Encapsulation of Dirac in ISO Base Media file format derivatives

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British Broadcasting Corporation

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Foreword

The British Broadcasting Corporation is a public service broadcaster based in the United Kingdom. Its network includes several TV and radio channels as well as a popular Internet web site.

The BBC's research department (formerly BBC Research & Development) has invented a video compression system called Dirac that is well suited to a large range of applications; from low bitrates (e.g. web streaming) to high and very high bitrates (e.g. broadcasting and video production).

A constrained profile of Dirac aimed at video production applications is being standardised by the SMPTE as (S2042) VC-2.

Further information on the activities of the BBC's research department are presented at: `<http://www.bbc.co.uk/rd/>`

Introduction

This document addresses the need to store Dirac coded bytestreams in file formats derived from the ISO base media file format such as the MP4 file format.

Encapsulation of Dirac in ISO Base Media file format derivatives

1   Scope

This specification defines the semantics required to reliably encapsulate Dirac coded bytestreams in formats compliant to the ISO base media file format.

The following are outside the scope of this document:

— encapsulation of Dirac in QuickTime files

2   Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this Encapsulation of Dirac in ISO Base Media file format derivatives. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this Encapsulation of Dirac in ISO Base Media file format derivatives are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 14496-12:2005, *Information technology – Coding of Audio-Visual Objects – Part12: ISO Base Media File Format* (Technically identical to ISO/IEC 15444-12)

Dirac Video Specification, *<http://www.diracvideo.org/specification>*

3   Terms and definitions

3.1
Data Unit
An object in a Dirac bytestream

4 File identification

4.1 File type (ftyp) box

The presence of the brand 'drc1' in the compatible_brands list indicates conformance with this specification.

This specification does not define the use of 'drc1' as a major_brand.

5 Storage of Dirac

This clause specifies the sample structure used to store Dirac bytestreams inside the ISO Base Media file format and derivatives.

NOTE   The following subclauses do not alter the box quantity value in the base specifications

5.1 Handler Reference (hdlr) Box

Samples of Dirac data shall be referenced from a track with handler_type 'vide'

5.2 Sample Description (stsd) box

Samples of Dirac data shall be identified by a VisualSampleEntry class with codingname 'drac'.

The frame_count field of the VisualSampleEntry class shall have the meaning as in ISO/IEC 14496-12.

The VisualSampleEntry class is not extended further by this standard.

NOTE   Future revisions of this standard may extend the VisualSampleEntry class

5.3 Definition of a sample containing Dirac

The unit of muxing in isom/mp4 is the sample; a sample of Dirac shall contain:

—   zero or more non-picture Dirac data units

followed by a single:

    —   Dirac picture data unit

OR —   Dirac end-of-sequence data unit

NOTE   It follows that no Dirac data unit shall span multiple samples.

Samples are numbered in stream coded (= decoding) order.

5.4 Sync Sample (stss) box

A sample of Dirac is a sync sample when the sample contains both:

—   A Dirac sequence header data unit, and

—   A Dirac intra picture data unit

– that are not separated by a Dirac end-of-sequence data unit.

5.5 Shadow Sync Sample (stsh) box

Use of the shadow sync sample box introduces severe complexities and restrictions; its use is discouraged. The ISO Media file format implicitly permits the following:

— a sample of Dirac shadowing a sample of Dirac

— a sample of Dirac shadowing a non-Dirac sample

— a non-Dirac sample shadowing a sample of Dirac

5.5.1 a sample of Dirac shadowing a sample of Dirac

When both the shadowed_sample_number and sync_sample_number refer to a sample of Dirac, the muxer must guarantee that:

— The all picture decoding dependencies may be satisfied

— Correct picture number

NOTE   Use of a shadow sync sample in this form will cause a decoder next/prev parse_offset mismatch

The shadow sample shall contain, in this order:

— A Dirac end-of-sequence data unit

— A Dirac sequence header data unit

— A Dirac (intra) picture data unit

5.5.2 a sample of Dirac shadowing a non-Dirac sample

If the shadowed_sample_number does not refer to a sample of Dirac, and the sync_sample_number is a sample of Dirac, the shadow sample shall contain, in this order:

— A Dirac end-of-sequence data unit

— A Dirac sequence header data unit

— A Dirac (intra) picture data unit

5.5.3 a non-Dirac sample shadowing a sample of Dirac

Since the non-Dirac sample is of no use to subsequent samples of Dirac, a muxer must provide the guarantee that shadowed_sample_number+1 meets the requirements of being a Sync Sample (see clause 5.4).

5.6 Degradation Priority (stdp) box

A priority of 0xffff indicates that a sample should not be degraded; otherwise the priority should be the number of samples between this and the last sample in the picture prediction dependency chain.

EXAMPLE 1   A priority of 0 indicates a sample has no dependants.

EXAMPLE 2   A priority of 24 indicates a sample's last dependant is in 24 samples time.

5.7 Padding Bits (padb) box

No padding bits are required for samples of Dirac (They are implicitly byte aligned). If a Padding Bits box is present, the number of padding bits shall be zero for samples of Dirac.

5.8   Use of AVC Extensions

The AVC extension boxes may be applied to Dirac samples. If AVC extension boxes are present, the brand 'avc1' should be listed in the compatible_brands list (in addition to 'drc1').

5.8.1   Independent and Disposable Samples (sdtp) box

Samples of Dirac are currently unable to contain multiple [redundant] encodings; sample_has_redundancy shall be zero (unknown).

5.8.2   Random access recovery points

This clause is applicable to some forms of Dirac video.

5.8.3   Sub-sample Information (subs) box

While Dirac does not have a notion of sub data units; multiple data units to exist within a sample. It may be appropriate in some circumstances to supply information about these sub-samples.

6   RTP Hint tracks

There is currently no mapping for Dirac over (S)RTP. Samples of Dirac therefore do not support RTP hinting.

NOTE   A future revision of this document will revise this clause