

Streaming protocols and video codecs and formats

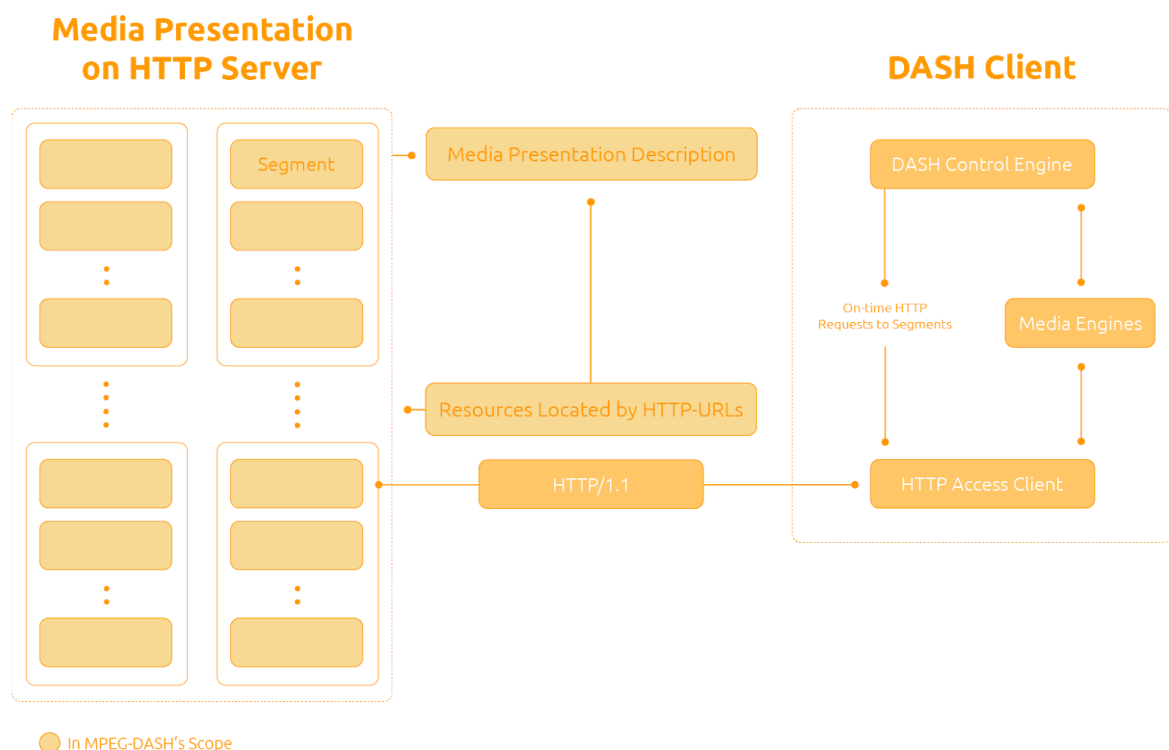
Used by popular video platforms

Aplicaciones Distribuidas

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Dynamic Adaptive Streaming over HTTP (DASH)

- It is an adaptive bitrate streaming technique that enables high quality streaming of media content over the Internet delivered from conventional **HTTP** web servers.
- MPEG-DASH works by breaking the content into a sequence of small **HTTP-based** file segments, each segment containing a short interval of playback time of content.
- The transport protocol that MPEG-DASH uses is **TCP**.
- Used by **YouTube**, **Netflix** or **Amazon Prime Video** (and many others).



¹ How MPEG-DASH works.

In this figure, the multimedia content is captured and stored on an HTTP server and is **delivered using HTTP**. The content exists on the server in two parts: **Media Presentation Description** (MPD), which **describes a manifest of the available content**, its various alternatives, their URL addresses, and other characteristics; and segments, which contain the actual multimedia bitstreams in the form of chunks, in single or multiple files.

¹ Source: <https://www.encoding.com/mpeg-dash/>

To play the content, the DASH client first obtains the MPD. The MPD can be delivered using HTTP, email, thumb drive, broadcast, or other transports. By parsing the **MPD**, the DASH client learns about the program timing, media-content availability, media types, resolutions, minimum and maximum bandwidths, and the existence of various encoded alternatives of multimedia components, accessibility features and required digital rights management (DRM), media-component locations on the network, and other content characteristics. Using this information, the DASH client selects the appropriate encoded alternative and starts **streaming the content** by fetching the segments using **HTTP GET** requests.

After appropriate **buffering** to allow for network throughput variations, the client continues fetching the subsequent segments and also monitors the network bandwidth fluctuations. Depending on its measurements, the client decides how to **adapt to the available bandwidth** by fetching segments of different alternatives (with lower or higher bitrates) to maintain an adequate buffer.

Sources:

1. https://en.wikipedia.org/wiki/Dynamic_Adaptive_Streaming_over_HTTP
 2. <https://www.encoding.com/mpeg-dash/>
 3. <https://medium.com/canal-tech/how-video-streaming-works-on-the-web-an-introduction-7919739f7e1>
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WebM

- WebM is an open, royalty-free, media file format designed for the web.
- WebM defines the **file container** structure, **video** and **audio** formats. WebM files consist of video streams compressed with the **VP8** or **VP9** video codecs and audio streams compressed with the Vorbis or Opus audio codecs.
- Used by YouTube alongside **HTML5** and **H.264**.

VP9

- VP9 is an open and royalty-free video coding format developed by **Google**.
- VP9 is the successor to VP8 and competes mainly with MPEG's High Efficiency Video Coding (HEVC/H.265). At first, VP9 was mainly used on Google's video platform **YouTube**.
- In contrast to HEVC, VP9 support is common among web browsers. The combination of VP9 video and Opus audio in the WebM container, as

served by YouTube, is supported by roughly **4/5 of the browser market** (mobile included) as of June 2018.

How Does it Work?

- While 4K video increases picture quality by making individual pixels smaller, VP9 codec and HEVC **make them bigger to reduce the bitrate and file size.**

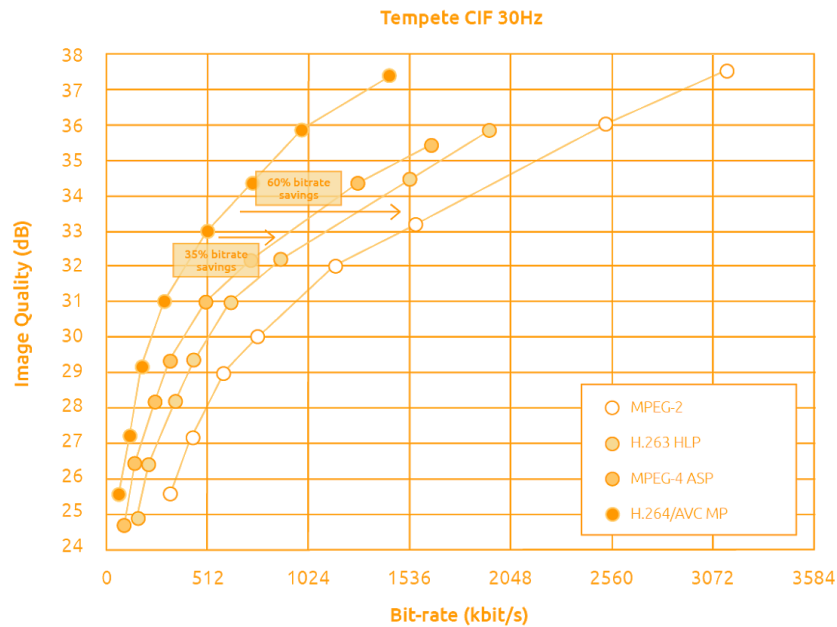


² Areas with much fine detail are encoded more efficiently using small blocks, while areas with very little detail are stored more efficiently using bigger block sizes.

H.264

- It's a block-oriented motion-compensation-based video compression standard.
- As of 2014, it is one of the most commonly used formats for the recording, compression, and distribution of video content.
- It supports resolutions up to 8192×4320, including 8K UHD.

² Source: <https://www.encoding.com/vp9/>



³ Example Coding Efficiency Comparison

Sources:

1. <https://www.youtube.com/html5>
2. <https://www.webmproject.org/about/>
3. <https://en.wikipedia.org/wiki/VP9>
4. <https://www.encoding.com/h-264/>

YouTube video formats

As previously commented, YouTube uses a combination of MPEG-DASH, HTML5, WebM, H.264 and VP9 to deliver and play video content.

YouTube accepts videos that are uploaded in most container formats, including **AVI**, **MP4**, **MPEG-PS**, **QuickTime File Format** and **FLV**. It supports **WebM** files and also **3GP**, allowing videos to be uploaded from mobile phones.

Sources:

1. https://en.wikipedia.org/wiki/YouTube#Video_technology

Movistar+

For web content, Movistar+ needs Microsoft Silverlight installed on the web browser. Currently, only Internet Explorer 11 supports Silverlight.

³ Source: <https://www.encoding.com/h-264/>

Microsoft Silverlight

- It is a deprecated application framework for writing and running rich Internet applications, similar to Adobe Flash.
- Silverlight supports H.264 video, Advanced Audio Coding, Windows Media Video (WMV), Windows Media Audio (WMA), and MPEG Layer III (MP3) media content across all supported browsers.

Sources:

1. https://es.wikipedia.org/wiki/Movistar%2B#Compatibilidad_de_dispositivos
 2. https://en.wikipedia.org/wiki/Microsoft_Silverlight
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Orange TV

Orange TV makes use of Hasplayer and is compatible with Firefox 51+. On other browsers such as Safari or Internet Explorer, Silverlight is needed.

Hasplayer

- Hasplayer is an Http Adaptive Streaming javascript player based on HTML5 premium extensions (MSE/EME).
- It is an extension of the dash.js project with the aim of supporting additional http adaptive streaming protocols such as Microsoft Smooth Streaming protocol and Apple Http Live Streaming.

Sources:

1. <https://ayuda.orange.es/particulares/orange-tv/multidispositivo/2315-como-ver-orange-tv-desde-un-ordenador-personal>
2. <https://github.com/Orange-OpenSource/hasplayer.js>