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Information technology — Coded representation of immersive media —

Part 10:
Carriage of visual volumetric video-based coding data

AMENDMENT 1: Support of packed video data

Technologies de l'information — Représentation codée de média immersifs —

Partie 10: Transport de données de codage basé sur la vidéo volumétrique

AMENDEMENT 1: Support de données vidéo comprimées

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

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Information technology — Coded representation of immersive media —

Part 10:
Carriage of visual volumetric video-based coding data

AMENDMENT 1: Support of packed video data

Normative references

Add the following reference:

ISO/IEC 14496-1, *Information technology — Coding of audio-visual objects — Part 1: Systems*

Update the reference ISO/IEC 23090-5:2021 to ISO/IEC DIS 23090-5:2021[1]).

Clause 3

Add a reference to ISO/IEC 14496-1 and ISO/IEC 14496-12 to the introductory sentence as follows:

For the purposes of this document, the terms and definitions given in ISO/IEC 14496-1, ISO/IEC 14496-12, ISO/IEC 23090-5 and the following apply.

3.2

Replace the definition of 3.2 and note 1 to entry as follows:

V3C content

volumetric media that is encoded using V3C or its derived specification

Note 1 to entry   V3C is defined in ISO/IEC 23090-5 and an example of derived specification is ISO/IEC 23090-12.

5.3.5, Table 5

Replace the V3C configuration item property four character code value 'v3cp' with 'v3cC'.

5.3.6, Table 6

Add the following new row at the bottom of Table 6:

v3vp	7.4.6.3	Referenced track is a V3C video component track carrying packed data

---

1)   Under preparation. Stage at the time of publication: ISO/IEC DIS 23090-5:2021.

Clause 6

Replace the entire clause with the following text:

Volumetric media related descriptions and definitions in ISO/IEC 14496-12:2022 apply.

7.2.1.1

Replace the first dashed item in the list with the following:

— `num_of_v3c_parameter_sets` in `V3CDecoderConfigurationRecord` shall be equal to 1.

Add a new dashed item in the list:

— NAL units of the same type and with the same `array_completeness` value should always be stored in a single setup unit array.

7.2.1.3

After the semantic definition of `v3c_parameter_set_length` add the following note:

NOTE v3c_parameter_set_length syntax element defined in ISO/IEC 23090-5 can be represented by up to 64 bits, this document limits the representation of the information to 16 bits as it suffice in practical implementations.

7.2.1.2

Replace the syntax for V3C decoder configuration record to include version explicitly as follows:

```
aligned(8) class V3CDecoderConfigurationRecord(unsigned int version) {
   if(version == 0){
      unsigned int(3) unit_size_precision_bytes_minus1;
      unsigned int(5) num_of_v3c_parameter_sets;
      for (int i=0; i < num_of_v3c_parameter_sets; i++) {
         unsigned int(16) v3c_parameter_set_length;
         // v3c_unit() as defined in ISO/IEC FDIS 23090-5
         v3c_unit v3c_parameter_set(v3c_parameter_set_length);
      }
      unsigned int(8) num_of_setup_unit_arrays;
      for (int j=0; j < num_of_setup_unit_arrays; j++) {
         unsigned int(1) array_completeness;
         bit(1) reserved = 0;
         unsigned int(6) nal_unit_type;
         unsigned int(8) num_nal_units;
         for (int i=0; i < num_nal_units; i++) {
            unsigned int(16) setup_unit_length;
            // nal_unit(size) as defined in ISO/IEC FDIS 23090-5
            nal_unit setup_unit(setup_unit_length);
         }
      }
   }
}
```

7.2.1.3

Update the semantics related to `setup_unit` as follows:

`setup_unit` contains a NAL unit according to related `nal_unit_type`. When present in `setup_unit`, `NAL_PREFIX_ESEI`, `NAL_PREFIX_NSEI`, `NAL_SUFFIX_ESEI`, or `NAL_SUFFIX_NSEI` contain SEI messages of a 'declarative' nature, that is, those that provide information about the stream as a whole.

7.2.2.2

Replace the syntax for V3C configuration box to pass version information to V3C decoder configuration record as follows:

```
class V3CConfigurationBox extends FullBox('v3cC', version = 0, 0) {
   V3CDecoderConfigurationRecord decoder_config(version);
}
```

7.2.2.3

Replace entire contents of the subclause with the following:

decoder_config contains a single instance of V3CDecoderConfigurationRecord which is defined in subclause 7.2.1

7.3.2.1

Replace the second and third paragraphs with the following text:

A V3C bitstream track sample entry shall contain a V3CConfigurationBox, as defined in subclause 7.2.2, with the following restrictions:

— under the 'v3e1' sample entry, the value of array_completeness shall be 1 for arrays containing atlas parameter sets,

— under the 'v3eg' sample entry, the value of array_completeness should be 0 for arrays containing atlas parameter sets.

7.4.1

Replace the last paragraph and dashed items with the following:

A multi-track encapsulated V3C data container shall include the following:

— One or more V3C atlas track(s) which may include track references:

   — to other tracks carrying the payloads of video compressed V3C units (i.e., V3C unit types equal to V3C_OVD, V3C_GVD, V3C_AVD, or V3C_PVD as specified in ISO/IEC 23090-5)

   — to V3C atlas tile tracks

   — to other V3C atlas tracks when multiple atlases are present in the bitstream

   Zero or more V3C video component tracks where the samples contain access units of a video-coded elementary stream for occupancy data (i.e., payloads of V3C units of type equal to V3C_OVD as specified in ISO/IEC 23090-5).

— Zero or more V3C video component tracks where the samples contain access units of video-coded elementary streams for geometry data (i.e., payloads of V3C units of type equal to V3C_GVD as specified in ISO/IEC 23090-5).

— Zero or more V3C video component tracks where the samples contain access units of video-coded elementary streams for attribute data (i.e., payloads of V3C units of type equal to V3C_AVD as specified in ISO/IEC 23090-5).

— Zero or more V3C video component tracks where the samples contain access units of video-coded elementary streams for packed data (i.e., payloads of V3C units of type equal to `V3C_PVD` as specified in ISO/IEC 23090-5).

7.4.2.1

Replace the text associated with dashed items with following:

V3C atlas tracks use `V3CAtlasSampleEntry` which extends `VolumetricVisualSampleEntry` with a sample entry type of `'v3c1'`, `'v3cg'`, `'v3cb'`, `'v3a1'`, or `'v3ag'`. Following restrictions are set for V3C atlas tracks:

— A V3C atlas track shall not carry ACL NAL units belonging to more than one atlas.

— A V3C atlas track sample entry contains a `V3CConfigurationBox`, as defined in subclause 7.2.2, and a `V3CUnitHeaderBox`, as defined in subclause 7.2.3.

NOTE   V3C atlas tracks with sample entry type `'v3cb'`, `'v3a1'` and `'v3ag'` are relevant for carrying multiple atlases.

Depending on V3C bitstream content or sample entry type of the atlas track, following restrictions are placed on V3C atlas tracks:

— When the V3C bitstream contains a single atlas, a V3C atlas track with sample entry `'v3c1'` or `'v3cg'` shall be used.

— When the V3C bitstream contains multiple atlases, each atlas bitstream shall be stored as a separate V3C atlas track with the sample entry type `'v3a1'` or `'v3ag'`. One additional track with the sample entry type `'v3cb'` shall be present, which is the entry point track referencing the other atlas tracks with `'v3a1'` or `'v3ag'`.

— Under the `'v3a1'` and `'v3ag'` sample entry, the `num_of_v3c_parameter_sets` shall be equal to 0. The V3C parameter set shall be stored in the sample entry of the atlas track with `'v3cb'`.

— A V3C atlas track with sample entry type `'v3cb'` shall not include any ACL NAL units.

— Under the `'v3c1'` and `'v3a1'` sample entry, the value of `array_completeness` shall be 1 for arrays containing atlas parameter sets.

— Under the `'v3cg'` and `'v3ag'` sample entry, the value of `array_completeness` should be 0 for arrays containing atlas parameter sets.

— The parameter sets and SEI messages present in a V3C atlas track with `'v3cb'` sample entry apply to all referenced V3C atlas tracks.

— For tracks with sample entry types `'v3c1'`, `'v3cg'` or `'v3cb'` the `track_in_movie` flag in track header is set to 1.

— For tracks with sample entry types `'v3a1'`, or `'v3ag'` the `track_in_movie` flag in track header is set to 0.

7.4.4.1

Replace the entire contents of the subclause with the following:

Each sample in a V3C atlas track or V3C atlas tile track corresponds to a single coded atlas access unit, with the following additional clarifications:

— The constraints provided in subclause 7.4.2.1 apply.

— When 'v3cb' sample entry is used, each sample in the V3C atlas track corresponds to one or more coded common atlas access unit(s).

— When a 'v3c1', 'v3cg', 'v3a1' or 'v3ag' sample entry is used, each sample in the V3C atlas track(s) corresponds to a coded atlas access unit associated with the same vuh_atlas_id as indicated in the V3C unit header box in the sample entry.

NOTE   When V3C atlas sample contains no reconstruction SEI message as defined in ISO/IEC FDIS 23090-5, it can be marked as non-output sample as defined in ISO/IEC 14496-12.

7.4.6.1

Replace the specific dated reference to ISO/IEC 14496-12:2020:8.3.3 with a non-dated reference as follows:

To link a V3C atlas track with sample entry 'v3cb' to V3C atlas tracks with sample entries 'v3a1' or 'v3ag', the track reference tool defined in ISO/IEC 14496-12 shall be used. The 4CCs of these track reference types shall be 'v3cs'.

7.4.6.3

Replace the entire contents of the subclause with the following:

To link a V3C atlas track with sample entries 'v3c1', 'v3cg', 'v3a1', or 'v3ag', or a V3C atlas tile track with sample entry 'v3t1' to video component tracks, the track reference tool of ISO/IEC 14496-12 shall be used. One or more track reference type boxes shall be added to a track reference box within the track box of the V3C atlas track or V3C atlas tile track, one for each component. The track reference type box shall contain an array of track_IDs designating the video tracks which the V3C atlas track or V3C atlas tile track references. The reference_type of a track reference type box identifies the type of the video component (i.e., occupancy, geometry, attribute, or packed). The 4CCs of these track reference types shall be:

— 'v3vo': the referenced track(s) contain the video-coded occupancy V3C component

— 'v3vg': the referenced track(s) contain the video-coded geometry V3C component

— 'v3va': the referenced track(s) contain the video-coded attribute V3C component

— 'v3vp': the referenced track(s) contain the video-coded packed V3C component

The type of the V3C component carried by the referenced restricted video track, and signalled in the restricted scheme info box of the track, shall match the reference type of the track reference from the V3C atlas track or V3C atlas tile track.

When 'v3ct' track reference is present, 'v3va', 'v3vo', 'v3vg' references shall not be used.

7.4.9, Table 10

Update row related to track references to include 'v3vp' as a valid track reference type as follows:

Track references	'v3vo' 'v3vg' 'v3va' 'v3vp' 'v3ct'	'v3vo' 'v3vg' 'v3va' 'v3vp' 'v3ct'	'v3cs'	'v3vo' 'v3vg' 'v3va' 'v3vp' 'v3ct'	'v3vo' 'v3vg' 'v3va' 'v3vp' 'v3ct'	'v3vo' 'v3vg' 'v3va'

8.2, first paragraph

Replace the first paragraph with the following paragraph:

A V3C atlas item is an item which represents an independently decodable coded atlas access unit or coded common atlas access unit depending on item type. Item type 4CC codes 'v3c1', 'v3cb', and 'v3a1' identify V3C atlas items. Items of type 'v3c1' or 'v3cb' shall be associated with one V3CConfigurationProperty. All atlas items shall be associated with one V3CUnitHeaderProperty.

8.4

Replace the entire contents of the subclause with the following:

A V3C component item is an item which represents visual V3C component data. V3C component items store V3C unit payload of V3C unit of type V3C_OVD, V3C_GVD, V3C_AVD, V3C_PVD as specified in ISO/IEC 23090-5. A V3C component item shall store only one access unit of related video component data.

An item type 4CC code for a V3C component item shall be set depending on the codec used to encode corresponding video components. A V3C component item shall be associated with corresponding V3C unit header item property and codec specific configuration item property. V3C component items shall be marked as hidden items.

In order to indicate the association between a V3C atlas item and V3C component items or between V3C atlas tile item and V3C component items, three item reference types with 4CC codes 'v3vo', 'v3vg', 'v3va', 'v3vp' are defined. Item reference is defined "from" either a V3C atlas item or a V3C atlas tile item "to" the related V3C component items. The 4CC codes of item reference types shall be:

— 'v3vo': the referenced V3C component item(s) contain the occupancy video data.

— 'v3vg': the referenced V3C component item(s) contain the geometry video data.

— 'v3va': the referenced V3C component item(s) contain the attribute video data.

— 'v3vp': the referenced V3C component item(s) contain the packed video data.

8.5.2.1

Replace the contents for the subclause with the following:

Box Types: 'v3cC'

Property type: Descriptive item property

Container: ItemPropertyContainerBox

Mandatory (per item):   Yes, for a V3C item of type 'v3c1' or 'v3cb'

Quantity (per item):   One or more for a V3C item of type 'v3c1' or 'v3cb'

V3CConfigurationProperty is stored as descriptive item property and shall be associated with the 'v3c1', 'v3a1', or 'v3cb' V3C atlas items. In this version of this document, only one V3C parameter set is stored in V3C configuration item property.

The V3C configuration item property is an essential property. The corresponding `essential` flag in the `ItemProperyAssociationBox` shall be set to 1 for a 'v3cC' item property.

8.5.2.2

Replace the contents for the subclause with the following:

```
aligned(8) class V3CConfigurationProperty
   extends ItemFullProperty('v3cC', version=0, flags) {
   V3CDecoderConfigurationRecord decoder_config(version);
}
```

8.5.2.3

Replace entire contents of the subclause with the following:

`decoder_config` contains a single instance of `V3CDecoderConfigurationRecord` which is defined in subclause 7.2.1

8.6

Add a new subclause 8.6, after 8.5 and before Clause 9, as follows:

8.6   V3C atlas item data format

8.6.1   General

`V3CItemData` is structurally identical to the syntax for an V3C atlas sample.

8.6.2   Syntax

```
aligned(8) class V3CItemData
{
   for (i=0; i<item_size; ){   // derived from ItemLocationBox
      sample_stream_nal_unit ss_nal_unit;  // as defined in ISO/IEC FDIS 23090-5
   i += ss_nal_unit.ssnu_nal_unit_size +
      V3CDecoderConfigurationRecord.unit_size_precision_bytes_minus1 + 1;
   }
}
```

8.6.2   Semantics

In the syntax above, the following applies:

— The value of `item_size` is equal to the sum of the `extent_length` values of each extent of the item, as specified in the `ItemLocationBox`.

— `V3CDecoderConfiurationRecord` indicates the record in the associated V3C configuration property.

`ss_nal_unit` contains a single NAL unit in NAL unit sample stream format as defined in ISO/IEC 23090-5 :—, Annex D.

`ssnu_nal_unit_size` specifies the size, in bytes, of the sample stream NAL unit. The number of bits used to represent `ssnu_nal_unit_size` is equal to (`V3CDecoderConfiurationRecord.unit_size_precision_bytes_minus1` + 1) * 8.