Multipoint Solution for Cisco TelePresence Systems

What You Will Learn

A multipoint Cisco TelePresence™ solution allows three or more Cisco TelePresence systems to participate in a virtual meeting. Multipoint Cisco TelePresence calls are handled in much the same manner as today's audio-conference calls. Each Cisco TelePresence system dials directly to the Cisco TelePresence Multipoint Switch, either by manually dialing the conference ID or using the One Button to Push feature on the Cisco® Unified IP Phone 7975G in the Cisco TelePresence room. All video and audio streams from Cisco TelePresence system rooms are terminated on the Cisco TelePresence Multipoint Switch and switched among the Cisco TelePresence system rooms in the meeting.

Today, multipoint capability is a required component for any collaborative application. More than 40 percent of today's meetings consist of individuals from three or more sites. However, providing multipoint support for a Cisco TelePresence system presents a number of new challenges not seen in today's video- and audio-conferencing solutions. The Cisco TelePresence system provides an in-person experience with its multidisplay high-definition video and spatial audio. Maintaining a true in-person experience for a multipoint solution requires strict network service-level agreements (SLAs) and a well-planned multipoint deployment. It is important to carefully consider all aspects of a Cisco TelePresence deployment, such as the current Cisco TelePresence network, future growth, and additional multipoint feature requirements, to help avoid having to redesign the network as the number of rooms and applications expands.

This document describes the Cisco TelePresence Multipoint Switch, including its features and general deployment guidelines.

Cisco TelePresence Multipoint Switch

The Cisco TelePresence Multipoint Switch is a purpose-built multipoint appliance developed by Cisco to directly address multipoint requirements for Cisco TelePresence systems. The patent-pending software architecture of the Cisco TelePresence Multipoint Switch provides extremely low-latency video and audio switching, adding less than 10 milliseconds (ms) of delay to any multipoint meeting. In combination with Cisco TelePresence Manager, the Cisco TelePresence Multipoint Switch provides a scalable multipoint solution for a Cisco TelePresence network of any size.

The Cisco TelePresence Multipoint Switch provides a highly scalable architecture, supporting up to 48 simultaneous table segments (a table segment is defined as a display and camera on any Cisco TelePresence system). A Cisco TelePresence 3000 or 3200 system consists of three table segments, while a Cisco TelePresence 1000, 500, or 1300 system is a single table segment. Each Cisco TelePresence Multipoint Switch supports up to 16 Cisco TelePresence 3200 or 3000 systems; 48 Cisco TelePresence 500, 1000, or 1300 systems; or any combination of the two up to 48 table segments in a single meeting or any number of meetings.

The high-performance server-based architecture and Linux-based Cisco voice operating system of the Cisco TelePresence Multipoint Switch provides a familiar and reliable platform. The Cisco TelePresence Multipoint Switch provides system management through Secure Shell (SSH), HTTPS, Cisco Discovery Protocol, and Simple Network Management Protocol (SNMP). From an administrator's perspective, the Cisco TelePresence Multipoint Switch is managed using tools and methodologies that are consistent with those used for Cisco Unified Communications Manager, Cisco TelePresence Manager, and Cisco TelePresence rooms (Figure 1).

Figure 1. Cisco TelePresence Multipoint Switch Administration

Cisco TelePresence Multipoint Switch Meeting Types

The Cisco TelePresence Multipoint Switch supports multiple meeting types, providing users with a number of scheduled and unscheduled meetings from which to choose according to their meeting requirements. The Cisco TelePresence Multipoint Switch supports scheduled meetings, unscheduled meetings, and a combination of both meeting types in a single deployment. However, Cisco TelePresence Manager is required for scheduled meetings, providing Cisco TelePresence Multipoint Switch resource management and integration with Microsoft Exchange or IBM Domino. The supported meeting types are defined here:

- **Static meeting:** Static meetings are unscheduled meetings configured on the Cisco TelePresence Multipoint Switch through the administration GUI. Each static meeting is assigned a meeting number that is used to access the meeting. Static meetings are always available and accessed simply by dialing the static meeting number from any Cisco TelePresence system or using a speed-dial entry on the Cisco Unified IP Phone 7975G in the Cisco TelePresence room. The meeting administrator can add Cisco TelePresence rooms to the meeting at any time using the Cisco TelePresence Multipoint Switch administrative GUI.
- **Hosted static meeting:** Hosted static meetings are the same as static meetings except that they require a preassigned host room to be present to start the meeting. All meeting rooms are placed on hold until the host room joins the meeting, and all rooms are disconnected when the host room leaves the meeting.
- **Ad-hoc meeting:** Ad-hoc meetings are unscheduled administrator-initiated dial-out meetings. The meeting administrator initiates the meeting through the Cisco TelePresence Multipoint Switch administrative GUI by dialing out to each participating Cisco TelePresence room, thereby requiring no end-user interaction. There is no way to dial into an Ad-hoc meeting, and additional Cisco TelePresence rooms must be added by the meeting administrator using the Cisco TelePresence Multipoint Switch administrative GUI.
- **Scheduled meeting:** Meetings are scheduled by the users using Microsoft Outlook or Lotus Notes, giving users one-button meeting access, thereby requiring no administrator interaction. Cisco TelePresence Manager is required for scheduled meetings, providing the interface between Microsoft Exchange and IBM Domino and the Cisco TelePresence Multipoint Switch. Rooms can be added to active scheduled meetings at

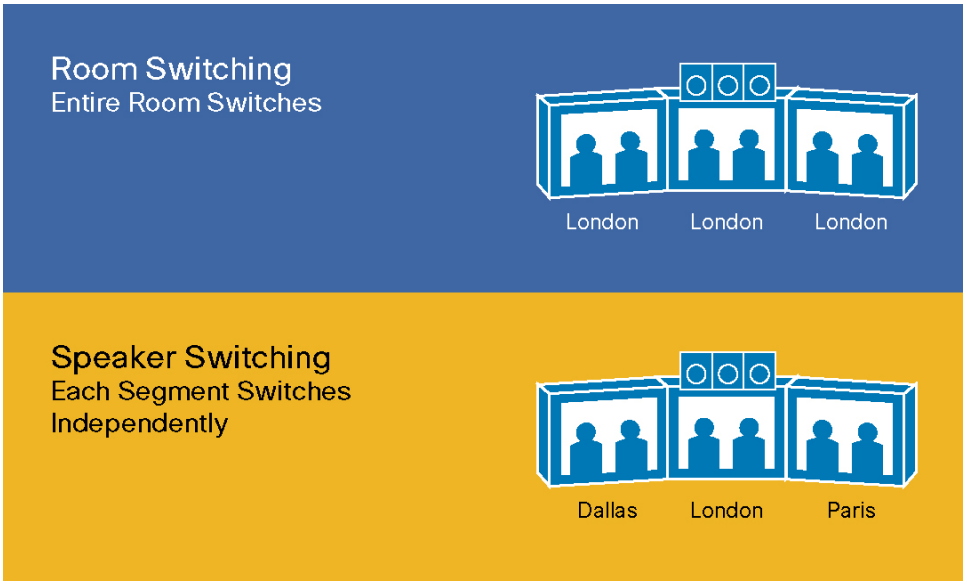
any time during the meeting, by the meeting administrator, using the Cisco TelePresence Multipoint Switch administrative GUI.

Cisco TelePresence Multipoint Switch Meeting Features

The Cisco TelePresence Multipoint Switch supports a number of meeting features that provide flexibility and security for multipoint meetings. Each multipoint meeting is configured with a default meeting policy that can be modified by the system administrator before or during the multipoint meeting. Features provided for each meeting are listed here.

- **Switching policy:** Two types of switching policy are available:
  - **Room switching:** Room switching switches the video from all table segments of a room to all other rooms in a meeting. If the active speaker (loudest speaker for approximately 2 seconds) changes, all table segments in the new active speaker's room will be displayed in all other rooms at the same time, replacing the previously active room.
  - **Speaker switching:** Speaker switching allows each segment to be switched independently, so that at any given time the three active segments, in one or multiple rooms, are displayed in all Cisco TelePresence rooms. If the active speaker changes, the speaker's table segment will be displayed in all other rooms on the corresponding screen, as shown in Figure 2.

Figure 2. Room and Speaker Switching



- **Maximum Number of Rooms:** This setting allows the administrator to limit the number of rooms allowed to join the meeting.
- **Video announce:** Upon joining the meeting, the Cisco TelePresence room will be displayed in all other rooms for 2 seconds. This feature prevents a muted room from joining without being noticed.
- **Lock meeting:** Administrators can lock a meeting through the administrative GUI after a meeting is in progress. Locking prevents any additional rooms from joining the meeting. Additional Cisco TelePresence systems can be added to a meeting that is locked, but only by the meeting administrator through the administrative GUI.
- **VIP mode:** VIP mode is similar to presenter mode available in the H.323 multipoint control unit (MCU). VIP mode allows an administrator to choose an entire Cisco TelePresence room, or the center segment of any Cisco TelePresence room, as the VIP. The VIP site can be locked on at all times or allowed to switch out through normal voice-activated switching. However, if a VIP site is not in locked mode and is switched out

during a conversation, it is automatically switched back in as soon as the conversation is complete. Unlike other sites in the meeting, the VIP site does not have to speak to be switched back into the meeting.

- **Quality:** The quality setting allows the configuration of 1080 or 720p on a per-call basis. It is important that meetings be configured for the lowest-resolution Cisco TelePresence room participating in the multipoint meeting. Cisco TelePresence systems can negotiate down from 1080 to 720p, allowing systems configured for 1080p to join a meeting configured for 720p. However, Cisco TelePresence systems configured for 720p cannot negotiate up to 1080p, and therefore will not connect to a meeting configured for 1080p.
- **Director controls:** With the release of Cisco TelePresence Multipoint Switch 1.6, a new feature allows administrators to completely control multipoint meetings for special events or company meetings. Director controls allow an administrator to statically map segments to a specific screen location, mute audio from some segments, and disable switching for specific segments in the call. The initial release of director controls will be controlled through the Cisco TelePresence Multipoint Switch command-line interface (CLI) and moved to the web GUI in a following release.
- **Interoperability:** Static meetings can be configured to support standard H.323, Session Initiation Protocol (SIP) or Secure Communication Cache Protocol (SCCP) video-conferencing systems, allowing Cisco TelePresence endpoints to communicate with existing video-conferencing systems. Interoperability is also supported for scheduled meetings, assuming that Cisco TelePresence Manager is deployed in conjunction with the Cisco TelePresence Multipoint Switch. More information about interoperability is provided later in this document, in the "Interoperability" section.

Security

A secure platform for any communications tool in today's technology environments is essential. The Cisco TelePresence Multipoint Switch supports the Security Architecture for Enterprises (SAFE), which provides end-to-end network security. Authentication with Cisco Unified Communications Manager is supported using a locally significant certificate (LSC) that is manually downloaded from a certificate authority proxy function (CAPF) server such as Cisco Unified Communications Manager. Media and signaling encryption is supported using the same methodologies found in the Cisco IP Telephony products. Media encryption is supported using Secure Real-Time Transport Protocol (SRTP) using HMAC-SHA-1 authentication tags and Advanced Encryption Standard (AES) 128 Integer Counter Mode (ICM) encryption. Also, the Cisco TelePresence Multipoint Switch uses Transport Layer Security (TLS) to authenticate and encrypt SIP signaling messages. More information about Cisco TelePresence security can be found at http://www.cisco.com/en/US/docs/solutions/Enterprise/Video/telepresence.html#wp42685.

Additionally, meeting security is a requirement for all collaboration technologies: audio, video conferencing, and Cisco TelePresence systems. Though it is important to provide users with options for multipoint meetings, it is also important that meetings provide the appropriate level of security for participants.

The Cisco TelePresence Multipoint Switch provides four types of meetings, described previously, each providing different levels of security. Scheduled and Ad-hoc meetings are inherently secure, not allowing uninvited Cisco TelePresence rooms to randomly dial into a meeting. Cisco TelePresence rooms can be added (using dial-out) to these meetings after the call is in progress, but only by a system administrator through the Cisco TelePresence Multipoint Switch administrative GUI.

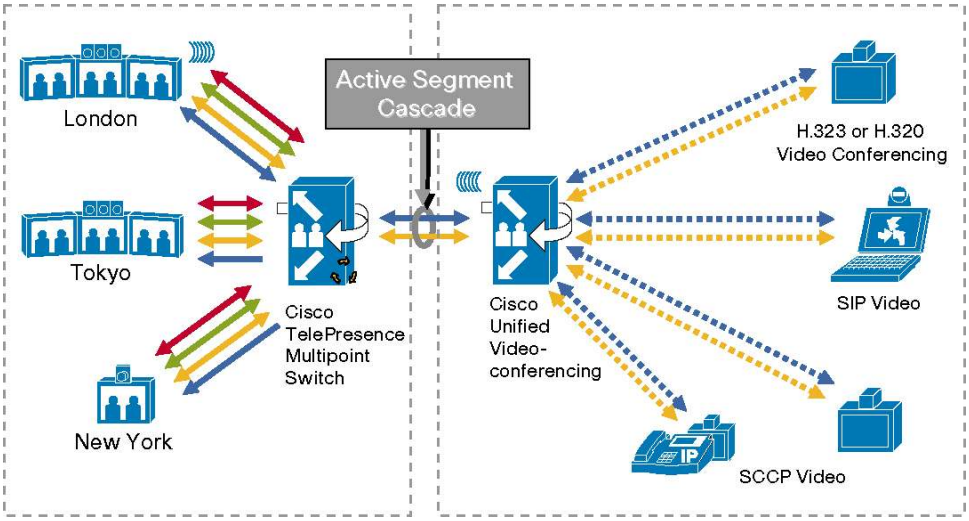
Static and hosted static meetings are always-available, unscheduled dial-in meetings that are less secure than scheduled and Ad-hoc meetings since any room can dial into them at any time. However, meeting features, as described earlier, are available to provide additional security for static meetings. Specific features that provide additional security for static meetings are lock meeting, video announce, and maximum number of rooms.

Note: All meeting features listed here (except Maximum Rooms, which is available only for static and hosted static meetings) can be applied to static, hosted static, scheduled, and Ad-hoc meetings.

Interoperability

Interoperability with systems other than Cisco TelePresence systems is provided by the Cisco TelePresence Multipoint Switch and Cisco Unified Videoconferencing MCU. All Cisco TelePresence meetings that require other than Cisco TelePresence participants must be terminated on a Cisco TelePresence Multipoint Switch, even if the meeting is between one Cisco TelePresence system and one videoconferencing system. Interoperability with a system other than a Cisco TelePresence system is achieved by cascading the Cisco TelePresence meeting on the Cisco TelePresence Multipoint Switch to a meeting on the Cisco Unified Videoconferencing MCU (Figure 3).

Figure 3. Cisco TelePresence Interoperability



This architecture allows existing videoconferencing endpoints to participate in Cisco TelePresence meetings with little or no change to the existing videoconferencing infrastructure. As mentioned earlier, interoperability meetings are supported for static or scheduled meetings on the Cisco TelePresence Multipoint Switch. From the perspective of Cisco TelePresence users, meeting initiation is no different than for a standard point-to-point or multipoint Cisco TelePresence meeting. For a scheduled meeting, the user enters the room and uses the One Button to Push entry on the Cisco Unified IP Phone 7975 touch screen to start the call. After the first Cisco TelePresence room dials into the meeting, the Cisco TelePresence Multipoint Switch automatically initiates the cascade link between the Cisco TelePresence Multipoint Switch and the Cisco Unified Videoconferencing MCU. Endpoints other than Cisco TelePresence endpoints manually dial the Cisco Unified Videoconferencing MCU conference ID to join the meeting. The Cisco Unified Videoconferencing MCU meeting number used by endpoints other than Cisco TelePresence endpoints is supplied in the meeting confirmation email sent by Cisco TelePresence Manager after the meeting is scheduled.

From the perspective of the Cisco TelePresence Multipoint Switch, the Cisco Unified Videoconferencing MCU is a single-screen Cisco TelePresence system that is switched in and out of the left segment of any three-screen TelePresence system (as shown in Figure 3). Audio from the Cisco Unified Videoconferencing MCU is mixed by the Cisco TelePresence Multipoint Switch and continuously sent to all Cisco TelePresence endpoints. As soon as the Cisco Unified Videoconferencing MCU is deemed the active speaker for the meeting, the Cisco TelePresence Multipoint Switch switches the Cisco Unified Videoconferencing MCU's video to all Cisco TelePresence systems. Cisco Unified Videoconferencing MCU video is displayed in the left segment of all three-screen Cisco TelePresence systems and on the main display of all single-screen systems.

The Cisco Unified Videoconferencing MCU sees the Cisco TelePresence Multipoint Switch as just another video endpoint capable of providing Common Internet File (CIF) format video and G.711 audio. The Cisco TelePresence Multipoint Switch does not transcode video and audio received from Cisco TelePresence endpoints. All Cisco

TelePresence endpoints send a copy of their audio in G.711 format, and only the active segment for the meeting sends a copy of its 1080p video in CIF format. The Cisco TelePresence Multipoint Switch then mixes the G.711 audio from all Cisco TelePresence endpoints and switches the mixed G.711 audio and CIF video (from the active Cisco TelePresence segment) to the Cisco Unified Videoconferencing MCU. More information about interoperability can be found at http://www.cisco.com/en/US/docs/solutions/Enterprise/Video/TP_InterOp_v2.html.

Cisco TelePresence Multipoint Switch Network Deployment

Maintaining the required SLAs for Cisco TelePresence can be challenging when multipoint is added to the network. The jitter and loss values remain the same as for point-to-point solutions and should not be affected by the addition of a multipoint solution. However, providing acceptable latency for multipoint meetings can be a challenge for dispersed installations. The two main network considerations that need to be carefully considered when deploying multipoint capabilities for Cisco TelePresence systems are latency and bandwidth provisioning. How and where the Cisco TelePresence Multipoint Switch is deployed on the network directly affects latency for multipoint meetings and bandwidth patterns on the network. Deploying the Cisco TelePresence Multipoint Switch in the wrong location, physical or geographical, may cause an undesirable meeting experience and directly affect network performance.

Two deployment options for Cisco TelePresence multipoint solutions are available today, based on the number and location of Cisco TelePresence endpoints.

Centralized Deployment

For Cisco TelePresence deployments with fewer than six Cisco TelePresence rooms, the Cisco TelePresence Multipoint Switch should be centrally located based on the geographic location of the Cisco TelePresence rooms. For centralized deployments, the Cisco TelePresence Multipoint Switch should be centrally located at a regional or headquarters site with the necessary WAN bandwidth. Centrally locating the Cisco TelePresence Multipoint Switch prevents unnecessary latency caused by backhauling calls to a site at the far edge of the network, preserving the overall user experience.

Distributed Deployment

For Cisco TelePresence deployments with more than six Cisco TelePresence rooms, assuming they are not located in the same region, the Cisco TelePresence Multipoint Switch should be distributed geographically to localize multipoint meetings and reduce the amount of additional latency. Depending on the location and number of endpoints, Cisco TelePresence regions should be defined based on the network layout and number of Cisco TelePresence endpoints. Currently, most large Cisco TelePresence deployments divide their networks into three regions; North America; Europe, the Middle East, and Africa (EMEA), and Asia-Pacific (APAC). As the Cisco TelePresence network grows, other regions will likely to be added to provide further localization for additional Cisco TelePresence endpoints. As described here, the regional location for each Cisco TelePresence Multipoint Switch is determined based on regional latency and available WAN bandwidth at the site.

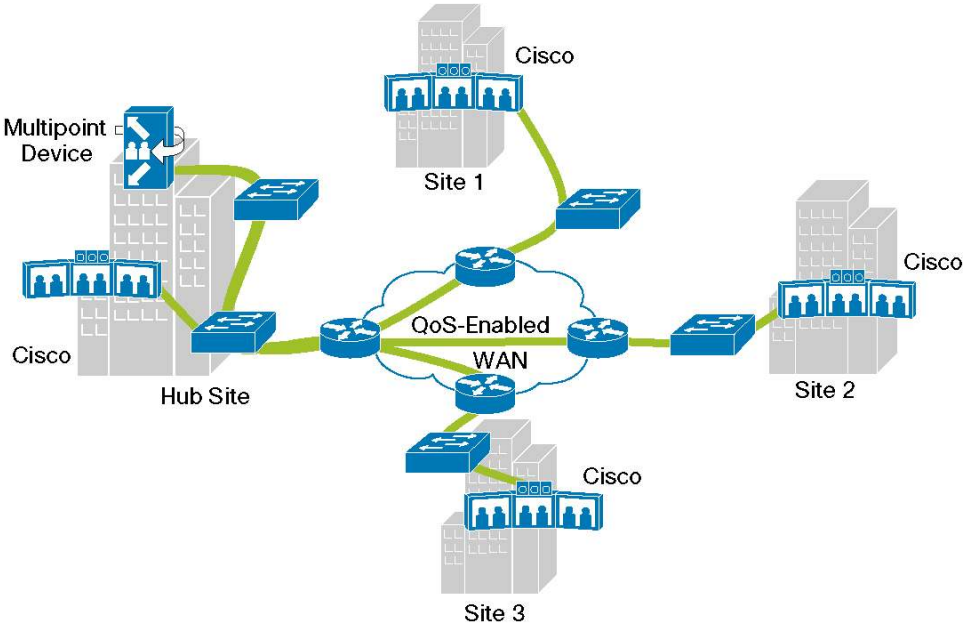
Latency

One of the main differentiators for Cisco TelePresence systems is the capability to maintain extremely low latency while providing multiple streams of high-quality, 1080p video and spatial audio. Excessive latency in any Cisco TelePresence meeting will degrade the in-person experience. Latency becomes an even bigger concern with multipoint solutions since all Cisco TelePresence endpoints dial into a Cisco TelePresence Multipoint Switch, which may not be located in the same geographic location as the Cisco TelePresence endpoints. Because of the nature of multipoint solutions, two Cisco TelePresence endpoints that provide very low latency in a point-to-point meeting may have considerably higher latency in a multipoint meeting. Inserting a multipoint device in the media path of a Cisco TelePresence system will introduce additional latency. However, proper placement of the Cisco TelePresence Multipoint Switch will help reduce additional latency and preserve the Cisco TelePresence experience.

A Cisco TelePresence network should always be designed to target one-way end-to-end, network latency of less than 150 ms. However, in some cases this is not possible due to long distances between international sites. Therefore, the upper limit allowed for one-way end-to-end network latency is 250 ms. Anything greater than 250 ms will cause the message “Experiencing Network Delay” to be displayed on the Cisco TelePresence endpoint, alerting users that the overall experience may be affected due to network delay. Therefore, multipoint deployments should provide one-way end-to-end network-only latency of less than 250 ms in all cases.

Figure 4 shows a three-site multipoint deployment with the Cisco TelePresence Multipoint Switch located in the hub site.

Figure 4. Multipoint Deployment with Latency Values



	Hub Site	Site 1	Site 2	Site 3
Hub Site		35 ms	75 ms	40 ms
Site 1	35 ms		48 ms	45 ms
Site 2	75 ms	48 ms		42 ms
Site 3	40 ms	45 ms	42 ms	

As mentioned earlier, one-way network-only latency must stay below 250 ms to maintain the Cisco TelePresence experience. In Figure 4, the hub site is chosen to deploy the Cisco TelePresence Multipoint Switch. Looking at the latency matrix in the figure, the greatest latency for any multipoint meeting is between Sites 2 and 3. To calculate the greatest latency for a multipoint deployment, take the two sites with the greatest latency between them and the Cisco TelePresence Multipoint Switch and add 10 ms for the Cisco TelePresence Multipoint Switch switching delay. The worst-case latency in Figure 4 is calculated as follows:

Site 2 to Hub = 75 ms + Site 3 to Hub = 40 ms + Cisco TelePresence Multipoint Switch = 10 ms = 125 ms

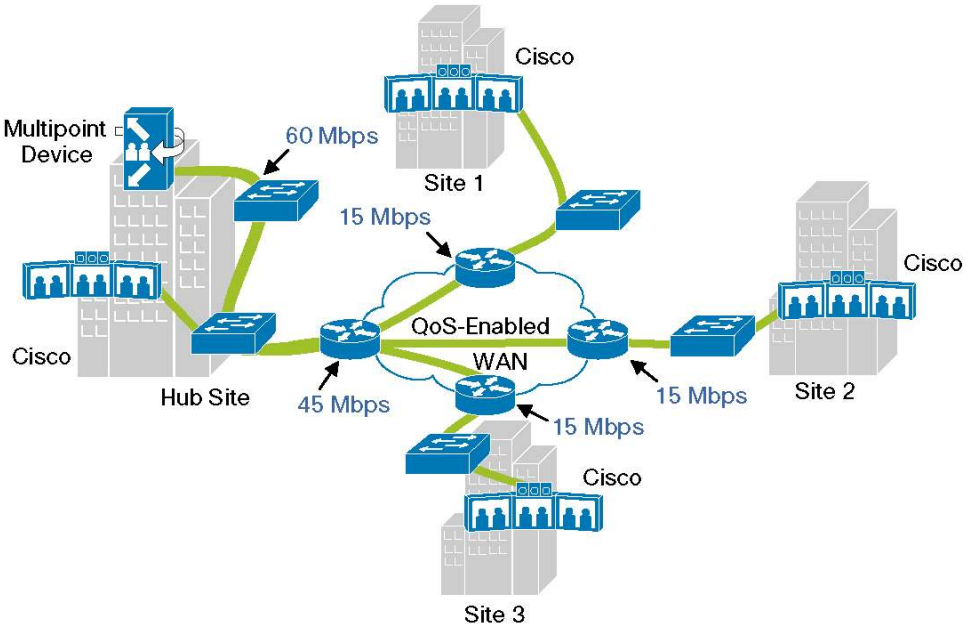
A latency matrix should be created for each Cisco TelePresence Multipoint Switch deployment to determine the best potential Cisco TelePresence Multipoint Switch locations based on end-to-end latency numbers.

Bandwidth and Provisioning

Bandwidth and provisioning must be carefully considered when implementing multipoint for Cisco TelePresence. Remember that multipoint meetings are simply multiple point-to-point meetings terminated on a Cisco TelePresence Multipoint Switch. This alone makes it obvious that physical connectivity of the Cisco TelePresence Multipoint Switch must be carefully considered. A single Cisco TelePresence Multipoint Switch is capable of simultaneously terminating 48 Cisco TelePresence 1000 and 500 rooms at 5.5 Mbps each, with a maximum throughput of 264 Mbps.

When Calculating Cisco TelePresence Multipoint Switch bandwidth requirements, you need to take into account the type of Cisco TelePresence endpoints and feature sets supported. Optional features such as Interoperability and the high-speed collaboration codec require additional bandwidth and may increase multipoint bandwidth requirements substantially. Bandwidth should be provisioned for the maximum bandwidth required to support the Cisco TelePresence endpoints and features supported in any deployment. For the example, in Figure 5, the circuit to the hub site must have sufficient bandwidth to support three Cisco TelePresence 3000 systems at 1080p, because the audio and video traffic from Site 1, Site 2, and Site 3 must traverse the WAN circuit at the hub site. Note that the LAN infrastructure within the hub site must also be designed to support the cumulative bandwidth of all four Cisco TelePresence systems.

Figure 5. Multipoint Bandwidth Example



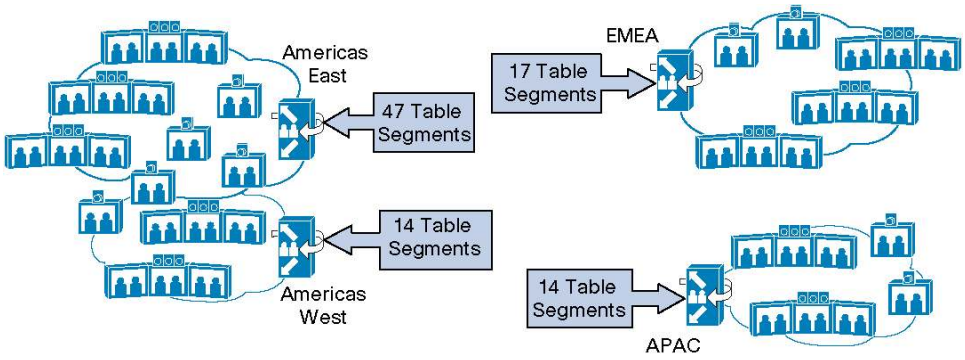
Provisioning the correct amount of bandwidth on the LAN and WAN is essential for a successful multipoint deployment. As shown in Figure 5, the maximum potential bandwidth for each Cisco TelePresence 3000 (15 Mbps) is provisioned to help ensure that no packet loss occurs. However, the actual bandwidth used during a multipoint meeting will average much less than the provisioned bandwidth. For example, the average bandwidth utilization for a Cisco TelePresence 3000 is 10 to 12 Mbps with six people sitting at the table participating in a meeting.

Because of the bandwidth requirements for a Cisco TelePresence Multipoint Switch (up to 264 Mbps) you must consider the placement of the switch in the network. The Cisco TelePresence Multipoint Switch must be located in a data center or location with adequate bandwidth.

As shown earlier, bandwidth provisioning for Cisco TelePresence deployments with a single Cisco TelePresence Multipoint Switch, a single type of Cisco TelePresence endpoint, and a limited number of Cisco TelePresence endpoints is fairly straightforward. However, in larger deployments with multiple Cisco TelePresence Multipoint

Switches and a mix of Cisco TelePresence 3200 and 3000 and Cisco TelePresence 500 and 1000 devices, bandwidth provisioning becomes more complicated. Figure 6 provides an example of a large Cisco TelePresence network with distributed Cisco TelePresence Multipoint Switches. On the basis of WAN bandwidth and meeting patterns, the Americas East Cisco TelePresence Multipoint Switch is configured with 47 table segments, providing enough capacity for all Cisco TelePresence endpoints in a single meeting. The remaining Cisco TelePresence Multipoint Switches provide different levels of capacity based on the number of regional Cisco TelePresence endpoints.

Figure 6. Cisco TelePresence Multipoint Switch Provisioning Example



When provisioning bandwidth for a large deployment such as the one in Figure 6, it is important to calculate the bandwidth based on available Cisco TelePresence 1000 endpoints first. In the example here, nine Cisco TelePresence1000 systems are deployed, so if possible, all nine Cisco TelePresence 1000 systems should be used to calculate the required multipoint bandwidth for each site. However, all table segments must be accounted for, and in some cases, it may not be possible to use all available Cisco TelePresence 1000 systems (as in the calculations that follow). The reason for this is that a Cisco TelePresence 1000 system requires more bandwidth than a Cisco TelePresence 3000 system when provisioning is performed based on table segment rather than system. The bandwidth required for a Cisco TelePresence 1000 system is 5.5 Mbps (one table segment), while the bandwidth required for a Cisco TelePresence 3000 system is 15 Mbps (5 Mbps per table segment).

Table 1 illustrates the required bandwidth for each system type running 1080p best resolution. Four bandwidth provisioning options are available for each Cisco TelePresence endpoint, depending on the feature mix:

- **Base 1080p:** Use this option for a Cisco TelePresence endpoint that does not use any optional features.
- **Interoperability 1080p:** Use this option for a Cisco TelePresence endpoint that supports interoperability with systems other than Cisco TelePresence systems.
- **HSCC 1080p:** Use this option for a Cisco TelePresence endpoint configured with the optional 30 frames per second (fps) high-speed collaboration codec (HSCC).
- **Interoperability plus HSAC 1080p:** Use this option for a Cisco TelePresence endpoint that supports interoperability with systems other than Cisco TelePresence systems and 30-fps HSCC.

In Figure 6, multipoint bandwidth is calculated for each site using Table 1. The calculations assume that all Cisco TelePresence systems are providing the base feature set running 1080p best resolution. In environments with mixed resolutions, you should provision bandwidth based on the highest resolution only.

Table 1. Bandwidth Requirements

Cisco TelePresence Endpoint	Base 1080	Interoperability 1080	HSCC 1080	Interoperability plus HSCC 1080
Cisco TelePresence 3000 and 3200	15 Mbps	16 Mbps	19.2 Mbps	19.2 Mbps
Cisco TelePresence 500 and 1000	5.5 Mbps	6.5 Mbps	9.7 Mbps	10.7 Mbps

As mentioned previously, multipoint systems must be calculated for maximum potential bandwidth use. In a mixed Cisco TelePresence 3200 and 3000 and Cisco TelePresence 1000 and 500 environment, doing so can be tricky. For example, assume that a customer wants the capability to support all endpoints in a single multipoint meeting. Since Americas East is the primary location, it is configured with enough capacity (47 segments) to accommodate all Cisco TelePresence endpoints in a single meeting. The calculation for Americas East is straightforward: the total number of Cisco TelePresence 1000 systems times 5.5 Mbps, and the total number of Cisco TelePresence 3000 systems times 15 Mbps. Notice in the calculations that follow that the multipoint bandwidth and site WAN bandwidth values are different. The Americas East site contains one Cisco TelePresence 3000 system, so the WAN bandwidth is 15 Mbps less than the maximum multipoint bandwidth.

The Americas West and APAC multipoint sites are provisioned with 14 segments, each supporting up to four Cisco TelePresence 3000 systems and two Cisco TelePresence 1000 systems. However, the calculation of bandwidth for four Cisco TelePresence 3000 systems and two Cisco TelePresence 1000 systems is not the maximum potential bandwidth for 14 segments because of the number of Cisco TelePresence 1000 systems on the network. The maximum potential bandwidth for 14 segments should be calculated with eight Cisco TelePresence 1000 systems times 5.5 Mbps and two Cisco TelePresence 3000 systems times 15 Mbps, for a total multipoint bandwidth of 74 Mbps. The WAN bandwidth for both Americas West and APAC is 89 Mbps because all multipoint resources can be used, consuming 74 Mbps of WAN bandwidth, while the local Cisco TelePresence 3000 is in another meeting, requiring an additional 15 Mbps of WAN bandwidth.

The calculation for EMEA is similar to the calculations used for Americas West and APAC except the site is provisioned for 17 segments to provide support for 15 Cisco TelePresence 3000 systems and two Cisco TelePresence 1000 systems. As with Americas West and APAC, the bandwidth calculation is based on eight Cisco TelePresence 1000 systems, and an additional 15 Mbps of WAN bandwidth is added for the on-site Cisco TelePresence 3000 system.

Americas East with 47 table segments:

9 Cisco TelePresence 1000 systems at 5.5 Mbps = 49.5 Mbps and 9 table segments

12 Cisco TelePresence 3000 systems at 15 Mbps = 180 Mbps and 36 table segments

Multipoint bandwidth = 229.5 Mbps and 47 required table segments

Site WAN bandwidth = 214.5 Mbps (site contains 1 Cisco TelePresence 3000 system)

Americas West and APAC with 14 table segments:

8 Cisco TelePresence 1000 systems at 5.5 Mbps = 44 Mbps and 8 table segments

2 Cisco TelePresence 3000 systems at 15 Mbps = 30 Mbps and 6 table segments

Multipoint bandwidth = 74 Mbps and 14 required table segments

Site WAN bandwidth = 89 Mbps (site contains 1 Cisco TelePresence 3000 system)

EMEA 17 with table segments:

8 Cisco TelePresence 1000 systems at 5.5 Mbps = 44 Mbps and 8 table segments

3 Cisco TelePresence 3000 systems at 15 Mbps = 45 Mbps and 9 table segments

Multipoint bandwidth = 89 Mbps and 17 required table segments

Site WAN bandwidth = 104 Mbps (site contains 1 Cisco TelePresence 3000 system)

Note: These calculations are based on base Cisco TelePresence functions with no support for interoperability or HSCC, which require additional bandwidth. Also, configuring the Americas East Cisco TelePresence Multipoint Switch with 47 scheduled segments provides only one Ad-hoc segment for adding unscheduled Cisco TelePresence rooms to scheduled meetings.

Flow Control

To help control bandwidth use during multipoint meetings, flow control has been implemented between the Cisco TelePresence Multipoint Switch and Cisco TelePresence endpoints. This feature enables inactive table segments in a multipoint meeting to stop transmitting video, reducing the total amount of bandwidth consumed during a multipoint meeting.

After the multipoint meeting is initiated and the active table segments have been established, the Cisco TelePresence Multipoint Switch instructs (using Real-Time Control Protocol [RTCP]) Cisco TelePresence endpoints to stop transmitting video for table segments that are not currently being displayed. Audio continues to be sent from all table segments and used by the Cisco TelePresence Multipoint Switch to determine when an inactive table segment becomes active. At that point, the Cisco TelePresence Multipoint Switch instructs the Cisco TelePresence endpoint to start transmitting video again for the newly active table segment. This process is continued throughout the meeting to proactively reduce the bandwidth consumed during a multipoint meeting. However, it is important to remember that the network must be provisioned for the maximum possible use not considering flow control.

A network readiness assessment is performed on all networks prior to any Cisco TelePresence multipoint installation. This process provides latency, jitter, and loss measurements between sites containing Cisco TelePresence rooms and validates Cisco TelePresence Multipoint Switch locations. This process helps ensure that the Cisco TelePresence Multipoint Switch is placed in the most appropriate location based on network uplink speeds and overall network layout.

Note: 15 Mbps is the maximum bandwidth used by a Cisco TelePresence 3000 system during periods of extremely high motion, such as the start of a meeting or when all participants stand up and walk around simultaneously. Average bandwidth use when people are seated at the table talking and gesturing normally is approximately 6 to 8 Mbps.

More detailed bandwidth and provisioning information can be found in the Cisco TelePresence 2.0 design guide at http://www.cisco.com/en/US/docs/solutions/Enterprise/Video/tpqos_ns656_Networking_Solutions_Design_Guide_Chapter.html.

Meeting Deployments

The next decision that needs to be made is what type of meetings will be supported: unscheduled, scheduled, or a combination of the two. Depending on the Cisco TelePresence Multipoint Switch deployment and overall environment, different recommendations apply for unscheduled and scheduled meetings.

Unscheduled Meetings

The centralized deployment is the only deployment that supports an unscheduled-only meeting environment. Attempting to implement an unscheduled-meeting environment in a large dispersed network with distributed Cisco TelePresence Multipoint Switches is **not** recommended.

A small deployment with fewer than six Cisco TelePresence rooms does not require resource management because the Cisco TelePresence Multipoint Switch will never be oversubscribed. A single static meeting number can be configured and added as a speed-dial option on each Cisco TelePresence endpoint, providing simple meeting access. However, Cisco TelePresence Manager always should be deployed in all Cisco TelePresence systems to provide scheduled-meeting support and one-button dialing.

Scheduled Meetings

Both centralized and distributed deployments support a scheduled-only meeting environment. Scheduled meetings require Cisco TelePresence Manager for integration with Microsoft Exchange and IBM Domino and Cisco TelePresence Multipoint Switch resource and location management. Cisco TelePresence Manager also provides one-button access for point-to-point and scheduled meetings.

Distributed deployments have an added level of complexity due to the potentially large number of Cisco TelePresence rooms and Cisco TelePresence Multipoint Switch distribution. As described previously, poor meeting placement causes excessive latency, affecting the overall user experience. Cisco TelePresence Manager provides geographical selection, allowing meetings to be scheduled on the Cisco TelePresence Multipoint Switch with the least amount of latency. Cisco TelePresence Manager also provides Cisco TelePresence Multipoint Switch resource management, helping ensure that multipoint resources are available at the time of a meeting. Trying to support a distributed Cisco TelePresence Multipoint Switch deployment without Cisco TelePresence Manager is an unmanageable task, since the administrator would have to manually manage the distribution of meetings, calculate latency, and choose a Cisco TelePresence Multipoint Switch with available resources.

Unscheduled and Scheduled Meetings

Both centralized and distributed deployments support a combination of scheduled and unscheduled meetings. As described earlier, Cisco TelePresence Manager is a requirement for scheduled meetings.

Centralized deployments implementing scheduled and Unscheduled meetings can use a single Cisco TelePresence Multipoint Switch for both types of meetings. However, distributed deployments should implement separate Cisco TelePresence Multipoint Switches for scheduled and unscheduled meetings. the Cisco TelePresence Multipoint Switch does not provide resource management for Unscheduled meetings, making it difficult to guarantee that unscheduled resources are available during peak hours.

Conclusion

The Cisco TelePresence Multipoint Switch provides a high-performance server-based platform for a Cisco TelePresence multipoint environment supporting up to 12 simultaneous Cisco TelePresence 3000 endpoints. Since multipoint requirements are different from point-to-point requirements, understanding how bandwidth and latency are magnified in a multipoint environment is essential for a successful multipoint deployment. However, without the proper resource and geographical management, even a well-engineered multipoint deployment may not provide the desired user experience. Cisco TelePresence Manager provides scheduled-meeting support, one-button dialing, and resource and geographical management for a multipoint environment. The combination of Cisco TelePresence Manager and the Cisco TelePresence Multipoint Switch provides a multipoint solution for a Cisco TelePresence deployment of any size.

For More Information

Quality of Service Design for TelePresence
http://www.cisco.com/en/US/docs/solutions/Enterprise/Video/tpqos_ns656_Networking_Solutions_Design_Guide_Chapter.html

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