Image Media Playlist for HLS

Overview

In HTTP Live Streaming (HLS), the I-Frame playlist provides a sparse track of video frames for a client to use during trick-play and seek operations. The format currently specified by HLS is a coded video I-frame. This approach is efficient because it references frame data directly from the video stream and has the added benefit of supporting digital rights management. However, additional video decoding resources are required to process these I-frames for display, which can be problematic in some cases. To make these images more accessible on a wider range of client devices, this specification proposes a second format using compressed graphic image files.

This specification extends RFC 8216-bis – HTTP Live Streaming 2nd Edition, draft-pantos-hls-rfc8216bis-04 (https://tools.ietf.org/html/draft-pantos-hls-rfc8216bis-04).

Revision History

Version	Date	Description
0.1	2019-05-07	
0.2	2019-05-07	Attribution update
0.3	2019-05-21	Github link

Master Playlist

EXT-X-IMAGE-STREAM-INF

The EXT-X-IMAGE-STREAM-INF tag identifies an Image Media Playlist file containing Images in a compressed graphic image format. It stands alone, in that it does not apply to a particular URI in the Master Playlist.

Its format is:

#EXT-X-IMAGE-STREAM-INF:<attribute-list>

All attributes defined for the EXT-X-I-FRAME-STREAM-INF tag are also defined for the EXT-X-IMAGE-STREAM-INF tag, except for HDCP-LEVEL and VIDEO-RANGE, which are not applicable.

The URI attribute value of EXT-X-IMAGE-STREAM-INF is a quoted-string containing a resource URI that identifies the Image Media Playlist file. That Playlist file MUST contain an EXT-X-IMAGES-ONLY tag. The URI attribute is REQUIRED.

The BANDWIDTH attribute is REQUIRED.

The CODECS attribute value of EXT-X-IMAGE-STREAM-INF is a quoted-string containing a comma-separated list of compressed graphic image formats present in the Image Media Playlist. For example, an Image Media Playlist file that references JPEG Images and BIF Image Archives would have a CODECS value of "jpeg,bif". Clients MUST ignore EXT-X-IMAGE-STREAM-INF tags with unsupported CODECS attribute values. The CODECS attribute is REQUIRED.

The RESOLUTION attribute of EXT-X-IMAGE-STREAM-INF declares a Target Resolution for the Image Media Playlist to assist clients with selection based on display requirements. The pixel dimensions of Images (or individual Image Tiles) referenced in an Image Media Playlist MUST NOT exceed the respective horizontal or vertical pixel dimension specified by RESOLUTION; otherwise, display errors can occur. The RESOLUTION attribute is REQUIRED.

The provisions in HLS Section 4.3.4.2.1 also apply to EXT-X-IMAGE-STREAM-INF tags with a VIDEO attribute.

A Master Playlist that specifies alternative VIDEO Renditions and Image Media Playlists SHOULD include an alternative Image VIDEO Rendition for each regular VIDEO Rendition, with the same NAME and LANGUAGE attributes.

Image Media Playlist

EXT-X-IMAGES-ONLY

The EXT-X-IMAGES-ONLY tag indicates that each resource URI in an Image Media Playlist is an Image Resource. By default, each Image Resource describes a single Image in a compressed graphic image format. If an Image Archive tag is present in the Playlist, the next Image Resource MAY contain multiple Images and require additional information for timing and display. Therefore, the client MUST use processing logic specific to the Image Archive type to ensure proper display.

The EXT-X-IMAGES-ONLY tag applies to the entire Image Media Playlist.

Its format is:

#EXT-X-IMAGES-ONLY

In a Playlist with the EXT-X-IMAGES-ONLY tag, the duration (EXTINF tag value) is the time between the presentation time of the Image Resource and the presentation time of the next Image Resource in the Playlist, or the end of the presentation if it is the last Image Resource in the Playlist. If the calculated duration of an Image Archive is greater than the EXTINF duration in the Playlist, the client MUST enforce the EXTINF Playlist duration and ignore Images that extend beyond the boundary.

When Image Media Playlists are present, all Media Playlists (audio, video, image, etc.) MUST contain synchronized EXT-X-DISCONTINUITY tags. When it is a Live presentation, all Media Playlists MUST also contain synchronized EXT-X-PROGRAM-DATE-TIME and EXT-X-DISCONTINUITY-SEQUENCE tags.

The requirement for declaring EXT-X-TARGETDURATION with a value greater-than or equal-to the largest EXTINF value in an Image Media Playlist MAY be ignored.

If an Image Resource is unavailable for the presentation, a placeholder Image Resource with an EXT-X-GAP tag and an EXTINF tag with appropriate duration SHOULD be used to signal the missing Image and preserve track alignment. The presence of an EXT-X-GAP tag on an Image Resource SHOULD NOT cause a client to look for another Variant Stream.

The File Signature (magic number) of an Image Resource, including Images referenced using EXT-X-BYTERANGE, MUST be a valid expected value for at least one entry in the CODECS attribute of the EXT-X-IMAGE-STREAM-INF tag referencing the Image Media Playlist. For example, the expected File Signature of a JPEG Image is 0xFFD8 and a BIF Archive is 0x894249460D0A1A0A.

EXT-X-TILES

The EXT-X-TILES tag indicates the Image Resource is an Image Archive that contains one or more Images arranged in a Grid. A client processing the EXT-X-TILES tag MUST be capable of displaying individual Image Tiles using the Grid Sequence and Timing Model.

Its format is:

#EXT-X-TILES:<attributes>

RESOLUTION
The value is a decimal-resolution describing the pixel dimensions of a single Image in the Grid. This attribute is REQUIRED.

LAYOUT
The value is a grid-item-dimension consisting of two positive decimal integers in the format: column-x-row ("4x3"). It describes the arrangement of Images in a Grid. The minimum valid LAYOUT is "1x1". The maximum valid LAYOUT will depend on RESOLUTION and the maximum valid pixel dimensions allowed by the compressed graphic image format. This attribute is REQUIRED.

DURATION
The value is a decimal-floating-point or decimal-integer number of seconds indicating the display duration of a single Image Tile. This attribute is REQUIRED.

The Time Remaining for an Image Resource is the EXTINF duration minus the Total Elapsed Time of the Image Archive. Tiles are selected from the Grid in a specific Sequence starting top-left, moving left-to-right and top-to-bottom, following the Grid Layout. Each Tile from the Sequence is displayed for DURATION seconds or Time Remaining seconds, whichever is less. If Time Remaining is greater than zero when the Sequence completes, the last Image is displayed until Time Remaining is zero.

EXT-X-BIF

The EXT-X-BIF tag indicates the Image Resource is an Image Archive stored in the BIF file format. A client processing the EXT-X-BIF tag MUST align the Image Resource start time in the Image Media Playlist with the internal BIF media timestamp of zero and extend this relative mapping to each Image referenced in the BIF Image Archive. If a gap exists between the start of the Image Resource and the presentation time of the first Image in the BIF Archive, the client MAY further adjust the presentation time of the first Image to start with the Image Resource, but it MUST NOT apply this shift to the entire BIF presentation.

Its format is:

#EXT-X-BIF

If the total duration of Images referenced in the BIF Archive is greater than the EXTINF Playlist duration, the client MUST enforce the EXTINF Playlist duration and ignore Images that extend beyond the boundary.

Example Playlists

Master Playlist Sample

```
#EXTM3U
#EXT-X-VERSION:7
#EXT-X-INDEPENDENT-SEGMENTS
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="aac",NAME="English",LANGUAGE="en",AUTOSELECT=YES, \
DEFAULT=YES,URI="layer8.m3u8"

#EXT-X-STREAM-INF:BANDWIDTH=1499000,RESOLUTION=640x360,AUDIO="aac", \
CODECS="avc1.4d401e,mp4a.40.2"
layer1.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=2885000,RESOLUTION=960x540,AUDIO="aac", \
CODECS="avc1.4d401f,mp4a.40.2"
layer2.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=3964000,RESOLUTION=1280x720,AUDIO="aac" \
CODECS="avc1.4d401f,mp4a.40.2"
layer3.m3u8

#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=129010,RESOLUTION=640x360,CODECS="avc1.4d401e", \
URI="layer1-iframe.m3u8"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=239655,RESOLUTION=960x540,CODECS="avc1.4d401f", \
URI="layer2-iframe.m3u8"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=352167,RESOLUTION=1280x720,CODECS="avc1.4d401f", \
URI="layer3-iframe.m3u8"

#EXT-X-IMAGE-STREAM-INF:BANDWIDTH=16460,RESOLUTION=240×135,CODECS="jpeg,bif", \
URI="sd-tn.m3u8"
#EXT-X-IMAGE-STREAM-INF:BANDWIDTH=29729,RESOLUTION=640×360,CODECS="jpeg,bif", \
URI="hd-tn.m3u8"
```

VOD Image Media Playlist Sample 1

```
#EXTM3U
#EXT-X-TARGETDURATION:6
#EXT-X-VERSION:7
#EXT-X-MEDIA-SEQUENCE:0
#EXT-X-PLAYLIST-TYPE:VOD
#EXT-X-IMAGES-ONLY

#EXTINF:6.006,
preroll-ad-1.jpg
#EXTINF:6.006,
preroll-ad-2.jpg
#EXTINF:3.003,
preroll-ad-3.jpg

#EXT-X-DISCONTINUITY

#EXTINF:60.060,
#EXT-X-TILES:RESOLUTION=640x360,LAYOUT=5x2,DURATION=6.006
content-0.jpg
#EXTINF:60.060,
#EXT-X-TILES:RESOLUTION=640x360,LAYOUT=5x2,DURATION=6.006
content-1.jpg
#EXTINF:60.060,
#EXT-X-TILES:RESOLUTION=640x360,LAYOUT=5x2,DURATION=6.006
content-2.jpg


.   .   .

#EXTINF:60.060,
#EXT-X-TILES:RESOLUTION=640x360,LAYOUT=5x2,DURATION=6.006
content-8.jpg
#EXTINF:54.054,
#EXT-X-TILES:RESOLUTION=640x360,LAYOUT=5x2,DURATION=6.006
content-9.jpg

#EXT-X-DISCONTINUITY

#EXTINF:6.006,
midroll-ad-1.jpg
#EXTINF:6.006,
midroll-ad-2.jpg
#EXTINF:3.003,
midroll-ad-3.jpg

#EXT-X-DISCONTINUITY

#EXTINF:60.060,
#EXT-X-TILES:RESOLUTION=640x360,LAYOUT=5x2,DURATION=6.006
content-10.jpg
#EXTINF:60.060,
#EXT-X-TILES:RESOLUTION=640x360,LAYOUT=5x2,DURATION=6.006
content-11.jpg


.   .   .

#EXTINF:60.060,
#EXT-X-TILES:RESOLUTION=640x360,LAYOUT=5x2,DURATION=6.006
content-39.jpg

#EXT-X-ENDLIST
```

VOD Image Media Playlist Sample 2

```
#EXTM3U
#EXT-X-TARGETDURATION:6
#EXT-X-VERSION:7
#EXT-X-MEDIA-SEQUENCE:0
#EXT-X-PLAYLIST-TYPE:VOD
#EXT-X-IMAGES-ONLY

# ~~ promo ~~

#EXTINF:6.006,
promo_1.jpg
#EXTINF:6.006,
promo_2.jpg
#EXTINF:3.003,
promo_3.jpg

#EXT-X-DISCONTINUITY

# ~~ movie ~~

#EXTINF:3600.360,
#EXT-X-BIF
two-hour-movie_pt1.bif
#EXTINF:3600.360,
#EXT-X-BIF
two-hour-movie_pt2.bif

#EXT-X-DISCONTINUITY

# ~~ translation credits ~~

#EXTINF:24.024,
#EXT-X-TILES:RESOLUTION=640x360,LAYOUT=4x3,DURATION=2.002
credits_2_1.jpg
#EXTINF:6.006,
#EXT-X-TILES:RESOLUTION=640x360,LAYOUT=4x3,DURATION=2.002
credits_2_1.jpg

#EXT-X-ENDLIST
```

Live Image Media Playlist Sample

```
#EXTM3U
#EXT-X-TARGETDURATION:6
#EXT-X-VERSION:7
#EXT-X-MEDIA-SEQUENCE:127228
#EXT-X-IMAGES-ONLY
#EXT-X-DISCONTINUITY-SEQUENCE:5

#EXT-X-PROGRAM-DATE-TIME:2019-04-17T19:28:12.046Z
#EXTINF:6.006,
content-123.jpg
#EXTINF:6.006,
content-124.jpg
#EXTINF:6.006,
content-125.jpg

#EXT-X-DISCONTINUITY

#EXT-X-PROGRAM-DATE-TIME:2019-04-17T19:28:30.064Z
#EXT-X-GAP
#EXTINF:6.006,
missing-midroll.jpg
#EXT-X-GAP
#EXTINF:6.006,
missing-midroll.jpg
#EXT-X-GAP
#EXTINF:3.003,
missing-midroll.jpg

#EXT-X-DISCONTINUITY

#EXT-X-PROGRAM-DATE-TIME:2019-04-17T19:28:45.079Z
#EXTINF:6.006,
content-128.jpg
#EXTINF:6.006,
content-129.jpg
#EXTINF:6.006,
content-130.jpg
#EXTINF:6.006,
content-131.jpg
```