DRAFT

Encapsulation of Dirac Video content and time-code markers in ISO/IEC 13818-1 Transport Streams

Revision History

Date	Changes
22 Sept 2006	Initial Draft
27 Jan 2007	Modifications based on BBC feedback: ● Remove dirac_descriptor() in favour of a Registration Descriptor for stream identifcation ● Use stream_id_extension and stream_id 0xFD. ● Remove specification of the timecode stream in favour of storing timecodes directly within the Dirac elementary stream.

Contents

1 Introduction

1.1 Purpose

This recommendation addresses the combination of Dirac video content with MPEG content in an ISO/IEC System Transport Stream. It also outlines a byte format for describing time-code information for each video frame, stored in a separate private data stream in the Transport Stream encapsulation.

The approach taken is to define values for Stream Type from the range of values specified in the ISO/IEC 131818-1 document as reserved for private implementation use and couple those with a custom stream descriptor to aid in identifying Dirac video and time-code streams at the decoders.

This approach may change in the future if a later revision of the Transport Stream specification includes an official identifier for Dirac video content.

1.2 Scope

This document should be read in conjunction with the ISO/IEC 13818-1 Systems and Dirac Video specifications. It documents extensions to the Transport Stream syntax, but is not intended to describe the entire Transport Stream. Inclusion of other audio/video content in a Transport Stream is as normally described in the ISO/IEC 13818 specifications.

Information about the Dirac video format is available from http://dirac.sf.net

Information about ISO/IEC specifications can be obtained from http://iso.org

1.3 Status

Draft of 15 February 2007. This mapping document is not yet finalised and the details are subject to change.

1.4 Additional References

ISO/IEC 13818-1:2000, *Information technology -- Generic coding of moving pictures and associated audio information: Systems*

ISO/IEC 13818-1:2000 Amd 2, *Information technology -- Generic coding of moving pictures and associated audio information: Systems*

ISO/IEC 13818-2:2000, *Information technology -- Generic coding of moving pictures and associated audio information: Video*

Dirac Video Specification 0.10.1, http://dirac.sf.net

1.5 Dirac Video

Dirac is a video compression system utilising wavelet transforms and motion compensation.

It is designed to be simple, flexible, yet highly effective. It can operate across a wide range of resolutions and application domains, including: internet and mobile streaming, delivery of standard-definition and high-

definition television, digital television and cinema production and distribution, and low-power devices and embedded applications.

2 Definitions

2.1 Terms and Abbreviations

2.1.1 **access unit**: A unit of coded presentation data. Access Units provide points at which the stream may be randomly accessed. In the case of MPEG-2 video, an access unit includes all the data for a picture and any stuffing that follows it, up to but not including the start of the next access unit.
For audio, an access unit is the coded representation of an audio frame.
For Dirac video, an access unit begins with a Dirac access unit header.
2.1.2 **Dirac video stream**: A stream of encoded video data as described in the Dirac Video Specification
2.1.3 **Packetised Elementary Stream**: An elementary stream divided up into logical packets as needed by the requirements of the particular stream.
2.1.4 **PES**: Abbreviation for Packetised Elementary Stream
2.1.5 **PES packet**: The basic unit of transmission for an Elementary Stream as defined in the ISO/IEC 13818-1 Systems specification. It consists of a PES packet header followed by a PES packet payload.
2.1.6 **PES Stream**: A sequence of related PES packets identified by the assigned PID
2.1.7 **PID**: A integer value used to identify the contents of each packet in a Transport Stream
2.1.8 **PMT**: Abbreviation for Program Map Table
2.1.9 **Program Map Table**: An ISO/IEC 13818-1 data structure which describes the contents of each elementary stream. (see ISO/IEC 13818-1)
2.1.10 **reserved**: The term “reserved” is used in bitstream specifications to indicate values that may be used in future extensions. Unless otherwise specified, all reserved bits should be set to '1'.

2.2 Bitstream Descriptions

Bitstream elements are described using a simple pseudo-code. Data items in the bitstream are identified in **bold** type, and are described by their name, length in bits and a mnemonic for the type. All types are described in big-endian most-significant-bit first order.

The description of optional or conditional elements uses a C-like pseudocode syntax, and relies on state variables that are explained in the corresponding text. Conditional data element constructs may be nested.

The following constructs are used to express the conditions when such data elements are present:

```
while ( condition ) {                  If the condition is true, then the group of data elements occurs next in
        data_element                   the data stream and repeat until the condition is not true.
                ...
}
if ( condition ) {                     If the condition is true, the set of data elements in the first clause occur
        data_element                   next in the data stream.
                ...
}
```

else {	
data_element ...	If the condition is false, then the data elements in the second clause occur next in the data stream.
}	

for (i = 0; i < N; i++) {
data_element
...
}
	Indicates that the group of data elements occurs 'N' times in the data stream. Nested conditional constructs may rely on the value of the loop control variable 'i', which is set to 0 for the first iteration on the loop, which is incremented by 1 for each iteration thereafter.

data_element []	data_element [] is an array of data. The number of data elements is indicated by the context
data_element [m..n]	is the inclusive range of bits between bit m and bit n in the data_element

2.3 Mnemonics

bits	Sequence of bits, written left to right from most to least significant bit.
uint	Unsigned integer, most significant bit first.

3 General

3.1 Signalling of Dirac Elementary Streams

The presence of MPEG-2 Elementary Streams carrying Dirac video elementary stream data shall be signaled in a Program Map Table as defined in ISO 13818-1 with Corrigendum 2 and Amendment 2.

3.1.1 Stream Type

The stream_type value in the Transport Stream Program Map Table (PMT) describing a Dirac video elementary stream should be set to 0xD1. This value has been taken from the range reserved in ISO 13818-1 for the carriage of private data streams.

The scope of this private value shall be captured by means of the Registration Descriptor defined below.

3.1.2 Registration Descriptor

At least one MPEG-2 **registration_descriptor()** shall be present in the inner descriptor loop of the MPEG-2 Program Element listed in the **TS_program_map_section()** corresponding to the Dirac video elementary stream.

The syntax and semantics for this descriptor appears in Table 1 and the subsequent text.

Table 1 – Syntax for **registration_descriptor ()**

Syntax	Value, if specified	No of bits	Mnemonic
registration_descriptor() {			
descriptor_tag	0x05	8	uint
descriptor_length		8	uint
format_identifier	0x64726163	32	uint
}			

descriptor_tag: This field shall take the value 0x05 to identify this descriptor as an MPEG-2 registration descriptor.

descriptor_length: This 8-bit field specifies the number of bytes of the descriptor immediately following the descriptor_length field.

format_identifier: The value for this 32-bit field shall be 0x64726163, which is the hexadecimal representation of the ASCII values for the string 'drac'

3.2 Encapsulation of Dirac Elementary Streams

The basic unit of transmission for Elementary Streams in a Transport Stream is the PES packet. Each PES packet consists of a PES packet header, followed by some number of payload bytes. The number of bytes of payload per packet is derived from the packet size encoded in the PES header, and may be up to 65535 bytes, or for Video Elementary Streams may be unbounded.

Dirac coded data encapsulated in PES packets shall comply with PES encapsulation procedures defined by ISO13818 in conjunction with its Corrigendum 2 and Amendment 2. ISO 13818-1 Amendment 2 provides an extension to the PES packet header structure for carring a **stream_id_extension** value. The stream_id_extension shall be used with PES packets carrying Dirac elementary stream content.

To improve random access to the stream, it is advantageous to coincide the start of a PES packet with a Dirac Parse Unit, although this is not required.

The layout of the PES packet header is specified in ISO/IEC 138181-1. For the purposes of this mapping, the interesting elements of the header are described below. All other fields not described below shall retain the definitions given in ISO 13818-1 in conjunction with Corrigendum 2 and Amendment 2.

3.2.1 PES_packet_length

The semantics of ISO 13818-1 associated with a PES_packet_length field of 0 shall be extended to Dirac video elementary streams.

PES_packet_length – A 16 bit field specifying the number of bytes in the PES packet following the last byte of the field. A value of 0 indicates that the PES packet length is neither specified nor bounded and is allowed only in PES packets whose payload is a video elementary stream contained in Transport Stream packets. This definition shall be applicable to Dirac video streams.

3.2.2 Stream ID

For Dirac video content, the value for **stream_id** shall be set to 0xFD to indicate the use of the stream_id_extension mechanism described in ISO 13818-1 Amendment 2.

3.2.3 Timestamps (PTS & DTS)

PTS & DTS - Presentation Timestamp and Decoding Timestamps. The PTS and DTS (if coded) refer to the timestamps associated with the first picture packet that begins within the first access unit that starts in the payload of the PES packet.

3.2.4 Extension Flags

Dirac video streams encapsulated in PES packets use the **stream_id_extension** to provide unambiguous identification of Dirac content. The use of this field requires providing proper values for the following three flags:

- The **PES_extension_flag** field shall be set to '1' to indicate the insertion of extensions in the PES packet header.
- The **PES_extension_flag_2** field shall be set to '1' to indicate the insertion of the second group of extensions in the PES packet header.
- The **stream_id_extension_flag** field shall be set to '0' to indicate the insertion of a valid **stream_id_extension** field.

3.2.5 Stream ID extension

For Dirac elementary streams, the stream_id_extension_flag field defined in ISO 13818-1, Amendment 2 shall have any value in the range 0x60 to 0x6F. These values are defined within the allowed private range in ISO 138181-1, Amendment 2.