

Designed for next-generation media processing and delivery workflows

Interra Systems' MPEG-2 Transport Stream Analyzer for Content Validation and Quality Assurance

Addressing a Critical Industry Need

Introduction

MPEG-2 transport stream (MPEG-2 TS) is a widely used container format for transmission and storage of compressed video. MPEG-2 TS specifies how to multiplex the audio, video, and other auxiliary data for a given TV program or an on-demand video file. An MPEG-2 TS can contain multiple videos, and the standard allows packetized elementary streams to form a complete transport stream. For a video service operator, this increases bandwidth efficiency since multiple TV programs can be sent via a single channel. MPEG-2 TS continues to be the de-facto video delivery standard for ATSC, DVB, and IPTV video systems and is also used by some OTT service providers.

Transport streams contain the actual video and audio packets as well as key information regarding each video service and program, enabling decoders to properly decode and present the data to viewers. The elementary streams of audio and video are encapsulated to form a packetized elementary stream. After packetization, they are multiplexed into a serial stream known as a transport stream. At one time, a 188-byte packet is transmitted. On the receive side, the stream is decoded, and individual audio and video data is extracted and displayed on the user device.

Some of the critical errors and important tables and parameters that contain data of significant consequence. These must be monitored and analyzed to ensure flawless delivery of MPEG-2 transport streams.

- **Program ID (PID):** PID is a unique identifier for the program and tells the decoder which program a particular elementary stream belongs to.
- **Program Association Table (PAT) and Program Map Table (PMT):** A transport stream's PAT is a listing of which PIDs contain the program map tables (PMTs). The PMT contains the list of audio and video PIDs that comprise programs in the transport stream. It also has a Program Clock Reference for each program.
- **Packetized Elementary Streams (PES):** The PES packets contain the actual audio and video data
- **Program Clock Reference (PCR):** PCR is used for the synchronization between the encoder and the decoder clock. If this synchronization is not properly maintained video-audio will be out of sync, and video might not be displayed correctly, directly affecting the viewers' quality of experience.
- **Transport Stream Target Decoder (T-STD) for buffer analysis:** In MPEG-2 TS, since different types of data are multiplexed and come in different packets, there is a possibility of introducing a delay in the transmission. This requires a proper buffering mechanism at both encoder and the decoder points. The MPEG-2 standard contains specifications for calculating buffer size (e.g., the VBV parameter specifies how much buffering is needed for a given elementary stream). Both the encoder and the decoder must adhere to these specs for proper synchronization.
- **TR 101 290:** The TR 101 290 guidelines define the measurements that are required for transport stream integrity. There are three levels of priority for the errors in a transport stream. Priority 1 error basically is a no-go; the signal might be illegal, with major faults that may mean the picture cannot be displayed. Priority 2 errors occur when the TS may be structurally fine, but the individual program cannot be played correctly. Priority 3 errors are where the main audio-video data can be presented correctly but there are errors in the supplemental data.

Why Having a Transport Stream Analyzer is Essential

Due to the complexity involved in packetizing and multiplexing elementary streams and the transport streams, tools that provide deep visibility into transport streams have become essential for ATSC, DVB, and IPTV video providers. Using such tools video providers can troubleshoot streaming media as well. OTT video is close to becoming the dominant media delivery format. For example, the Apple HTTP Live Streaming (HLS) protocol uses MPEG-2 TS for encapsulating the ABR segments. Errors in the transport stream will result in issues, such as video tiling, lip sync errors, and audio problems, thus directly affecting viewers' quality of experience. MPEG-2 TS analyzers provide critical insights into a transport stream's logical structure, including teletext, subtitling, and the actual audio and video content. This information helps with error detection and troubleshooting of compressed media.

Introducing VEGA Vista: A TS Analyzer for the Next-Generation Video Workflow

MPEG compression systems are inherently complex and prone to errors as the video goes through multiple processing stages, often requiring a full decode and re-encode, before it reaches the final destination. Although the MPEG-2 TS standard has been in existence for more than two decades and has largely remain unchanged, video equipment and service providers are dealing with new and evolving test environments and delivery workflows.

New audio and video formats have emerged over the years, such as HEVC and AV1. These new data delivery formats require organizations to test the compressed video on a continuous basis. On top of this, the volume of content organizations are handling is ever increasing, which necessitates a more efficient way to test transport streams.

Typically, transport stream analyzers are available on stand-alone hardware that performs offline or real-time MPEG-2 TS analysis. Over the last few years, the industry is seeing a new trend where professionals involved with content preparation and delivery prefer automated workflows as opposed to manual intervention. This is driving the shift toward software-based, more powerful analyzers that can perform fast analysis on large volumes of data and support virtual machine (VM) and cloud environments.

Interra Systems' VEGA Vista is a software application for checking end-to-end compliance and performing debug and analysis of TS. Using VEGA Vista, media professionals can create customized profiles for different types of errors via a user-friendly GUI and get conformance reports outputted in XML/HTML format. VEGA Vista is easy to deploy it in an automated workflow, as it can run as a separate microservice, performing MPEG-2 TS file validation.



