Introducing Adobe® Flash® Media Server 4

Reducing the complexity of video delivery

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The Adobe Flash Media family of products revolutionizes media delivery, with support for consistent, uninterrupted streaming on the widest array of devices—tablets, mobile devices, IPTV, and the desktop. Flash Media Server continues to be the industry-leading solution for integrating streaming video with real-time communication, now with both RTMP and RTMFP (peer-to-peer networking) support. Providing content protection that is right for the situation, Flash Media Server supports simple stream encryption or more sophisticated protection with business rules applied through Adobe Flash Access®. With the release of Flash Media Server 4 software, customers benefit further from new features such as fast switching, enhanced buffer controls, HTTP Dynamic Streaming, and secure enterprise deployment with IP multicast and secure peer-assisted networking. Developers can now take advantage of these new features quickly and easily with Flash Media Server for Amazon Web Services.

This white paper outlines the powerful features of Flash Media Server 4, explains protection options, introduces the various editions and their features, and how they can lower your total cost of delivery. You will learn about the multiple delivery protocols available on the Flash Platform, and gain the knowledge you need to make informed choices about how to deliver and monetize video and communication services to the largest online audience.

Adobe Flash Media Server 4 software provides powerful new delivery methods that can save significant bandwidth costs and lighten network load. Advances in integrated real-time communication open up new business opportunities. From user-generated content to movies and television shows to corporate training and large-scale internal broadcasts, Adobe Flash Media Server offers enterprise-level solutions to deliver content and communications. Improved performance and quality of service (QoS) metrics enhance playback, while prebuilt media players make deployment easier than ever.

The ubiquity of the Adobe Flash platform across all screens—from desktop computers to mobile devices, and even into the living room—is a powerful advantage. Flash Media Server allows you to stream video to web browsers via Flash Player, to the desktop on the Adobe AIR® platform, or to devices through Flash Player 10.1, so you can fully monetize your video, reaching the most people with the least hassle.

Unlike other video delivery technologies, which just present prebranded players to your viewers, Flash Media Server 4 integrates with Flash Player and AIR, which allows you to create completely customized interfaces. Real-time data sharing, server-side plug-ins, logging, and monitoring APIs provide developers and IT teams with the tools they need to develop and administer large-scale rich media applications. The Open Source Media Framework (OSMF) provides a standards-based structure for building custom video players, enabling developers to take advantage of the latest Flash Platform features and delivery methods without the heavy lifting of coding from scratch. If a simple branded player is all that is needed, Flash Media Playback and Strobe Media Playback provide prebuilt solutions built on OSMF. Whether it's a totally custom player built on OSMF, or one of the prebuilt players, deploying full-featured playback applications is simpler than ever.

What's new in Flash Media Server 4

Adobe Flash Media Server 4 is a scalable, real-time media server that delivers high-quality (up to HD level), on-demand, live audio and video content with great efficiency and superior QoS to reach the largest possible audience, regardless of the platform. It can deliver prerecorded video, live video, playlists, music, video blogging, video messaging, multimedia chat environments, real-time datacasting, multiuser gaming, and more, via multiple delivery protocols.

Flash Media Server communicates and streams to Flash Player and Adobe AIR across platforms, browsers, and devices, with multiple protocols available.

Flash Media Server 4 has many improvements and new features.

Expanded media streaming options

- HTTP Dynamic Streaming with adaptive bitrate
- IP multicast with encryption
- Application-layer multicast (using peer-assisted networking)
- Multicast fusion for maximum reach
- RTMP streaming enhancements (fast forward, stream reconnect, step seeking, and faster adaptive bitrate switching)
- Integrated support for Flash Media Playback and OSMF
- Preconfigured origin for HTTP Dynamic Streaming
- Absolute timecode

Server platform

- Cloud offering with Amazon Web Services
- Native 64 bit
- Support for CentOS, a free version of the Linux® operating system

Interactive development

- Peer-assisted networking using RTMFP
- Support for Flash Media Gateway for Voice over IP (VoIP)
- Secure peer-to-peer introductions
- Low-latency RTMFP unicast communication

These improvements represent the continued evolution of Flash Media Server, giving developers much-needed technology for creating breakthrough rich media applications. In addition, OSMF reduces the learning curve and speeds up your time to market.

The Adobe Flash Media Server 4 Family

Flash Media Server offers the following editions, including an option to run in the cloud:

- Adobe Flash Media Development Server 4 (free from Adobe)
- Adobe Flash Media Streaming Server 4
- Adobe Flash Media Interactive Server 4
- Adobe Flash Media Enterprise Server 4 (new version)
- Adobe Flash Media Server for Amazon Web Services (new)

Flash Media Interactive Server 4, Flash Media Enterprise Server 4, and Flash Media Server for Amazon Web Services can operate as either an origin or edge server to distribute traffic load. For more details on origin and edge configurations, see the "Scaling Flash Media Server 4" section of the *Flash Media Server 4 Technical Overview* white paper.

The following table provides an overview of the supported features in each edition. Features supported in all editions are highlighted.

Feature	Flash Media Enterprise Server 4	Flash Media Interactive Server 4	Flash Media Streaming Server 4	Flash Media Development Server 4*	Flash Media Server for Amazon Web Services
HD live streaming					
Stream reconnect	•	•	•	•	•
Live stream metadata (data keyframes)	•	•	•	•	•
Live adaptive bitrate streaming (HTTP)	•	•	•	Limited to 30 minutes	•
Live stream splitting	•	•		•	•
Live adaptive bitrate streaming (RTMP)	•	•		•	•
DVR functionality (HTTP)	•	•		Limited to 10 minutes	•
DVR functionality (RTMP)	•	•		•	•
Instant replay (RTMP)	•	•		•	•
Linear server playlists (VOD>live)	•	•		•	•
IP multicast	•	•		Limited to 10 minutes	•
Multicast fusion (peer assist)	•			Limited to 50 peers	•
HD on-demand streaming					
Stream reconnect	Available in all versions to enable high-quality streaming across the entire product offering				
In-buffer seeking (RTMP)					
Fast forward					
Slow motion					
Frame stepping					
Back buffer for instant replay					
VOD adaptive bitrate streaming (HTTP)	•	•		•	•
VOD adaptive bitrate streaming (RTMP)	•	•		•	•
Content protection					
RTMPe	•	•	•	Limited to 10 simultaneous connections	•
SWF verification	•	•	•	•	•
Flash Access streaming	•	•	•	•	•
Real-time Flash Access protection for live HTTP Dynamic Streaming	•	•		•	•
RTMFP	•	Unicast mode only		Limited to 50 peers	•
IP multicast (encrypted)	•	•		Limited to 10 minutes	•

* A separate Flash Access license is required.

Feature	Flash Media Enterprise Server 4	Flash Media Interactive Server 4	Flash Media Streaming Server 4	Flash Media Development Server 4*	Flash Media Server for Amazon Web Services
Server platform and security					
White/Black list domains	•	•	•	•	•
IPV4, IPV6	•	•	•	•	•
C++ access control extensibility	•	•	Access C++ plug-in only	•	64-bit only
32-bit and 64-bit Windows® and Linux	•	•	•	•	CentOS
Preconfigured HTTP origin for HTTP Dynamic Streaming	•	•	•	•	•
LDAP Active Directory support	•	•		•	•
Scalable process scopes	•	•		•	•
RTMP edge caching	•	•		•	•
C++ file management extensibility	•	•		•	•
Quality of service					
Robust logging	•	•	•	•	•
Enhanced buffer control	•	•	•	•	•
Bandwidth detection	•	•	•	•	•
RTMP QoS (DiffServ)	Linux only	Linux only	Linux only	Linux only	CentOS
Enhanced caching	•	•		•	•
Licensing					
Processor (CPU) limits	8-way SMP (cores)	8-way SMP (cores)	4-way SMP (cores)	8-way SMP (cores)	No limits
Bandwidth limits	None	None	None	None	No limits
Connection limits	None	None	None	o 10 simultaneous RTMP connections o 50 simultaneous RTMFP peers o 10 minutes of IP multicast o 30 minutes of live HTTP Dynamic Streaming	RTMFP P2P connection limits 100, 1,000, 10,000
Interactive programming					
Server-side record	•	•		•	•
Shared objects	•	•		•	•
Data push	•	•		•	•
Socket server ingest	•	•		•	•
Server proxy programming	•	•		•	•

* A separate Flash Access license is required.

Feature	Flash Media Enterprise Server 4	Flash Media Interactive Server 4	Flash Media Streaming Server 4	Flash Media Development Server 4*	Flash Media Server for Amazon Web Services
P2P introduction services (RTMFP)	•			•	•
Custom server-side programming	•	•		•	•
AMF3 support	•	•		•	•
Unified communications					
VoIP	•	•		•	•
Webcam chat	•	•		•	•
Support for Flash Media Gateway	•	•		•	•
RTMFP unicast	•	•		•	•
RTMFP peer introduction services	•			Limited to 50 peers	•
RTMFP object replication	•			Limited to 50 peers	•
RTMFP posting and directed routing	•				•

* A separate Flash Access license is required.

Let's explore the capabilities of each server to help you select the best solution for your specific application.

Adobe Flash Media Development Server 4

Adobe Flash Media Development Server 4 enables developers to test and develop using the features of Flash Media Enterprise Server 4. With full functionality with a few connectivity limitations, you can test drive features such as peer-assisted networking and multicast fusion streaming. This free edition is available from *www.adobe.com*. It can be used in production for anyone who wants to implement basic, low-volume streaming or social communication solutions. It has a capacity limit of 10 simultaneous inbound RTMP connections, 50 peer connections, 10 minutes of IP multicast, and 30 minutes of continuous live HTTP Dynamic Streaming.

Adobe Flash Media Streaming Server 4

Flash Media Streaming Server 4 is an economical solution that enables you to start streaming live and on-demand content quickly and easily to a wide variety of platforms and devices. It provides all the features you need to stream video and audio, and works in unison with the Adobe Flash Media Live Encoder to stream live video. This edition is ideal for:

- Basic video on demand (VOD) and live streaming
- Small to medium businesses that want to implement training or broadcast
- Bloggers who want to broadcast live or on-demand streams
- Videographers who need to allow clients to securely view their videos on the web
- Company-wide video messages
- Website owners who want to embed and protect high-quality streaming video
- One-way, secure video streaming

Flash Media Streaming Server 4 ships with two services that make it easy to start streaming right out of the box:

Live video streaming—The standard live video streaming application allows you to start publishing right away. It supports Adobe Flash Media Live Encoder for stream capture and Flash Media Playback and OSMF for playback.

Video on demand—The standard VOD application features server-to-client bandwidth detection, domain-based authentication, full support for Flash Media Playback and OSMF, and ships with sample media files for testing.

Both applications support the stream data access feature in Flash Media Server 3 and later (all editions), which allows you to access the bitmap data of a stream. This feature has a myriad of uses, such as taking snapshots from a webcam feed or creating thumbnails or video previews dynamically. With the Flash Media Interactive Server edition, however, you can enhance the applications with custom functionality, record streams, utilize remote shared objects, and access additional scalability features.

Adobe Flash Media Interactive Server 4

Flash Media Interactive Server 4 offers powerful network efficiencies with support for new IP multicast and HTTP Dynamic Streaming. This edition provides consistent, secure interactive playback experiences and real-time communication across the broadest range of platforms and devices. It is ideal for:

- Medium to large businesses that can benefit from flexible delivery methods
- Social media companies requiring multiuser experiences
- Large-scale deployment
- Developing custom video solutions
- Developing communication experiences
- Supplementing live or on-demand video streaming services with interactive features

Flash Media Interactive Server lets you include value-added multiway solutions to help you socialize your streaming media with advanced real-time communication and collaboration services. It is the only high-performance and scalable server on the market that supports multiway applications, including webcam video chat, recording, VoIP, and online games. Flash Media Interactive Server is the workhorse of the Flash Media family.

Flash Media Interactive Server can also be used to interact with specialty data servers such as LDAP for authentication, Flash Remoting, Simple Object Access Protocol (SOAP), or XML, and it integrates with Adobe Flash Media Live Encoder. For even more customization, you can implement custom, server-side ActionScript®, and develop plug-ins in C++ that further extend the functionality of the server.

Adobe Flash Media Enterprise Server 4 (new)

Flash Media Enterprise Server 4 provides maximum reach with minimum network load through peer-assisted networking support. Designed to use the network more efficiently for large-scale media delivery and real-time communication, Flash Media Enterprise Server 4 is ideal for:

- Large enterprises with large global networks
- Massive social media applications
- Companies that need to maximize delivery capacity while minimizing network costs
- Large enterprises with media requirements over multiple locations and networks
- Customer-facing marketing (such as press conferences or product demos)
- Enterprises that want complete control over their media delivery

Adobe Flash Media Server 4 for Amazon Web Services

Adobe has partnered with Amazon Web Services to simplify billing and deployment of interactive media applications. This cloud-based service enables multiuser interaction and high-quality streaming for both live and on-demand content.

Flash Media Server 4 for Amazon Web Services is ideal for any individual or organization that wants to take advantage of the full feature set of Flash Media Enterprise Server 4 with minimal upfront investment, such as:

- Social media, online gaming startups
- Enterprises evaluating new technology
- Small to medium businesses that need to maximize delivery capacity while minimizing network and licensing costs
- Education institutions
- Government agencies
- Companies that want to take advantage of OSMF as well as Strobe Media Playback and Adobe Flash Media Playback prebuilt players for fast, easy deployment

Multiprotocol delivery

Adobe's traditional streaming protocol, RTMP, has served and protected millions of hours of video and enabled revolutionary interactive experiences. Flash Media Server 4 introduces support for an even wider range of delivery protocols, providing a consistent playback experience across platforms and devices.

Video delivery is becoming increasingly fragmented and complex, with differing protocols, screen sizes, and processor capabilities. Delivering video with Flash Media Server reduces the complexity of media publishing because you know you can depend upon consistent codec support, protection, and a high-quality experience wherever Flash Player is available. Flash Media Server 4 offers the publisher a very simple workflow to publish and protect video with multiple protocols optimized for different networks.

The following table outlines the supported transport protocols, delivery methods, and associated server versions.

Transport Protocol	Delivery method	Flash Media Streaming Server	Flash Media Interactive Server	Flash Media Enterprise Server	Flash Media Server for Amazon Web Services	Flash Media Development Server
RTMFP (new)	Unicast		•	•	•	Limited to 50 peers
	Native IP multicast		•	•	•	Limited to 10 minutes
	Peer-assisted (application-level multicast)			•	•	Limited to 50 peers
	Multicast fusion			•	•	Limited to 50 peers
HTTP	Progressive download	•	•	•	•	•
	HTTP Dynamic Streaming VOD	•	•	•	•	Limited to 30 minutes
	HTTP Dynamic Streaming live		•	•	•	Limited to 30 minutes
RTMP	RTMP	•	•	•	•	•
	RTMPE	•	•	•	•	•
	RTMPT	•	•	•	•	•
	RTMPS (SSL)	•	•	•	•	•

Flash Media Server for Amazon Web Services options

Instances	Description
Large	Limited to 100 RTMFP P2P introductions
Extra Large	Limited to 100 RTMFP P2P introductions
High-memory extra large	Limited to 1,000 RTMFP P2P introductions
High-CPU extra large	Limited to 1,000 RTMFP P2P introductions
High-memory double extra large	Limited to 10,000 RTMFP P2P introductions
High-memory quadruple extra large	Limited to 10,000 RTMFP P2P introductions

The Flash Platform for video delivery

Flash Player has evolved along with Flash Media Server. With Flash Player 10.1, the client runtime supports an array of new video-related features. Coupled with Flash Media Server 4, the Flash Platform now has the ability to stream video and enables communications to more screens than ever before. You can achieve maximum reach with the ubiquitous Flash Player in the browser, Adobe AIR on the desktop, and moving to mobile and devices with Flash Player 10.1.

Flash Media Server support for different versions of Adobe Flash Player

Features	Version 6	Version 7	Version 8	Version 9	Version 9,0,115,0	Version 10	Version 10.1
IP multicast							•
HTTP Dynamic Streaming							•
RTMFP groups							•
Multicast fusion							•
Flash Access protection							•
GPU hardware acceleration (including Mac support)							•
Stream reconnect, buffer access, trick modes (fast forward, rewind, back buffer)							•
Sorenson Video (H.263) with Nellymoser audio, play and capture	•	•	•	•	•	•	•
On2 VP6 video codec, play only			•	•	•	•	•
H.264 and high-efficiency AAC, play only					•	•	•
RTMPE or RTMPTE					•	•	•
SWF verification					•	•	•
Limited GPU hardware acceleration					•	•	•
Multicore support					•	•	•
Smart buffering (in-buffer seeking)					•	•	•
RTMP Dynamic Streaming (adaptive bitrate)						•	•
XMP metadata						•	•
RTMFP						•	•
Speex audio codec						•	•

Note: AIR 1.0 supports Flash Player 9 and earlier. AIR 1.5 supports Flash Player 10 and earlier. AIR 2.0 and AIR 2.5 support Flash Player 10.1 and earlier.

Adobe AIR (version 1.0 or later)
Adobe AIR is a cross-operating system runtime that enables you to use your existing HTML, Ajax, Flex, or Flash web development skills and tools to build and deploy rich Internet applications (RIAs) to the desktop or devices.

AIR applications support native operating-system integration, including clipboard and drag-and-drop support, local file input and output, and system notification. AIR applications can connect to Flash Media Server to stream audio and video or share data, just as SWF files do.

	AIR 2.5
Flash Player 10.1 features	•
Open Source Media Framework	External plug-ins not supported
Flash Access 2 integration	•

For more information about Adobe AIR, visit *www.adobe.com/products/air*.

Delivery methods

There are six methods for delivering video over the Internet using Adobe Flash Player:

- Embedded video
- HTTP progressive download
- RTMP streaming
- HTTP Dynamic Streaming
- IP multicast streaming
- Multicast fusion streaming

Although this section focuses on delivering video files, these same methods can be used to deliver audio-only experiences.

Embedded video is used for very specialized applications with low-quality, short video clips.

In both progressive download and streaming delivery, the video content is external to the SWF file. To deploy on-demand video content to the web, the SWF file and the video files are uploaded to a server.

Keeping the video external and separate offers a number of benefits over the embedded video method:

- High-quality experiences with multi-bitrate
- Protected experiences
- Reduced client memory usage
- Advanced streaming options that improve the experience, such as live video, enhanced seeking, large file support, and alternative delivery, such as HTTP Dynamic Streaming
- Improved player performance overall
- Lower SWF file size
- Faster startup time

Progressive downloads

Progressive download has been supported for video delivery since Flash Player 7 (released in 2004). This method allows developers to load external video files into a Flash Player or Flex interface and play them back during runtime. This can be accomplished using ActionScript commands with the Video object or OSMF, or by setting parameters of prebuilt players such as Flash Media Playback, as shown in the following figure.

Flash Media Server has a built-in Apache server with configurations that can make it very easy to transition from progressive download to streaming.

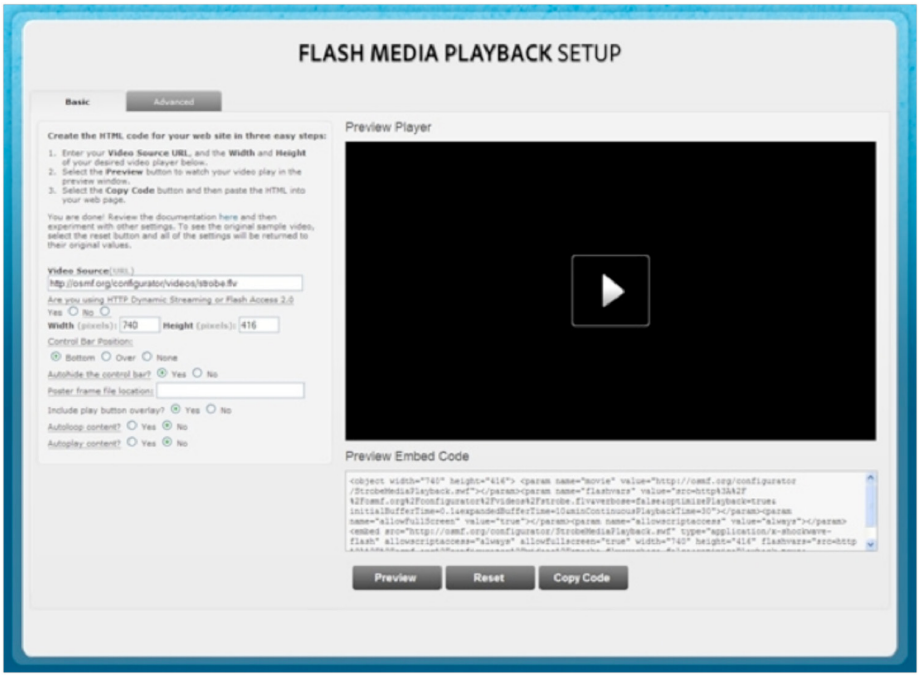

Figure 1. Parameters are set to stream an external video file into the Flash Media Playback SWF file using the online Configurator.

When the video is played, the video file first begins to download to the user's hard drive and then playback starts. When enough of it has been downloaded, the video begins playing. The file is served from a standard web server through an HTTP request, just like a regular web page or any other downloadable document.

In comparison to streaming video, progressive download has only one consistent benefit: You don't need a streaming server to deliver the video. It can be served from any typical web server.

While this can be convenient and potentially cost-effective, there are some potential issues:

- It offers limited seek and navigation capabilities.
- Often the entire video file is downloaded, even if the viewer did not play back the entire file, which wastes bandwidth.
- Viewers can access and repurpose content.

When to choose progressive download

Progressive download is a good choice for hobbyists or websites that have low traffic requirements, if they don't mind if their content is cached on a user's computer, they only need to deliver videos less than 3 minutes long, or their visitors cannot receive streaming video for some reason. You must stream your video if you need to do the following:

- Take advantage of advanced features and control over video delivery
- Display higher quality video
- Deliver videos with long durations (more than 3 minutes)
- Deliver high volume
- Track and report usage or viewing statistics
- Offer viewers the best interactive playback experience

Streaming delivery also consumes less bandwidth than progressive delivery, because only the portion of the video that is watched is actually delivered.

Specific use cases for progressive delivery include:

- Publishers of short video clips, such as video blogs
- Publishers who don't need real-time content protection (Flash Access can be used to protect content delivered via progressive delivery)
- Individuals or companies who have low-volume media delivery requirements

RTMP streaming delivery

The ability to stream video and audio was first available with Flash Player 6.

Publishers use video player applications such as Flash Media Playback to deliver video. Flash Media Playback supports RTMP streaming, HTTP Dynamic Streaming, and progressive delivery. Video files are stored external to the other content for these delivery methods. Plug-ins that enable simple integration with third-party APIs and add features such as in-stream advertising and analytics are available. Developers can use OSMF or Strobe Media Player to further customize their player applications with ActionScript commands that extend functionality.

Flash Player manages streaming video in a similar way to progressive downloaded video. However, streaming video over RTMP requires a persistent connection to the server and cannot operate without a network connection. This connection provides additional benefits, including better memory management and no resident video files on the client computer.

This tight connection between the server and the client, and the server's ability to precisely control and deliver any portion of a stream as requested, enables the developer to take advantage of some advanced capabilities.

Large-scale live streaming—Creating webcast live events or recorded events where all viewers access the same content at the same time.

QoS—Measuring and tracking the stream's quality of delivery and switching to a lower (or higher) bitrate stream if needed (for example, if network congestion increases).

Dynamic previews—Automatically generating thumbnails or playing short previews of the video clip without having to create separate images or video clips, and without downloading the entire video in the background.

Dynamic chapter navigation—Automatically creating "chapters" (with appropriate thumbnails) that can be used for navigation of longer videos, without having to break the video into smaller files.

Stream swapping—Seamlessly switching midstream from one camera angle or one stream to another.

On-the-fly editing—Piecing video clips together to create one continuous video for playback. For example, playing the first 10 seconds of clip 1, followed by the content between the 30- and 40-second marks of clip 2, followed by the last 20 seconds of clip 3.

Bandwidth detection—Determining the client bandwidth and serving a stream with an appropriate bitrate.

RTMP streaming benefits

RTMP streaming provides the publisher many more options for high-quality video and protected media delivery and interactive video experiences.

The advantages of streaming video from Flash Media Server are numerous:

Real-time content protection—Simple workflow to encrypt and protect streams, with options to increase protection with Flash Access file encryption.

Faster start—Fastest way to start playing any video on the web.

In-buffer seeking for fast response time—Instant seeking within the buffer with the new buffer access feature in Flash Player 10.1 and later.

Stream reconnect—Uninterrupted playback experiences when connectivity with the server is lost; play through the buffer while automatically reconnecting.

Simple content-protection workflows—Protect video with a wide range of solutions from RTMPE to Flash Access encryption.

Low-latency live video—Deliver live video and audio from any connected webcam or DV camera, and even directly from some video cards, natively in Flash Player.

Advanced video control—Features such as bandwidth detection, QoS monitoring, automatic thumbnail creation, server-side playlists, and more.

Efficient use of network resources—Customers who pay for their video hosting or bandwidth by the number of bits that are transferred can reduce costs because only the bits that the client actually views are transferred.

More secure, protected media delivery—Because the media data is not saved to the client's cache when streamed, viewers can't retrieve the video or audio file from their temporary Internet file folder. Additional security features in Flash Media Server 4 also prevent stream ripping and other risks.

Minimal use of client resources—Less memory and disk space used because the client doesn't need to download and store the entire file.

Tracking, reporting, and logging capabilities—Because progressive download is a simple download of a file, it's not easy to log relevant statistics such as how long the video was viewed, if the user navigated forward, backward, or paused the video, how many times the viewer played the video, if the viewer left the webpage before the video completed playing, and so on. Streaming enables you to easily capture this important data.

Full seek and navigation—Because viewers can seek to any point in the video and start playing immediately from that point, streaming a great solution for longer-playing videos or uses such as video blogging, classroom lectures, and conference sessions, where viewers want to jump to a specific point rather than being required to watch from the beginning.

Deep interactivity—Streaming's precise control lets developers create extensive interaction in their video applications. For example, the ability to switch camera angles, have one video spawn another video, or seamlessly switch to alternate endings are all enabled by streaming.

Video capture and record (Flash Media Interactive Server and Flash Media Enterprise Server only)—Record video either in conjunction with the live stream, such as archiving an event, or on its own, such as video messaging.

Multiuser capabilities (Flash Media Interactive Server and Flash Media Enterprise Server only)—In addition to live one-to-many streaming, Flash Media Server enables multiuser streaming of audio, video, and data for the creation of video communication applications.

RTMP streaming and progressive download delivery methods are very similar to deploy. Streaming just gives the developer more power to create rich, interactive video applications. Flash Media Playback can be used for either delivery method. If more customization is required, the OSMF or Strobe Media Playback can be used.

Video publishers who have high-volume streaming needs, popular content, or critical uptime requirements but don't want to build their own infrastructure can get the benefits of streaming video in Flash Player by utilizing a Flash Video Streaming Service (FVSS). These Adobe partners offer load-balanced, redundant deployment of Flash Media Server over a reliable content-delivery network. For more information about FVSS partners, visit *www.adobe.com/go/fvss*.

When to choose RTMP streaming

You can use streaming with Flash Media Server in situations where you need to do the following:

- Deliver files longer than 30 seconds or larger than 100Kbps
- Protect content in real time with RTMPE and SWF verification
- Broadcast low-latency live streams
- Provide adaptive bitrate delivery, allowing you to deliver the best quality video for the available hardware and connection speed
- Monitor QoS
- Perform real-time tracking
- Provide real-time data sharing and interactivity to your video experiences
- Stream live video and audio
- Record video and audio
- Serve more streams with less bandwidth
- Achieve massive scale delivery

If your website or blog relies heavily on video, audio, or real-time data sharing, you can give your user the best experience by using the features of Flash Media Server. Examples of typical use cases for RTMP streaming include:

- Medium to large businesses that could benefit from complex deployment requirements, such as edge, origin, C++, SSAS, ACL, or LDAP
- Social networks requiring real-time communication, such as video chat, VoIP, multiplayer games, or text chat alongside video content
- Educational institutions that want to create a virtual classroom or broadcast live, interactive experiences
- Government agencies that want to implement real-time communication or interactive training
- News broadcasters streaming live programming
- Podcasters who need to accurately measure viewership and interaction
- Sports broadcasters that want to enable DVR functionality
- Anyone seeking scalable, secure streaming with custom server-side application logic

HTTP Dynamic Streaming

Flash Player 10.1 introduced support for HTTP Dynamic Streaming, enabling an adaptive-bitrate, protected streaming experience with common HTTP servers, caching devices, and networks. Using a standard MPEG-4 fragment container format media format, HTTP Dynamic Streaming supports both live and on-demand media content that adjusts to the viewer's connection speed and processing power. It uses standard HTTP protocol infrastructures that can scale efficiently and affordably.

The following tools to process and deliver content via HTTP Dynamic Streaming are included in the Flash Media Server 4 installation:

- File Packager for VOD—Creates MP4-fragmented media (F4F) and the manifest file (F4M) from existing content encoded for Flash technology. The tool also optionally encrypts using Flash Access.
- Live Packager—Prebuilt service that converts any RTMP live stream into protected F4F files to create a streaming experience over HTTP. The tool also optionally encrypts using Flash Access.
- HTTP Origin Services built on Apache—The Apache web server has been preconfigured as an HTTP origin server, making it easy to serve F4F files to content delivery networks (CDNs) or your own HTTP infrastructure.

Video players that are built using OSMF, such as Flash Media Playback, provide the player logic required to parse and play media sets and manifest files, request media, monitor QoS, and render playback.

Benefits of HTTP Dynamic Streaming

HTTP Dynamic Streaming reproduces much of the functionality of RTMP delivery, providing the publisher a choice in delivery options. The primary benefit that HTTP offers is its ability to cache content, which is important for enterprise customers who deploy internal caching systems to optimize network usage and for the open Internet to increase capacity without increasing cost (with optimized CDN configuration).

HTTP Dynamic Streaming can enable significant improvements over progressive delivery. Some of the benefits of HTTP Dynamic Streaming over HTTP progressive download include the following:

- Delivery cost reduction by using the Internet caching infrastructure
- Higher burstable capacity using standard CDN load-balanced networks and HTTP infrastructure caching
- Support for adaptive bitrate, DVR, and integrated content protection powered by Adobe Flash Access on live streams
- Content protection throughout the distribution chain, closing some potential vulnerabilities
- Rapid, custom video player development through OSMF, which offers built-in logic and easy integration with advertising and analytics
- Bitrate throttling, ensuring that only what is watched is delivered
- Broader media navigation, including enhanced seeking and start-anywhere

HTTP Dynamic Streaming considerations include:

- Flash Player 10.1 or later is required. For Flash Player penetration statistics, visit *www.adobe.com/products/player_census/flashplayer/version_penetration.html*.
- The F4F format is only compatible with HTTP Dynamic Streaming or other players that support the MPEG-4 fragment format. The same files cannot yet be delivered using RTMP streaming or progressive download.
- Additional workflow steps are required to prepare content.
- Flash Access 2 is required for content protection.
- Live streams experience increased latency when compared with RTMP streaming due to the media fragmentation and encryption process before delivery.

When to choose HTTP Dynamic Streaming

Examples of use cases for HTTP Dynamic Streaming include the following:

- Adaptive streaming behind restrictive firewalls
- Massive-scale live broadcasting
- Enhanced seeking over standard HTTP connections
- Enterprise streaming on an existing network infrastructure

Multicast delivery

Multicast streaming, introduced in Flash Player 10.1 and Flash Media Server 4, enables the distribution of NetStreams across peer-to-peer connections. The stream can be audio, video, or even a data stream.

Benefits over unicast (RTMP or HTTP)

Multicast can provide huge network efficiencies, dramatically reducing the use of bandwidth and server resources, resulting in lower total cost of delivery. It can also provide ultra-low latency for sharing video, audio, and data over networks enabled with multicast support.

When to choose multicast

Multicast is the obvious delivery solution for enterprise, especially those with networks enabled with multicast support. It can also be useful for multiplayer gaming, because it provides very low latency. Other use cases include:

- Inter-office videoconferencing
- Company-wide broadcasts
- Real-time financial or news tickers
- Medium to large companies that need to maximize delivery capacity while minimizing network costs
- Large enterprises with media requirements over multiple locations and networks

Key technology concepts

Three types of multicast delivery are available: application-level (P2P) multicast, IP multicast, and multicast fusion, an Adobe innovation that increases the quality, reach, and network efficiency of live video delivery.

Application-level multicast, sometimes referred to as P2P multicast, provides an optimized stream distribution among peers. This approach can be very cost-effective because the stream payload is distributed among the peers rather than taxing your servers and network. The original stream can be distributed either from a client or from Flash Media Server. Application-level multicast can help reduce bandwidth costs for product marketing, user-generated content, or internal broadcasts. It is supported in Flash Media Interactive Server and Flash Media Enterprise Server.

Native IP multicast enables businesses to use existing multicast-enabled networks to deliver large internal broadcasts without overwhelming the network. This approach is best for internal, enterprise, VPN, or LAN networks.

Multicast fusion is an innovative combination of native IP and application-level multicast. Available in Flash Media Enterprise Server, multicast fusion allows employees to receive live video via IP multicast and use those clients to help distribute to employees not connected to a multicast-enabled network. This approach is best for large organizations broadcasting both internally and externally.

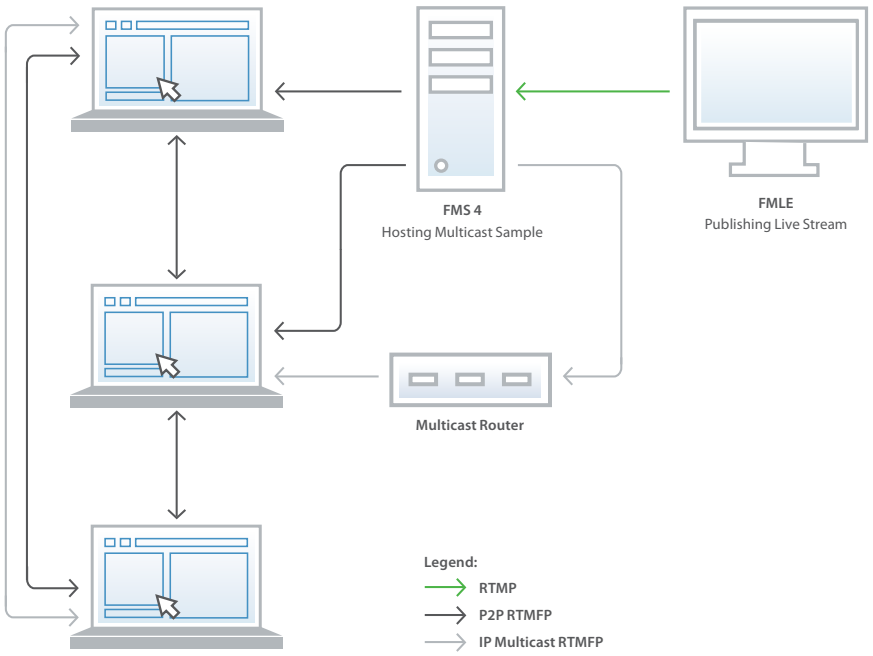

Figure 2. Multicast fusion overview

Flash Media Server 4 ships with a Configurator tool that makes multicast publishing very simple. The tool lets you create an IP multicast, application-level multicast, or multicast fusion broadcast using Flash Media Live Encoder. The Configurator generates a standard manifest (F4M) file that can be used with OSMF, Flash Media Playback, or Strobe Media Playback, so you can get started streaming high-quality video quickly.

Figure 3. Multicast Configurator tool

RTMFP and peer-assisted networking

Flash Media Server 4 enables peer introductions as well as support for the new RTMFP Groups technology in Flash Player 10.1. This technology reduces the demand for server bandwidth, opening up possibilities for a new wave of multiuser applications, such as video chat and other real-time media applications that may have been previously hindered by bandwidth costs.

Peer-to-peer introductions enable Flash runtime clients to establish a connection with other Flash runtimes to start sharing data and media over RTMFP. This introduction service, which had been available only via the Cirrus service (previously named Stratus), is now a feature of Flash Media Interactive Server and Flash Media Enterprise Server. RTMFP Groups support is available in Flash Media Enterprise Server.

Benefits of RTMFP and peer-assisted networking

The most significant benefit of peer-assisted networking is the offloading of network traffic from the server to the client, which results in significant bandwidth and infrastructure cost savings. While latency might be slightly higher than with RTMP streaming, it is lower than HTTP Dynamic Streaming.

RTMFP Groups adds new posting and directed routing features to basic peer-assisted networking, allowing any client participating in a group to broadcast data to the rest of the group or even target a specific client. Object replication, another powerful feature of RTMFP Groups, allows all members of a group to maintain a consistent view of a potentially large set of objects. This provides low-latency data-sharing that can be used for applications such as social media and real-time games. The efficient topology of RTMFP Groups allows developers to achieve massive scale, because routing through a single peer or server cluster is not required.

Peer-assisted networking through Flash Player is a secure, managed communication solution. For Internet-based applications, a server, such as Flash Media Server or the Cirrus 2 service, is required to connect and authenticate clients for any communication to take place. After the clients have been authorized, data can be transmitted between peers via RTMFP, which is an encrypted protocol. For additional security, RTMFP Groups can be configured to require authentication before allowing data to be posted to the group. Before allowing a P2P connection, Flash Player requests explicit authorization by the client.

When to use RTMFP and peer-assisted networking

RTMFP is a natural choice for real-time communication and streaming when massive scale is needed. It eliminates the need for huge server and network infrastructures to share large amounts of data. Examples of use cases include the following:

- Webcam chat rooms
- VoIP
- Live customer support
- Dating sites
- Company-wide communication
- Swarming file delivery
- Massive multiplayer gaming

Key technology concepts

RTMFP communication is based on User Datagram Protocol (UDP). It is always encrypted and can traverse NATs and firewalls. UDP supports a lossy transmission of data, which is useful for low-latency audio, video, and data delivery. RTMFP is a managed and controllable protocol that requires a server to always be present to perform client introductions and eliminate network probing. RTMFP has unique IP mobility functionality that allows a connection to be maintained even if the client changes networks, such as Wi-Fi networks or mobile towers. RTMFP can be used to support unicast communication as well as IP multicast and multicast fusion broadcasts.

Comparing RTMP and RTMFP

To clarify when it is best to use RTMFP rather than RTMP, it is useful to examine their differences and similarities. The following figure illustrates the basic topology of RTMP, basic peer-assisted networking, and RTMFP Groups.

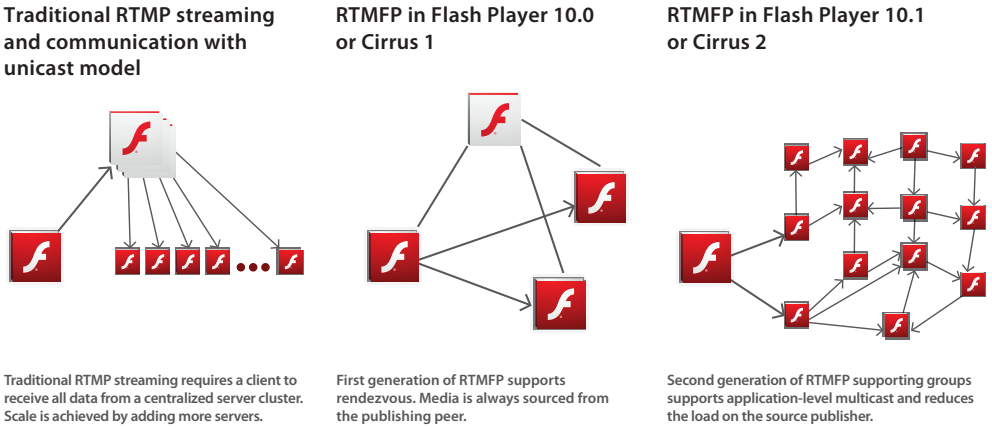

Figure 4. Evolution of media and communication delivery on the Flash Platform

Key differences between RTMP and RTMFP

RTMP is a unicast delivery method. It simply delivers streams from a server to individual connected clients. Unicast consumes a large amount of network resources. For example, a 1 MBps stream delivered to 1,000 clients requires 1GB upstream from the server, which is very CPU- and network-intensive.

While RTMFP does support unicast delivery, its benefit lies in its multicast support. Native IP multicast reduces the network load in the enterprise by distributing the data using customized network hardware. However, reducing network load in this way does require a hardware investment. Flash Media Server 4 introduces new multicast fusion support, which eliminates this hardware investment by offloading the data delivery to peer-assisted networking, enabling clients consuming a stream to help distribute it to others on the network.

RTMP is a Transmission Control Protocol (TCP), whereas RTMFP is based on UDP. TCP is lossless; each data packet is guaranteed to arrive in the same order it was sent. UDP has no ordering of packets and no guarantee that the data will arrive at all, which makes RTMFP more lightweight and faster but less reliable than RTMP. However, some routers do not allow UDP traffic, so it might be necessary for developers to fall back to RTMP.

RTMP is not encrypted by default, but it can be encrypted using RTMPE. RTMFP communication is always encrypted. RTMP can utilize additional content protection, such as Flash Access file encryption along with SWF verification.

Similarities between RTMP and RTMFP

Both RTMP and RTMFP deliver live and on-demand video, audio, and data streams. They both provide low-latency, real-time communication, powering applications such as videoconferencing, text chat, live broadcasts, multiplayer gaming, and live support. They both offer stream encryption.

Delivery comparison for video on demand

The following table compares the video delivery techniques for VOD in Flash Media Server.

	Embedded video	Progressive download	RTMP streaming	HTTP Dynamic Streaming
Mobile and devices	Not recommended because file sizes are large and hardware acceleration isn't available	Flash Player 10.1 and later supported on a wide array of devices. Hardware acceleration available for optimal playback. H.264 recommended.		
Adaptive bitrate	Not supported	Not supported	Enables bandwidth detection and bitrate switching over RTMP connections.	Enables bandwidth detection and bitrate switching over HTTP.
Content protection	Not supported	Flash Access support	Provides inherent protection because the video file is never cached. Additional options include: o Flash Access encryption o Real-time protection with RTMPE o SWF verification o RTMFP encrypted delivery	Flash Access support
OSMF	Not supported	Use OSMF to build custom players or use prebuilt Flash Media Playback or Strobe Media Playback. Plug-in architecture enables easy extension of player features and integration with third-party APIs.	Use OSMF to build custom players or use prebuilt Flash Media Playback or Strobe Media Playback. Handles RTMP connection and supports adaptive bitrate delivery.	Recommended approach to implementing HTTP Dynamic Streaming. Use OSMF to build custom players or use prebuilt Flash Media Playback or Strobe Media Playback. Pass in manifest file URL. Supports adaptive bitrate delivery.
Encoding	Video and audio are encoded on import into Flash Player using a Sorenson Spark or VP6-E codec. Alternately, FLV files (encoded elsewhere) can be imported and placed on the Flash Timeline (re-encoding is not necessary).	Video files are encoded in either the built-in or standalone version of Adobe Flash Media Live Encoder through Flash Video Exporter and a third-party nonlinear editing or encoding product, or using a standalone video encoding application such as Sorenson Squeeze or On2 Flix.	Same as progressive delivery. Live video feeds can be captured and recorded from client-side webcams or DV cameras or using Adobe Flash Media Live Encoder. Live encoding variables, such as bitrate, frames per second, and video playback size, can be controlled programmatically.	File Packager prepares prerecorded media, and Live Packager prepares live RTMP streams. These utilities create MP4 fragment-compliant files (F4F) and generate an XML-based manifest file (F4M).
SWF file size	SWF files contain both video and audio streams as well as the Flash Player interface, resulting in a single, substantially larger file size.	SWF and video files are stored separately, resulting in a smaller SWF file size. Video delivered via progressive delivery is stored in memory and is not recommended for large video assets.	Same file size as progressive delivery.	

	Embedded video	Progressive download	RTMP streaming	HTTP Dynamic Streaming
Start time	Large SWF files often require users to wait before the video starts playing, resulting in a negative user experience.	Starts relatively quickly after enough of the video has downloaded to begin playback.	Immediate. The fastest way to go from initial load to playing the video.	Quick start. Begins to play after the manifest file has been read and the first fragment data is received.
Timeline access	When embedded in the Flash Timeline, video appears on individual frames and can be treated like any other object on the stage.	Video is played back only at runtime. Individual frames are not visible on the stage. Timeline events can be triggered at selected times during video playback using ActionScript.		
Publishing	Each time the movie is published or tested, the entire video file is republished. Changes to video files require manually reimporting the files into the timeline.	Video files are only referenced at runtime. Publishing SWF files is much faster than embedded video. Video files can be updated or modified without recompiling the SWF file.	Same as progressive delivery. You can dynamically pull video files from virtual locations, such as your storage area network (SAN), a FVSS, or other CDN.	Content must be packaged into F4F format. Manifest files can be updated with new F4F file information.
Frame rate	Video frame rate and SWF movie frame rate must be the same.	The video file can have a different frame rate than the SWF file. Live video capture has programmable control over frame rate.		
Seek and navigation ability	The entire SWF file must be downloaded before user can seek or navigate the video.	User can only seek to portions of the video that have been downloaded.	User can seek anywhere at any time. New buffer controls enable smooth playback during reconnection if connection is lost. Instant replay and other trick play functionality	
Web delivery	The entire SWF file must be downloaded to the client and loaded into memory to play back video.	Video files are progressively downloaded, cached, and then played from the local disk. The entire video clip doesn't need to fit in memory.	Video files are streamed from Flash Media Server, displayed on the client's screen, and then discarded from memory in a play-as-you-go method.	Manifest and video fragment files are downloaded, cached, and then played from the local disk. The entire video clip doesn't need to fit in memory.
Playback performance	Audio and video sync is limited. Sync between audio and video suffer after about 120 seconds of video. Total file duration is limited to available RAM on the playback system.	Improved performance over embedded SWF video with higher resolution and reliable audio synchronization. Provides best image quality, which is limited only by the amount of available hard-drive space on the playback system.	Improved efficiency from a web delivery perspective, with optimal bitrate delivery on an as-needed basis to as many customers as necessary.	Like RTMP streaming, optimal bitrate can be delivered. Network efficiencies of standard HTTP server and network hardware can potentially decrease overall cost of delivery.
Compatibility	Flash Player 6 and later, including mobile devices.	Flash Player 7 and later, including mobile devices.	Flash Player 6 and later, including mobile devices.	Flash Player 10.1 and later, including mobile devices.

Delivery comparison for live streaming

The following table compares the video delivery techniques available for live streaming in Flash Media Server. Progressive download and embedded video do not support live streaming.

	RTMP live	HTTP live	IP multicast	Application-level multicast	Multicast fusion
Video source	Flash Media Live Encoder, local webcam in Flash Player, or third-party encoder. Visit *www.adobe.com/products/premiere/dvhdwrdb.html* for compatible devices. Could also be a server-side VOD stream broadcast as live.				
Content protection	Provides inherent protection because the video file is never cached. Additional options include: o Real-time Flash Access encryption o Real-time protection with RTMPE o SWF verification RTMFP encrypted delivery	Media is cached. Flash Access 2 is required for protection.	RTMFP is encrypted. Internal network is used. Flash Access 2 supported.		
Video player	Custom player applications, OSMF-based players (Flash Media Playback, Strobe Media Playback or custom).				
Network hardware	Port 1935 and RTMP required. For caching, additional FMS servers are required.	Standard HTTP caching technology can be used. For media packaging, FMS is required at the ingest.	Multicast-enabled routers required. If WAN is not multicast-enabled, an additional FMS is required to replicate. UDP-enabled.	UDP-enabled with ports open. Network partitioning may be required to optimize data flow.	Both IP and application-multicast requirements.
Firewall traversal	Good traversal. Port 80 tunneling available if needed.	Uses standard HTTP delivery protocol.	Internal network must be tuned to accept multicast traffic.	Might be restricted. RTMFP used to open P2P connection between clients.	Flexible firewall traversal. Uses P2P over RTMFP if network isn't configured for IP multicast traffic.
Latency	Lowest latency	Higher latency due to real-time fragmenting process.	Latency of 5¬–8 seconds should be expected for multicast streams, based on network configuration and buffer settings.		
Adaptive bitrate	Dynamic streaming enables bandwidth detection and bitrate switching over RTMP connections.	Dynamic streaming enables bandwidth detection and bitrate switching over HTTP connections	Not supported. Multicast supports delivery of a single stream only.		
DVR functionality	Supported. Pause and rewind live streams.	Supported. Pause and rewind live streams.	Not supported.		

Glossary

Adaptive bitrate—Using bandwidth detection and processor performance measurement to deliver the most appropriate bitrate stream to a client.

Adobe AIR—Cross-platform tool that lets developers use their existing web development skills in HTML, Ajax, Flash technology, and Flex to build and deploy RIAs to the desktop.

Application-level multicast—Sometimes referred to as P2P multicast, this delivery method provides an optimized stream distribution among peers, which can result in a bandwidth cost-savings. Participating peers organize themselves into an overlay topology for data delivery. Each edge corresponds to a unicast path between two peers in the underlying Internet. All multicast-related functionality is implemented at the peers instead of at routers. The goal is to construct and maintain an efficient overlay for data transmission. The original stream can be distributed from a client or from Flash Media Server.

Bandwidth—Amount of throughput for a server or client computer. Usually measured in megabits per second (Mbps) or kilobits per second (kbps). A typical, wired Ethernet connection is 100Mbps, and Wi-Fi is 54Mbps. Server and client bandwidth limits determine how much video can be served or received.

Buffer—Amount of video stored in RAM on the client computer. The larger the buffer, the smoother the video plays back. The buffer is never written to disk.

Client—Consumer connecting to Flash Media Server via the Flash Player or AIR application.

Codec—Format in which a video or audio file is encoded. Flash uses the Sorenson Spark, On2 VP6-S, On2 VP6-E, or H.264 codec for video, and Nellymoser, MP3, or AAC for audio. Short for "code/decode," the decoding part must be present in the player to play back video using a specific codec.

Connection—When clients are streaming video, they consume one connection. Multiple clients streaming at the same time is referred to as simultaneous connections.

Content—Video or audio data streamed from Flash Media Server.

Content delivery network (CDN)—A company that offers streaming services and bandwidth so that customers do not need to set up and install their own servers.

Digital Rights Management (DRM)—Video encoded with DRM can be sold and protected against stealing and unauthorized sharing.

Encoder—Software that compresses or transcodes video from one format to another.

Enhanced RTMP—Next-generation RTMP that increases security and performance.

Flex—Cross-platform, open source framework for creating RIAs that run identically in all major browsers and operating systems.

Flash Media Live Encoder—Free desktop application for Windows and Mac OS that connects to Flash Media Server and allows you to stream live video and audio to Flash Player.

Flash Media Solution Provider—Partner program that helps promote a strong ecosystem around Flash technology and Flash Media Server.

Flash Video Streaming Service—Provider program consisting of select CDNs.

IP multicast—Network-efficient delivery method that uses existing multicast-enabled network hardware to deliver large internal broadcasts without overwhelming the network. Multicast-enabled routers create optimal distribution paths for data sent to a multicast destination address. The most common use case is live video, but it can be used to deliver on-demand video.

Live—Live streaming using Flash Media Encoder or Flash Player.

Latency—How long it takes for a packet of data to get from one point to another.

Multicast address—IP address that identifies zero or more computers in a network simultaneously. An IP multicast address can be any IPv4 or IPv6 multicast address.

Multicast fusion—Adobe's innovative combination of application-level multicast and IP multicast. Used cooperatively for a single stream. Allows for distribution of video to internal clients via IP multicast, and uses those clients to help distribute to clients outside of the multicast-enabled internal network.

On2 VP6—Video codec available for playback since Flash Player 8, offering high-quality, lightweight, full-screen playback. VP6-S is a simplified version of the codec that is ideal for delivery of high-quality video to older computers (available in Flash Player 9 and later). VP6-E, the original codec that shipped with Flash Player 8, is slightly higher quality, thus requiring more processing power for playback.

Publishing point—Directory on Flash Media Server where customers can place video and audio, or publish live video.

Real Time Media Flow Protocol (RTMFP)—Peer-assisted communication protocol supported in Flash Player 10.1 and later.

Real Time Message Protocol (RTMP)—Adobe's proprietary method of communication between Flash Player clients and Flash Media Server.

Quality of service (QoS)—Refers to the quality of the consumer's playback experience.

Solution provider—Consulting and enablement organizations that provide advanced knowledge of Flash Media Server and Flash technology, and their integration over multiple devices.

Sorenson Spark—Original video codec in Flash Player 6 and 7. An encoder for this codec is built into Flash Player, allowing for webcam broadcast and archiving when used with Flash Media Server.

Transcoding—Conversion from one video format to another. Usually transcoding allows you change the codec. Quality is lost each time a file is transcoded.

Video on demand (VOD)—Delivery of pre-recorded video streaming.

About the author

Lisa Larson-Kelley is a developer, consultant, and teacher of subjects related to electronic media. She coauthored the book *Flash Video for Professionals* (Wiley, 2007). Her blog is at www.LearnFromLisa.com.

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