Video Distribution Behind the Firewall
Approaches for Deploying an Enterprise Content Delivery Network
Businesses are embracing video as an effective method of communicating with employees. But video is bandwidth intensive and most corporate networks are not adequately sized to handle the impact of video traffic. To mitigate network congestion, IT departments deploy enterprise content delivery networks (eCDN), network infrastructure that optimizes the distribution of video behind the firewall. Organizations have a choice of five approaches for deploying an eCDN and one size does not fit all. Understanding the options will help IT leaders choose the right combination of architecture, technologies and protocols to maintain an efficient network and prepare the company for the growing demands of video in the future.

Growing use of video for business communications

The use of video for communication has been growing significantly over the past several years. In 2016 video accounted for 73% of all IP traffic, consumer and business, and is expected to grow at CAGR of 26% from 2016 to 2021. While internet video statistics are staggering, the growth of business video is tracking at an even faster pace. U.S. adoption of enterprise video is up 14% in the past three years and enterprise viewership outside the U.S. is up 25% in just one year from 2015 to 2016. Several years ago Frost & Sullivan went so far as to report enterprises were creating more video in one day than Hollywood creates in a year.

A well-connected and geo-distributed workforce, influenced by consumer expectations, is certainly driving the growing use of video in business. But the ROI of video captures the attention of executives and keeps them invested. E-learning alone yields an impressive rate of return. For example, Microsoft reduced per hour employee training costs from $320 to $17 by incorporating video. Combined with evidence that memory retention is improved by as much as 85% when video is incorporated, embracing video is clearly a good business practice.

E-learning is not the only cost-effective use of video. Live and on-demand video for one-to-many communications amplifies the savings at a comparable rate. Oracle reported $10 million in cost savings when video replaced in-person annual kickoff meetings for its international salesforce. Executive adoption of video suggests Oracle’s story is not an anomaly. According to Cisco, 82% of executives record their own business videos, 64% of these executives upload recorded videos to their company’s video-sharing portal, and more than 70% expect to increase their use of one-way video such as live webcasting in the coming years. And they plan to fund it as well. Nearly 50% of mid to large companies have enterprise streaming budgets that exceed $100,000 for 2017.
Video creates a burden on corporate networks

Whether driven by cost factors or simply confidence in the power of video, this growing use of video inside the enterprise presents a new set of challenges for IT departments. Video transfer is bandwidth intensive, and the higher the quality (HD and Ultra-HD) or the more interactive (augmented reality and 360°) the more bandwidth it consumes. Most corporate networks are not properly sized to handle the volume of video traffic coming from the cloud over the corporate internet connection nor the bandwidth consumption of video traversing far-reaching corners of the network. Unlike non-real-time network traffic, video is particularly sensitive to and visibly affected by network latency, packet loss, and jitter. The result is a low and inconsistent quality viewing experience, with buffering and reliability issues, that can lead to frustration and a lack of confidence in using video for important communications. Meanwhile network administrators worry about network capacity, consumption, and scalability issues, especially over WAN links and Wi-Fi networks with limited bandwidth, and fear the very real possibility that video will jeopardize the delivery of higher priority information and transactional data. To alleviate these problems without inhibiting the use of video, IT departments deploy enterprise content delivery networks (eCDN), an overlay to the existing network infrastructure that optimizes the distribution of video behind the firewall.

What is an eCDN?

An enterprise content delivery network adds software or hardware to the network to help manage and optimize the distribution of bandwidth-intensive media such as video, thus lightening the burden of this kind of data on the corporate network. By intelligently routing the flow of video traffic around the network, performance is significantly improved and congestion is minimized or eliminated. Audiences enjoy less latency and buffering, faster video start times and an overall higher quality, more reliable viewing experience.

Most problems can be solved in a variety of ways, and video delivery behind the firewall is no exception. Organizations have a choice of five distinct approaches to deploying an eCDN.

The best approach for a given organization depends on a variety of factors, including the topology of the network, the type of video being streamed, budget requirements, and IT policies, such as security and management. The different types of eCDNs are not mutually exclusive and can often be deployed in combination with one another to best meet the needs of the business.
An eCDN is an enterprise-owned private network infrastructure deployed on-premises, with some components that may reside in the enterprise’s private cloud. Unlike a pure eCDN, a CDN is a globally distributed network infrastructure owned, operated, and managed by a CDN service provider. Typically CDNs are used by content providers such as media and e-commerce companies that pay the service providers based on network usage to deliver content to consumers over the Internet.

In some instances, enterprises may need to use a CDN to reach geographic areas not reachable by the eCDN. For instance, a number of remote employees may work in metropolitan areas where branch offices don’t exist, but a CDN service provider has a presence. The CDN can be used to distribute company material to these employees, and can also be used to include viewers outside the enterprise such as partners or customers. So while a CDN may be beneficial to augment an eCDN, because it is external to the corporate network it will not alleviate network performance problems caused by video inside the firewall.

**BEST FOR**
- Need to distribute video to viewers outside the corporate network
- Global distribution to corporate locations

**ADVANTAGES**
- Extends distribution of video to viewers outside the corporate network

**DISADVANTAGES**
- Doesn’t alleviate the impact of video streaming inside the corporate firewall
- External control and management of infrastructure
- Usage-based pricing
WAN optimization is a broad category of techniques used to improve the performance of data delivery across corporate networks. Most WAN optimization solutions are general purpose and not designed specifically for video. Furthermore, solutions will vary based on the techniques employed, so the process of selecting the right one may be more involved than with other approaches to eCDN. Organizations need to evaluate the type of data to be optimized and select the type of optimization most suitable to technical and business requirements. Optimization can be achieved through techniques such as compression, prioritization of certain types of data over others, and attempts to parallelize data retrieval. A single solution may combine a variety of techniques, but because these types of optimization apply to all kinds of data, they are not as lightweight as other eCDN options and carry significantly higher price tags by comparison. In the case of compression, that cost is essentially lost on video data due to the effectiveness of compression standards already widely used in today’s video encoders. Historically WAN optimization solutions are also hardware based, which further contributes to the cost and introduces complexities for deployment and management.

Some WAN optimization techniques such as live stream splitting, byte caching and content prepositioning are specifically for HTTP streaming and therefore more targeted to video data. Many of these types of optimization capabilities, however, are not isolated to hefty WAN optimization solutions and can be found in traditional cache eCDN options. If an organization has already invested in WAN optimization infrastructure, expanding its capabilities for specialized video optimization may be a cost-effective approach. However, other options such as enterprise caching are likely to be more affordable for video and can co-exist with WAN optimization solutions already in place.

**BEST FOR**

- Need to optimize a variety of data, not just video
- Organizations with previous investment in WAN optimization solutions

**ADVANTAGES**

- General purpose data optimization
- May be cost effective if WAN optimization infrastructure is already deployed

**DISADVANTAGES**

- Significantly more costly than other eCDN options
- General purpose, may not be specialized for video optimization
- Doesn’t address LAN delivery bottlenecks
- Historically these are hardware-based solutions, adding to the cost and complexity of deployment
The peer-to-peer (P2P) approach to eCDN decentralizes video distribution by utilizing the resources available in all the connected personal devices already on the network. Once a viewer requests a video, it is now available on that client device and subsequent viewers may be able to retrieve it from that device rather than the originating source. As more viewers consume the video, it becomes more widely available through a larger number of P2P hosts. In this manner, P2P becomes a highly efficient model at scale, as additional infrastructure develops dynamically in correlation with demand. The converse, however, is also true and resource availability is equally as fluid.

To build a P2P network, client software must be distributed to the connected devices, a process than can become costly in terms of licensing as well as maintenance and support as the deployment grows.

The decentralized nature of P2P eliminates a single point of failure that can be inherent in the centralized approaches. If a host client becomes unavailable, the video may still be retrieved from any number of other clients. Failover scenarios can also be established, such as deploying some caches to use in the event resource availability is limited or unreachable.

Using P2P on Wi-Fi networks may not be an ideal choice because of the large amount of traffic congestion it can generate by sending individual video streams for each recipient over a shared wireless connection. Furthermore, this approach should be evaluated for compliance with security policies since client devices run the risk of transmitting viruses, spyware and other malware across the peering network.

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### BEST FOR

- Live video broadcasting to large distributed audiences
- Don’t require a fully on-premises video solution
- Willing to use connected client devices and device resources for peer-to-peer distribution

### ADVANTAGES

- Resources are shared across clients distributed throughout the network
- No single point of failure
- Scales dynamically based on demand
- Good candidate to pair with other eCDN options such as multicast to optimize video in network locations not multicast enabled (see more on multicast below)

### DISADVANTAGES

- Client software must be deployed, managed and updated on all viewing devices
- Requires cloud services provided by eCDN provider to manage the delivery of video
- Resource availability fluctuates with the volume of P2P-enabled devices online
- The potential of transmitting malicious data such as viruses, spyware and other malware across the peering network
- Redirecting resources to service the peer network can impact the performance of client devices
Multicasting is a one-to-many network protocol that reduces traffic by simultaneously delivering a single stream, such as a live video stream, to hundreds or thousands of users. Enterprise networks must be multicast-enabled to take advantage of a multicast eCDN solution. A multicast sender retrieves a live video stream from a video source, often a cloud-based broadcasting platform, and sends it out over the multicast-enabled network. Depending on the network topology, additional senders may be placed in locations around the network to serve as forwarding engines. Viewing devices on the network, such as personal computers, each host receiver software capable of tapping into the broadcast stream. Video traffic on the network is drastically minimized by eliminating the need for each device to pull an independent stream from the originating source.

Most large enterprises have adopted multicast technology to handle streaming video because it has been proven to be an extremely efficient method of reaching a large number of viewers with stable, reliable transmissions. In the past these companies relied on legacy multicast solutions such as Windows Media Service, Cisco Enterprise Content Delivery System (ECDS) and Adobe Media Server, all of which are reaching end-of-life and end-of-support status. Fortunately a new generation of affordable multicast solutions are readily available in the market, allowing organizations to continue leveraging the investment already made in multicast network infrastructure.

**BEST FOR**

Live video broadcasting to large distributed audiences

Enterprises with multicast-enabled networks

**ADVANTAGES**

Distributes a single video stream to a large group of simultaneous viewers

Centralizes management of network video traffic

Efficient for WAN links and Wi-Fi networks with limited bandwidth

Eliminates network traffic redundancy and reduces processing load on streaming servers

**DISADVANTAGES**

Multicasting only works for live video streaming, not video on demand (VOD)

The network switches and wireless access points must be multicast enabled

Some solutions require routing of multicast over the WAN

Pockets of network locations not multicast enabled will not benefit from multicasting

Client software must be deployed, managed and updated on all viewing devices

Multicast networks require management at the router level
Caching technology has been utilized for a number of years for web content to optimize data transfer on the network and improve performance for users. This same concept is now being applied to video streaming to achieve similar benefits. HTTP caching servers specifically designed for video are deployed in strategic locations around the network, such as at the edge of the enterprise WAN close to users in regional and branch offices. Upon the first request for a video, the cache retrieves it from the video source and stores a local copy to distribute to subsequent viewers directed to that cache. Not only are fewer video streams pulled across the corporate internet connection, but less video is traveling the full distance from source to viewer, reducing the overall volume of traffic on the network.

Storing streaming video closer to viewers also reduces buffering and latency and speeds up start times. Because the video has less distance to travel, it encounters fewer opportunities to be impacted by the effects of network performance. Viewers enjoy much improved playback quality and a better overall viewing experience.

The distribution of caching servers provides deployment flexibility with the ability to scale as needs grow. Some advanced caching solutions support hierarchical or mesh topologies and intelligent routing for even greater scalability and resiliency.

**BEST FOR**

- Streaming both live and video on demand (VOD)
- Flexible deployments with the desire to start small and scale over time

**ADVANTAGES**

- Low cost of entry for software-only caching solutions
- Easy to start small and scale as needs grow
- Supports both live and video on demand
- No client software required
- Good candidate to pair with other eCDN options such as multicast to optimize video in network locations not multicast enabled

**DISADVANTAGES**

- Proprietary and open source caching solutions may be more difficult to deploy and manage than enterprise systems that can be centrally managed and monitored
- Hardware caching systems can be expensive
Summary

As the adoption of video for business communications continues to grow, enterprises will be faced with the need to manage the delivery of video over the corporate network. No two enterprises will have all the same requirements for video platforms and no two enterprise networks will look the same. Each organization will have to evaluate the landscape of their video deployment and the topology of their network, weighing the pros and cons of each eCDN approach, and deploy the solutions that best meets their needs today and into the future.

More information about best practices for deploying an eCDN can be found in our companion paper “Principles of a Common Enterprise Streaming Infrastructure: Five Considerations for Deploying an Enterprise Content Delivery Network.”

About The Author

Ramp specializes in optimizing the distribution of video behind the firewall to alleviate network congestion and significantly reduce bandwidth consumption. Ramp’s AltitudeCDN™ enterprise content delivery network (eCDN) is a suite of software solutions for multicasting and advanced video caching, two of the most effective approaches for managing the impact of live and on-demand video traffic on the corporate network. Including enterprise administration capabilities and real-time analytics for performance monitoring, AltitudeCDN is a common enterprise streaming infrastructure that will optimize video from all the streaming platforms deployed within an organization. Many providers in our ecosystem of technology partners have tightly integrated AltitudeCDN with their platforms to simplify deployment and management of the combined video solution and provide a seamless solution that ensures the best viewing experience inside the enterprise. For more information, visit ramp.com.

Footnotes


3statistics that prove enterprise video is on the rise https://www.ibm.com/blogs/cloud-computing/2017/03/3-statistics-prove-enterprise-video-rise/


10A Review on P2P Video Streaming https://pdfs.semanticscholar.org/6cef/d8c9b80bd4a318d09199fbbf90fc9d358a3.pdf