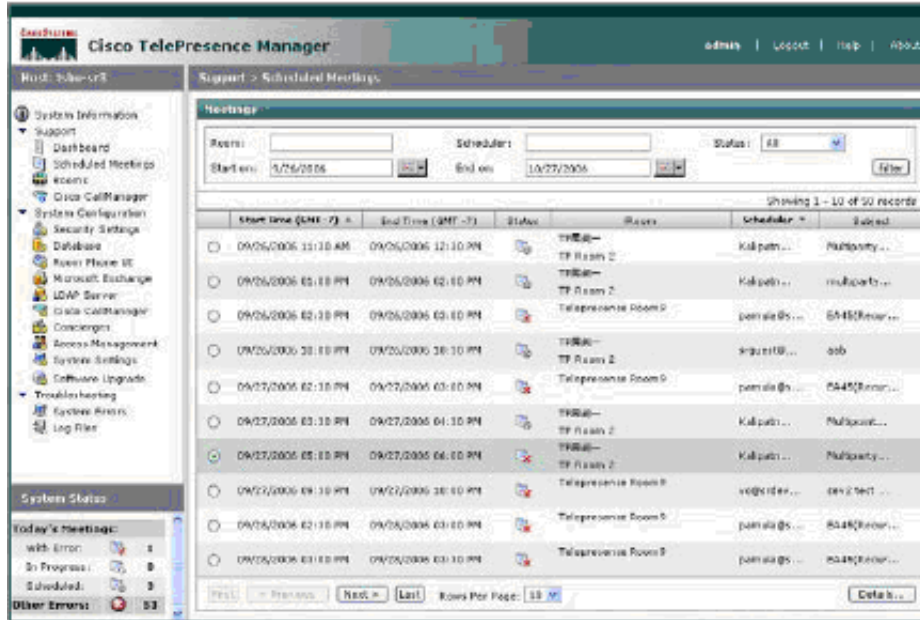
Compression

Inside the Cisco TelePresence Codecs an onboard array of DSPs encode the audio signal from the microphones into RTP packets using the Advanced Audio Coding-Low Delay (AAC-LD) encoding and compression standard. The resulting bandwidth required to transport the audio signals between the systems is 64kbps per microphone. Therefore, a CTS-3000 which has three microphones and speakers requires 192kbps of audio bandwidth, whereas the CTS-1000 requires 64kbps of audio bandwidth. Note that the Cisco TelePresence System also supports a fourth auxiliary audio channel which is used to transmit audio from a PC (used in conjunction with the projector when displaying PC graphics) or from an audio-only participant which is conferenced into the meeting using the Conference/Join softkey on the Cisco 7975G IP Phone (also known as the Audio Add-In feature). Therefore, a CTS-3000 can transmit and receive up to 256kbps of audio, as detailed in [Table 4-1](#). The CTS-1000 transmits up to 128kbps of audio, but can receive up to 256kbps when participating in a meeting with a CTS-3000 (in such a configuration, the CTS-1000 receives three separate [64 kbps] primary audio streams from the CTS-3000, as well as a potentially additional [64 kbps] auxiliary audio stream). Note that none of these bandwidth numbers include network overhead.

Cisco TelePresence Manager

Cisco TelePresence Manager (CTS-MAN) simplifies the scheduling and management of Cisco TelePresence virtual meeting room solutions. CTS-MAN is a Linux-based appliance running on a Cisco 7800 Series Media Convergence Server platform. It is the middleware glue between Cisco Unified Communications Manager, the Cisco TelePresence meeting rooms, and the customer's groupware calendaring and scheduling application (e.g., Microsoft Exchange/Outlook).

Figure 1-11 Cisco TelePresence Manager



191 208

CTS-MAN collects information about Cisco TelePresence systems from Cisco Unified Communications Manager and associates those systems to their physical location or conference room as defined in the customer's Microsoft Active Directory and Microsoft Exchange and IBM Domino.¹ This allows users to schedule Cisco TelePresence meetings using their Microsoft Outlook group calendar and have that schedule automatically sent to the Cisco TelePresence systems involved in the call. Hence users can launch the Cisco TelePresence call with the push of one button, by simply selecting their meeting from the list of meetings shown on the Cisco Unified 7975G IP phone in the meeting room.

CTS-MAN is managed via SSH, HTTPs, and SNMP. From an administrator's perspective, CTSMGR is managed using tools and methodologies that are similar to those used with a Cisco Unified Communications Manager server.

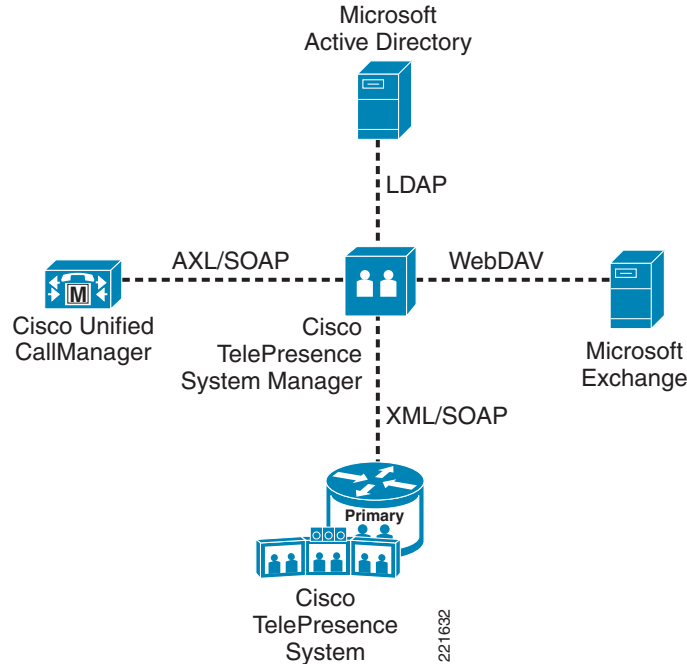
CTS-MAN communicates with Cisco Unified Communications Manager using Application XML Layer/Simple Object Access Protocol (AXL/SOAP) and Computer Telephony Integration/Quick Buffer Encoding (CTI/QBE).

CTS-MAN communicates with Microsoft Active Directory and Microsoft Exchange using Light-Weight Directory Access Protocol (LDAP) and Web-Based Distributed Authoring and Versioning (WebDAV) standards.

CTS-MAN communicates with the Cisco TelePresence Systems using eXtensible Markup Language/Simple Object Access Protocol (XML/SOAP).

1. Cisco TelePresence Manager supports Microsoft Active Directory 2003 and Microsoft Exchange 2003 and 2007. Cisco TelePresence Manager also supports IBM Domino 7.0 and Notes 6.5 and 7.0.

Figure 1-12 Cisco TelePresence Manager Connectivity



Cisco Unified 7975G IP Phone

To further enhance the meeting participants' experience of the meeting, cumbersome hand-held remote controls are eliminated, the cameras are fixed in their positions (no panning, tilting, or zooming controls), and the microphones are fixed in their positions on the table. There are virtually no moving parts or user interfaces that users must master to use a Cisco TelePresence meeting room.

Rather, the Cisco TelePresence meeting room solutions use a Cisco Unified 7975G IP phone, conveniently located on the table, to launch, control, and conclude meetings. For simplicity, the IP Phone is referred to as a 7975G IP phone. This makes Cisco TelePresence as easy to use as a telephone. Using the high-resolution touch-screen display of the Cisco Unified 7975G IP phone, the user simply dials the telephone number of the Cisco TelePresence room with which they wish to have a meeting and the call is connected. Softkey menu buttons on the phone allow the user to place the call on hold or conference in an audio-only participant. When used in conjunction with Cisco TelePresence Manager, the schedule of meetings for the day are displayed on the phone and the user simply touches the appropriate location on the screen to launch that scheduled meeting.

Figure 1-13 Cisco Unified 7975G IP Phone

Cisco TelePresence Multipoint Solutions

To enable Cisco TelePresence meetings between more than two rooms, a Cisco TelePresence Multipoint Switch (CTMS) is required. The Cisco TelePresence Multipoint Switch is a purpose-built Linux-based appliance running on a Cisco 7800 Series Media Convergence Server platform. It provides high-capacity, low-latency multipoint switching for Cisco TelePresence only. Details about the Cisco TelePresence Multipoint Solution can be found in [Chapter 10, “Cisco TelePresence Multipoint Solution Essentials,”](#) [Chapter 11, “Cisco Multipoint Technology and Design Details,”](#) and [Chapter 12, “Cisco TelePresence Multipoint Solution Circuit and Platform Recommendations.”](#)

The CTMS is represented by the icon in [Figure 1-14](#).

Figure 1-14 CTMS Icon