Design Considerations for Video Collaboration over a PIN Architecture

At-A-Glance

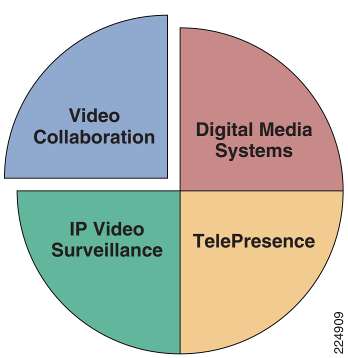
Benefits of Desktop Video Collaboration

The adoption of desktop video collaboration technology has enabled organizations to capture the benefits of increased productivity through more effective meetings. This can translate into more rapid implementation of corporate strategies and faster time-to-market through increased decision-making. Organizations can benefit from reduced travel expense and increased productivity due to reduced downtime resulting from business travel. In addition, desktop video collaboration offers a means for organizations to maintain a positive corporate image by reducing carbon emissions through decreased travel—as social and governmental pressures mount to address the growing concern of global warming.

Benefits of Enabling the Network for Video Collaboration

In order to maximize the business benefits of increased productivity through the use collaborative tools that include desktop video conferencing, each organization must enable its network infrastructure to support such technology. Enabling the network infrastructure to support desktop video collaboration helps to minimize or eliminate disruptions of service and periods of degraded quality. Further, enabling the network to support desktop video collaboration also helps to minimize or eliminate disruptions to other business critical applications as network demands for collaborative tools continue to increase.

Figure 1 Video Collaboration Solution

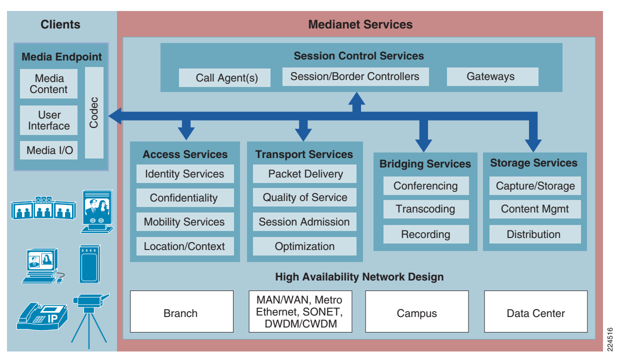


Cisco Medianet Framework

A Cisco medianet (Figure 2) provides a network-wide framework for enterprise network designs with video services in mind. It is designed for enterprise customers considering various types of video applications in use today or that might be used in the future. A Cisco medianet starts with an end-to-end network infrastructure designed and built to achieve high availability. It also defines the sets of services the network can provide to video applications. Services include the following:

- Access services—These provide access control, identity, mobility, and location services to video clients.
- Transport services—These provide packet delivery, ensuring service levels with QoS and delivery optimization.
- Bridging services—These include transcoding, conferencing, and recording services.
- Storage services—These include content capture, storage, retrieval, distribution, and management services.
- Session control services—These include signaling and control to setup and tear-down sessions, as well as gateway services.

Figure 2 Media Ready Network Framework



These services are applied to the network infrastructure components and technologies defined within the Places-in-the-Network (PIN)—Branch, WAN, Campus, and Data Center.

SLA Determination

In order to properly enable desktop video collaboration within a network, it is essential to first characterize the key service-level agreement (SLA) parameters to be met. These parameters include the following:

- Bandwidth—The bandwidth used per desktop video conference call is typically at the discretion of the network administrator and based on the business requirements of the organization. Typical video rates go up to 1.5 Mbps for SD desktop video conferencing systems. For business quality desktop video conferencing, rates above 384 Kbps per call are often used. High frame rates (up to 30 fps) and larger video formats (CIF and 4CIF) typically lead to better video quality, with the trade-off being higher bandwidth utilization. Application sharing components bundled with collaboration tools require additional bandwidth in addition to the requirements for audio and video media.
- Packet Loss—Due to the high amount of compression and motion-compensated prediction utilized by video codecs, even a small amount of packet loss can result in visible degradation of the video quality. Packet loss tolerances for good video quality is highly subjective and can depend on a variety of factors, such as video resolution, frame rate, configured data rate, codec implementation, and even the specific PC upon which the video conferencing application is running. However, values between 0.1 and 1 percent often yield acceptable video quality.
- Jitter—The tolerance of video codecs to jitter is often variable, depending upon the video codec deployed (H.263 or H.264). All packets that comprise a video frame must be delivered to the desktop video conferencing endpoint before the replay buffer is depleted. Otherwise degradation of the video quality can occur. The network should be designed to minimize jitter.
- Latency—The latency requirement for desktop video conferencing is in line with requirements for VoIP, which is based on the recommendations of the International Telecommunications Union-Telecommunication Standardization Sector (ITU-T) G.114 standard. When one-way latency begins to exceed approximately 200 msec, there is a noticeable degradation in the overall quality of the conversation. Desktop video conferencing

brings the additional requirement of voice and audio synchronization. This often requires that audio and video media have the same service-level across the network.

- Bursts—Video typically appears as a variable bit-rate stream with somewhat random bursts. The network infrastructure must be able to accommodate these bursts. Video quality will degrade if packets associated with bursts are dropped or delayed excessively by any traffic policing or shaping within the network.

PIN Architecture Design Considerations

Figure 3 shows the overlay of desktop video collaboration components over a PIN architecture.

Branch PIN Design Considerations

Desktop video conferencing endpoints come in various forms. These include hardware systems such as the Cisco IP Phone 7985G and software systems such as the Cisco Unified Personal Communicator, Cisco Unified Video Advantage with IP Communicator, and Cisco WebEx web conferencing (which uses just a web browser)—as well as a combination of hardware and software systems such as Cisco Unified Video Advantage with IP Phone (Figure 3). Because the endpoints are often PCs running additional applications that are not necessarily trusted from a QoS perspective, the classification of the audio and video media must often be accomplished via ACLs on a branch LAN switch such as the Cisco Catalyst 3750E Series. These switches also provide both ingress and egress queueing to ensure desktop video conferencing traffic is allocated the appropriate bandwidth on the branch LAN.

High-availability (HA) designs within the branch for desktop video collaboration include the use of redundant WAN Integrated Services Routers (ISR) with circuits to separate service provider networks. This provides a resilient path for audio and video media in the event of a circuit failure. It also provides a resilient path for call signaling to the Cisco Unified Communications Manager cluster. Additional Session Control Services such as Cisco SRST can be deployed within the Cisco 3800 and Cisco 2800 Series ISR routers for additional resilience for supported desktop video conferencing endpoints. High-availability must also be considered for conferencing services that include the Cisco Unified Video Conferencing 35xx Series MCU, which provides conferencing and transcoding for multipoint desktop video conference calls.

Cisco ISRs provide software defined QoS for multiple service classes across the WAN. This allows the network administrator to separate desktop video conferencing from other video traffic classes and even business critical traffic, effectively protecting each from affecting the other. During normal operation, optimization services such as Cisco's Performance Routing (PfR) within the Cisco ISRs ensures that desktop video collaboration traffic utilizes the best path to the campus based on SLA requirements.

WAN PIN Design Considerations

When desktop video collaboration is deployed across a service provider (SP) managed WAN infrastructure-such as an Multiprotocol Label Switching (MPLS) network-the network administrator must ensure that the SLA parameters defined are met by the service provider. In addition, the enterprise might define more QoS service classes than available within the SP MPLS network. For example, the Cisco 12-class QoS model (based on IETF RFC 4594) defines a Multimedia Conferencing service class for desktop video conferencing-marking the audio and video media as AF41. However, the SP network might only implement six service classes. In such cases, the network administrator must take into account the mapping of the Multimedia Conferencing service class into the appropriate MPLS service class as traffic enters the MPLS network. Traffic might also need to be identified and re-mapped back to the appropriate service class as it exits the MPLS network.

When desktop video collaboration is deployed across an enterprise-managed WAN infrastructure, the network administrator is responsible for ensuring SLA requirements are met. Jitter can be the result of long queue lengths, indicating that additional bandwidth might be required. In some cases parts of the network design might need to be modified to reduce the number of hops, which potentially add latency and jitter. The choice of routing protocol implemented across the WAN and tuning of the timers should be done with rapid convergence in mind. At the WAN aggregation point, high-availability features-including built-in hardware and processor redundancy, In-Service Software Upgrade (ISSU) and nonstop forwarding (NSF) with stateful switchover (SSO) can be deployed within Cisco Aggregation Services Router (ASR) platforms.

Campus PIN Design Considerations

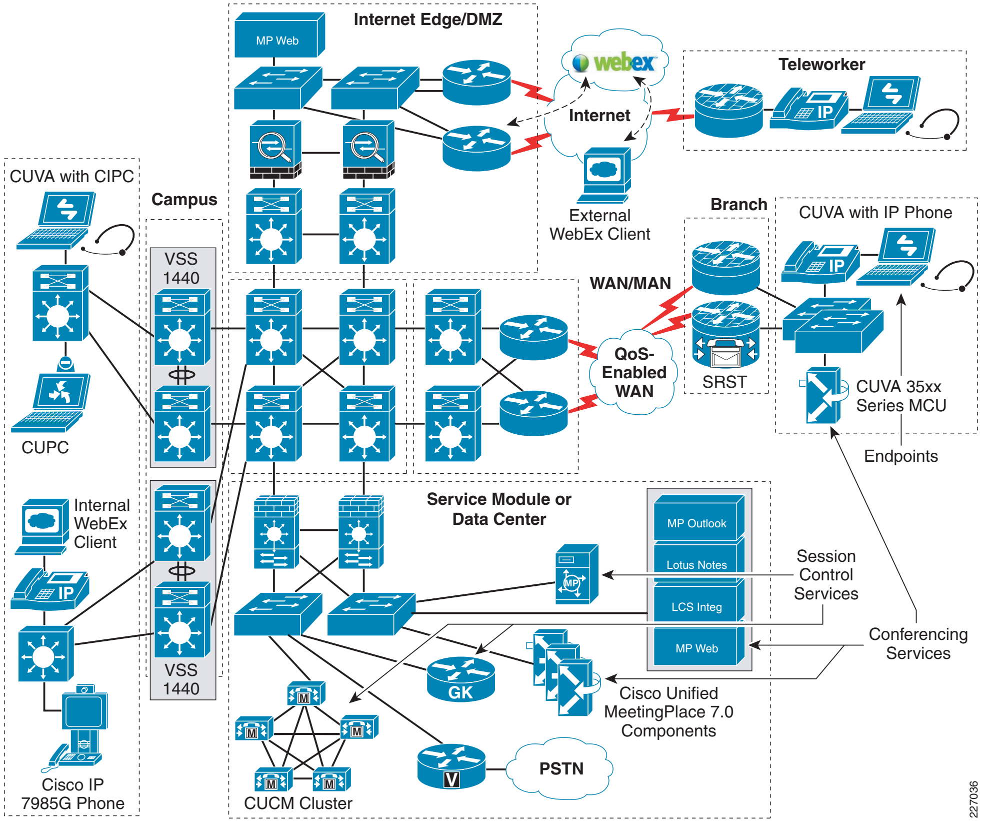
A hierarchical campus design consisting of core, distribution, and access layers, utilizing redundant 1 and 10 Gigabit Ethernet links provides bandwidth and high availability for desktop video collaboration. Additional features, such as the Cisco Catalyst 6500 Virtual Switching System (VSS) can be deployed within the core and distribution layers of the campus, as well as within the data center/services module. VSS provides scalability and high availability through cross-chassis EtherChannel load-balancing and ease of administration. Technologies such as Gateway Load Balancing Protocol (GLBP), Hot Standby Routing Protocol (HSRP), and Virtual Router Redundancy Protocol (VRRP) can provide rapid convergence times for video applications operating across the LAN. Additional HA features, including built-in hardware and processor redundancy, ISSU and NSF/SSO, can be deployed within Cisco Catalyst 6500 Series platforms.

As with the branch PIN, the access Cisco Catalyst 6500, Cisco Catalyst 4500, or Cisco Catalyst 3750E switch within the campus establishes the QoS trust boundary, classification, and marking of audio and video media as it enters the network-as well as providing ingress and egress queueing to ensure desktop video conferencing traffic is allocated the appropriate bandwidth on the campus LAN. The addition of the Catalyst 6500 Network Analysis Module (NAM) can add detailed traffic analysis capability on top of the deep-packet inspection and classification capability of the Cisco Catalyst 6500 Sup32 PISA, which provides more granular classification of desktop video collaboration traffic as it enters the campus LAN. Additionally, NetFlow statistics captured from Cisco Catalyst 6500 platforms can provide real-time monitoring for all application traffic flows, allowing visibility into voice and video flows within the campus network. Finally, the Cisco IPSLA capability of Cisco Catalyst 6500 platforms allow network administrators to proactively verify the network operation and accurately measure network performance.

Figure 3 Desktop Video Collaboration PIN Overlay

Summary

Organizations are increasingly turning to desktop video collaboration to enhance business productivity. However, the increasing demand for collaborative tools places increased strain on networking resources. A Cisco medianet provides a framework for enterprise organizations to design their networks to support multiple video applications that can be used today or which may be deployed in the future. In order to properly enable desktop video collaboration within a network, it is essential to first characterize key service-level agreement (SLA) parameter requirements such as bandwidth, packet loss, latency, jitter, and bursts. Once these SLA parameters are understood, the network design engineer can begin to identify critical services such as QoS and high availability which need to be provided to support desktop video collaboration. These services are then applied to the various Places-in-the-Network (PINs) architectures—Branch, WAN, and Campus in order to minimize disruptions to desktop video collaboration sessions as well as to prevent disruptions to business critical applications which could result from excessive video traffic.



For more information, refer to the Media Ready Network documents at the following URL:

http://www.cisco.com/go/designzone