

## HLS master playlist management made easy

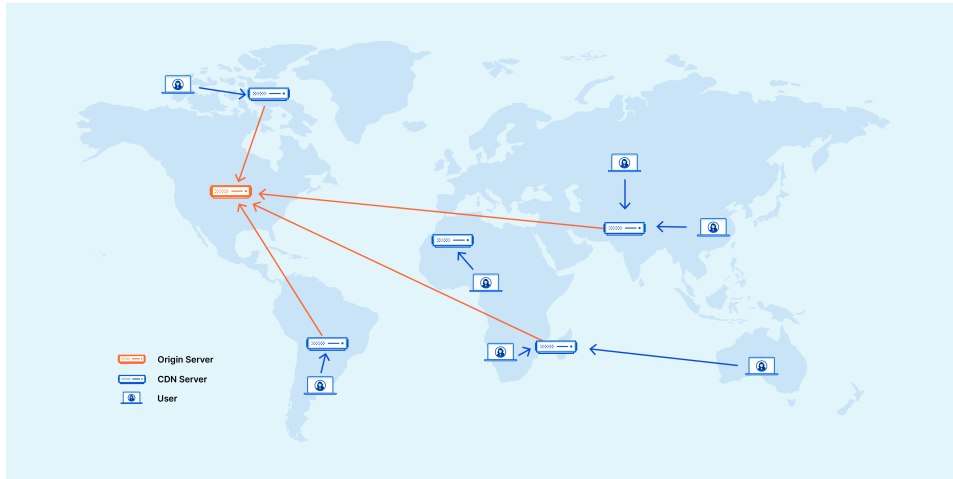
Sanchayan Maity

- ▶ Open source consulting firm based out of Bangalore and Toronto.
- ▶ Building high-quality, low-level systems software.
- ▶ Providing services for audio/video using GStreamer and PipeWire.

- ▶ What's HTTP Live Streaming (HLS)
- ▶ HLS media and multi-variant playlist examples
- ▶ Multi-variant playlist helper bin implementation
- ▶ Future work

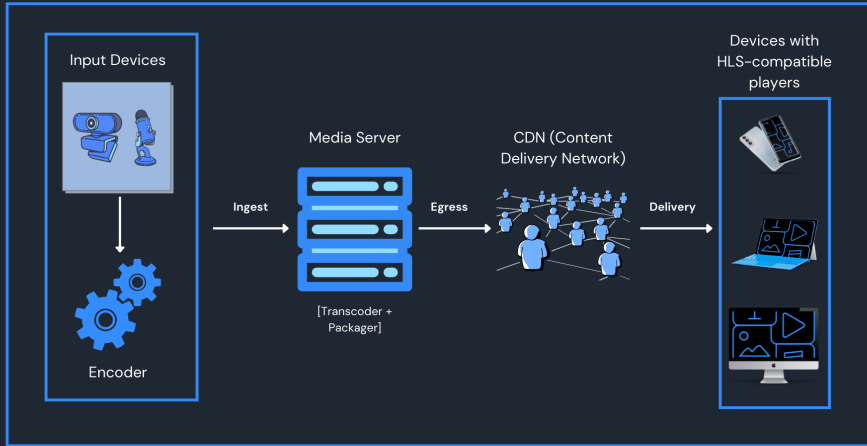
- ▶ Developed by Apple and released in 2009
- ▶ Standardised in **RFC 8216**
- ▶ HTTP-based adaptive bit-rate streaming communications protocol
- ▶ HTTP traffic, unlike UDP-based protocols such as RTP
- ▶ Delivered over widely available HTTP-based content delivery networks

# Content Delivery Networks<sup>1</sup>



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<sup>1</sup>What's a CDN?



A Typical HLS Architecture

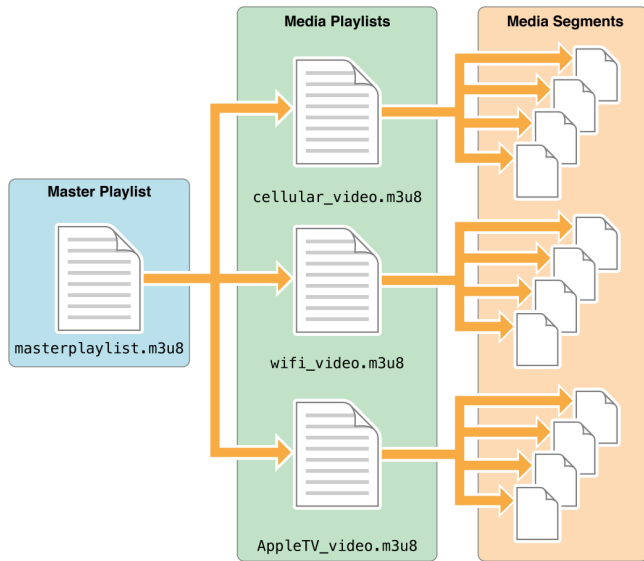
<sup>2</sup>HTTP Live Streaming

```
#EXTM3U
#EXT-X-TARGETDURATION:10
#EXT-X-VERSION:3
#EXTINF:9.009,
http://media.example.com/first.ts
#EXTINF:9.009,
http://media.example.com/second.ts
#EXTINF:3.003,
http://media.example.com/third.ts
#EXT-X-ENDLIST
```

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<sup>3</sup> RFC 8216

# Master/Multivariant playlist<sup>4</sup>



<sup>4</sup>About HTTP Live Streaming



```
#EXTM3U
#EXT-X-STREAM-INF:BANDWIDTH=1280000,AVERAGE-BANDWIDTH=1000000
http://example.com/low.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=2560000,AVERAGE-BANDWIDTH=2000000
http://example.com/mid.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=7680000,AVERAGE-BANDWIDTH=6000000
http://example.com/hi.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=65000,CODECS="mp4a.40.5"
http://example.com/audio-only.m3u8
```

---

<sup>5</sup> RFC 8216

```
#EXTM3U
#EXT-X-STREAM-INF:BANDWIDTH=1280000,CODECS="...",AUDIO="aac"
low/video-only.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=2560000,CODECS="...",AUDIO="aac"
mid/video-only.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=7680000,CODECS="...",AUDIO="aac"
hi/video-only.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=65000,CODECS="mp4a.40.5",AUDIO="aac"
main/english-audio.m3u8
```

```
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="aac",NAME="English", \
    DEFAULT=YES,AUTOSELECT=YES,LANGUAGE="en", \
    URI="main/english-audio.m3u8"
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="aac",NAME="Deutsch", \
    DEFAULT=NO,AUTOSELECT=YES,LANGUAGE="de", \
    URI="main/german-audio.m3u8"
```

- ▶ Stream
  - ▶ AAC low complexity (AAC-LC) audio
  - ▶ H.264 Main Profile Level 3.0 video
  - ▶ Codec string: mp4a.40.2,avc1.4d401e

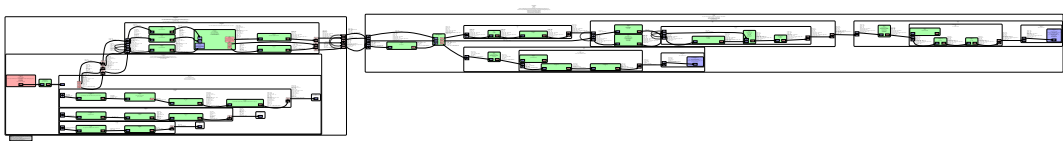
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<sup>7</sup>RFC 8216

```
adaptivedemux2:  hlsdemux2: HLS Demuxer
hls:  hlsdemux: HLS Demuxer
libav:  avmux_hls: libav Apple HTTP Live Streaming muxer
typefindfunctions: application/x-hls: m3u8
```

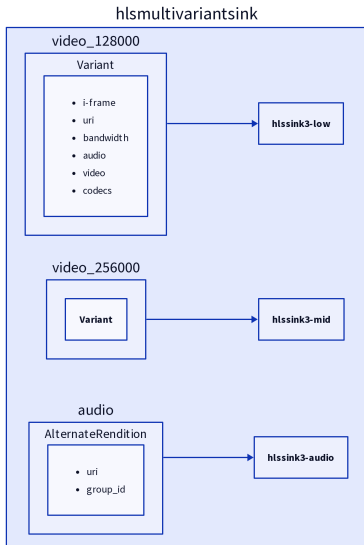
```
gst-play-1.0 https://devstreaming-cdn.apple.com/videos/streaming/examples/img_bipbop_adv_example_ts/master.m3u8
```

# Playback pipeline graph



```
hls:  hlssink: HTTP Live Streaming sink
hls:  hlssink2: HTTP Live Streaming sink
hlssink3:  hlssink3: HTTP Live Streaming sink
hlssink3: hlscmafsink: HTTP Live Streaming CMAF sink
aws:  awss3hlssink: Streams HLS data to S3
```





SINK template: 'video\_%u'

Availability: On request

Capabilities:

ANY

Type: HlsMultivariantSinkPad

Pad Properties:

alternate-rendition : Alternate Rendition

flags: readable, writable, changeable only in  
NULL or READY state

Boxed pointer of type "GstStructure"

variant : Variant Stream

flags: readable, writable, changeable only in  
NULL or READY state

Boxed pointer of type "GstStructure"

- ▶ New GStreamer helper bin `hlsmultivariantsink`
- ▶ Alternate renditions & Variant streams specified via pad properties
- ▶ Generates codec string
  - ▶ For CMAF, uses `codec_utils_caps_get_mime_codec` helper and `codec_data`
  - ▶ For MPEG-TS, parses SPS/PPS from buffers with `gst::BufferFlags::HEADER` set
- ▶ In Rust, uses `m3u8-rs`, `cros-codecs` and `hlscmafsink/hlssink3`
- ▶ Open MR: [!1515](#)

- ▶ Support for
  - ▶ Closed Captions
  - ▶ WebVTT
    - ▶ Open MR: [hlswebvtttsink: !982](#)
- ▶ Helper bin on top of `hlsmultivariantsink`
  - ▶ Generate bit-rate ladder for variant streams
- ▶ LL-HLS

- ▶ Reach out on
  - ▶ email:
    - `hello@asymptotic.io`
    - `sanchayan@asymptotic.io`
  - ▶ Mastodon: [sanchayanmaity.com](https://sanchayanmaity.com)
  - ▶ Blog: [sanchayanmaity.net](https://sanchayanmaity.net)