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Information technology — Coded representation of immersive media —

Part 5: Visual volumetric video-based coding (V3C) and video-based point cloud compression (V-PCC)

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

Partie 5: Codage basé sur la vidéo volumétrique (V3C) et compression de nuage de points basée sur la vidéo (V-PCC)

Reference number
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Foreword

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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*.

This fourth edition cancels and replaces the third edition (ISO/IEC 23090-5:2025), which has been technically revised.

The main changes are as follows:

— Additions needed for ISO/IEC 23090-29 video-based dynamic mesh coding.

— Various minor improvements and corrections.

A list of all parts in the ISO/IEC 23090 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

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Introduction

Advances in 3D capturing and rendering technologies have unleashed a new wave of innovation in Virtual/Augmented/Mixed reality (VR/AR/MR) content creation and communication, of which visual volumetric video is an integral part.

Visual volumetric video, a sequence of visual volumetric frames, if uncompressed, may be represented by a large amount of data, which can be costly in terms of storage and transmission. This has led to the need for a high coding efficiency standard for the compression of visual volumetric data.

Visual volumetric frames can be coded by converting the 3D volumetric information into a collection of 2D images and associated data. The converted 2D images can be coded using widely available video and image coding specifications, such as ISO/IEC 14496-10 and ISO/IEC 23008-2 and the associated data can be coded with mechanisms specified in this document. The coded images and the associated data can then be decoded and used to reconstruct the 3D volumetric information. This document specifies a generic mechanism for visual volumetric video coding, i.e. visual volumetric video-based coding. The generic mechanism may be used by applications targeting volumetric content, such as point clouds, immersive video with depth, mesh representations of visual volumetric frames, etc.

In addition to the generic mechanism of coding volumetric content, this document specifies one of the applications of visual volumetric video-based coding targeting point cloud representations of visual volumetric frames. In a point cloud sequence, each point cloud frame contains a collection of points. Each point has a 3D position, i.e. geometry information, and each point may also be associated with a number of attributes, such as colour, reflectance, surface normal, etc.

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Information technology — Coded representation of immersive media —

Part 5:
Visual volumetric video-based coding (V3C) and video-based point cloud compression (V-PCC)

1 Scope

This document specifies the syntax, semantics, and decoding for visual volumetric media using video-based coding methods. Furthermore, this document specifies processes that can be needed for reconstruction of visual volumetric media, and can also include additional processes such as post-decoding, pre-reconstruction, post-reconstruction, and adaptation.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitute requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 8825-1, *Information technology — ASN.1 encoding rules — Part 1: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

ISO/IEC 10646, *Information technology — Universal coded character set (UCS)*

ISO/IEC 14496-10, *Information technology — Coding of audio-visual objects — Part 10: Advanced video coding*

ISO/IEC 14496-12, *Information technology — Coding of audio-visual objects — Part 12: ISO base media file format*

ISO/IEC 14496-15, *Information technology — Coding of audio-visual objects — Part 15: Carriage of network abstraction layer (NAL) unit structured video in the ISO base media file format*

ISO/IEC 23002-7, *Information technology — MPEG video technologies — Part 7: Versatile supplemental enhancement information messages for coded video bitstreams*

ISO/IEC 23008-2, *Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 2: High efficiency video coding*

ISO/IEC 23090-3, *Information technology — Coded representation of immersive media — Part 3: Versatile video coding*

ISO/IEC 23090-12, *Information technology — Coded representation of immersive media — Part 12: MPEG immersive video*

ISO/IEC 23090-29, *Information technology — Coded representation of immersive media — Part 29: Video-based dynamic mesh coding (V-DMC)*

ISO/IEC 23091-2, *Information technology — Coding-independent code points — Part 2: Video*

ISO/IEC 60559:2020, *Information technology — Microprocessor Systems — Floating-Point arithmetic*

Rec. ITU-T T.35, *Procedure for the allocation of ITU-T defined codes for non standard facilities*

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Rec. ITU-T H.271, *Video back-channel messages for conveyance of status information and requests from a video receiver to a video sender*

IETF RFC 1321, *The MD5 Message-Digest Algorithm*

IETF RFC 5646, *Tags for Identifying Languages*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
3D bounding box
volume defined as a cuboid solid having six rectangular faces placed at right angles

3.2
associated non-ACL NAL unit
non-ACL NAL unit (3.85) that is associated with an *ACL NAL unit* (3.5) for the purpose of decoding or other operations specified by this document

3.3
atlas
collection of 2D bounding boxes and their associated information placed onto a rectangular frame and corresponding to a volume in 3D space on which volumetric data is rendered

3.4
atlas bitstream
sequence of bits that forms the representation of *atlas frames* (3.7) and associated data forming one or more *CASs* (3.38)

3.5
atlas coding layer NAL unit
ACL NAL unit
collective term for coded atlas tile layer *NAL units* (3.83) and the subset of *NAL units* (3.83) that have reserved values of nal_unit_type that are classified as being of type class equal to ACL in this document

3.6
atlas coordinates
two scalars (x, y) with finite precision and dynamic range that indicate the location of an atlas sample relative to the top left corner of an atlas frame, with x and y indicating the horizontal and vertical direction, respectively

3.7
atlas frame
2D rectangular array of atlas samples onto which *patches* (3.93) are projected and additional information related to the *patches* (3.93), corresponding to a *volumetric frame* (3.143)

3.8
atlas frame parameter set
AFPS
syntax structure (3.125) containing *syntax elements* (3.124) that apply to zero or more entire coded *atlas frames* (3.7) as determined by the content of a *syntax element* (3.124) found in each tile header

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3.9
atlas sample
position on the rectangular frame onto which *patches* (3.93) that are associated with an *atlas* (3.3) are projected

3.10
atlas sequence
collection of *atlas frames* (3.7)

3.11
atlas sequence parameter set
ASPS
syntax structure (3.125) containing *syntax elements* (3.124) that apply to zero or more entire *coded atlas sequences* (3.38) as determined by the content of a *syntax element* (3.124) found in the AFPS referred to by a syntax element found in each tile header

3.12
atlas sub-bitstream
extracted *sub-bitstream* (3.114) from the *V3C bitstream* (3.133) containing a part of an atlas NAL bitstream

3.13
atlas unit
set of *NAL units* (3.83) that contain all *ACL NAL units* (3.5) of a *coded atlas* (3.36) and their *associated non-ACL NAL units* (3.2)

3.14
attribute
scalar or vector property optionally associated with each point in a *volumetric frame* (3.143) such as colour, reflectance, surface normal, transparency, material ID, etc.

3.15
attribute frame
2D rectangular array created through the aggregation of *patches* (3.93) containing values of a specific *attribute* (3.14)

3.16
attribute map
attribute frame (3.15) containing attribute *patch* (3.93) information projected at a particular depth indicated by the corresponding *geometry map* (3.69)

3.17
auxiliary attribute frame
2D rectangular array that is associated with *RAW patches* (3.109) and *EOM patches* (3.62), and contains values of a specific *attribute* (3.14)

3.18
auxiliary geometry frame
2D rectangular array that is associated with *RAW patches* (3.109) and contains *geometry* (3.67) values

3.19
auxiliary video component
video component (3.130) indicated as being of auxiliary type through an appropriate flag in the *VPS* (3.139) and containing data only associated with *RAW patches* (3.109) and/or *EOM patches* (3.62)

3.20
auxiliary video sub-bitstream
video sub-bitstream (3.132) indicated as being of auxiliary type through an appropriate flag in the *VPS* (3.139) and containing data only associated with *RAW patches* (3.109) and/or *EOM patches* (3.62)

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3.21
basemesh
mesh structure containing possibly a reduced number of *Cartesian coordinates* (3.32) and their associated connectivity, along with scalar or vector property optionally associated with each coordinate and/or set of connectivity

3.22
basemesh bitstream
bitstream (3.25) conforming to a mesh specification that may represent a *V3C component* (3.134) as specified by this document

3.23
basemesh data unit
syntax structure (3.125) containing basemesh data information, such as a *NAL unit* (3.83) in the context of Annex H of ISO/IEC 23090-29:2026

3.24
basemesh sub-bitstream
extracted *sub-bitstream* (3.114) from the *V3C bitstream* (3.133) containing a part of a *basemesh bitstream* (3.22)

3.25
bitstream
ordered series of bits that forms the coded representation of the data

3.26
byte
sequence of 8 bits, within which, when written or read as a sequence of bit values, the left-most and right-most bits represent the most and least significant bits, respectively

3.27
broken link access access unit
BLA access unit
access unit in which the *coded atlas* (3.36) with nal_layer_id equal to 0 is a *BLA coded atlas* (3.28)

3.28
broken link access coded atlas frame
BLA coded atlas
BLA atlas frame
IRAP coded atlas (3.80) frame for which each *ACL NAL unit* (3.5) has nal_unit_type equal to NAL_BLA_W_LP, NAL_GBLA_W_LP, NAL_BLA_W_RADL NAL_GBLA_W_RADL, NAL_BLA_N_LP or NAL_GBLA_N_LP

Note 1 to entry: A BLA coded atlas does not use inter prediction in its decoding process, and could be the first coded atlas in the bitstream in decoding order, or could appear later in the bitstream. Each BLA coded atlas begins a new CAS, and has the same effect on the decoding process as an instantaneous decoding refresh (IDR) coded atlas. However, a BLA coded atlas contains syntax elements that specify a non-empty DAB. When a BLA coded atlas frame for which each ACL NAL unit has nal_unit_type equal to NAL_BLA_W_LP or NAL_GBLA_W_LP, it may have associated random access skipped leading (RASL) coded atlas frames, which are not output by the decoder and may not be decodable, as they may contain references to atlas frames that are not present in the bitstream. When a BLA coded atlas frame for which each ACL NAL unit has nal_unit_type equal to NAL_BLA_W_LP or NAL_GBLA_W_LP, it may also have associated RADL coded atlas frames, which are specified to be decoded. When a BLA coded atlas frame for which each ACL NAL unit has nal_unit_type equal to NAL_BLA_W_RADL or NAL_GBLA_W_RADL, it does not have associated RASL coded atlas frames but may have associated random access decodable leading (RADL) coded atlas frames. When a BLA coded atlas frame for which each ACL NAL unit has nal_unit_type equal to NAL_BLA_N_LP or NAL_GBLA_N_LP, it does not have any associated leading coded atlas frames.

3.29
byte-aligned
positioned as an integer multiple of 8 bits from the position of the first bit in the *bitstream* (3.25)

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3.30
byte-aligned position
position in a *bitstream* (3.25) that is *byte-aligned* (3.29)

3.31
byte-aligned byte
byte (3.26) that appears in a position in a *bitstream* (3.25) that is *byte-aligned* (3.29)

3.32
Cartesian coordinates
three scalars (x, y, z) with finite precision and dynamic range that indicate the location of a point relative to a fixed reference point (the origin)

3.33
clean random access access unit
CRA access unit
access unit in which the *coded atlas* (3.36) with nal_layer_id equal to 0 is a *CRA coded atlas* (3.34)

3.34
clean random access coded atlas frame
CRA coded atlas
CRA atlas frame
IRAP coded atlas (3.80) for which each *ACLNAL unit* (3.5) has nal_unit_type equal to NAL_CRA or NAL_GCRA

Note 1 to entry: A CRA coded atlas does not use inter prediction in its decoding process, and could be the first coded atlas in the bitstream in decoding order, or could appear later in the bitstream. A CRA coded atlas could have associated RADL or RASL coded atlas frames. When a CRA coded atlas has NoOutputBeforeRecoveryFlag equal to 1, the associated RASL coded atlas frames are not output by the decoder, because they might not be decodable, as they could contain references to coded atlas frames that are not present in the bitstream.

3.35
codec
specification, device, or system that specifies or uses well defined instructions for encoding or decoding a digital data, i.e. image or video, stream or signal

3.36
coded atlas
coded atlas frame
coded representation of an *atlas* (3.3)

3.37
coded atlas access unit
set of atlas *NAL units* (3.83) that are associated with each other according to a specified classification rule, are consecutive in decoding order, and contain all atlas *NAL units* (3.83) pertaining to one particular output time

3.38
coded atlas sequence
CAS
sequence of *coded atlas access units* (3.37), in decoding order, of an *IRAP coded atlas access unit* (3.79) with NoOutputBeforeRecoveryFlag equal to 1, followed by zero or more *coded atlas access units* (3.37) that are not *IRAP coded atlas access units* (3.79) with NoOutputBeforeRecoveryFlag equal to 1, including all subsequent *access units* (3.37) up to but not including any subsequent *coded atlas access unit* (3.37) that is an *IRAP coded atlas access unit* (3.79) with NoOutputBeforeRecoveryFlag equal to 1

Note 1 to entry: An IRAP coded atlas access unit may be an IDR coded atlas access unit, a BLA coded atlas access unit, or a CRA coded atlas access unit. The value of NoOutputBeforeRecoveryFlag is equal to 1 for each IDR coded atlas access unit, each BLA coded atlas access unit, and each CRA coded atlas access unit that is the first coded atlas access unit in the atlas bitstream in decoding order, is the first coded atlas access unit that follows an end of sequence NAL unit in decoding order, or has HandleCraAsBlaFlag equal to 1.

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3.39
coded common atlas access unit
set of common atlas *non-ACL NAL units* (3.85) that are associated with each other according to a specified classification rule, are consecutive in decoding order, and contain all common atlas *NAL units* (3.83) pertaining to one particular output time

3.40
coded common atlas frame
coded representation of a *common atlas frame* (3.46)

3.41
coded common atlas sequence
CCAS
sequence of *coded common atlas access units* (3.39), in decoding order, of an *IRAP coded common atlas access unit* (3.82), followed by zero or more *coded common atlas access units* (3.39) that are not *IRAP coded common atlas access units* (3.82), including all subsequent *access units* (3.39) up to but not including any subsequent *coded common atlas access unit* (3.39) that is an *IRAP coded common atlas access unit* (3.82)

3.42
coded volumetric frame
single *V3C composition unit* (3.136) pertaining to one particular time instance

3.43
coded V3C sequence
CVS
sequence of *V3C sub-bitstreams* (3.137) identified and separated by appropriate delimiters, required to start with a *VPS* (3.139), included in at least one *V3C unit* (3.140) or provided through external means, and contains one or more V3C units that can be factored into *V3C composition units* (3.136), where the first V3C composition unit is a *V3C IRAP composition unit* (3.137)

3.44
coded representation
data element as represented in its coded form

3.45
coded V3C component
coded representation of a *V3C component* (3.134)

3.46
common atlas frame
CAF
common information (e.g. projection parameters) that applies to all *atlas frames* (3.7) in a *volumetric frame* (3.143)

3.47
common atlas sequence
collection of *common atlas frames* (3.46)

3.48
common atlas sub-bitstream
extracted *sub-bitstream* (3.114) from the *V3C bitstream* (3.133) containing a part of a common atlas NAL bitstream

3.49
component bitstream
bitstream (3.25) representing a *V3C component* (3.134)

3.50
component sub-bitstream
portion of *component bitstream* (3.46)

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3.51
composition time
time or time period at which a frame needs to be composed, used for reconstruction, or presented

3.52
composition time index
index to an ordered list of *composition times* (3.51)

3.53
composition unit
partition of a *bitstream* (3.25) that has a certain *composition time* (3.51)

3.54
decoder under test
DUT
decoder that is tested for conformance to this document by operating the hypothetical stream scheduler to deliver a conforming *bitstream* (3.25) to the decoder and to the hypothetical reference decoder and comparing the values and timing or order of the output of the two decoders

3.55
displacement
set of 3D vectors that are added to the vertices of the subdivided mesh to closely approximate the input mesh surface

3.56
displacement bitstream
bitstream (3.25) conforming to a mesh specification that may represent a *V3C component* (3.134) of type *displacement* (3.55) as specified by this document

3.57
displacement data unit
syntax structure (3.125) containing displacement data information, such as a *NAL unit* (3.83) in the context of Annex J of ISO/IEC 23090-29:2026

3.58
displacement sub-bitstream
extracted *sub-bitstream* (3.114) from the *V3C bitstream* (3.133) containing a part of a *displacement bitstream* (3.56)

3.59
decoding unit
sub-set of a *coded atlas access unit* (3.37) consisting of one or more ACL NAL units in a *coded atlas access unit* (3.37) and the *associated non-ACL NAL units* (3.2)

3.60
enhanced occupancy mode
EOM
patch coding mode where a *patch* (3.93) is associated with enhanced occupancy information

3.61
EOM coded points
coded representation of 3D points located at intermediate depth positions for which *geometry* (3.67) values are stored as codewords in the *occupancy frame* (3.92) and their corresponding attributes values are stored in additional patches, referred to as *EOM patches* (3.62), in the *attribute frames* (3.15)

3.62
EOM patch
patch (3.93) with *patch mode* (3.95) equal to I_EOM, P_EOM, or P_SKIP

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3.63
EOM patch type
patch type (3.96) indicating an *EOM patch* (3.62)

3.64
essential supplemental enhancement information
ESEI
SEI (3.122) that is deemed as essential by the decoding process and should not be ignored or discarded

3.65
essential supplemental enhancement information NAL unit
ESEI NAL unit
NAL unit (3.83) corresponding to an *ESEI* (3.64) and has nal_unit_type equal to NAL_PREFIX_ESEI or NAL_SUFFIX_ESEI

3.66
flag
variable or single-bit syntax element that can take one of the two possible values: 0 and 1

3.67
geometry
set of *Cartesian coordinates* (3.32) associated with a *volumetric frame* (3.143)

3.68
geometry frame
2D array created through the aggregation of the *geometry* (3.67) information associated with each *patch* (3.93)

3.69
geometry map
geometry frame (68) containing geometry *patch* (3.93) information projected at a particular depth

3.70
global broken link access coded atlas frame
GBLA atlas frame
IRAP coded atlas (3.80) frame for which each *ACL NAL unit* (3.5) has nal_unit_type equal to NAL_GBLA_W_LP, NAL_GBLA_W_RADL, or NAL_GBLA_N_LP respectively

3.71
global clean random access coded atlas frame
GCRA atlas frame
IRAP coded atlas (3.80) frame for which each *ACL NAL unit* (3.5) has nal_unit_type equal to NAL_GCRA

3.72
global instantaneous decoding refresh coded atlas frame
GIDR atlas frame
coded atlas (3.36) for which each *ACL NAL unit* (3.5) has nal_unit_type equal to NAL_GIDR_W_RADL, NAL_GBLA_N_LP, or NAL_GCRA, or in the range of NAL_GBLA_W_LP to NAL_GBLA_N_LP, inclusive, and specify a random access association between the current *coded atlas* and its corresponding coded video frames at the same composition time

3.73
hypothetical reference decoder
HRD
hypothetical decoder model that specifies constraints on the variability of conforming atlas *NAL unit* (3.83) streams or conforming *coded atlas* (3.36) sample streams that an encoding process may produce

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3.74
hypothetical stream scheduler
HSS
hypothetical delivery mechanism used for checking the conformance of an *atlas sub-bitstream* (3.12) or a decoder with regards to the timing and data flow of the input of an *atlas sub-bitstream* (3.12) into the *hypothetical reference decoder* (3.73)

3.75
instantaneous decoding refresh coded atlas access unit
IDR coded atlas access unit
access unit in which the *coded atlas* (3.36) with nal_layer_id equal to 0 is an *IDR coded atlas* (3.76)

3.76
instantaneous decoding refresh coded atlas frame
IDR coded atlas
IDR atlas frame
IRAP coded atlas (3.80) for which each *ACL NAL unit* (3.5) has nal_unit_type equal to NAL_IDR_W_RADL, or NAL_IDR_N_LP, NAL_GIDR_W_RADL, or NAL_GIDR_N_LP

Note 1 to entry: An IDR coded atlas does not refer to any atlases other than itself for inter prediction in its decoding process, and may be the first atlas in the bitstream in decoding order, or may appear later in the bitstream. Each IDR coded atlas is the first atlas of a CAS in decoding order. When an IDR coded atlas for which each ACL NAL unit has nal_unit_type equal to NAL_IDR_W_RADL or NAL_GIDR_W_RADL, it may have associated RADL coded atlases. When an IDR coded atlas for which each ACL NAL unit has nal_unit_type equal to NAL_IDR_N_LP or NAL_GIDR_N_LP, it does not have any associated leading coded atlases. An IDR coded atlas does not have associated RASL coded atlases.

3.77
inter atlas tile
atlas tile that may be decoded using both intra or inter prediction methods

3.78
intra atlas tile
atlas tile that is decoded using only intra prediction methods

3.79
intra random access point coded atlas access unit
IRAP coded atlas access unit
access unit in which the *coded atlas* (3.36) with nal_layer_id equal to 0 is an *IRAP coded atlas* (3.80)

3.80
intra random access point coded atlas frame
IRAP coded atlas
IRAP coded atlas frame
coded atlas (3.36) for which each *ACL NAL unit* (3.5) has nal_unit_type in the range of NAL_BLA_W_LP to NAL_RSV_IRAP_ACL_29, inclusive

Note 1 to entry: An IRAP coded atlas does not refer to any coded atlases other than itself for prediction in its decoding process, and may be a BLA coded atlas, a CRA coded atlas, or an IDR coded atlas. Provided the necessary parameter sets are available when they need to be activated, the IRAP coded atlas and all subsequent non-RASL coded atlas in decoding order can be correctly decoded without performing the decoding process of any coded atlases that precede the IRAP coded atlas in decoding order.

3.81
intra random access point coded common atlas
IRAP coded common atlas
coded common atlas frame (3.40) *for which at least one non-ACL NAL unit* (3.85) *has nal_unit_type equal to NAL_CAF_IDR*

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3.82
intra random access point coded common atlas access unit
IRAP coded common atlas access unit
coded common access unit (3.39) in which the *coded common atlas frame* (3.40) has nal_layer_id equal to 0 is and and nal_unit_type equal to NAL_CAF_IDR

3.83
network abstraction layer unit
NAL unit
syntax structure containing an indication of the type of data to follow and *bytes* (3.26) containing that data in the form of an *RBSP* (3.107)

3.84
network abstraction layer unit stream
NAL unit stream
sequence of *NAL units* (3.83)

3.85
non-ACL NAL unit
NAL unit (3.83) that is not an *ACL NAL unit* (3.5)

3.86
non-auxiliary video component
regular video component
video component (3.130) indicated as being of non-auxiliary type through an appropriate flag in the *VPS* (3.139)

3.87
non-auxiliary video sub-bitstream
regular video sub-bitstream
video sub-bitstream (3.132) indicated as being of non-auxiliary type through an appropriate flag in the *VPS* (3.139)

3.88
non-essential supplemental enhancement information
NSEI
SEI (3.122) that is deemed as non essential by the decoding process and may be ignored or discarded without any adverse effects

3.89
non-essential supplemental enhancement information NAL unit
NSEI NAL unit
NAL unit (3.83) corresponding to a *NSEI* (3.88) and has nal_unit_type equal to NAL_PREFIX_NSEI or NAL_SUFFIX_NSEI

3.90
occupancy
values that indicate whether *atlas samples* (3.9) correspond to associated samples in 3D space

3.91
occupancy access unit
set of video data units of an occupancy bitstream that are associated with each other according to a specified classification rule, are consecutive in decoding order, and pertaining to one particular output time

3.92
occupancy frame
collection of *occupancy* (3.90) values that constitute a 2D array and represents the entire *occupancy* (3.90) information of a single *atlas frame* (3.7)

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3.93
patch
rectangular region within an *atlas* (3.3) associated with volumetric information

3.94
patch data
data in an *atlas* (3.3) associated with a *patch* (3.93) that enables the conversion of 2D projected data back to 3D space

3.95
patch mode
syntax element (3.124) in the *atlas bitstream* (3.4) that indicates how a *patch* (3.93) is defined and associated with other *V3C components* (3.133) and provides information of how to reconstruct such *V3C components* (3.133)

3.96
patch type
classification of *patch modes* (3.95) based on how the characteristics of a *patch* (3.93) are signalled and interpreted

3.97
point local reconstruction
process of adding extra points in the reconstruction step that generates samples in 3D space associated to an *atlas sample* (3.9) from a *PROJECTED patch* (3.101), using information associated to neighboring atlas samples in the patch

3.98
prefix ESEI NAL unit
essential SEI NAL unit (3.65) that has nal_unit_type equal to NAL_PREFIX_ESEI

3.99
prefix NSEI NAL unit
non-essential SEI NAL unit (3.89) that has nal_unit_type equal to NAL_PREFIX_NSEI

3.100
prefix SEI NAL unit
SEI NAL unit (3.123) that has nal_unit_type equal to NAL_PREFIX_NSEI or NAL_PREFIX_ESEI

3.101
PROJECTED patch
patch (3.93) with *patch mode* (3.95) equal to I_INTRA, P_INTRA, P_INTER, P_MERGE, or P_SKIP that is associated with projected information onto a 2D image

3.102
PROJECTED patch type
patch type (3.96) indicating a *PROJECTED patch* (3.101)

3.103
random access
act of starting the decoding process for a *bitstream* (3.25) at a point other than the beginning of the stream

3.104
random access decodable leading coded atlas frame
RADL coded atlas
RADL atlas frame
coded atlas (3.36) for which each *ACL NAL unit* (3.5) has nal_unit_type equal to NAL_RADL_R or NAL_RADL_N

Note 1 to entry: All RADL coded atlases are leading coded atlas. RADL coded atlases are not used as reference atlases for the decoding process of trailing coded atlases of the same associated IRAP coded atlas. When present, all RADL coded atlases precede, in decoding order, all trailing coded atlases of the same associated IRAP coded atlas.

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3.105
random access skipped leading access unit
RASL access unit
access unit in which the *coded atlas* (3.36) with nal_layer_id equal to 0 is a *RASL coded atlas* (3.106)

3.106
random access skipped leading coded atlas frame
RASL coded atlas
RASL atlas frame
coded atlas (3.36) for which each *ACL NAL unit* (3.5) has nal_unit_type equal to NAL_RASL_R or NAL_RASL_N

Note 1 to entry: All RASL coded atlases are leading coded atlas of an associated BLA or CRA coded atlas. When the associated IRAP coded atlas has NoOutputBeforeRecoveryFlag equal to 1, the RASL coded atlas is not output and may not be correctly decodable, as the RASL coded atlas may contain references to coded atlases that are not present in the bitstream. RASL coded atlases are not used as reference atlases for the decoding process of non-RASL coded atlases. When present, all RASL coded atlases precede, in decoding order, all trailing coded atlases of the same associated IRAP coded atlas.

3.107
raw byte sequence payload
RBSP
syntax structure (3.125) containing an integer number of *bytes* (3.26) that is either empty or has the form of a *string of data bits* (3.113) containing *syntax elements* (3.124) followed by a bit equal to 1 and zero or more subsequent bits equal to 0

3.108
RAW coded point
coded representation (3.44) of a 3D point for which its *geometry* (3.67) value is directly stored in the corresponding region of a *RAW patch* (3.109) in either the first component of the first *geometry map* (3.69) or the *auxiliary geometry frame* (3.19), and for which its attribute values, if present, are directly stored in the corresponding region of a *RAW patch* (3.109) in either first *attribute map* (3.16) or the *auxiliary attribute frame* (3.17), without any form of projection

3.109
RAW patch
patch (3.93) with *patch mode* (3.95) equal to I_RAW, P_RAW, or P_SKIP

3.110
RAW patch type
patch type (3.96) indicating a *RAW patch* (3.109)

3.111
reserved
term that may be used to specify that some values of a particular *syntax element* (3.124) are for future use by ISO/IEC and shall not be used in *bitstreams* (3.25) or atlas *bitstreams* (3.4) conforming to this version of this document, but may be used in *bitstreams* (3.25) or atlas *bitstreams* (3.4) conforming to future extensions of this document

3.112
step-wise temporal sub-layer access coded atlas frame
STSA atlas frame
coded atlas (3.36) for which each *ACL NAL unit* (3.5) has nal_unit_type equal to NAL_STSA_R or NAL_STSA_N

3.113
string of data bits
SODB
sequence of some number of bits representing *syntax elements* (3.124), represented as a sequence of bytes, where in of each byte the left-most bit is considered to be the first and most significant bit, and the right-most bit is considered to be the last and least significant bit

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3.114
sub-bitstream
portion of a *bitstream* (3.25)

3.115
sub-bitstream composition unit
partition of a *sub-bitstream* (3.114) that has a certain composition time

3.116
sub-bitstream IRAP composition unit
sub-bitstream composition unit (3.115) that forms an independent random access point for the *sub-bitstream* (3.114)

3.117
sub-layer
temporal scalable layer of a temporal scalable *atlas sub-bitstream* (3.12), consisting of *ACL NAL units* (3.5) with a particular value of the TemporalId variable and the *associatednon-ACL NAL units* (3.2)

3.118
sub-layer non-reference coded atlas frame
SLNR coded atlas
SLNR atlas frame
atlas frames (3.7) that contains *patches* (3.93) that cannot be used for inter prediction in the decoding process of subsequent *atlas frames* (3.7) of the same sub-layer in decoding order

3.119
suffix ESEI NAL unit
ESEI NAL (3.65) unit that has nal_unit_type equal to NAL_SUFFIX_ESEI

3.120
suffix NSEI NAL unit
NSEI NAL unit (3.89) that has nal_unit_type equal to NAL_SUFFIX_NSEI

3.121
suffix SEI NAL unit
SEI NAL unit (3.123) that has nal_unit_type equal to NAL_SUFFIX_NSEI or NAL_SUFFIX_ESEI

3.122
supplemental enhancement information
SEI
information that may be inserted into the *bitstream* (3.25) for various purposes such as indicating *bitstream* (3.25) properties or for specifying various constraints that may apply to the *bitstream* (3.25)

3.123
supplemental enhancement information NAL unit
SEI NAL unit
NAL unit (3.83) , intended for providing *supplemental enhancement information* (3.122) that has nal_unit_type equal to NAL_PREFIX_NSEI, NAL_PREFIX_ESEI, NAL_SUFFIX_NSEI, or NAL_SUFFIX_ESEI

3.124
syntax element
element of data represented in the *bitstream* (3.25)

3.125
syntax structure
zero or more *syntax elements* (3.124) present together in the *bitstream* (3.25) in a specified order

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3.126
temporal sub-layer access coded atlas frame
TSA coded atlas
TSA atlas frame
coded atlas (3.36) for which each *ACL NAL unit* (3.5) has nal_unit_type equal to NAL_TSA_R or NAL_TSA_N

3.127
tile
independently decodable rectangular region of an *atlas frame* (3.7)

3.128
unspecified
term that may be used to specify some values of a particular *syntax element* (3.124) to indicate that the values have no specified meaning in this document and will not have a specified meaning in the future as an integral part of future versions of this document

3.129
video bitstream
bitstream (3.25) conforming to a video specification that may represent a *V3C component* (3.134) as specified by this document

3.130
video component
V3C component (3.134) of type *occupancy* (3.90), *geometry* (3.67), or *attribute* (3.14)

3.131
video data unit
syntax structure (3.125) containing video data information, such as a *NAL unit* (3.83) in the context of ISO/IEC 23008-2 or ISO/IEC 14496-10

3.132
video sub-bitstream
extracted *sub-bitstream* (3.114) from the *V3C bitstream* (3.133) containing a part of a *video bitstream* (3.129)

3.133
visual volumetric video-based coding bitstream
V3C bitstream
sequence of bits that forms the representation of *coded volumetric frames* (3.42) and associated data forming one or more *CVSs* (3.43)

3.134
visual volumetric video-based coding component
V3C component
atlas (3.3), *basemesh* (3.21), *occupancy* (3.90), *geometry* (3.67), or *attribute* (3.14) of a particular type that is associated with a V3C volumetric content representation

3.135
visual volumetric video-based coding component frame
V3C component frame
single *V3C component* (3.134) pertaining to one particular output time

3.136
visual volumetric video-based coding composition unit
V3C composition unit
set of all *sub-bitstream composition units* (3.115) that share the same *composition time* (3.51), where one of the *sub-bitstream composition units* (3.115) is a *coded atlas access unit* (3.37)

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3.137
visual volumetric video-based coding IRAP composition unit
V3C IRAP composition unit
V3C composition unit (3.136) for which all *sub-bitstream composition units* (3.115) are *sub-bitsteam IRAP composition units* (3.116), where one of the *sub-bitstream composition units* (3.115) is a *coded atlas access unit* (3.37) for which each *ACL NAL unit* (3.5) has nal_unit_type in the range of NAL_GBLA_W_LP to NAL_GBLA_N_LP, or is in the range of NAL_GIDR_W_RADL to NAL_GIDR_N_LP, or is equal to NAL_GCRA, inclusive

3.138
visual volumetric video-based coding sub-bitstream
V3C sub-bitstream
sub-bitstream (3.114) of a *V3C bitstream* (3.133) corresponding to a *V3C component* (3.134)

3.139
visual volumetric video-based coding parameter set
V3C parameter set
VPS
syntax structure (3.125) containing *syntax elements* (3.124) that may be referred to by *syntax elements* (3.124) found in the *V3C unit header* (3.141)

3.140
visual volumetric video-based coding unit
V3C unit
syntax structure (3.125) containing a *V3C unit header* (3.141) and a *V3C unit payload* (3.142)

3.141
visual volumetric video-based coding unit header
V3C unit header
syntax structure (3.125) containing an indication of the type of data to follow

3.142
visual volumetric video-based coding unit payload
V3C unit payload
syntax structure (3.125) containing the *bytes* (3.26) containing *V3C sub-bitstream* (3.138) data

3.143
volumetric frame
set of 3D points specified by their *Cartesian coordinates* (3.32) and zero or more corresponding sets of *attributes* (3.14) at a particular time instance

3.144
point
data specified by single set of *Cartesian coordinates* (3.32) and zero or more corresponding *attributes* (3.14)

3.145
point cloud
point cloud frame
set of *points* (3.144) at a particular time instance

3.146
point cloud sequence
sequence of *point cloud frames* (3.145) at a particular time instance

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4 Abbreviated terms

1D	one-dimensional
2D	two-dimensional
3D	three-dimensional
4D	four-dimensional
5D	five-dimensional
6D	six-dimensional
7D	seven-dimensional
ACL	atlas coding layer
AAPS	atlas adaptation parameter set
AFPS	atlas frame parameter set
ASN.1	abstract syntax notation one
ASPS	atlas sequence parameter set
AU	access unit
BLA	broken link access
CAB	coded atlas buffer
CRA	clean random access
DAB	decoded atlas buffer
HSS	hypothetical stream scheduler
I	intra
IDR	instantaneous decoding refresh
IRAP	intra random access point
LSB	least significant bit
MSB	most significant bit
NAL	network abstraction layer
P	predictive
PBF	patch border filtering
PCC	point cloud compression
PLR	point local reconstruction
RAFL	reference atlas frame lList
RBSP	raw byte sequence payload

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