Are the Streaming Format Wars Over?

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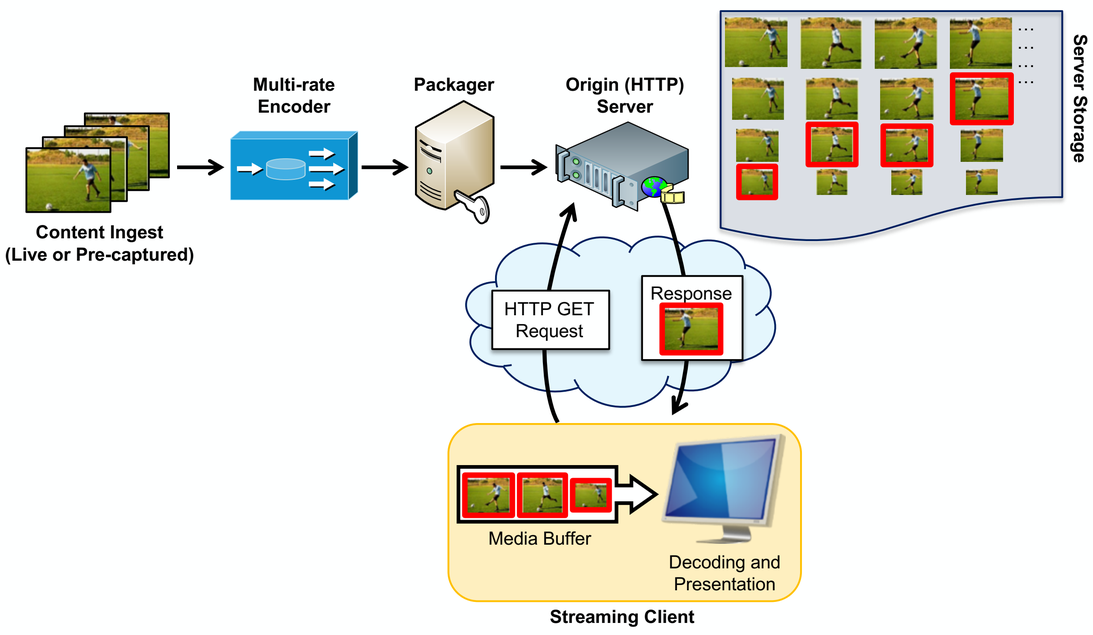
INTERNET VIDEO ESSENTIALS

Reach	Reach all connected devices
Scale	Enable live and on-demand delivery to the mass market
Quality of Experience	Provide TV-like consistent rich viewer experience
Business	Enable revenue generation thru paid content, subscriptions, ads, etc.
Regulatory	Satisfy regulations such as captioning, ratings and parental control

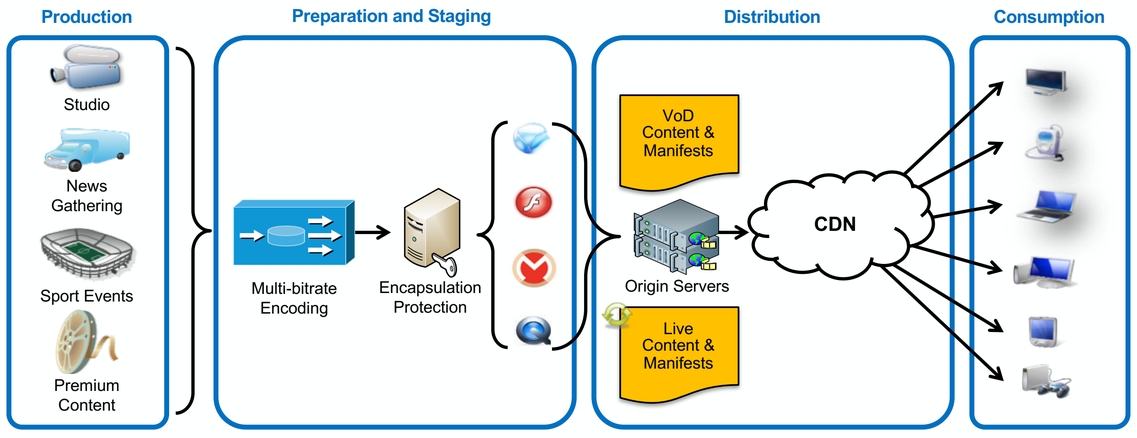
HTTP ADAPTIVE STREAMING



DEAD, SURVIVING, MATURING AND NEWBORN TECHNOLOGIES

- Move Adaptive Stream (Long gone, but some components are in Slingbox)
  - http://www.movenetworks.com
- Microsoft Smooth Streaming (Legacy)
  - http://www.iis.net/expand/SmoothStreaming
- Adobe Flash (Almost dead)
  - http://www.adobe.com/products/flashplayer.html
- Adobe HTTP Dynamic Streaming (Legacy)
  - http://www.adobe.com/products/httpdynamicstreaming
- Apple HTTP Live Streaming (The elephant in the room)
  - https://tools.ietf.org/html/rfc8216
  - https://datatracker.ietf.org/doc/draft-pantos-hls-rfc8216bis/
- MPEG DASH and CMAF (The standards)
  - http://mpeg.chiariglione.org/standards/mpeg-dash
  - http://mpeg.chiariglione.org/standards/mpeg-a/common-media-application-format

END-TO-END WORKFLOW FOR OTT



More packaging $

More storage $

Less efficient caching

THIS RESULTS IN

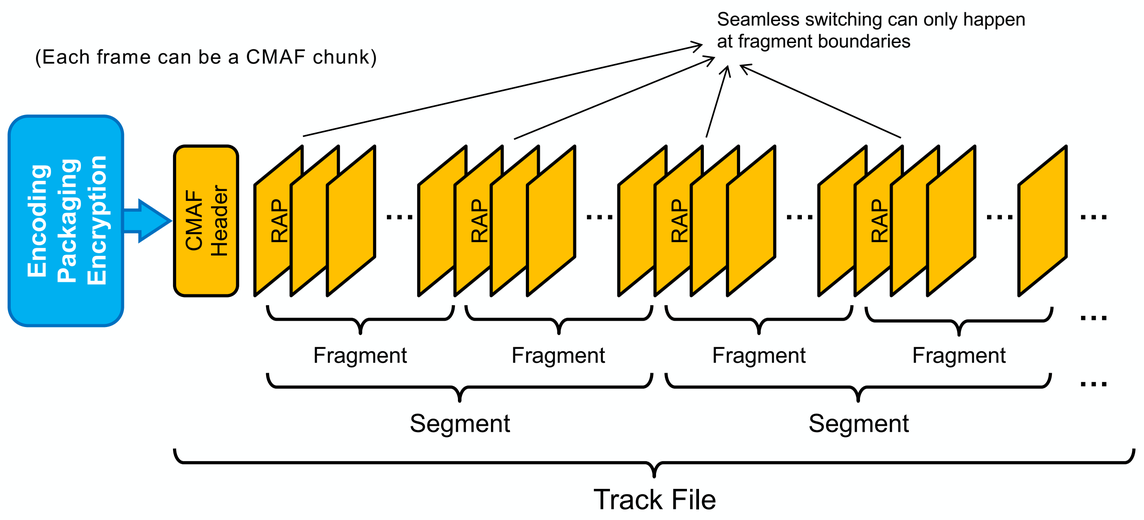
Higher Costs
Less Scalability
Smaller Reach

Frustration
Skepticism
Slow Adoption

COMMON MEDIA APPLICATION FORMAT (CMAF)

- CMAF defines the media format and can be used with any manifest (DASH MPD, HLS playlist, etc.)
- CMAF uses ISO-BMFF and common encryption (CENC)
  - CENC means the media fragments can be decrypted/decoded by devices using different DRMs
  - CMAF does not mandate CTR or CBC mode
- CMAF has media (video, audio, subtitle) and presentation profiles
- Any delivery method may be used for delivering CMAF content
  - HTTP
  - RTP multicast/unicast
  - LTE broadcast
- Current status
  - 1st edition was published in Jan. 2018
  - Supported in iOS 10+ (with HLS playlists)
  - Amd. 1: SHVC media profile and additional audio media profiles
  - Amd. 2: xHE-AAC and other media profiles

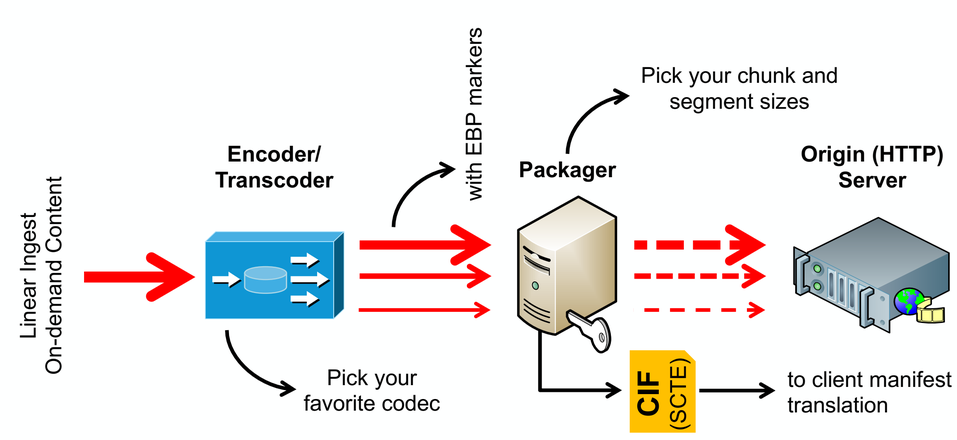
CMAF MEDIA OBJECTS



Manifests may provide URLs to

- Track files
  → curl http://example.com/video.mp4
- CMAF header + segments
  → curl http://example.com/video.mp4 -H “Range: bytes=0-511”
  Download and parse the SegmentIndexBox (sidx) referenced in the manifest to learn the byte ranges of fragments in a CMAF track file
- CMAF header + chunks
  - From the packager, CMAF chunks can be transferred to the origin server using a reliable object delivery protocol
  - On the origin server, once all the respective CMAF chunks are received, the CMAF segment is written to the disk cache and the complete CMAF segment becomes available for the subsequent requests
  - In low-latency mode, after fetching the CMAF header, the streaming client determines and requests the segment closest to the live edge
  - If the origin server is running HTTP/1.1 (RFC 7230)
    - The origin server returns the requested segment via HTTP Chunked Transfer Coding, where each HTTP chunk contains a single CMAF chunk (The particular mapping may vary and is done by the origin server)
  - If the origin server is using HTTP/2 (RFC 7540)
    - Do not use HTTP chunked transfer coding; instead, CMAF chunks can be individually referenced in the manifest and the streaming client fetches them one by one
    - To reduce the request rate, use server push methods (ISO/IEC 23009-6)

ENCODE AND PACKAGE ONCE, DELIVER EFFICIENTLY



NON-HTTP TRANSPORT OPTIONS

RTP Multicast
- Define RTP payload format for CMAF chunks/fragments/segments
- Use RFC 4588 and 6285 for loss recovery and rapid acquisition

Broadcast
- TS 26.346 and TS 26.347: Delivering DASH content via MBMS
- A/331:2017: Carrying DASH content over broadcast and/or broadband networks

Peer-to-Peer
- WebRTC: Clients fetch DASH/CMAF pieces from each other in addition to CDN servers
- This helps reduce the load on the CDN as well as the stream start times

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