International Standard

ISO/IEC 23090-16

Information technology — Coded representation of immersive media —

Part 16: Reference software for versatile video coding

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

Partie 16: Logiciel de référence pour le codage vidéo polyvalent (VCC)

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Foreword

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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).

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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*, in collaboration with ITU-T (as Rec. ITU-T H.266.2).

This second edition cancels and replaces the first edition (ISO/IEC 23090-16:2022), which has been technically revised.

The main changes are as follows:

— Inclusion of software implementation of additional SEI messages defined in Rec. ITU-T H.266 | ISO/IEC 23090-3 and in Rec. ITU-T H.274 | ISO/IEC 23002-7.

— General software improvements such as bug fixes, run time improvements, and additional encoder configuration options.

— Modified encoder configuration files yielding improved compression performance.

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

0.1 General

This document provides reference software for Rec. ITU-T H.266 | ISO/IEC 23090-3. The reference software includes both encoder and decoder functionality.

Reference software is useful in aiding users of a video coding standard to establish and test conformance and interoperability, and to educate users and demonstrate the capabilities of the standard. For these purposes, the accompanying software is provided as an aid for the study and implementation of Rec. ITU-T H.266 | ISO/IEC 23090-3.

0.2 Purpose

The purpose of this document is to provide the following:

— Reference decoder software capable of decoding bitstreams that conform to Rec. ITU-T H.266 | ISO/IEC 23090-3 in a manner that conforms to the decoding process specified in Rec. ITU-T H.266 | ISO/IEC 23090-3.

— Reference encoder software capable of producing bitstreams that conform to Rec. ITU-T H.266 | ISO/IEC 23090-3.

0.3 Examples of use

Some examples of uses that can be appropriate for the reference decoder software are as follows:

— As an illustration of how to perform the decoding process specified in Rec. ITU-T H.266 | ISO/IEC 23090-3.

— As the starting point for the implementation of a decoder that conforms to Rec. ITU-T H.266 | ISO/IEC 23090-3.

— For testing the conformance of a decoder implementation with the decoding process specified in Rec. ITU-T H.266 | ISO/IEC 23090-3 (as the values of the samples in all output cropped decoded pictures and the relative ordering of those pictures will be identical to all conforming decoder implementations that support the profile and level used in a bitstream that conforms to Rec. ITU-T H.266 | ISO/IEC 23090-3).

— For testing the conformance of a bitstream to the constraints specified for bitstream conformance in Rec. ITU-T H.266 | ISO/IEC 23090-3, as the software can detect and report many bitstream conformance violations.

NOTE 1 The lack of the detection of any conformance violation by the reference decoder software is not considered as definitive proof that the bitstream conforms to all constraints specified for bitstream conformance in Rec. ITU-T H.266 | ISO/IEC 23090-3.

Some examples of uses that can be appropriate for the reference encoder software are as follows:

— As an illustration of how to perform an encoding process that produces bitstreams that conform to the constraints specified for bitstream conformance in Rec. ITU-T H.266 | ISO/IEC 23090-3.

— As the starting basis for the implementation of an encoder that conforms to Rec. ITU-T H.266 | ISO/IEC 23090-3.

— As a means of generating bitstreams for testing the conformance of a decoder implementation with the decoding process specified in Rec. ITU-T H.266 | ISO/IEC 23090-3.

— As a means of evaluating and demonstrating examples of the quality that can be achieved by an encoding process that conforms to Rec. ITU-T H.266 | ISO/IEC 23090-3.

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NOTE 2 No guarantee of the quality that will be achieved by an encoder is provided by its conformance to Rec. ITU-T H.266 | ISO/IEC 23090-3, as the conformance of an encoder to Rec. ITU-T H.266 | ISO/IEC 23090-3 is defined only in terms of format constraints imposed on the bitstream syntax. While the reference encoder software suffices to provide some illustrative examples of what quality can be achieved in conformance to Rec. ITU-T H.266 | ISO/IEC 23090-3, it provides neither an assurance of minimum guaranteed video encoding quality nor maximum achievable video encoding quality.

0.4 Warranty disclaimer

Regardless of any and all statements made herein or elsewhere regarding the possible uses of the reference software, the following disclaimers of warranty apply to the provided reference software:

— ITU and ISO/IEC disclaim any and all warranties, whether express, implied or statutory, including any implied warranties of merchantability or of fitness for a particular purpose.

— In no event are the contributor(s), ITU or ISO/IEC to be liable for any incidental, punitive or consequential damages of any kind whatsoever arising from the use of these programs.

— This disclaimer of warranty extends to the user of these programs and user's customers, employees, agents, transferees, successors and assignees.

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Information technology — Coded representation of immersive media —

Part 16:
Reference software for versatile video coding

1 Scope

This document establishes a reference software package for Rec. ITU-T H.266 | ISO/IEC 23090-3 available at https://standards.iso.org/iso-iec/23090/-16/ed-2/en/. The software is an integral part of this document.

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.

Recommendation ITU-T H.266 (2023), *Versatile video coding*

ISO/IEC 23090-3:2024, *Information technology — Coded representation of immersive media — Part 3: Versatile video coding*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in Rec. ITU-T H.266:2023 | ISO/IEC 23090-3:2024 and the following 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
bitstream
sequence of bits that conforms to specified syntax requirements or is to be tested for conformance to such syntax requirements

3.2
decoder
embodiment of a specified decoding process or process to be tested for conformance to such a decoding process specification

3.3
encoder
embodiment of a process that produces a *bitstream* (3.1)

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3.4
reference software decoder
particular *decoder* (3.2) provided as a software package for use as an example available for study, as a potential starting basis for the development of other decoders, as a way of testing *bitstreams* (3.1) for conformance to a decoding process specification, or as a reference for comparison with the behaviour of other decoders

3.5
reference software encoder
particular *encoder* (3.3) provided as a software package for use as an example available for study, as a potential starting basis for the development of other encoders, or as a reference for comparison with the behaviour of other encoders

4 Abbreviated terms

The relevant abbreviated terms are specified in Rec. ITU-T H.266:2023 | ISO/IEC 23090-3:2024, Clause 4.

5 Conventions

The relevant conventions are specified in Rec. ITU-T H.266:2023 | ISO/IEC 23090-3:2024, Clause 5.

6 Reference software for Rec. ITU-T H.266 | ISO/IEC 23090-3

The reference software for Rec. ITU-T H.266 | ISO/IEC 23090-3 is available at https://standards.iso.org/iso-iec/23090/-16/ed-2/en/. This software package contains one part, referred to as VTM software, that comprises a reference software encoder and a reference software decoder with support for the following profiles:

— The Main 10, Main 10 Still Picture, Main 10 4:4:4, Main 10 4:4:4 Still Picture, Multilayer Main 10 and Multilayer Main 10 4:4:4 profiles;

— The Main 12, Main 12 4:4:4 and Main 16 4:4:4 profiles;

— The Main 12 Intra, Main 12 4:4:4 Intra and Main 16 4:4:4 Intra profiles;

— The Main 12 Still Picture, Main 12 4:4:4 Still Picture and Main 16 4:4:4 Still Picture profiles.

In addition to encoding and decoding capabilities, the reference software includes capabilities for the use of supplemental enhancement information messages specified in Rec. ITU-T H.266 | ISO/IEC 23090-3 and Rec. ITU-T H.274 | ISO/IEC 23002-7, such as encoding and parsing of syntax, demonstration of functionality or export of associated data.

The use of this reference software is not required for making an implementation of an encoder or decoder in conformance to Rec. ITU-T H.266 | ISO/IEC 23090-3. Requirements established in Rec. ITU-T H.266 | ISO/IEC 23090-3 take precedence over the behaviour of the reference software.

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