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Adaptive Transport Stream

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1 INTRODUCTION

1.1 Overview

There are a variety of Adaptive Streaming wire formats. Some are based on an MPEG-2 Transport Stream container such as HLS (HTTP Live Streaming: Apple) and others on a fragmented MP4 container such as HSS (HTTP Smooth Streaming: Microsoft) and HDS (HTTP Dynamic Streaming: Adobe); whereas DASH (Dynamic Adaptive Streaming over HTTP: MPEG) supports both containers. While different, they utilize common video and audio compression formats; namely: ISO/IEC 14496-10 (AVC) and ISO/IEC 14496-3 (AAC). Additional audio formats, such as Dolby Digital Plus and DTS-HD, *may* also be supported by these or a subset of these Adaptive Bit Rate (ABR) formats.

In a unified ABR encoding and packaging system, video and audio data are encoded and conditioned for adaptive streaming purposes and the resultant elementary compressed access units are fed to one or more ABR packagers or encapsulators to be formatted into ABR-specific wire formats.

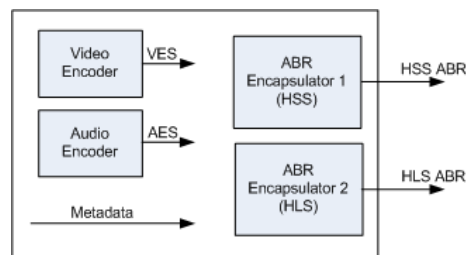


Figure 1 - Unified Transcoder/Packager

The Adaptive Transport Stream (ATS) format described in this specification allows for streaming/storage of adaptive streaming content originating as Transport Streams in a generic manner without restricting this to a particular adaptive streaming delivery technology (HSS/HLS/HDS). As Figure 2 illustrates, this allows for a separation of the transcoding process from the encapsulation process that produces ABR-specific formats.

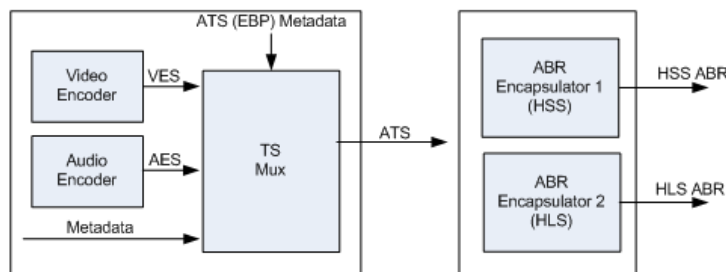


Figure 2 - Separate Transcoder/Packager with ATS between

This specification defines a fully **compliant** continuous single program MPEG-2 Transport Stream which follows the HRD model and provides markers in the stream through the use of PES frame encapsulated *af*_descriptors (adaptation field descriptors) [11]. These markers identify conditioned points in the stream that are virtual segments that can be partitioned into segments used for ABR applications [11]. Downstream encapsulation is expected to re-encapsulate an ATS, which *may* involve partial or complete de-encapsulation (demux) prior to encapsulating into a target ABR format. Since this downstream encapsulation does no re-encoding of the media data, the video and audio access units in the ATS need to be pre-conditioned for adaptive streaming purposes [in accordance with section 8 of this specification]. Additionally this specification defines *af*_descriptor metadata, Boundary Descriptor /Labeling Descriptor/Timeline Descriptor and collectively called Encoder Boundary Points (EBP) data [as defined in section 7.5], that are injected and carried in the transport stream layer to provide adaptive boundary information to downstream processing tasks. The EBP data provides a hinting mechanism for taking continuous streams conditioned for adaptive streaming and creating discrete chunks of decodable content with boundaries in one

component stream in the multiplex (Fragment) or across the multiplex (Segment). This specification also references additional PMT descriptors as specified in 13818-1 [11] that may be carried in the ATS for informative purposes to describe the various conditioning and boundary points used in the stream(s). Lastly, structural information on a related set of ATS streams *may* be carried through an ATS Source Description.

The EBP data contained within an ATS stream is carried as data descriptors of the public adaptation field (af_descriptors) of an MPEG-2 TS packet for video or audio and can be applied to each video packetized elementary stream (PES) and audio PES packet, resolved down in many cases to a single Video access unit (AU) or a group of audio AUs [11]. It contains a set of af_descriptors to indicate Boundary, Labeling, and Timeline information.

1.2 Purpose of Document

The purpose of this document is to define an ATS stream, the boundary points within it, both explicit and implicit, how boundary points map to various ABR formats such as HSS Fragments and HLS Segments (both in the video and audio domain), and the time stamps, durations and byte ranges of these chunks.

To that end, a significant portion of this document describes the basic requirements for adaptive video and audio conditioning. These sections detail conditioning considerations such as varying frame rates, advertising splice points and input loss handling.

1.3 Scope

This standard describes the requirements and constraints on a single program transport stream (SPTS) that allow it to be used as an Adaptive Transport Stream, including stream conditioning and signaling of segment boundary points. Typically, multiple ATSS will be generated from a single input and sent to a packager, recorder or other device. The EBP structure can be inserted at the time of encoding or added during the transcoding process. This specification does not describe how an ATS is stored or how it *may* be converted to target delivery formats.

This document describes the wrapping, chunking, and conditioning of packetized elementary streams carried over MPEG-2 TS. These elementary streams are codec independent and could carry AVC, HEVC, or even MPEG-2 video. Reference is made to SCTE 128 [3][33] to be compliant with MPEG-2 Systems layer constraints on the use of adaptation field public data.

These created ATS streams are then sent to a packager(also called a fragmentor or encapsulator) directly or stored to be sent to a packager upon request at a later time. Upon receiving such streams, an packager then processes these streams with EBP data and produces chunks according to the one or more adaptive streaming encapsulating technologies.

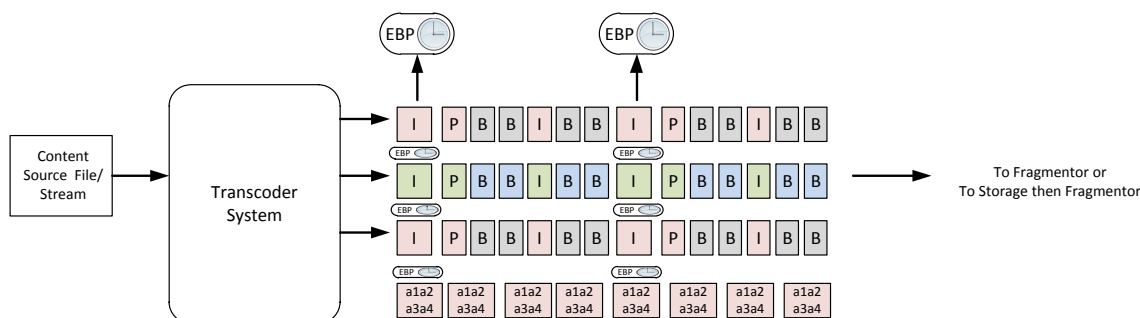


Figure 3 – ATS Streams with EBP data inserted at transcoder