International Standard

ISO/IEC 23090-3

Third edition
2024-07

Information technology — Coded representation of immersive media —

Part 3: Versatile video coding

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

Partie 3: Codage vidéo polyvalent

iTeh Standards
(https://standards.iteh.ai)
Document Preview

ISO/IEC 23090-3:2024
https://standards.iteh.ai/catalog/standards/iso/7495d761-3c62-4936-8c6b-2e7ae2a033ba/iso-iec-23090-3-2024

Reference number
ISO/IEC 23090-3:2024(en)

© ISO/IEC 2024

iTeh Standards
(https://standards.iteh.ai)
Document Preview

ISO/IEC 23090-3:2024
https://standards.iteh.ai/catalog/standards/iso/7495d761-3c62-4936-8c6b-2e7ae2a033ba/iso-iec-23090-3-2024

COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Foreword vi
Introduction vii
1 Scope 1
2 Normative references 1
3 Terms and definitions 1
4 Abbreviated terms 17
5 Conventions 19
5.1 General 19
5.2 Arithmetic operators 19
5.3 Logical operators 20
5.4 Relational operators 20
5.5 Bit-wise operators 20
5.6 Assignment operators 21
5.7 Range notation 21
5.8 Mathematical functions 21
5.9 Order of operation precedence 22
5.10 Variables, syntax elements and tables 22
5.11 Text description of logical operations 24
5.12 Processes 25
6 Bitstream and picture formats, partitionings, scanning processes and neighbouring relationships 25
6.1 Bitstream formats 25
6.2 Source, decoded and output picture formats 26
6.3 Partitioning of pictures, subpictures, slices, tiles, and CTUs 28
6.3.1 Partitioning of pictures into subpictures, slices, and tiles 28
6.3.2 Block, quadtree and multi-type tree structures 30
6.3.3 Spatial or component-wise partitionings 31
6.4 Availability processes 32
6.4.1 Allowed quad split process 32
6.4.2 Allowed binary split process 33
6.4.3 Allowed ternary split process 35
6.4.4 Derivation process for neighbouring block availability 36
6.5 Scanning processes 36
6.5.1 CTB raster scanning, tile scanning, and subpicture scanning processes 36
6.5.2 Up-right diagonal scan order array initialization process 41
6.5.3 Horizontal and vertical traverse scan order array initialization process 41
7 Syntax and semantics 42
7.1 Method of specifying syntax in tabular form 42
7.2 Specification of syntax functions and descriptors 43
7.3 Syntax in tabular form 45
7.3.1 NAL unit syntax 45
7.3.2 Raw byte sequence payloads, trailing bits and byte alignment syntax 46
7.3.3 Profile, tier, and level syntax 65
7.3.4 DPB parameters syntax 68
7.3.5 Timing and HRD parameters syntax 68
7.3.6 Supplemental enhancement information message syntax 69
7.3.7 Slice header syntax 70

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ISO/IEC 23090-3:2024
https://standards.iteh.ai/catalog/standards/iso/...-2a033ba/iso-iec-23090-3-2024

© ISO/IEC 2024 – All rights reserved

7.3.8 Weighted prediction parameters syntax 72
7.3.9 Reference picture lists syntax 73
7.3.10 Reference picture list structure syntax 74
7.3.11 Slice data syntax 74
7.4 Semantics 97
7.4.1 General 97
7.4.2 NAL unit semantics 97
7.4.3 Raw byte sequence payloads, trailing bits and byte alignment semantics 106
7.4.4 Profile, tier, and level semantics 166
7.4.5 DPB parameters semantics 173
7.4.6 Timing and HRD parameters semantics 174
7.4.7 Supplemental enhancement information message semantics 178
7.4.8 Slice header semantics 178
7.4.9 Weighted prediction parameters semantics 189
7.4.10 Reference picture lists semantics 191
7.4.11 Reference picture list structure semantics 192
7.4.12 Slice data semantics 193
8 Decoding process 220
8.1 General decoding process 220
8.2 NAL unit decoding process 223
8.3 Slice decoding process 224
8.3.1 Decoding process for picture order count 224
8.3.2 Decoding process for reference picture lists construction 225
8.3.3 Decoding process for reference picture marking 231
8.3.4 Decoding process for generating unavailable reference pictures 232
8.3.5 Decoding process for symmetric motion vector difference reference indices 233
8.3.6 Decoding process for collocated picture and no backward prediction 234
8.4 Decoding process for coding units coded in intra prediction mode 234
8.4.1 General decoding process for coding units coded in intra prediction mode 234
8.4.2 Derivation process for luma intra prediction mode 236
8.4.3 Derivation process for chroma intra prediction mode 239
8.4.4 Cross-component chroma intra prediction mode checking process 241
8.4.5 Decoding process for intra blocks 243
8.5 Decoding process for coding units coded in inter prediction mode 278
8.5.1 General decoding process for coding units coded in inter prediction mode 278
8.5.2 Derivation process for motion vector components and reference indices 284
8.5.3 Decoder-side motion vector refinement process 306
8.5.4 Derivation process for geometric partitioning mode motion vector components and reference indices 312
8.5.5 Derivation process for subblock motion vector components and reference indices 314
8.5.6 Decoding process for inter blocks 345
8.5.7 Decoding process for geometric partitioning mode inter blocks 370
8.5.8 Decoding process for the residual signal of coding blocks coded in inter prediction mode 376
8.5.9 Decoding process for the reconstructed signal of chroma coding blocks coded in inter prediction mode 378
8.6 Decoding process for coding units coded in IBC prediction mode 380
8.6.1 General decoding process for coding units coded in IBC prediction mode 380
8.6.2 Derivation process for block vector components for IBC blocks 383
8.6.3 Decoding process for IBC blocks 387
8.7 Scaling, transformation and array construction process 388
8.7.1 Derivation process for quantization parameters 388
8.7.2 Scaling and transformation process 390
8.7.3 Scaling process for transform coefficients 391
8.7.4 Transformation process for scaled transform coefficients 394

© ISO/IEC 2024 – All rights reserved

8.7.5 Picture reconstruction process 415
8.8 In-loop filter process 419
8.8.1 General 419
8.8.2 Picture inverse mapping process for luma samples 420
8.8.3 Deblocking filter process 420
8.8.4 Sample adaptive offset process 451
8.8.5 Adaptive loop filter process 454
9 Parsing process 467
9.1 General 467
9.2 Parsing process for k-th order Exp-Golomb codes 467
9.2.1 General 467
9.2.2 Mapping process for signed Exp-Golomb codes 469
9.3 CABAC parsing process for slice data 469
9.3.1 General 469
9.3.2 Initialization process 471
9.3.3 Binarization process 494
9.3.4 Decoding process flow 505
Annex A (normative) Profiles, tiers and levels 523
Annex B (normative) Byte stream format 543
Annex C (normative) Hypothetical reference decoder 546
Annex D (normative) Supplemental enhancement information and use of SEI and VUI 572

iTeh Standards
(https://standards.iteh.ai)
Document Preview

ISO/IEC 23090-3:2024
https://standards.iteh.ai/catalog/standards/iso/7495d761-3c62-4936-8c6b-2e7ae2a033ba/iso-iec-23090-3-2024

© ISO/IEC 2024 – All rights reserved

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

ISO and IEC draw attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO and IEC take no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO and IEC had received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents and https://patents.iec.ch. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

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*, in collaboration with ITU-T (as ITU-T H.266).

This third edition cancels and replaces the second edition (ISO/IEC 23090-3:2022), which has been technically revised.

The main changes are as follows:

— the specification of level 15.5 for the video profiles, to provide a suitable label for bitstreams that can exceed the limits of all other specified levels,

— the addition of support for the green metadata SEI message specified in ISO/IEC 23001-11, the video decoding interface SEI envelope SEI message specified in ISO/IEC 23090-13, and the neural-network post-filter characteristics, neural-network activation, and phase indication SEI messages specified in Rec. ITU-T H.274 | ISO/IEC 23002-7.

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.

© ISO/IEC 2024 – All rights reserved

Introduction

Purpose

This document specifies a video coding technology known as versatile video coding. It has been designed with two primary goals. The first of these is to specify a video coding technology with a compression capability that is substantially beyond that of the prior generations of such standards, and the second is for this technology to be highly versatile for effective use in a broader range of applications than that addressed by prior standards. Some key application areas for the use of this document particularly include ultra-high-definition video (e.g., with 3840×2160 or 7620×4320 picture resolution and bit depth of 10 bits as specified in Rec. ITU-R BT.2100), video with a high dynamic range and wide colour gamut (e.g., with the perceptual quantization or hybrid log-gamma transfer characteristics specified in Rec. ITU-R BT.2100), and video for immersive media applications such as 360° omnidirectional video projected using a common projection format such as the equirectangular or cubemap projection formats, in addition to the applications that have commonly been addressed by prior video coding standards.

Profiles, tiers, and levels

This document is designed to be versatile in the sense that it serves a wide range of applications, bit rates, resolutions, qualities, and services. Applications include, but are not limited to, video coding for digital storage media, television broadcasting, video streaming services, real-time communication. In the course of creating this document, various requirements from typical applications have been considered, necessary algorithmic elements have been developed, and these have been integrated into a single syntax. Hence, this document is designed to facilitate video data interchange among different applications.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

Considering the practicality of implementing the full syntax of this document, however, a limited number of subsets of the syntax are also stipulated by means of "profiles", "tiers", and "levels". These and other related terms are formally defined in Clause 3.

A "profile" is a subset of the entire bitstream syntax that is specified in this document. Within the bounds imposed by the syntax of a given profile it is still possible to require a very large variation in the performance of encoders and decoders depending upon the values taken by syntax elements in the bitstream, such as the specified size of the decoded pictures. In many applications, it is currently neither practical nor economical to implement a decoder capable of dealing with all hypothetical uses of the syntax within a particular profile.

iTeh Standards
https://standards.iteh.ai/catalog/standards/iso/7...-...-...-

cropped decoded output pictures to those produced by the process described herein (with the correct output order or output timing, as specified) is considered to be in conformance with the requirements of this document.

Rec. ITU-T H.274 | ISO/IEC 23002-7 specifies the syntax and semantics of the video usability information (VUI) parameters and supplemental enhancement information (SEI) messages that do not affect the conformance specifications in Annex C. These VUI parameters and SEI messages may be used together with this document.

Versions of this document

Rec. ITU-T H.266 | ISO/IEC 23090-3 version 1 refers to the first approved version of this document. The first edition published by ISO/IEC as ISO/IEC 23090-3:2021 corresponded to the first version.

Rec. ITU-T H.266 | ISO/IEC 23090-3 version 2 refers to the integrated text additionally containing operation range extensions, a new level (level 6.3), additional supplement enhancement information, and corrections to various minor defects in the prior content of the document. The second edition published by ISO/IEC as ISO/IEC 23090-3:2022 corresponded to the second version.

Rec. ITU-T H.266 | ISO/IEC 23090-3 version 3 (the current version) refers to the integrated text containing the specification of a new level (level 15.5) for the video profiles to provide a suitable label for bitstreams that can exceed the limits of all other specified levels, additional supplement enhancement information, and corrections to various minor defects in the prior content of the document. This document corresponds to the third version. At the time of publication of this document, a corresponding third edition of Rec. ITU-T H.266 was in preparation for publication by ITU-T.

Overview of the design characteristics

The coded representation specified in the syntax is designed to enable a high compression capability for a desired image or video quality. The algorithm is typically not mathematically lossless, as the exact source sample values are typically not preserved through the encoding and decoding processes, although some modes are included that provide lossless coding capability. A number of techniques are specified to enable highly efficient compression. Encoding algorithms (not specified within the scope of this document) may select between inter, intra, intra block copy (IBC), and palette coding for block-shaped regions of each picture. Inter coding uses motion vectors for block-based inter-picture prediction to exploit temporal statistical dependencies between different pictures, intra coding uses various spatial prediction modes to exploit spatial statistical dependencies in the source signal within the same picture, and intra block copy coding uses block displacement vectors to reference previously decoded regions of the same picture to exploit statistical similarities among different areas of the same picture. Motion vectors, intra prediction modes, and IBC block vectors are specified for a variety of block sizes in the picture. The prediction residual can then be further compressed using a spatial transform to remove spatial correlation inside a block before it is quantized, producing a possibly irreversible process that typically discards less important visual information while forming a close approximation to the source samples. Finally, the motion vectors, intra prediction modes, and block vectors can also be further compressed using a variety of prediction mechanisms, and, after prediction, are combined with the quantized transform coefficient information and encoded using arithmetic coding.

How to read this document

It is suggested that the reader starts with Clause 1 and moves on to Clause 3. Clause 6 should be read for the geometrical relationship of the source, input, and output of the decoder. Clause 7 specifies the order to parse syntax elements from the bitstream. See subclauses 7.1 to 7.3 for syntactical order and subclause 7.4 for semantics; e.g. the scope, restrictions, and conditions that are imposed on the syntax elements. The actual parsing for most syntax elements is specified in Clause 9. Finally, Clause 8 specifies how the syntax elements are mapped into decoded samples. Annexes A through D also form an integral part of this document.

iTeh Standards
(https://standards.iteh.ai)
Document Preview
https://standards.iteh.ai/catalog/standards/iso/iec-23090-3-2024

© ISO/IEC 2024 – All rights reserved

Annex A specifies profiles, each being tailored to certain application domains, and defines the so-called tiers and levels of the profiles. Annex B specifies syntax and semantics of a byte stream format for delivery of coded video as an ordered stream of bytes. Annex C specifies the hypothetical reference decoder, bitstream conformance, decoder conformance, and the use of the hypothetical reference decoder to check bitstream and decoder conformance. Annex D specifies syntax and semantics for supplemental enhancement information (SEI) message payloads that affect the conformance specifications in Annex C. Rec. ITU-T H.274 | ISO/IEC 23002-7 specifies the syntax and semantics of the video usability information (VUI) parameters as well as SEI messages that do not affect the conformance specifications in Annex C. These VUI parameters and SEI messages may be used together with this document.

The term "this document" is used to refer to this Recommendation | International Standard.

In this document, the following verbal forms are used:

— “shall” indicates a requirement;

— “should” indicates a recommendation;

— “may” indicates a permission;

— “can” indicates a possibility or a capability.

Information marked as “NOTE” is intended to assist the understanding or use of the document. “Notes to entry” used in Clause 3 provide additional information that supplements the terminological data and can contain provisions relating to the use of a term.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

ISO/IEC 23090-3:2024
https://standards.iteh.ai/catalog/standards/iso/7495d761-3c62-4936-8c6b-2e7ae2a033ba/iso-iec-23090-3-2024

© ISO/IEC 2024 – All rights reserved

iTeh Standards
(https://standards.iteh.ai)
Document Preview

ISO/IEC 23090-3:2024
https://standards.iteh.ai/catalog/standards/iso/7495d761-3c62-4936-8c6b-2e7ae2a033ba/iso-iec-23090-3-2024

Information technology — Coded representation of immersive media —

Part 3:
Versatile video coding

1 Scope

This document specifies a video coding technology known as versatile video coding (VVC), comprising a video coding technology with a compression capability that is substantially beyond that of the prior generations of such standards and with sufficient versatility for effective use in a broad range of applications.

Only the syntax format, semantics, and associated decoding process requirements are specified, while other matters such as pre-processing, the encoding process, system signalling and multiplexing, data loss recovery, post-processing, and video display are considered to be outside the scope of this document. Additionally, the internal processing steps performed within a decoder are also considered to be outside the scope of this document; only the externally observable output behaviour is required to conform to the specifications of this document.

This document is designed to be generic in the sense that it serves a wide range of applications, bit rates, resolutions, qualities and services. Applications include, but are not limited to, video coding for digital storage media, television broadcasting and real-time communication. In the course of creating This document, various requirements from typical applications have been considered, necessary algorithmic elements have been developed, and these have been integrated into a single syntax. Hence, this document is designed to facilitate video data interchange among different applications.

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ISO/IEC 23090-3:2024
https://standards.iteh.ai/catalog/standards/iso/7495d761-3c62-4936-8c6b-2e7ae2a033ba/iso-iec-23090-3-2024

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes 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 23001-11, *Information Technology — MPEG Systems technologies — Part 11: Energy-efficient media consumption (green metadata)*

Rec. ITU-T H.274 | ISO/IEC 23002-7, *Versatile supplemental enhancement information messages for coded video bitstreams*

ISO/IEC 23090-13, Information technology — *Coded representation of immersive media — Part 13: Video decoding interface for immersive media*

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

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/

© ISO/IEC 2024 – All rights reserved

3.1
access unit
set of *PUs* that belong to different *layers* and contain *coded pictures* associated with the same time for output from the *DPB*

3.2
adaptive colour transform
cross-*component transform* applied to the decoded *residual* of a *coding unit* in the 4:4:4 colour format prior to reconstruction and loop filtering

3.3
adaptive loop filter
filtering process that is applied as part of the *decoding process* and is controlled by parameters conveyed in an *APS*

3.4
ALF APS
APS that controls the *ALF* process

3.5
adaptation parameter set
syntax structure containing *syntax elements* that apply to zero or more *slices* as determined by zero or more *syntax elements* found in *slice headers*

3.6
associated GDR picture
previous *GDR picture* (when present) in *decoding order*, for a particular picture with nuh_layer_id equal to a particular value layerId, that has nuh_layer_id equal to layerId and between which and the particular *picture* in *decoding order* there is no *IRAP picture* with nuh_layer_id equal to layerId

3.7
associated IRAP picture
previous *IRAP picture* (when present) in *decoding order*, for a particular picture with nuh_layer_id equal to a particular value layerId, that has nuh_layer_id equal to layerId and between which and the particular *picture* in *decoding order* there is no *GDR picture* with nuh_layer_id equal to layerId

3.8
associated IRAP subpicture
previous *IRAP subpicture* (when present) in *decoding order*, for a particular subpicture with nuh_layer_id equal to a particular value layerId and subpicture index equal to a particular value subpicIdx, that has nuh_layer_id equal to layerId and subpicture index equal to subpicIdx and between which and the particular sub*picture* in *decoding order* there is no *GDR subpicture* with nuh_layer_id equal to layerId and subpicture index equal to subpicIdx

3.9
associated non-VCL NAL unit
non-VCL NAL unit (when present) for a *VCL NAL unit* where the *VCL NAL unit* is the *associated VCL NAL unit* of the *non-VCL NAL unit*

3.10
associated VCL NAL unit
preceding *VCL NAL unit* in *decoding order* for a *non-VCL NAL unit* with nal_unit_type equal to EOS_NUT, EOB_NUT, SUFFIX_APS_NUT, SUFFIX_SEI_NUT, FD_NUT, RSV_NVCL_27, UNSPEC_30, or UNSPEC_31; or otherwise the next *VCL NAL unit* in *decoding order*

3.11
bin
bit of a *bin string*

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ISO/IEC 23090-3:2024
https://standards.iteh.ai/catalog/standards/sist/7e8e1e01-3c0c-4e26-8bbb-2c7ae2a0130a/iso-iec-23090-3-2024

© ISO/IEC 2024 – All rights reserved

3.12
binarization
set of *bin strings* for all possible values of a *syntax element*

3.13
binarization process
unique mapping process of all possible values of a *syntax element* onto a set of *bin strings*

3.14
binary split
split of a rectangular MxN *block* of samples into two *blocks* where a vertical split results in a first (M / 2)xN *block* and a second (M / 2)xN *block*, and a horizontal split results in a first Mx(N / 2) *block* and a second Mx(N / 2) *block*

3.15
bin string
intermediate binary representation of values of *syntax elements* from the *binarization* of the *syntax element*

3.16
bi-predictive slice
B slice
slice that is decoded using *intra prediction* or using *inter prediction* with at most two *motion vectors* and *reference indices* to *predict* the sample values of each *block*

3.17
bitstream
sequence of bits, in the form of a *NAL unit stream* or a *byte stream*, that forms the representation of a sequence of *AUs* forming one or more coded video sequences *(CVSs)*

3.18
block
MxN (M-column by N-row) array of samples, or an MxN array of *transform coefficients*

3.19
block vector
two-dimensional vector that provides an offset from the coordinates of the current *coding block* to the coordinates of the reference block in the same decoded *slice*

3.20
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

3.21
byte-aligned
<*bitstream*> positioned an integer multiple of 8 bits from the position of the first bit in the *bitstream*

3.22
byte-aligned
<bit or *byte* or *syntax element*> position at which it appears in a *bitstream* is byte-aligned

3.23
byte stream
encapsulation of a *NAL unit stream* into a series of *bytes* containing *start code prefixes* and *NAL units*

3.24
chroma

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ISO/IEC 23090-3:2024
https://standards.iteh.ai/catalog/standards/iso/7495d761-3c62-4936-8c6b-2e7ae2a033ba/iso-iec-23090-3-2024

© ISO/IEC 2024 – All rights reserved

sample array or single sample representing one of the two colour difference signals related to the primary colours, represented by the symbols Cb and Cr

Note 1 to entry: The term chroma is used rather than the term chrominance in order to avoid the implication of the use of linear light transfer characteristics that is often associated with the term chrominance.

3.25
CRA PU
PU in which the *coded picture* is a *CRA picture*

3.26
CRA picture
IRAP picture for which each *VCL NAL unit* has nal_unit_type equal to CRA_NUT

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

3.27
CRA subpicture
IRAP subpicture for which each *VCL NAL unit* has nal_unit_type equal to CRA_NUT

3.28
coded layer video sequence:
sequence of *PUs* with the same value of nuh_layer_id that consists, in *decoding order*, of a *CLVSS PU*, followed by zero or more *PUs* that are not *CLVSS PUs*, including all subsequent *PUs* up to but not including any subsequent *PU* that is a *CLVSS PU*

Note 1 to entry: A CLVSS PU could be an IDR PU, a CRA PU, or a GDR PU. The value of NoOutputBeforeRecoveryFlag is equal to 1 for each IDR PU, and each CRA PU that has HandleCraAsClvsStartFlag equal to 1, and each CRA or GDR PU that is the first PU in the layer of the bitstream in decoding order or the first PU in the layer of the bitstream that follows an EOS NAL unit in the layer in decoding order.

3.29
CLVSS PU
PU in which the *coded picture* is a *CLVSS picture*

3.30
CLVSS picture
coded picture that is an *IRAP picture* with NoOutputBeforeRecoveryFlag equal to 1 or a *GDR picture* with NoOutputBeforeRecoveryFlag equal to 1

3.31
coded picture
coded representation of a *picture* comprising *VCL NAL units* with a particular value of nuh_layer_id within an *AU* and containing all *CTUs* of the *picture*

3.32
coded picture buffer
first-in first-out buffer containing *DUs* in *decoding order* specified in the *hypothetical reference decoder*

Note 1 to entry: The hypothetical reference decoder is specified in Annex C.

3.33
coded representation
data element as represented in its coded form

3.34
coded slice NAL unit
NAL unit that contains a coded *slice*

iTeh Standards
(https://standards.iteh.ai)
ISO/IEC 23090-3:2024
https://standards.iteh.ai/catalog/standards/iso/95d761-3c62-4936-8c6b-2e7ae2a033ba/iso-iec-23090-3-2024

© ISO/IEC 2024 – All rights reserved