Redundant Encoding and Packaging for Segmented Live Media

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ABSTRACT

We present the MPEG standardization activity on redundant encoding and packaging for live segmented media. The standardization includes profiling the Dynamic Adaptive Streaming over HTTP (DASH) Media Presentation Description for ingest, storage and redundant packaging applications. Further, a Common Media Application Format (CMAF) segment and track format is defined to support redundant encoding and packaging using a common timeline relative to the Unix epoch. The standardization is still ongoing and we solicit feedback from academic and industry practitioners.

CCS CONCEPTS

• **Networks** → **Application layer protocols**; • **Information systems** → *Multimedia streaming*.

KEYWORDS

MPEG, DASH, HLS, ingest, contribution, failover, REaP.

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OVERVIEW

Enabling truly fault-tolerant and distributed workflows is critical for the online delivery of broadcast media. Workflows typically include two or more encoders and two or more origin or packager servers that need to produce interchangeable and synchronized outputs.

In July 2021, a workshop was organized on Redundant Encoding and Packaging (REaP). Around 100 practitioners attended the workshop, and significant feedback enabled the development of a specific set of requirements and use cases for initiating the REaP standardization activity in MPEG. The use cases and requirements [3] and the Call for Proposals [2] were published in early 2022. This activity aims to standardize formats generated by distributed encoders and packagers to enable interoperable workflows. In addition, topics around the interoperable storage of content archives are considered. The standardization activity was initiated later in 2022, and REaP is currently at the Committee Draft (CD) stage [4].

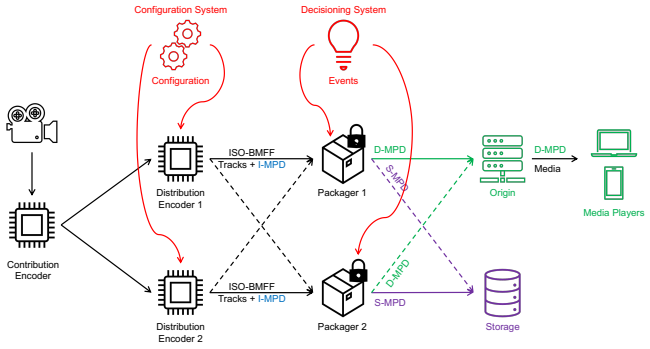

Figure 1: Redundant encoding and packaging (REaP) workflow.

Figure 1 illustrates the current scope of REaP. It is assumed that a single contribution signal is used to feed two or more distribution encoders and that this signal contains input timing information. REaP defines CMAF [1] track segment format constraints for redundant encoding and packaging of segmented media. The most significant constraint to the segment format is the introduction of the common timeline origin of epoch 1-1-1970 (excluding leap seconds) and a track segmentation constraint resulting in consistent segment durations and aligned segment boundaries. Using REaP, any distribution encoder joining a session can compute and encode segments with a corresponding earliest segment presentation time, as demonstrated in [5]. REaP segments received from different distribution encoders are interchangeable. The track format also contains general features for ingest, such as signaling missing content, the last segment and insertion of timecodes using Producer Reference Time.

Additionally, REaP defines the Ingest Media Presentation Description (I-MPD). The I-MPD describes the representations in a presentation a priori and is intended to be read by a packager or origin server (not a media player). The I-MPD is fully DASH compliant with additional constraints in the signaling to make the I-MPDs interchangeable and enable interpretation by packaging or origin servers.

Furthermore, REaP defines a Delivery MPD (D-MPD) generated by redundant packagers. A D-MPD is interchangeable between different origin or packager servers for media players and can be played as a regular MPD. Redundant packaging is achieved by additional constraints on the output D-MPD generated by distributed sources (avoiding potential race conditions). Formats for HTTP Live Streaming (HLS, [6]) are also defined. Finally, REaP also defines a storage format (S-MPD) for large-scale asset storage, useful, for example, for cloud storage of content archives.

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