White Paper

White Paper Series: Harnessing Video Collaboration for Business Transformation
1st in the 3-Part Series

Video Collaboration: Consider the User Experience and Operational Efficiency

What You Will Learn

Video Collaboration projects are highly visible and, if well planned, can showcase the strategic value of IT to the organization. This paper, intended for IT leaders and personnel, explains considerations in planning and designing a medianet (media-optimized network) for an excellent user experience and operational efficiency:

- Different capabilities are required to support telepresence videoconferencing and web-based video portals.
- Designing the medianet with future use scenarios in mind generally reduces costs and mitigates risk.
- Design considerations include availability, bandwidth and burst, latency and jitter, and even telepresence room design.

Reviewing considerations for the different types of business video presented in this paper can help you determine whether your organization has the internal resources to plan and design the deployment internally or would benefit from working with a trusted advisor.

Why Not Just Deploy First and Then Fine-Tune Later?

Video is fundamentally transforming the way organizations communicate, collaborate, educate, and protect people and assets. Many organizations plan to eventually adopt multiple video collaboration tools, such as telepresence for team integration, interviewing, and sharing centralized experts with branch customers; conferencing for team meetings and customer training; and internal web portals for on demand training videos.

It might seem pragmatic to design the network for the first application you plan to adopt, see how it goes, and then add other capabilities for additional video applications just before adopting them. In practice, however, this approach has two drawbacks, the most serious of which is the potential for early problems that discourage user adoption, such as poor video quality, difficulty connecting, complicated interfaces, or, in the case of telepresence,

a distracting room design. Overcoming an initial poor impression can take a long time, preventing the organization from realizing the full value of its investment in business video.

Another problem with neglecting to discover all requirements before designing the network is that adding capabilities later often costs significantly more than planning for them from the outset. For example, consider an organization that plans to adopt telepresence as well as desktop videoconferencing. It is commonly assumed that a network designed for telepresence will also support desktop videoconferencing applications, which have different tolerances for latency and jitter. But in fact, desktop videoconferencing requires network capabilities that telepresence does not. For example, videoconferencing sessions are often unscheduled, which has implications for bandwidth planning. Similarly, video streaming requires switches and routers that support bandwidth optimization techniques to enable dozens or hundreds of viewers to view the same video stream simultaneously rather than clogging up the network with multiple duplicate streams. An organization that designed its network for telepresence without also considering desktop videoconferencing and video streaming requirements would deliver an unsatisfactory experience for the users of both.

In summary, it is more efficient and less costly to thoroughly plan the business video deployment at the outset of the project rather than at each new adoption point.

The Value of Thorough Planning for Business Video: Real-Life Examples

A network optimized for business video is called a medianet. The optimal medianet design can vary greatly between organizations, even if those organizations are using the same business video application. For example, consider the telepresence deployments for the Fuqua School of Business at Duke University and GE. Both organizations deployed Cisco® TelePresence™ conferencing in an auditorium setting, using a triple codec (H.264, MPEG-4, and MJPEG compression) to provide an immersive experience. However, the similarity ends there.

Duke uses its TelePresence system in a specially built “virtual lecture hall” to bring experts from around the world into the classroom without the time, costs, and environmental impact of travel. The university wanted the classroom technology to enable physically present and remote students and instructors to interact naturally, rather than adapting their behavior in response to technology. The design called for a highly interactive environment, including:

- Push-to-talk microphones for more than 130 students. When a student pushes the button on the microphone, a pan-tilt-zoom camera focuses in on that student so that participants in remote locations see the speaker on screen.
- Displays built-into the podium so that instructors can view and have eye contact with participants in remote locations.
- Pan-tilt-zoom camera to capture instructors as they move about the lecture hall as they would in an ordinary classroom.

The university medianet has very high bandwidth capacity. Therefore, Duke decided not to implement a special class of service for TelePresence traffic, regarding possible performance degradation during peak traffic times as an acceptable risk.

GE, in contrast, implemented its TelePresence system in a training facility, to enable remote experts to teach an executive class. Unlike Duke, GE prefers tightly-controlled interaction between class participants and remote presenters, and did not require technology for a local presenter. GE had already implemented QoS and is working to integrate its telepresence system with National Lambda Rail (NRL), the 12,000-mile network owned by the U.S. research and education community.

Cisco Services engaged a community of partners to work with both Duke and GE to plan the entire TelePresence environment, not just the medianet. The collaborative planning effort helped both organizations adapt the technology to their business requirements instead of adjusting their requirements to the solution capabilities.

Other real-life examples of unusual video collaboration requirements that IT teams have discovered during the planning stage (or wish they had discovered) include:

- **Delivering video over wireless:** A major auto manufacturer uses telepresence to allow managers to view assembly line issues with their own eyes rather than relying on someone else's verbal description. Both the wireless network in the assembly area and the WAN connection between branches and the main campus require the bandwidth and QoS to transmit high-definition video. Neither of these requirements is needed for room-to-room telepresence, the more typical use case.
- **Integrating telepresence and smartphones:** A retailer wanted to allow mobile executives to join telepresence sessions over Wi-Fi, using smartphones. A partner recommended the solution, which was using the Cisco Media Experience Engine to sense callers' device characteristics, and then automatically transrate the video for the lower bandwidth available on the Wi-Fi network and transcode it to match the quality of mobile phone displays.
- **Delegating deployment of desktop video to branch-office IT teams:** A North American pharmaceutical company wanted to use desktop video for quarterly webcasts from the CEO, executive briefings, team meetings, and employee training. Sending a team of engineers to implement the solution in all 80 offices in North America, Europe, and the Asia Pacific region would be costly and take too long. Therefore, the company engaged a partner with extensive experience with global deployments of desktop video to develop an easy-to-use instruction guide for local IT staff. The company now uses the system to host up to 20 live events monthly.

While it is difficult to anticipate every way your organization might use business video, it is prudent to plan for as many use cases as you can. Experienced partners have the tools and intellectual capital to anticipate possibilities and unexpected requirements based on your industry and business models. Working with a partner can be helpful even if you have in-house expertise, because network and video technologies change very rapidly.

Mapping Business Video Characteristics to Medianet Requirements

Effective planning and design for a medianet requires an in-depth understanding of the requirements for each type of business video, and knowing which of those requirements are already present in the existing network. Table 1 summarizes the five broad categories of business video. The remainder of this white paper provides a short summary of planning and design considerations for each category.

Table 1. Different Categories of Video Require Different Medianet Characteristics

Category	Example	Requirements
Many-to-Many, Real-Time Interactive, High-Definition	Telepresence	• 4-12 Mbps bandwidth for each endpoint • QoS • Bandwidth reservation for scheduled calls
Many-to-Many, Real-Time Interactive, Low-Definition	Standard-definition videoconferencing Cisco WebEx®	• Packet inspection • Support for unpredictable usage patterns
Many-to-Few, Non-Real-Time, Non-interactive	Video web portals Enterprise TV	• Integration with other video applications, such as video streaming or broadcasts • Interface for self-service content submission by other organizations, such as advertisers or customers
Unmanaged	Public video-sharing websites	• Monitoring of this type of traffic, to allow enforcement of organizational use policies to prevent congestion

Many-to-Many, Real-Time Interactive, High-Definition

Telepresence and high-definition videoconferencing belong in this category. The major design challenge is achieving very stringent network performance targets. Telepresence, for example, is 100 times more sensitive to packet loss than voice over IP. The reason is that telepresence traffic is compressed by nearly 99 percent, so even one dropped packet out of 10,000 is clearly visible to participants when displayed on a large screen, detracting from the immersive experience. General requirements for a medianet used for telepresence and high-definition videoconferencing include:

- **Sufficient bandwidth:** The typical requirement is 4-12 Mbps per endpoint.
- **Quality of service:** Network switches and routers look at each packet's QoS markings to determine its priority relative to other traffic on the network. Telepresence traffic needs the highest priority, above application traffic, FTP, email, and so on.
- **Scheduling, using Network Admission Control:** If telepresence traffic for a scheduled session from 1 to 2 p.m. will pass through three routers, the scheduling application needs to instruct all three routers to reserve the appropriate amount of bandwidth for the duration of the session.
- **Storage and playback considerations.** If your organization plans to use Cisco TelePresence Recording Studio to capture and store high-definition video for later playback, the medianet design must consider the bandwidth needed for playback. Playing back the video in another telepresence room requires the same bandwidth as an interactive telepresence session, while playing it back on a desktop requires less bandwidth. Centrally recording and storing video significantly affects storage requirements, depending on the number of videos, stored video resolution, and retention periods.

Many-to-Many, Real-Time Interactive, Low-Definition Video

Examples of video applications in this category include Cisco WebEx and standard-definition video conferencing. It might at first seem as though a medianet designed for telepresence would have all the capabilities needed for Cisco WebEx and videoconferencing. However, these applications actually require capabilities that telepresence does not:

- **Packet inspection functionality:** Switches and routers ordinarily regard Cisco WebEx traffic as data traffic. But the packets actually need priority treatment because they include latency-sensitive video.
- **Support for unpredictable usage patterns:** While telepresence calls are usually prescheduled, Cisco WebEx and videoconferencing calls are often spontaneous, as when one employee needs a quick consultation with another to resolve a customer issue. Therefore, the medianet design for Cisco WebEx and videoconferencing must account for unpredictable traffic patterns.

Video from Outside Sources

During planning, remember to also consider the effects on the network when employees access public video-sharing websites, such as YouTube, Hulu and Netflix. Some colleges and universities have reported decreased Wi-Fi network performance from students watching video and TV shows on their smartphones and tablets, both for classes and entertainment. If competition for bandwidth is a potential problem in your organization, it is wise to include monitoring tools in the design so that you can spot trends early and then enforce usage policies if necessary.

Common Requirements and Recommendations for Designing a Medianet

Services partners with experience designing medianets for video collaboration generally consider the following factors for their customers (The following discussion is not meant to be comprehensive, but rather to provide a high-level view of the variables that can affect the user experience and operational efficiency of business video deployments.):

High Availability

Traditional network designs for data applications target packet loss at less than 1 to 2 percent. Network designs for voice target packet loss at 0.5 to 1 percent. The packet-loss targets for business video are far more stringent: 0.05 percent or less.

Another factor affecting availability is network convergence, defined in simple terms as the length of time it takes to begin forwarding traffic once a topology change has occurred. In headquarter networks, the network convergence target for business video is 200 milliseconds. The target might be higher on the WAN and branch-office networks, depending on your topology and service provider capabilities.

Designing the medianet for high availability is an especially worthwhile investment because it benefits all applications, including business video as well as business-critical applications such as enterprise resource planning (ERP), business intelligence, web portals, and unified communications applications used for collaboration within the company and with customers and partners.

Bandwidth and Burst

Streaming video applications require sufficient bandwidth for ordinary traffic levels and also accommodations for burst, defined as the amount of traffic transmitted each millisecond that exceeds the per-second average. A services partner can help you measure typical bandwidth requirements and determine if existing routers and switches provide adequate buffering capacity to handle bursts.

Bandwidth and burst requirements depend somewhat on the location of the media sources and viewers. For example, if you are implementing desktop videoconferencing, the desktop is both the source and consumer of the video. This type of video traffic affects the campus switching network, WAN, and LAN. Videoconferencing and Cisco WebEx usage patterns can be difficult to predict, but you can get an idea by looking at your recent voice calling patterns.

The optimal design for video on demand might be different. On-demand media streams typically originate from within the data center, not the desktop, so they affect the WAN, branch office LAN, and possibly even a home worker's home network. For video on demand, duplicating the media stream to each viewer is inefficient, so a solid plan includes broadcast optimization technologies such as IP multicast or stream splitting.

Latency and Jitter

A well-designed medianet controls latency and jitter so that users see smooth movement synchronized with the audio, not distracting jerky and pixilated images that can take away from the in-person experience. The network latency target specified in the ITU G.114 specification for voice and video networks is 150 milliseconds. Jitter targets for real-time interactive media applications are typically less than 10 milliseconds, peak to peak.

Application Intelligence and Quality of Service

When planning the medianet, determine how many distinct classes of service you need for different types of traffic, for the purposes of assigning priority. A simple plan might define three classes of service, for voice and video, business-critical applications, and best effort. More complex plans might have up to a dozen classes of service. Cisco Services recommends that organizations use RFC 4594, "Configuration Guidelines for DiffServ Service Classes," with minor modifications (Table 2).

Table 2. Recommended Service Classes for Medianets

Application Class	PHB	Admission Control	Queuing and Dropping	Application Examples
VoIP Telephony	EF	Required	Priority Queue (PQ)	Cisco IP Phones
Real-Time Interactive	CS4	Required	(Optional) PQ	Cisco TelePresence
Multimedia Conferencing	AF4	Required	BW Queue + DSCP WRED	Desktop Video Conferencing
Network Control	DS6		BW Queue	EIGRP, ISPF, BGP, HSRP, IKE
Call Signaling	CS3		BW Queue	SCCP, SIP, H.323
OAM	CS2		BW Queue	SNMP, SSH, Syslog
Transactional Data	AF2		BW Queue + DSCP WRED	Cisco WebEx, Cisco MeetingPlace, ERP Apps
Bulk Data	AF1		BW Queue + DSCP WRED	Email, FTP, Backup Apps, Content Distribution
Best Effort	Default		Default Queue + RED	Default Class Traffic
Scavenger	CS1		Min BW Queue (deferential)	YouTube, iTunes, BitTorrent, XboxLive

Security

Video applications are subject to the same security threats as other applications traveling over the network, such as eavesdropping, distributed denial of service (DDoS), compromised video clients, and system integrity breaches. The basic security principles for a medianet include network foundation protection; threat control and containment; and monitoring, analysis, and correlation. A partner can recommend a layered approach to security, spanning desktops, LANs, WANs, and the data center.

Visibility and Monitoring Service Levels

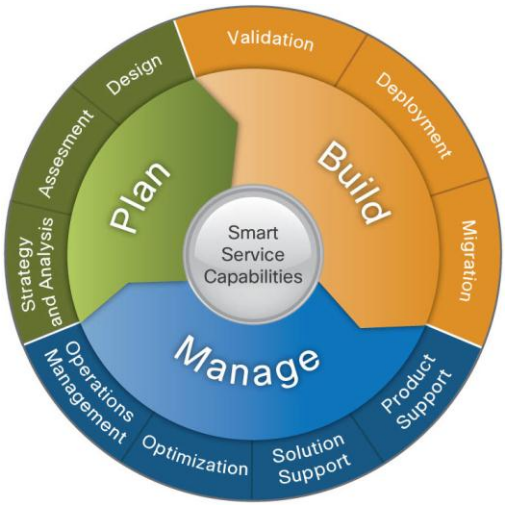
A partner can also provide guidance on using IP service-level agreement (IP SLA) tools to send periodic probes through the network to measure critical performance parameters such as latency, jitter, and loss. Monitoring can help you discover trouble spots with high latency, for example, so that you can correct them before users report problems.

As video usage increases, you might want to monitor the ratio of managed traffic and unmanaged traffic, such as videos viewed on entertainment sites. If unmanaged traffic begins affecting performance of critical business video, you can implement usage policies that give preference to enterprise video-sharing sites and telepresence traffic, for example.

Integration within the Audiovisual Environment

A good design also includes a plan for ongoing quality checks for the overall system and a methodology for quality support through documentation, mentoring, best practices, and advisory services. Cisco Services works with AV integrators on quality planning.

Conclusion



IT teams play a strategic role in their organization's success by introducing Video Collaboration to meet targeted business needs. The better the user experience, the bigger the transformational potential of business video will be and the more valuable the role of IT. Planning ahead rather than working by trial and error improves the user experience, helps to avoid surprises when the organization extends its use of business video, and often minimizes support costs.

Many variables affect the optimal medianet design, including the type of business video application and your organization's specific use cases. IT departments that do not have the resources to provide these services internally, or whose skilled resources are already engaged on other strategic projects, can get help from a partner, such as Cisco Services. Whether you plan and design the medianet internally or with a partner's help, these services are essential for fully realizing the transformative potential of video for communication, collaboration, education, and security.

For More Information

To find out more about video collaboration services from Cisco, visit www.cisco.com/go/services/businessvideo.

To read the other white papers in the "Harnessing Business Video for Business Transformation" series, visit www.cisco.com/go/services/businessvideo/whitepapers.

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