Accelerating Video Using Cisco Wide Area Application Services and Digital Media Systems

Most enterprises understand the power of video-based information delivered directly to their employees in the workplace. They also understand that the technical quality of that video presentation, in addition to content quality, has a significant effect on the video's ability to engage the viewer and impart the message. Previous efforts to deliver high-quality video messaging, either live or recorded on video tape or DVD, have proven expensive, time consuming, difficult to control, and difficult to maintain. Network-based delivery of live video and video on demand (VoD) requires significant bandwidth and dedicated content distribution networks.

Cisco® Wide Area Application Services (WAAS) and Cisco Digital Media Systems (DMS) provide a simple and efficient solution for delivering high-quality live video and VoD throughout the enterprise while also providing state-of-the-art WAN acceleration for other TCP-based applications.

The Value of Business Video

Few would argue that video is the next-best thing to being there. However, "being there" involves a significant cost in travel and lost productivity and does not guarantee that the information being offered will be received, digested, and absorbed by the listener. Live video streaming can provide a sense of immediacy and personal involvement. If that information is not immediately useful and applied, it can be lost as other, more pertinent information is acquired and applied. The concept of "video on demand," or VoD, has been implemented in various forms over the years in an attempt to mitigate this problem and provide precise information at just the right time when the viewer is ready and willing to receive the material and able to apply it immediately.

Live video and VoD can also help unify an organization, as each viewer in the organization receives the same message whether it is delivered today or next year. Live video and VoDs can uniformly educate employees about corporate goals and priorities, new products and procedures, regulatory compliance mandates, or any other information transfer requirement, providing a sense of intimacy and immediacy between the speaker and viewer, difficult to achieve otherwise in any medium other than a live interaction. This intimacy makes live video and VoD especially useful for:

- **Executive communications about corporate goals, achievements, changes in direction, and new campaigns:** Employees appreciate getting a sense of the person making the announcement, and the executive's urgency, pride, and priorities come across naturally.
- **Sales force and product training:** Viewers can return to parts of the video that they need to watch again, training can be delivered no matter where the employee is, and the content can be updated frequently. This feature is especially valuable for technology, pharmaceutical, financial, and other industries where products change frequently.

- **Employee regulatory compliance training:** Viewers can repeat certain sections to make sure they understand them, and the video can display documents along with a person talking to clarify the information. In addition, the delivery system can monitor which employees have seen the material.

The Problem with Business Video

The appeal of video is widely recognized, but its immediacy is not, and immediacy is a crucial part of its usefulness. Live streaming broadcasts can satisfy this requirement, and recordings can be saved for future playback. The material must be delivered in a timely way so it is fresh and accurate: yesterday's news loses its value. When it is not live, it is usually best delivered at the viewer's convenience, when it fits into the viewer's schedule and preferably at the viewer's workspace. With any more than a few video assets, managing the currency of business video becomes problematic.

Cost becomes a concern when large numbers of viewers in geographically disbursed locations are involved. Each time the content changes, new video must be prepared and distributed. With physical media such as video tape or DVD, managing the creation, distribution, version control, and asset management in the local office becomes a burdensome and cost-prohibitive task.

To reduce these costs, an alternative is to deliver the video directly to the viewer over the network. This method requires substantial network bandwidth for even low-bit-rate (relatively small size and low quality) video. High-quality, and thus more engaging, video is not possible with this method without significant network infrastructure and investment.

For live video streaming, in lieu of a full multicast environment, all viewers must receive individual streams at their desktop players. Without some form of optimization, each individual stream will originate at the source origin media server and be streamed across the entire network. This transmission can quickly overwhelm even the most robust network.

For VoD, one way to mitigate the network bandwidth problem is to preposition video content on a device close to the viewer, reducing the distance between the viewer and the video source. Cisco Application and Content Networking System (ACNS) Software (and other vendors' products) provides dedicated electronic content distribution network (eCDN) capabilities that address the bandwidth problem, but require deployment and management of a relatively complex eCDN. eCDNs work well for providing a wide range of features and functions for acquiring and distributing digital media assets throughout the enterprise, but at a significant cost for features seldom, if ever, used.

Clearly, an alternative solution is needed that treats high-quality video, both live and VoD, as just another application requiring acceleration and optimization in its delivery from a centrally managed data repository to the requesting user at the edges of the enterprise network.

A Simple End-To-End Solution

Addressing the video problem requires that addressing both the management of the video assets (that is, the creation, cataloging, advertising, updating, etc.) and the delivery of the video assets to the viewer. A number of vendors address one or the other of these problems, but only Cisco offers a simple end-to-end solution by combining the digital media management capabilities of the Cisco DMS Digital Media Manager (DMM), simplified search and access provided by the Cisco Video Portal, and the file distribution and HTTP application optimization capabilities of Cisco WAAS.

The simplicity of Cisco DMM allows nontechnical departments, such as sales and marketing, human resources, education, safety and security, and public relations, to reach their audiences without relying on network or IT groups for support, thereby accelerating the delivery of information while at the same time decreasing the overall cost of distributing communications and relieving the burden on IT. With Cisco DMM, functional groups can make robust and compelling digital media communications such as training, executive communications, and marketing information available to remote teams, activities that may have been cost prohibitive or impractical in the past.

Cisco DMM can be deployed as one of many collaboration applications on a Cisco Service-Oriented Network Architecture (SONA) network, a flexible, feature-rich framework that can help you achieve your business and technology goals. By making the network more capable and intelligent, Cisco DMM improves the efficiency of everything the network touches, freeing funds for new, strategic investments and innovation.

Cisco DMM allows you to:

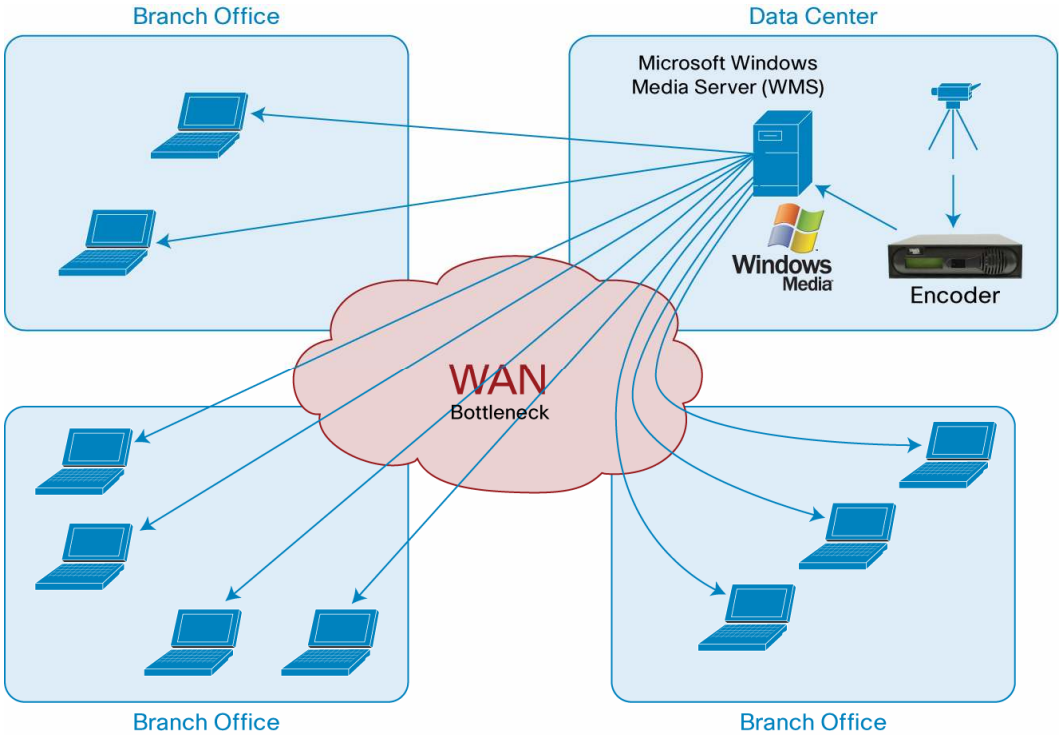
- Manage rich and effective communications with customers, investors, partners, students, media relations, and more
- Publish live and on-demand events and content to geographically dispersed audiences
- With a single and centralized management platform, publish content through the web for desktop viewing on the Cisco Video Portal

Live Video

Delivering high-quality live video events over the WAN is one of the most challenging networking tasks. Such live events typically involve high-ranking executives and expensive production studios and crews and relay vital business information. In such situations, the event must be delivered right the first time. Organizations that do not have multicast-enabled networks, or that have a mix of unicast and multicast networks, face significant difficulties in providing high-quality video while accommodating all other active WAN traffic.

Unicast networks in particular pose a serious challenge as congestion on the link from multiple clients attempting to view the live event may result in unacceptable video quality and a disruption of other business-critical applications (Figure 1).

Figure 1. Live Video Unicast WAN Bottleneck



Cisco WAAS 4.1 offers special protocol-level optimizations for Windows Media Technologies (WMT) over Real-Time Streaming Protocol (RTSP) according to specifications licensed from Microsoft. This special optimization is offered in addition to the generic Layer 4 optimization (transport flow optimization [TFO], data redundancy elimination [DRE], and Lempel-Ziv [LZ] compression) currently offered for other video formats and protocols, including VoD applications. This generic optimization covers video over HTTP, Adobe Flash, QuickTime, RealVideo, and any other video protocol delivered over TCP.

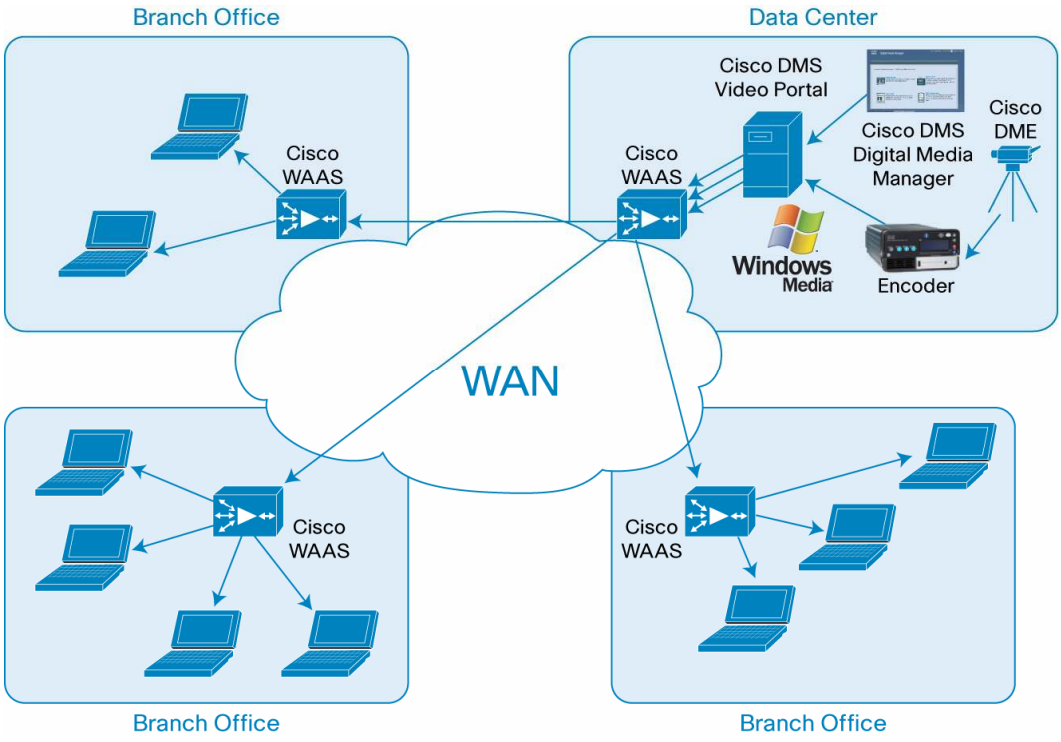
For live video events, the new Cisco WAAS 4.1 video application optimizer provides a simple solution with automatic and transparent video stream splitting at the edge of the network. No configuration is required for Windows Media live streams. Cisco DMM is used to publish links to future live Windows Media events to Cisco Video Portal. When multiple users click these links in Cisco Video Portal and make identical requests to join a live streaming event, the edge Cisco Wide Area Application Engine (WAE) Appliances using Cisco WAAS detects the identical requests and automatically splits a single incoming stream into as many outgoing streams as are requested. The video optimizations provided by the Cisco WAAS 4.1 video application optimizer uses automatic stream classification at Layer 7 and does not require any management or coordination prior to or during the video event. This behavior enables reduced management overhead, simplifies the production of live video events, and allows each IT and video production group in the organization to concentrate on the task at hand.

A client request to join a live Windows Media streaming event is initiated using a TCP connection. This TCP connection request is redirected to the Cisco WAE Appliances using Cisco WAAS, and the Cisco WAAS video policy is applied. Typically, the Windows Media Player (WMP) embedded in the Cisco Video Portal will initially request a User Datagram Protocol (UDP) connection to the video server in the data center. When the Cisco WAAS video application optimizer identifies this request as a request to join a Windows Media live event, it will deny this request for a UDP

connection. WMP, as part of its default behavior, will resend the request, this time asking for a TCP connection. This default behavior by WMP is called protocol rollover.

When the live event starts, as soon as the first client connects through Cisco WAAS, the video application optimizer automatically identifies the event as live; communicates the user authentication, authorization, and control commands to the video server at the data center; and, if authorized, delivers the video stream to the client. Any additional clients from that site that request the same live stream will, after authorization, be served locally without incurring additional streams on the wire. The user credentials and access control will always be delegated all the way to the video server, which is the authoritative entity. Each new client request will reuse the existing incoming stream from the WAN for the same stream's URL, creating a splitting effect for the outbound streams (Figure 2). For the incoming accelerated stream, DRE and LZ compression are disabled, reducing resource overhead on the Cisco WAAS WAE devices for the optimized connections.

Figure 2. Live Video Unicast with Cisco DMS 5.0 and Cisco WAAS 4.1 Video Application Optimizer Live Stream Splitting

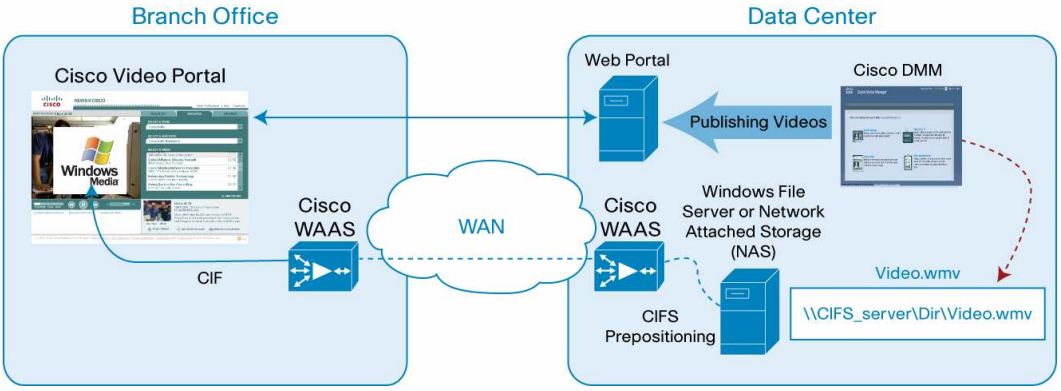


Video on Demand

VoD can also help unify an organization, as each viewer in the organization receives the same message whether it is delivered today or next year. VoD can uniformly educate employees about corporate goals and priorities, new products and procedures, regulatory compliance mandates, and any other information that needs to be communicated, providing a sense of intimacy and immediacy between the speaker and viewer that is difficult to achieve otherwise in any medium other than a live interaction.

A typical VoD implementation of Cisco DMS for a single site or campus would involve a web server to host and deliver the content to the requesting user's desktop Cisco Video Portal. For efficient delivery over a WAN, a more efficient distribution mechanism involving staging, or prepositioning of large-file-size VoD content, is required. Until now, the distribution technology of choice has been Cisco ACNS. With the growing demand for WAN optimization in general, Cisco WAAS can now be employed to provide similar VoD distribution and prepositioning capabilities, though in a different manner from that offered by Cisco ACNS (Figure 3).

Figure 3. Cisco DMS 5.0 and WAAS 4.1 Video on Demand Prepositioning and Access



While ACNS prepositioning capability encompasses web objects and files using HTTP, Cisco WAAS prepositioning is file based using the CIFS protocol and can be employed for protocols that can accommodate file-based access such as Windows Media. In a typical enterprise deployment of Cisco Video Portal over a WAN, in addition to standard HTTP web content, two types of video content are involved, Adobe Flash and Windows Media. The Cisco WAAS standard WAN acceleration techniques, including DRE, LZ compression, TFO, and now, with the release of Cisco WAAS 4.1, the HTTP application optimizer with its TCP connection reuse capability, the Cisco Video Portal HTTP and Adobe Flash content is optimized and delivered directly from the origin server. The high-bandwidth, large-file-based Windows Media video content, comprising the vast majority of the potential WAN traffic, can be fully prepositioned from the origin server and served locally from the edge Cisco WAAS WAE devices, thereby removing most of the Cisco Video Portal traffic that would otherwise traverse the network. The remaining non-file-based content, the HTTP and Adobe Flash content, is still prepositioned to the edge, but served from the origin server. Prepositioning the HTTP and Adobe Flash content allows the DRE cache to be preloaded so that any subsequent requests for this content can be re-created from the DRE cache, reducing the download bandwidth requirements and access time.

Video Optimization Benefits

Cisco WAAS 4.1 provides the capability to optimize video distribution in much the same way as it optimizes the delivery of any TCP-based application. However, Cisco WAAS goes beyond optimization of an existing application by providing the capability to deliver an entirely new and potentially valuable service that would not be possible without it: scalable, live, high-quality Windows Media video streaming. As more users request to join the live broadcast and additional splitting of the single incoming live stream occurs, the acceleration benefit becomes a multiple of the number of users, without using additional WAN bandwidth.

Additionally, by removing the need to serve and manage a streaming connection to each requesting user, Cisco WAAS reduces the burden on the origin video server by intelligently multiplexing remote-user requests over a single connection per location. Thus, video servers see fewer connections and are required to serve less data, thereby enabling video server scalability.

Cisco WAAS also enables the prepositioning of VoD media using its new CIFS application optimizer, making recorded video easily and conveniently accessible to the branch-office user without disrupting normal WAN traffic with large file downloads during prime business hours. VoD caching used in conjunction with prepositioning by the Cisco WAAS CIFS application optimizer and delivery by Cisco Video Portal together provide a powerful VoD-delivery architecture for enterprise e-learning, training, and video message archiving and playback.

The Cisco WAAS video optimization policy also provides data reduction and optimization for video other than Windows Media video, both live and VoD. This feature enables WAN optimization using DRE and LZ compression and bandwidth reduction with TFO for other video formats: video over HTTP, Adobe Flash, QuickTime, RealVideo, and any other video protocol that uses TCP as a transport mechanism.

Conclusion

Cisco WAAS 4.1 makes WAN optimization easy to deploy, while preserving existing network services. It adds application-specific acceleration, developed and validated in partnership with application vendors, and enables efficient delivery of video to the branch office with little effect on bandwidth.

Cisco DMM facilitates daily media management operations by allowing you to upload, catalog, edit, package, and publish all video content and playlists to Cisco Video Portal for live or on-demand playback, all through the pervasive, secure reach of a Cisco SONA network.

By combining the digital media management capabilities of the Cisco DMM; the search, access, and display capabilities of Cisco Video Portal;, and the distribution and HTTP application optimization capabilities of Cisco WAAS, Cisco provides a simple end-to-end solution to the problems associated with delivering high-quality, high-bandwidth live video and VoD to today's global enterprises.

For More Information

For more information, please visit http://www.cisco.com/go/waas or http://www.cisco.com/go/dms.

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