

IBM Watson Media

Internal video delivery without bottlenecks

Comparing unicast, multicast and P2P delivery

IBM

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The problem: Video is bandwidth-intensive

Network bandwidth (megabits per second or Mbps)

■ 1.5 Mbps

Just one person watching an HD (720p) video consumes about 1.5 Mbps of network bandwidth.

■ 50 Mbps

A 100-person office might have a 50-Mbps internet connection.

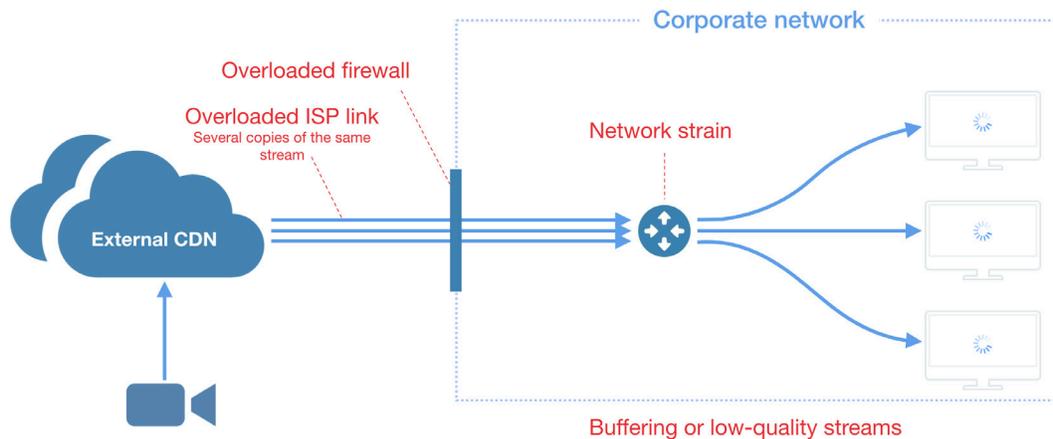
■ 51 Mbps

If just 34 people at the office watch HD video, they consume 51 Mbps of bandwidth, overloading the connection.

Video delivery puts great strain on a network. As the diagram above shows, if just a fraction of employees at a site watch streaming video concurrently, the internet connection can break or the performance of other applications on the network will be disrupted.

There are several solutions on the market that can streamline internal video delivery, but it is hard to determine which solution is the optimal choice for your company and network. This guide provides an objective side-by-side comparison to help you make a wise decision.

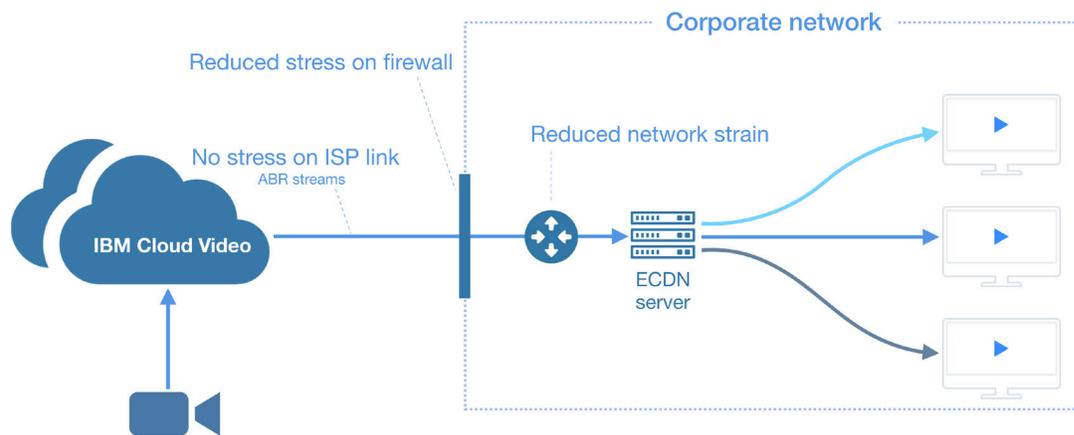
The problem with using only external content delivery networks (CDNs)



When users connect to external CDN, or CDNs, they download multiple copies of the same live unicast stream, overloading the internet service provider (ISP) link.

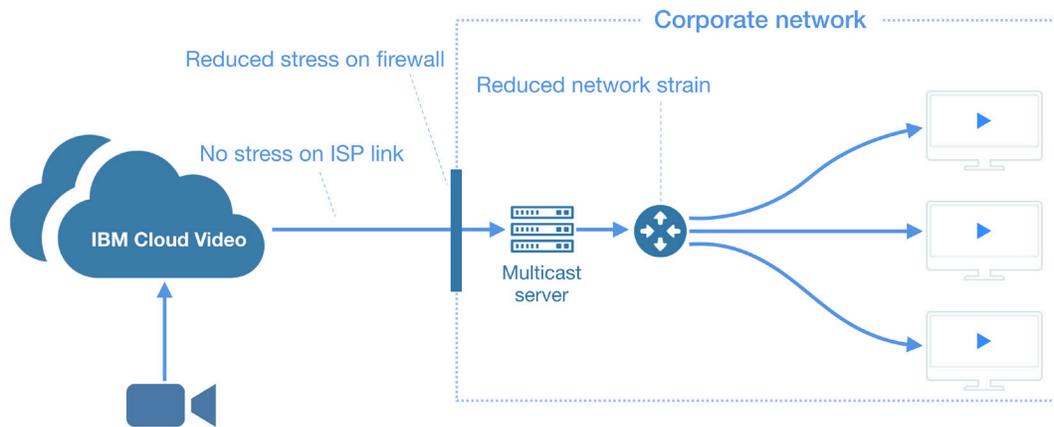
Three leading methods deliver internal video at scale

Unicast Delivery



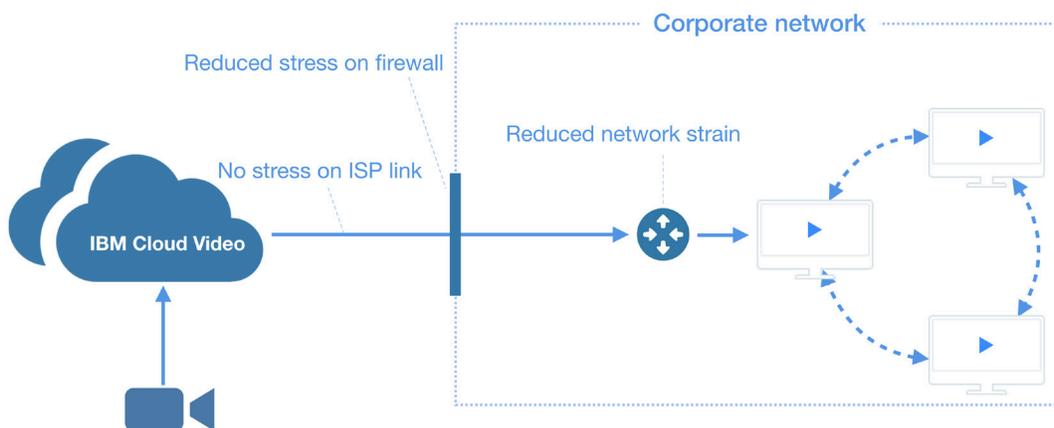
The most common solution to the problem is to distribute the live or video on-demand (VOD) stream to the viewers using a local unicast server. For example, IBM Watson Media Enterprise Content Delivery Network (ECDN) is a virtual server that receives a single, adaptive-bitrate video stream and distributes it to dozens, hundreds or even thousands of viewers at a site while minimizing impact on the organization's internet connection and network.

Multicast Delivery



A multicast server distributes the live stream to routers that have been configured to deliver multicast streams. The routers forward the multicast IP packets just to those network segments where users have subscribed to the video.

Peer to Peer (P2P) Delivery



Using the peer-to-peer (P2P) delivery protocol, end-user machines share fragments of the video data with each other in a distributed application architecture.

Comparing unicast, multicast and P2P solutions

Color Key

- Fewer challenges/concerns
- Some challenges/concerns
- More challenges/concerns

Factors to Consider	Unicast	Multicast	P2P
Summary of Approach	The stream from the video source reaches the virtual server or appliance, on a physical host at each site, and then the server distributes the stream to viewers while minimizing network impact.	<p>In a fully multicast-enabled and multicast-routed enterprise network, the stream from the video source is consumed by the multicast server, usually located at the data center, and a multicast stream is then distributed by routers to all network segments where viewers have subscribed.</p> <p>In a partially multicast-enabled and/or multicast-routed enterprise network, the stream from the video source is consumed by multiple multicast servers, located in network “islands” with multicast distribution, and multicast streams are then distributed within the participating network segments where viewers have subscribed.</p>	The stream from the video source reaches a viewer who serves as the super node/leader at the site; that viewer’s system shares fragments of the stream with other viewers. After the initial buffering, other viewers share video fragments with each other, resulting in reduced load on the wide area network (WAN).

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Factors to Consider	Unicast	Multicast	P2P
Updates	<p>General: The server software is either manually or automatically updated.</p> <p>IBM ECDN: As an extension of the IBM cloud, the ECDN servers update automatically with fixes, patches and new features.</p>	<p>Server software updates are usually deployed manually through a portal to servers.</p> <p>Updates to the multicast receiver client application can be rolled out by the IT team through standard software distribution processes to desktops, mobile phones and tablets.</p>	<p>Updates to the P2P receiver application can be rolled out periodically by the IT team to desktops, mobile phones and tablets.</p>
Cost/scalability	<p>General: Up to a few hundred new users can typically be added without additional IT staff work on unicast capabilities. Scaling over a certain level eventually requires additional host servers and virtual machine licenses.</p> <p>The virtual server can run on certain routers that support virtual servers, reducing the need for adding new physical servers as hosts.</p> <p>Some vendors charge for new user licenses; the cost of adding users is typically less expensive than boosting the bandwidth of the internet link.</p> <p>IBM ECDN: IBM charges per authenticated user for IBM Enterprise Video Streaming and per server license for ECDN. When growth requires another ECDN virtual server, a standardized template can be remotely deployed, reducing deployment effort.</p>	<p>Requires only two server licenses (primary and backup) if the network is already fully multicast-enabled, or two servers per “multicast island” if there are distinct multicast network regions.</p> <p>Adding new users requires additional multicast receiver licenses.</p> <p>Multicast is especially cost-competitive in large networks that serve many branch offices or sites. Configuring routers at those sites for multicasting can be labor-intensive.</p>	<p>Adding new users requires the rollout of additional P2P receiver applications and additional licenses.</p>

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Factors to Consider	Unicast	Multicast	P2P
Management portal	<p>General: Sometimes on premises, sometimes cloud-based.</p> <p>IBM ECDN: Managed from a centralized, cloud-based portal that is included in the price.</p>	<p>General: Usually an on-premises portal. Sometimes requires a separate license.</p> <p>IBM ECDN and Multicast*: A centralized management and monitoring platform for multicast is available as a separate item for IBM Enterprise Video Streaming customers.</p>	<p>Cloud-based portal included in the price.</p>
Use cases	<p>Live and video on-demand (VOD).</p>	<p>Live video only. VOD can be delivered using either a unicast distribution server or through an external CDN.</p>	<p>Live video only. VOD might be cached on another user's machine. VOD can be also delivered by a unicast distribution server or through an external CDN.</p>
Added software required on end-user systems	<p>No.</p>	<p>General: Yes, browsers do not natively support multicast delivery.</p> <p>IBM ECDN and Multicast: A desktop receiver application enhances security through enterprise-grade encryption and provides stable, reliable stream delivery using forward error correction and bandwidth smoothing.</p>	<p>Yes, desktop receiver application is required in most of the cases.</p> <p>Some features might be available in Chrome and Firefox using web real-time communication (WebRTC) protocol.</p>

* With a multicast component powered by [Ramp AltitudeCDN Multicast+](#)

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Factors to Consider	Unicast	Multicast	P2P
Server required on premises	<p>General: Yes, either virtualized host hardware or appliance is needed at most site locations. In some cases, the virtualized routers can be used as the host.</p> <p>IBM ECDN: Delivered as virtual machine and deployed remotely to each site location. Additionally, a deployment script can automate larger deployments.</p>	<p>General: Yes, bare metal or virtualized host is required at one site/ datacenter location.</p> <p>When the network is not fully multicast enabled, separate servers are required in each distinct network segment.</p> <p>IBM ECDN and Multicast: Can be deployed on bare metal, virtual CentOS or Windows Server.</p>	No.
Mobile device support	<p>Yes. Works in mobile browsers without any configuration.</p> <p>IBM ECDN: Provides adaptive bitrate streaming (ABR) in both mobile browsers and native apps.</p>	Does not work in mobile browsers. Can work only through a mobile application from the multicast vendor.	Does not work in mobile browsers. Can work only through a mobile application from the multicast vendor.
Fault tolerance	<p>General: Usually multiple server instances are deployed. Some solutions require a load balancer.</p> <p>IBM ECDN: ECDN virtual servers can be clustered to enable load balancing and failover support. Load balancing is built-in, no additional load balancer is required</p>	<p>General: Multicast servers are usually deployed in pairs. Some network segments might get cut off in the event of a hardware failure or unexpected router configuration changes.</p> <p>IBM ECDN and Multicast: Fault tolerance can be further increased by adding ECDN servers to larger sites. Fallback to an external CDN can be dangerous during large events as a high number of live streams can congest the ISP link.</p>	<p>When several users leave the swarm at once, including the super-node or leader, users might experience interruptions until a new leader is selected.</p> <p>Fault tolerance can be increased by adding a unicast distribution server. Fallback to an external CDN can be dangerous during large events as a high number of live streams can congest the ISP link.</p>

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Factors to Consider	Unicast	Multicast	P2P
Ability to catch-up or pause a live event, like a DVR	Has the potential to cache videos until space is needed for newer videos.	<p>General: Partially. The client receiver usually caches the content for scroll back at the expense of disk space. For full functionality, support from a unicast distribution server or an external CDN is recommended.</p> <p>IBM ECDN and Multicast: The amount of caching is configurable and can be set to attain full functionality. Normally this configuration is set at a reasonable limit that balances disk space demands with useful DVR capabilities.</p>	<p>Partially. The content might be cached by the local swarm for scroll back, but assistance by a unicast distribution server or an external CDN might be needed.</p> <p>When WebRTC is used instead as part of the receiver application, the browser's memory can limit DVR functionality.</p>
Firewall changes required	<p>General: Some vendors might require larger IP ranges to be whitelisted (e.g. Akamai IP ranges).</p> <p>IBM ECDN: Requires that only outbound HTTP(S) 80, 443 ports are open, and a limited set of IBM-operated servers are whitelisted.</p>	<p>Usually a limited number of IPs and ports need to be whitelisted for outbound connection.</p> <p>Multicast IP addresses and User Datagram Protocol (UDP) ports need to be whitelisted on the internal network.</p>	<p>Usually a limited number of IPs and ports need to be whitelisted for outbound connection.</p> <p>A larger number of ports are used for communication between receiver applications on the local network, making it hard to monitor network traffic.</p>

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Factors to Consider	Unicast	Multicast	P2P
Security/ stability	<p>General: Transport-layer encryption (SSL/TLS) between the upstream server and the unicast server.</p> <p>IBM ECDN: Single sign-on (SSO), transport-layer encryption (SSL/TLS), randomized chunk URLs. Keys can be provided by IBM, or for higher security, an organization can use its own certificate authority (CA) and decide not to share the keys with IBM.</p>	<p>General: Transport-layer encryption (SSL/TLS) between the upstream server and the multicast server.</p> <p>On the internal network, encryption keys can be provided by the vendor or for higher security, an organization's own CA.</p> <p>IBM ECDN and Multicast: Encrypts video while in motion and at rest and also supports multicasting over HTTPS.</p>	<p>Transport-layer encryption (SSL/TLS) between the upstream server and the super node/leader.</p> <p>Video chunks are shared but encrypted.</p> <p>Client application on every computer might be an IT security concern.</p>
Network upgrade, maintenance	<p>Once the servers are deployed in each location, the need for a long-haul network or network device upgrade could possibly be postponed or eliminated.</p> <p>Network maintenance usually doesn't affect the delivery of video.</p>	<p>Once the servers are deployed at one location (or sometimes to multiple locations in the case of separate network segments), the need for a long-haul network or network device upgrade could possibly be postponed or eliminated.</p> <p>Network upgrades or changes may require additional tuning to avoid disruption of the multicast capability.</p>	<p>Once deployed, the need for a long-haul network or network device upgrade could possibly be postponed or eliminated.</p> <p>Network upgrades or changes require additional tuning to avoid disruption. There are more settings to tune than with multicast, such as traffic shaping and quality of service (QoS).</p>
LAN bandwidth utilization	<p>More efficient than P2P because traffic traverses only once from the local server to the viewer.</p>	<p>The most efficient bandwidth utilization.</p>	<p>The least optimal bandwidth utilization, as video packets flow back and forth between all.</p>

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Factors to Consider	Unicast	Multicast	P2P
Wi-Fi	A large viewer base on Wi-Fi networks can trigger the need for an upgrade to achieve higher concurrent throughput.	<p>General: Forward error correction is required to be resilient on Ethernet and especially on Wi-Fi.</p> <p>IBM ECDN and Multicast: Provides built-in technology for forward error correction.</p>	<p>P2P can overload Wi-Fi access points because traffic travels not just towards a viewer but also back to the access point and then to another viewer, either on the same access point or on another; this is a sub-optimal use of the available spectrum.</p> <p>Newer Wi-Fi access points provide greater throughput, and therefore greater P2P capacity.</p>
Ideal use-cases	ECDN is an optimal solution for use-cases where it's possible to deploy a virtualized server or router.	Multicast is usually the optimal choice when an organization already has a multicast-enabled network and/or needs to replace an end-of-life solution from Microsoft, Cisco or Adobe. It is also optimal when an organization has a large number of branch offices or retail locations where security is a concern, and it's difficult to deploy an ECDN server.	P2P is optimal when an organization has a large number of branch offices or retail locations where security is less of a concern, and it's difficult to deploy an ECDN server.

Finding the right fit for your network

No single method for delivering internal video is best for every network. At IBM, we work with all three major approaches to this challenge: unicast with enterprise content delivery networks, multicast, and peer-to-peer. Often, a combination of approaches delivers optimal results. Ask us to survey your organization's infrastructure, share best practices and determine the solution that is the right fit for your needs.

For more information, contact an expert at [IBM Watson Media](#) or call 800-778-3090.

What IBM customers are saying:

“Without the IBM Watson Media Enterprise Content Delivery Network, we had five viewers that could watch our videos without crashing our network. And with the ECDN solution, we now can have thousands.”

Senior Digital Infrastructure Specialist
A global pharma-related organization

“One of our customers, a large state senate, had congestion issues within their network every time they attempted to stream. They used the IBM Enterprise Content Delivery Network to get smooth, streaming video from end to end.”

Colin Sandy, CEO
[Sandy Audio Visual LLC](#) (case study)

“We used the IBM ECDN product to consolidate streams to two of our remote offices. This ensured multiple, individual streams wouldn't clog the top of our router and impact network performance and user experience at our offices.”

Michael Coates, VP Technical Sales Strategy
N3 ([From a review at TrustRadius.com](#))

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About IBM Watson Media

IBM Watson Media delivers reliable and scalable video streaming services globally. Combining robust video functionality and exceptional cognitive abilities, IBM Watson Media provides one of the most comprehensive video offerings available today. For more information on IBM Watson Media, please visit [our site](#).

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