Managing Cisco TelePresence Networks

Executive Summary

Cisco® TelePresence facilitates close relationships among colleagues separated by distance, even around the world. It is essential to actively manage the underlying converged network throughout the solution lifecycle, from planning and preparation, to design and implementation, throughout operations, and optimizing performance over time.

Through the eyes of a fictional company, Cisco illustrates the roles and functions of network management tools for Cisco TelePresence:

- Cisco TelePresence Readiness Assessment Manager
- Cisco TelePresence onboard tools
- CiscoWorks QoS Policy Manager
- Cisco Unified Operations Manager
- Cisco Bandwidth Quality Manager
- Cisco Network Analysis Module

What Is Cisco TelePresence?

The foundation of a successful business is effective relationships. Cisco TelePresence helps enable close relationships among colleagues, customers, and partners separated by distance, even around the world. Facilitating face-to-face collaboration without the need for travel, Cisco TelePresence helps global companies develop and enhance valuable business exchanges, allowing participants to focus on doing their jobs without fussing with complicated cameras and controls. Setup is as simple as making a phone call. High-definition video helps participants experience the nuances of interpersonal communications by observing body language and facial expressions. Clear audio helps them hear each other as if they were in the same room.

The foundation of an effective Cisco TelePresence experience is the converged network, which must deliver consistent reliability, quality, and security to achieve seamless quality of experience. Cisco TelePresence hides its complexity from users, yet successful service delivery depends upon an intricate interaction of signaling protocols, bandwidth, and quality of service (QoS) mechanisms. Therefore, it is essential to actively manage the underlying network throughout the solution lifecycle, from planning and preparation, to design and implementation, throughout operations, and optimizing performance over time.

Cisco offers a series of management applications that support effective delivery of Cisco TelePresence throughout the network management lifecycle. To illustrate how enterprises might use and benefit from this set of applications, this paper shows how Cisco network management applications in combination with Cisco Advanced Services and best practices assist Cisco TelePresence deployment and operation in a fictional financial services network connecting offices in New York, San Francisco, London, Tokyo, and Hong Kong.

Plan and Prepare

In an Internet-driven industry, news travels fast. Fiction & Associates Financial Services needs to anticipate the effects of global trends and local issues so that it can profitably represent its clients. Executives and regional managers often need to share urgent information and discuss its ramifications to make coordinated decisions. However, Fiction & Associates has found that culture and language barriers can impede the effectiveness of communicating through audio conference calls. To help it bridge these gaps and augment its ability to capitalize on emerging trends, it decides to deploy Cisco TelePresence.

Fortunately, Fiction & Associates already owns a converged Cisco network that it uses to make trades and support Unified Communications through applications, messaging, and IP Phones. Because it already manages a complex, time-sensitive trading application, the IT staff at Fiction & Associates understands the critical importance of using proactive network management to help ensure consistent service quality.

While an organization may choose to self-plan and deploy Cisco TelePresence, many choose to purchase the Cisco TelePresence Planning, Design, and Implementation Service. By hiring Cisco expertise, Fiction & Associates receives the best-practices advantages that result in efficient planning and deployment of its TelePresence solution.

During the plan and prepare phases, the planning team uses Cisco TelePresence Readiness Assessment Manager to help assess the baseline status of the Fiction & Associates network before designing or deploying the TelePresence solution. To run Cisco TelePresence Readiness Assessment Manager, the team puts a laptop into each room with a software agent, which communicates with the central console in New York. The agent generates synthetic traffic for evaluation. It runs for a couple of weeks to collect enough data for an accurate traffic analysis.

Cisco TelePresence Readiness Assessment Manager helps network planners to detect common problems that may hinder optimal user experience. Cisco TelePresence Readiness Assessment Manager identifies this information using features such as:

- **Automated network path discovery:** Discovers the network elements on the paths between proposed TelePresence sites.
- **Automated best-practice compliance analysis:** Determines the network device configuration compliance with the best-practice recommendations.
- **Switch and line-card recommendations:** Determines and flags the noncompliance of line cards in the network path.
- **End-of-service/end-of-life detection:** Determines and flags the end-of-service/end-of-live status of the devices in the network path.
- **Resource utilization baseline determination:** Determines resource utilization for the devices on the network path to detect potential capacity bottlenecks.
- **Comprehensive reports:** Generates comprehensive executive and operational reports, which contain assessment results and recommendations.

- Traffic simulation and analysis capabilities provide delay, jitter, and packet loss metrics along each pathway. This information helps Fiction & Associates assess traffic loads among strategically deployable software agents and calculate service quality metrics. This capability determines and flags network paths where quality metrics violate TelePresence traffic quality recommendations.

In our fictional scenario, a Cisco TelePresence Readiness Assessment Manager report identifies several issues that the Cisco service engineers address with the Fiction & Associates planning team during the design and implement phases:

- The existing 512 kbps WAN link between San Francisco and Tokyo has insufficient bandwidth to support high-quality TelePresence traffic.
- A router in London has an older module with insufficient buffer memory to support TelePresence.
- The pathway between New York and London has acceptable jitter, but too much packet loss for acceptable service quality.

Design and Implement

The design team decides to build a hub-and-spoke TelePresence architecture based at the network operations center (NOC) in New York, which will house the Cisco TelePresence Multipoint Switch. As part of this process, the team performs path qualification, analyzing site-to-site links between offices. It identifies the appropriate network pathways to support TelePresence. Cisco TelePresence Readiness Assessment Manager has given them information about critical network elements between endpoints. With this baseline information, the team can bridge the feature and capacity gaps between existing network resources and those recommended by best practices.

Fiction & Associates approves budget to make these changes to the existing network prior to implementation:

- Upgrade the WAN link between San Francisco and Tokyo to DS3, to accommodate TelePresence traffic alongside voice and data traffic.
- Upgrade the older router module in London.
- Analyze QoS settings along the path between New York and London. This analysis shows improper differentiated services code point (DSCP) settings at one router hop and requires a change in QoS setting.

With the design phase complete, it is time to implement Cisco TelePresence at each site. Several Cisco network management tools assist the implementation team, including Cisco TelePresence Administration, Cisco Unified Communications Manager (), Cisco TelePresence Multipoint Switch Administration, and CiscoWorks QoS Policy Manager The Cisco TelePresence system also has a command-line interface (CLI).

- **Cisco TelePresence Administration:** The administrative interface (CLI or Web) that resides on the Cisco TelePresence System codec. It allows administrators to configure, monitor, and troubleshoot a particular endpoint.

- **Cisco Unified Communications Manager:** Allows administrators to manage the configuration and firmware of Cisco TelePresence System endpoints. It also facilitates configuration and implementation of the dial plan and call routing for all Cisco TelePresence calls.
- **Cisco TelePresence Multipoint Switch Administration:** The management interface for each multipoint switch, controlling configuration, management, and troubleshooting.

The administrator uses the Cisco Unified Communications Operations Manager to define each endpoint, assign it a directory number, and configure all device-level settings, such as video resolution and bandwidth, access privileges for the local Web administration interface, firmware version, and other attributes. A Cisco TelePresence codec in each room manages all the local elements of the Cisco TelePresence meeting room solution, including plasma displays, cameras, speakers, microphones, and the Cisco 7970 IP Phone (where users initiate TelePresence calls). The design team uses Cisco Unified Communications Operations Manager to create configuration settings for every TelePresence endpoint, which are downloaded to the local systems in each room using the Cisco TelePresence Administration tool embedded in the codec. In the network operations center, administrators use the Cisco TelePresence Multipoint Switch Administration tool to configure the central multipoint switch.

Using CiscoWorks QoS Policy Manager to deploy policies, the design team prioritizes network traffic like this:

- **First priority:** TelePresence calls
- **Second priority:** Voice calls
- **Third priority:** Citrix-based trading application
- **Fourth priority:** Best-effort data traffic (Outlook, Exchange, file transfers, and other data applications)
- **Bottom priority (one percent allocation):** Scavenger traffic

CiscoWorks QoS Policy Manager facilitates centralized, comprehensive QoS provisioning and monitoring capabilities. Administrators can use CiscoWorks QoS Policy Manager to manage QoS policy creation, validation, deployment, and monitoring to help enable the secure and predictable delivery of business applications, such as video, voice over Internet Protocol (VoIP), TelePresence, and critical data center applications.

Designing, deploying, and monitoring QoS for TelePresence is a complex process that requires enterprise-grade automation. CiscoWorks QoS Policy Manager provides network administrators with comprehensive QoS provisioning and monitoring capabilities allowing them to manage and fine-tune the delay, delay variation (jitter), bandwidth, and packet loss parameters required for successful end-to-end deployment and optimal utilization of network resources. It delivers end-to-end intelligent, consistent, and sophisticated QoS that allows performance protection for TelePresence and other networked services.

Packet loss is caused by queuing. During periods of congestion, QoS configuration can drop packets that exceed the subscribed rate of the queue. Packet loss is also caused by policing, when the network drops packets that exceed the allocated rate.

Jitter is caused by queuing, shaping, and by the serialization delay introduced on link speeds less than 30 Mbps. Latency, also called propagation delay, is caused by the physical distance each packet has to travel between rooms.

Fiction & Associates follows recommended best practices when deploying QoS. It wants end-to-end QoS for TelePresence to meet these quality metrics:

- **Packet loss:** Less than 0.5 percent
- **Jitter:** Less than 10 ms one way
- **Latency:** Less than 150 ms one way

Therefore, it follows these best-practice guidelines for its entire network, not just TelePresence:

- Classify and mark traffic using DSCP as close to its source as technically and administratively feasible. Allow trusted hosts to mark their own traffic.
- Follow standards-based DSCP per hop behaviors to help ensure interoperation and future expansion as specified in RFC 4594, Configuration Guidelines for DiffServ Service Classes.
- Limit the amount of real-time voice and video traffic to 33 percent of link capacity; if higher than this, TelePresence data may be starved out, resulting in slow or erratic performance of data applications.
- Reserve at least 25 percent of link bandwidth for the best-effort data class.
- Deploy a 1 percent Scavenger class to help ensure that unruly applications do not dominate the best-effort data class.
- Use DSCP-based Weighted Random Early Detection (WRED) queuing on all TCP flows, wherever possible.

After TelePresence implementation is complete, the team runs Cisco TelePresence Readiness Assessment Manager again to verify that the compliance deficiencies identified during the planning phase were resolved during implementation.

Operate

After a testing period, the Fiction & Associates TelePresence rooms go live. The network operations group uses Cisco Unified Operations Manager Cisco TelePresence Manager, Cisco Bandwidth Quality Manager, and the Cisco Network Analysis Module to monitor and troubleshoot TelePresence services during operations. Fiction & Associates also has the option of outsourcing management of its Cisco TelePresence solution to Cisco Remote Operations Services, which offer the Cisco TelePresence Select Operate Service and the Cisco TelePresence Remote Assistance Service.

Cisco Unified Operations Manager is part of the Cisco Unified Communications Management Suite, and features built-in, real-time, service-level monitoring of all Unified Communication elements, including Cisco TelePresence. It performs automatic discovery of the entire system and provides contextual diagnostics for rapid troubleshooting. With Cisco Unified Operations Manager there are no rules to write, no thresholds to define, and no extensive and time-consuming initial setup.

Its primary features include:

- Real-time visualization and monitoring of the entire Unified Communications system that aid in troubleshooting.
- Active service assurance to help ensure that devices and applications are functioning as they should and to reveal faults and performance issues before they affect service.
- Powerful diagnostic tests and troubleshooting capabilities that rapidly isolate faults and increase productivity.
- Correlation, analysis, and presentation of voice service quality data and alerts that make information available for use through Cisco Unified Service Monitor (when it is deployed).
- Inventory and change monitoring that facilitate tracking of complete details of unified communications devices and IP phone inventory.

Cisco Unified Operations Manager does not deploy any agent software on monitored devices, so it does not disrupt system operations.

Cisco Unified Communications Manager registers the Cisco TelePresence codec in each room the same way it does a Cisco IP Phone. Cisco Unified Operations Manager discovers each codec and associates it with a Cisco Unified Communications Manager. The Fiction & Associates network operators use Cisco Unified Operations Manager to verify that TelePresence components in each room are online and properly configured. A single URL in the management interface allows operators to log into the codec and check status of all peripheral devices, such as cameras, microphones, and displays. From the NOC in New York, an operator can use Cisco Unified Operations Manager to configure or shut down any device in any TelePresence room.

A Cisco IP Phone in each TelePresence room is associated with the codec, and it is used to initiate and terminate TelePresence calls with other rooms. As part of its best practices, the Fiction & Associates IT staff configures Cisco Unified Operations Manager to ring this Cisco IP Phone in every room each day at 0500 local time. By verifying call processing status in a room, the staff knows that the codec can place and terminate calls. Cisco Unified Operations Manager generates a status report through e-mail for the network operations manager each day.

One morning a group in London attempts to initiate a TelePresence call with San Francisco, and it won't go through. Someone calls the help desk in New York and reports the problem. Using Cisco Unified Operations Manager, the operator quickly determines that the codec in San Francisco is not registered with its Cisco Unified Communications Manager. The operator generates a trouble ticket, which contacts the onsite technician in San Francisco. The technician checks the TelePresence room and determines that a power fluctuation knocked the system offline. In a few moments, the system is rebooted and operational, and the London team can talk to its counterparts in San Francisco over TelePresence.

Cisco TelePresence Manager provides more detailed information for daily monitoring tasks. Where Cisco Unified Operations Manager can tell an operator whether a system is registered to the Cisco Unified Communications Manager, Cisco TelePresence Manager can show the entire status of a system, such as call status (active or standby), error conditions, and meeting schedules. It also manages multipoint switch resources for multipoint meetings. If Fiction & Associates needs to take a multipoint switch down for maintenance, it uses Cisco TelePresence Manager to move one (or all) scheduled multipoint meetings from that switch to another one. Cisco TelePresence Manager

also provides call records from meeting and user perspectives, providing additional information beyond call detail records kept by Cisco Unified Operations Manager.

Cisco Bandwidth Quality Manager provides bandwidth visibility and provisioning that measures compliance with service-level QoS policies. The control of network latency, jitter, and packet loss is a vital ingredient in delivering maximum performance for Cisco TelePresence. Cisco TelePresence requires consistent delivery of controlled latency and low jitter in the network.

Cisco Bandwidth Quality Manager features provide:

- **Network service quality:** Cisco Bandwidth Quality Manager measures the packet loss, jitter, and latency experienced by actual application traffic between any two Cisco Bandwidth Quality Manager appliances in the network providing information on how long each packet was delayed (and whether it arrived at all).
- **Expected quality:** Cisco Bandwidth Quality Manager calculates in real time the level of loss and queuing delay expected to be induced by observed traffic as it encounters downstream low speed (bottleneck) links or QoS shaping in the network. It allows Fiction & Associates to understand the amount of performance degradation due to traffic-induced congestion versus performance degradation in the network cloud.
- **Event analysis:** Cisco Bandwidth Quality Manager allows users to set thresholds for network service quality (loss, jitter, latency), expected quality (delay and loss), Corvil Bandwidth (delay protected, loss protected), and traffic insight (microburst rate, packet rate, and other) measurements. These thresholds define bounds of normal or expected levels of performance on each TelePresence connection. If any threshold is violated, Cisco Bandwidth Quality Manager triggers a 10-second leading and trailing trace capture around the event for every packet on a managed interface.
- **Bandwidth sizing:** Cisco Bandwidth Quality Manager uses a technology called Corvil Bandwidth to determine how much bandwidth protects TelePresence traffic from exceeding quality thresholds.

During deployment, Fiction & Associates placed a Cisco Bandwidth Quality Manager appliance in each TelePresence room. It opted for medium-level compression of TelePresence signals between rooms. While the audio component is predictable at approximately 8 kbps, the video component is “bursty.” Depending upon the activity level in a room, a typical TelePresence call requires anywhere from 2 to 15 Mbps of video bandwidth from moment to moment. Even with compression, TelePresence video can experience microbursts up to 5 Gbps within a 100 ms window. Cisco BQM can see these microbursts, which are invisible to less granular tools with 1-second intervals. The operators set 15 Mbps thresholds in the Cisco Bandwidth Quality Manager appliances that generate an event alarm when detecting microbursts that exceed the bandwidth threshold.

Nanosecond granularity allows Cisco Bandwidth Quality Manager to detect microvariations in packet delivery that affect delay and jitter. The operations team configures Cisco Bandwidth Quality Manager to generate warnings when actual service levels begin to exceed quality thresholds. The TelePresence system terminates a call when quality metrics are too high (Table 1).

Table 1. Measuring Service Quality Using Cisco Bandwidth Quality Manager

Metric	Target SLA	Warning Message	Call Terminated
Packet Loss	Less than 0.5%	Greater than 0.1%	Greater than 0.2%
Jitter (one way)	Less than 10 ms	Greater than 20 ms	Greater than 40 ms
Latency (one way)	Less than 150 ms	Greater than 200 ms	Greater than 400 ms

Based on real-time and historical information provided by Cisco Bandwidth Quality Manager, operators can use CiscoWorks QoS Policy Manager to modify QoS settings as needed to bring service levels into compliance with quality parameters.

Cisco Network Analysis Modules are intelligent services modules installed in Catalyst® 6500 Series switches, Cisco 7600 Series routers, and Cisco 2800 and Cisco 3800 Series Integrated Services Routers. The Cisco Network Analysis Modules combine rich instrumentation with advanced analytics to provide detailed visibility into network utilization and how users experience network-enabled services. With the ability to analyze traffic from within the switch or router itself, the Cisco Network Analysis Module gives Fiction & Associates greater insight into the performance of its converged network and overall user experience to help ensure consistent application and service delivery.

The Cisco Network Analysis Module offer a comprehensive set of performance management features including:

- **Flow monitoring:** It classifies network traffic and protocol types and identifies application and host bandwidth usage to monitor ongoing business operations and quantify “before and after” effects of implementing a change in network resources, such as introducing TelePresence.
- **Voice and video quality analytics:** It analyzes voice traffic flows in near real time to collect critical performance information, including call-setup details and voice-quality metrics. After a call, administrators can gather packet loss and jitter information from Session Initiation Protocol (SIP) to evaluate the TelePresence audio component. The Cisco Network Analysis Module can also monitor video packet quality to help assure a high packet delivery rate. To help evaluate TelePresence video quality, administrators use Real-time Transport Protocol (RTP) stream monitoring to examine the rate of packet loss at a granularity level of 10–6 and the actual number of packets lost on the video transfer layer.
- **Troubleshooting:** It helps enable administrators to set aggressive thresholds on various network parameters to assure optimal TelePresence call quality during calls. When it identifies a potential problem (such as high packet loss), it triggers packet capture and decodes packets to help resolve the problem before it affects users.
- **Application performance analytics:** The Cisco Network Analysis Module monitors TCP application packets, measuring network round-trip time, client response time, and server response time. These latency metrics define how well the network is delivering services to the end user.

One day in early February while monitoring TelePresence video streams, the Cisco Network Analysis Module sends a trap to Fiction & Associates operators, alerting them to intermittent problems with video reception during a TelePresence call between Tokyo and San Francisco. Drilling into the Cisco Network Analysis Module data, the operator determines that, during the TelePresence call, other users in the Tokyo office were downloading Superbowl ads from

YouTube. As video traffic, YouTube traffic shares the same queuing priority level with TelePresence. The operator escalates the issue to the network engineer, who uses Cisco QoS Policy Manager to downgrade YouTube traffic to best-effort status.

Optimize

Over time, network requirements change to accommodate business growth. The Fiction & Associates IT staff proactively manages change to maintain optimal quality of experience in its Cisco TelePresence rooms. It periodically runs Cisco TelePresence Readiness Assessment Manager to evaluate network pathways and devices for compliance with TelePresence standards. It runs Cisco QoS Policy Manager to assure compliance with QoS policies.

Nine months after its TelePresence deployment, Fiction & Associates decides to build a secondary data center in Hong Kong. Knowing that this project would dramatically change traffic profiles, the IT staff works with Cisco services engineers to run a what-if scenario using Cisco Bandwidth Quality Manager. The tool provides data that helps the team determine the size of its new router and upgraded WAN trunks into the Hong Kong offices and data center. The team then uses CiscoWorks QoS Policy Manager to implement QoS controls on the new router.

Managing for Success

A proactive approach to network management helps enable Fiction & Associates Financial Services, Inc., to successfully manage its Cisco TelePresence solution throughout the management lifecycle. Proactive network management that follows proven best practices assures consistent service delivery. Predictable service quality makes the new TelePresence rooms very popular throughout Fiction & Associates. Participants in Fiction & Associates offices worldwide can meet face to face to build business relationships without the expense and delay of travel. Like our fictional company, any distributed enterprise can benefit from Cisco TelePresence—when it is properly managed.

For More Information

Cisco TelePresence Readiness Assessment Manager: http://www.cisco.com/go/ctram.

Cisco Unified Communications Manager: http://www.cisco.com/web/solutions/smb/products/voice_conferencing/unified_communications_manager/index.html.

Cisco TelePresence Manager: http://www.cisco.com/en/US/products/ps7074/index.html.

CiscoWorks QoS Policy Manager: http://www.cisco.com/en/US/products/sw/cscowork/ps2064/index.html.

Cisco Unified Operations Manager: http://www.cisco.com/go/cuom.

Cisco Bandwidth Quality Manager: http://www.cisco.com/go/bqm.

Cisco Branch Office Routers Network Analysis Module: http://www.cisco.com/en/US/products/ps7176/index.html.

Cisco TelePresence Services: http://www.cisco.com/en/US/products/ps7072/serv_group_home.html.

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