

HLS 101

...

The basics of adaptive bitrate streaming

Who is this guy?

Trevor Hunsaker

Software Engineer

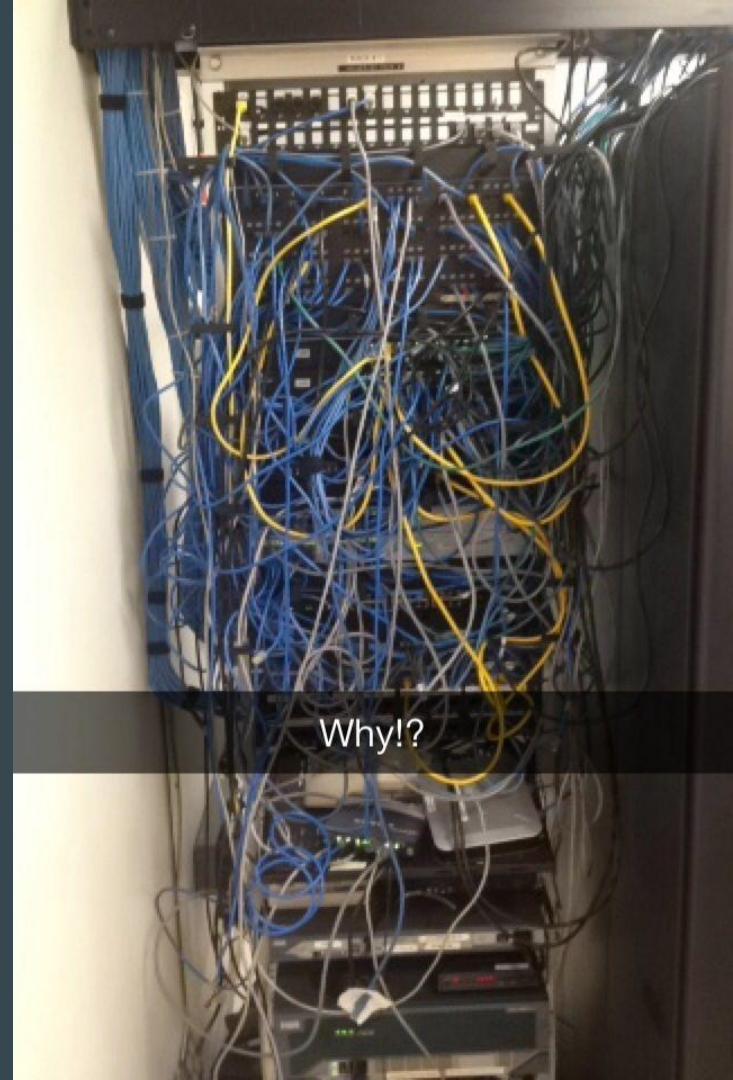
Verizon Digital Media Services

What / Why? + Tools to Get You Started

What & Why?

HLS == HTTP Live Streaming

Uses existing HTTP infrastructure
for delivery



Why HLS?

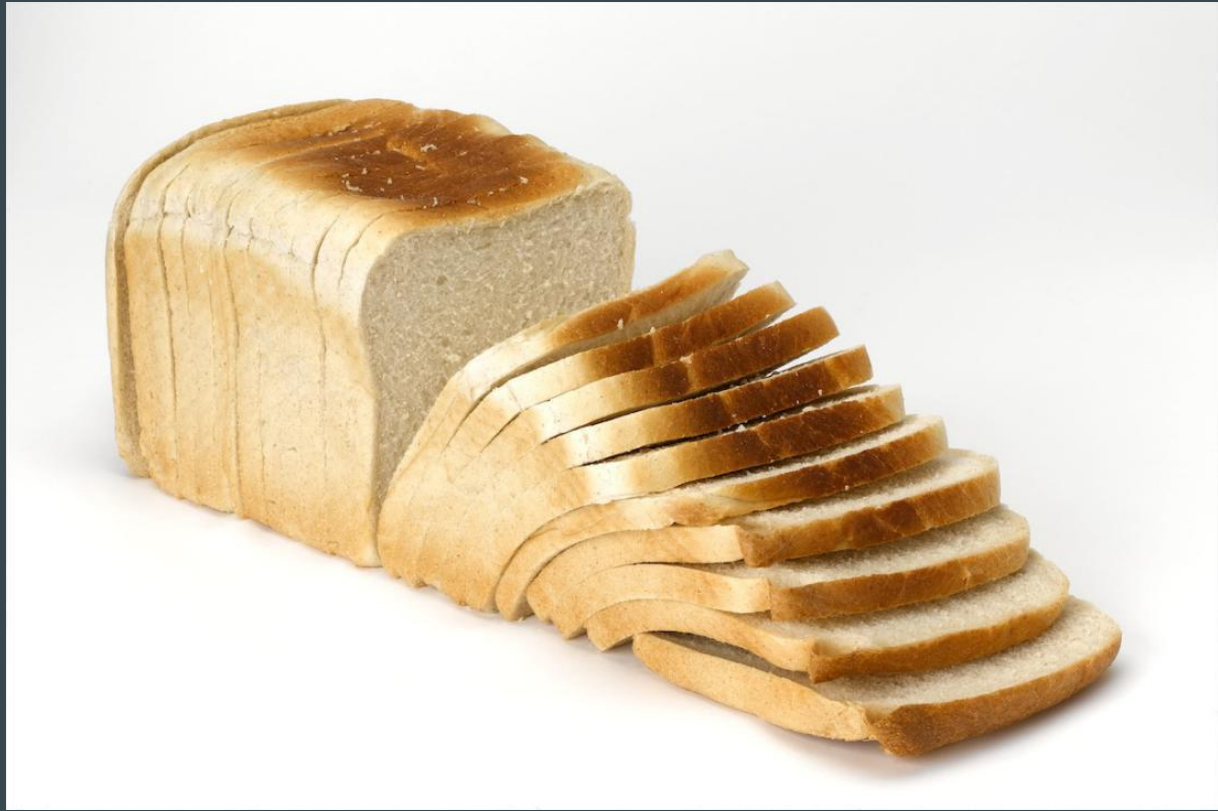
(What does it do for me?)



HLS stream setup process in a nutshell

1. Pre-process your video
2. Prepare your playlists
3. Upload prepared video and playlists to web server
4. Publish URL to master playlist

1. Pre-process your video



A dense, overlapping collage of numerous cassette tapes of various colors and brands, including Sony, TDK, and others. The tapes are arranged in a chaotic, layered fashion, with some showing handwritten labels like "MIX TAPE" and "I'm insane!". The image is a vibrant, textured composition of retro music media.

**3. Upload prepared video
and playlists to web server**



A white and grey megaphone with a black strap. The handle is grey with a red trigger. A circular label on the handle reads "ER-1515", "MEGAPHONE", "15000 OHM", "1000 WATT", "1000 HZ", "1000 V", "1000 A", "1000 M". The megaphone has a large white horn and a grey body. A black strap is attached to the handle.



Master Playlist

`http://example.com/crashing/master.m3u8`

- Just a text file, with an m3u8 extension.
 - Serve with mime-type `application/x-mpegURL` or `vnd.apple.mpegURL`
- Specifies different bitrate variants. Clients pick which one to play.
- Lists where variant playlists can be found
- Lists stream's other capabilities
 - Alternate Audio (Foreign Language / Commentary)
 - Closed Captions

Master Playlist Example

```
#EXTM3U
```

```
#EXT-X-VERSION:5
```

```
#EXT-X-INDEPENDENT-SEGMENTS
```

```
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="aac",NAME="English",LANGUAGE="en",DEFAULT=YES
```

```
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="aac",NAME="Deutsch",DEFAULT=NO,
```

```
AUTOSELECT=YES\
```

```
    LANGUAGE="de",URI="main/german-audio.m3u8"
```

```
#EXT-X-STREAM-INF:RESOLUTION=534x300,BANDWIDTH=2020000,CODECS="mp4a.40.5,\
```

```
    avc1.42000b",FRAME-RATE=29.97,AUDIO="aac",AVERAGE-BANDWIDTH=1455000
```

```
https://example.com/crashing/med.m3u8
```

```
#EXT-X-STREAM-INF:RESOLUTION=320x180,BANDWIDTH=1211000,CODECS="mp4a.40.5,\
```

```
    avc1.42000b",FRAME-RATE=29.97,AUDIO="aac",AVERAGE-BANDWIDTH=952000
```

```
https://example.com/crashing/low.m3u8
```

```
#EXT-X-STREAM-INF:RESOLUTION=720x480,BANDWIDTH=2937000,CODECS="mp4a.40.5,\
```

```
    avc1.42000b",FRAME-RATE=29.97,AUDIO="aac",AVERAGE-BANDWIDTH=2092000
```

```
https://example.com/crashing/high.m3u8
```


Variant Playlist

`https://example.com/crashing/high.m3u8`

- Lists the URLs for each the segment required to play that variant
- Lists the durations of each segment
- Lists decryption key URL (if any) for each segment

Variant Playlist Example (VOD)

```
#EXTM3U
#EXT-X-VERSION:5
#EXT-X-PLAYLIST-TYPE:VOD
#EXT-X-TARGETDURATION:5

#EXT-X-KEY:METHOD=AES-128,URI="http://example.com/crashing/high-key00",\
    IV=0x00000000000000000000000000000000
#EXTINF:2.002000,
http://example.com/crashing/high-00.ts

#EXT-X-KEY:METHOD=AES-128,URI="http://example.com/crashing/high-key01",\
    IV=0x00000000000000000000000000000001
#EXTINF:2.002000,
http://example.com/crashing/high-01.ts

<...>

#EXT-X-ENDLIST
```

Open Source Tools

FFMPEG



FFMPEG Command

```
ffmpeg -i wecrashing.mp4 \
```

```
\
```

```
-hls_segment_filename 'crashing/high-%02d.ts' -hls_playlist_type vod -g 2 \  
-framerate 24 crashing/high.m3u8 \
```

```
-hls_segment_filename 'crashing/med-%02d.ts' -hls_playlist_type vod -g 2 \  
-framerate 24 -s 534x300 crashing/med.m3u8 \
```

```
-hls_segment_filename 'crashing/low-%02d.ts' -hls_playlist_type vod -g 2 \  
-framerate 24 -s 320x180 crashing/low.m3u8 \
```

Bandwidth attributes for master playlist

<https://gist.github.com/saturdayplace/dc092fef6724c9bb23bb8a8075c9d4a0>

<https://goo.gl/Yo6PMd>


VideoJS + HLS library

```
<head>
  <link href="videojs/video-js.css" rel="stylesheet">
</head>

<body>
  <video id="my-video" class="video-js" controls preload="auto" width="720"
height="480" data-setup="{ }">

    <source src="./master.m3u8" type='application/x-mpegURL'>
  </video>

  <script src="videojs/video.js"></script>
  <script src="videojs/videojs-contrib-hls.min.js"></script>
</body>
```



Complications when doing Live stuff

- Make sure your encoding process can stay far enough ahead of the players
- Need to continuously update the variant playlists with new segment URLs (and drop old segments from it). Clients will continually re-request.
 - Master playlists can stay the same

Stuff to Read

Apple's links to stuffs: <https://developer.apple.com/streaming/>

The Actual HLS spec: <http://tools.ietf.org/html/draft-pantos-http-live-streaming>

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