International Telecommunication Union

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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Coding of moving video

Reference software for ITU-T H.265 high efficiency video coding

Recommendation ITU-T H.265.2

ITU-T H-SERIES RECOMMENDATIONS

AUDIOVISUAL AND MULTIMEDIA SYSTEMS

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T H.265.2

Reference software for ITU-T H.265 high efficiency video coding

Summary

Recommendation ITU-T H.265.2 contains an accompanying reference software for Rec. ITU-T H.265 | ISO/IEC 23008-2 *High efficiency video coding*. 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.265 | ISO/IEC 23008-2. This edition of ITU-T H.265.2 matches the technical descriptions in the second edition of ITU-T H.265 (2014-10).

The software has been jointly developed by the ITU-T Video Coding Experts Group (VCEG, Question 6 of ITU-T Study Group 16) and the ISO/IEC Moving Picture Experts Group (MPEG, Working Group 11 of Subcommittee 29 of ISO/IEC Joint Technical Committee 1). It was developed jointly with MPEG and corresponds in a technically aligned manner to ISO/IEC 23008-5.

The Reference source code for ITU-T H.265.2 is found in the electronic attachment to this Recommendation.

History

Edition	Recommendation	Approval	Study Group	Unique ID[*]
1.0	ITU-T H.265.2	2014-10-14	16	11.1002/1000/12298
2.0	ITU-T H.265.2	2016-02-13	16	11.1002/1000/12645
3.0	ITU-T H.265.2 (V3)	2016-12-22	16	11.1002/1000/12947

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[*] To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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Electronic attachment: Reference source code

Introduction

0.1 Purpose

The purpose of this Recommendation | International Standard is to provide the following:

- Reference decoder software capable of decoding bitstreams that conform to Rec. ITU-T H.265 | ISO/IEC 23008-2 in a manner that conforms to the decoding process specified in Rec. ITU-T H.265 | ISO/IEC 23008-2.

- Reference encoder software capable of producing bitstreams that conform to Rec. ITU-T H.265 | ISO/IEC 23008-2.

0.2 Examples of use

Some examples of use that may 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.265 | ISO/IEC 23008-2.

- As the starting basis for the implementation of a decoder that conforms to Rec. ITU-T H.265 | ISO/IEC 23008-2.

- For testing the conformance of a decoder implementation with the decoding process specified in Rec. ITU-T H.265 | ISO/IEC 23008-2 (as the values of the samples in all decoded pictures and the relative ordering of those pictures will be identical from all conforming decoder implementations that support the profile and level used in a bitstream that conforms to Rec. ITU-T H.265 | ISO/IEC 23008-2).

- For testing the conformance of a bitstream to the constraints specified for bitstream conformance in Rec. ITU-T H.265 | ISO/IEC 23008-2, as the software can detect and report many bitstream conformance violations.

  NOTE 1 – However, the lack of the detection of any conformance violation by the reference decoder software should not be considered as definitive proof that the bitstream conforms to all constraints specified for bitstream conformance in Rec. ITU-T H.265 | ISO/IEC 23008-2.

Some examples of use that may 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.265 | ISO/IEC 23008-2.

- As the starting basis for the implementation of an encoder that conforms to Rec. ITU-T H.265 | ISO/IEC 23008-2.

- As a means of generating bitstreams for testing the conformance of a decoder implementation with the decoding process specified in Rec. ITU-T H.265 | ISO/IEC 23008-2.

- 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.265 | ISO/IEC 23008-2.

  NOTE 2 – However, no guarantee of the quality that will be achieved by an encoder is provided by its conformance to Rec. ITU-T H.265 | ISO/IEC 23008-2, as the conformance of an encoder to Rec. ITU-T H.265 | ISO/IEC 23008-2 is defined only in terms of format constraints imposed on the bitstream syntax. Thus, while the reference encoder software may suffice to provide some illustrative examples of what quality can be achieved in conformance to Rec. ITU-T H.265 | ISO/IEC 23008-2, it provides neither an assurance of minimum guaranteed video encoding quality nor maximum achievable video encoding quality.

0.3 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 shall the contributor(s), ISO/IEC or ITU be liable for any incidental, punitive, or consequential damages of any kind whatsoever arising from the use of these programs.

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– Information regarding the common patent policy for ITU-T/ITU-R/ISO/IEC is available from the ITU website at http://itu.int/ITU-T/dbase/patent/patent-policy.html.

Recommendation ITU-T H.265.2

Reference software for ITU-T H.265 high efficiency video coding

1 Scope

This Recommendation | International Standard provides accompanying reference software for Rec. ITU-T H.265 | ISO/IEC 23008-2 as an electronic attachment. The software is an integral part of this Recommendation | International Standard.

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.265 | ISO/IEC 23008-2. Requirements established in Rec. ITU-T H.265 | ISO/IEC 23008-2 take precedence over the behaviour of the reference software.

2 References

2.1 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1.1 ITU-T Recommendations

None.

2.1.2 Identical Recommendations | International Standards

None.

2.1.3 Paired Recommendations | International Standards equivalent in technical content

– Recommendation ITU-T H.265 (in force), *High efficiency video coding*.

ISO/IEC 23008-2 (in force), *Information technology – High efficiency coding and media delivery in heterogeneous environments – Part 2: High efficiency video coding*.

2.2 Additional references

None.

3 Definitions

For the purposes of this Recommendation, the terms, definitions, abbreviations and symbols specified in Rec. ITU-T H.265 | ISO/IEC 23008-2 (particularly in clause 3) apply. Definitions 3.1, 3.2, and 3.3 below replace the corresponding definitions in Rec. ITU-T H.265 | ISO/IEC 23008-2. Definitions 3.4 and 3.5 are additional definitions.

3.1   bitstream: A sequence of bits that may conform to Rec. ITU-T H.265 | ISO/IEC 23008-2. A bitstream that conforms to Rec. ITU-T H.265 | ISO/IEC 23008-2 will contain one or more slices.

3.2   decoder: An embodiment of a process that operates on a bitstream and may conform to the decoding process requirements specified for conformance to Rec. ITU-T H.265 | ISO/IEC 23008-2. The scope of decoder, as considered herein, does not include a display process, which is outside the scope of this Recommendation | International Standard.

3.3   encoder: An embodiment of a process, not specified in this Recommendation | International Standard, that produces a bitstream.

3.4   reference software decoder: The decoding software accompanying this Recommendation | International Standard.

3.5   **reference software encoder**: The encoding software accompanying this Recommendation | International Standard.

4   Abbreviations

For the purposes of this Recommendation | International Standard, relevant abbreviations are specified in clause 4 of Rec. ITU-T H.265 | ISO/IEC 23008-2.
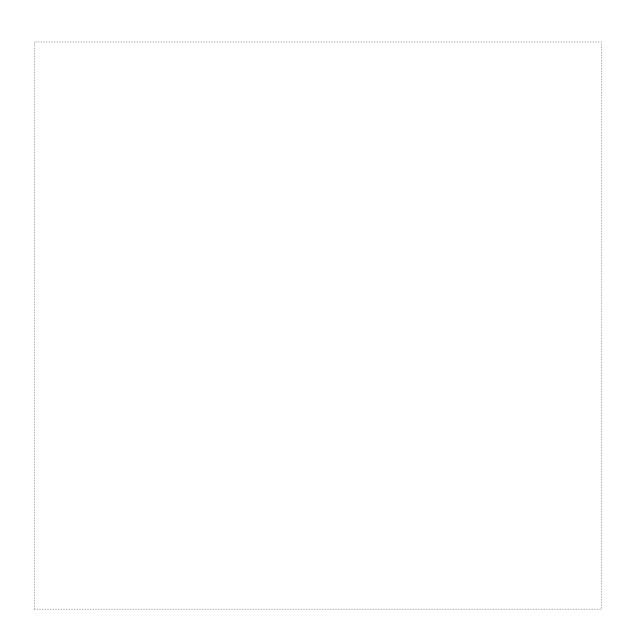
5   Conventions

For the purposes of this Recommendation | International Standard, relevant conventions are specified in clause 5 of Rec. ITU-T H.265 | ISO/IEC 23008-2.

6   Reference software for Rec. ITU-T H.265 | ISO/IEC 23008-2

The reference software for Rec. ITU-T H.265 | ISO/IEC 23008-2 is found in the electronic attachment to this Recommendation | International Standard.

The attached software package contains four parts:

–   HM software: Support for the following profiles:
   •   the Main, Main 10, and Main Still Picture profiles
   •   the Monochrome, Monochrome 12 and Monochrome 16 profiles
   •   the Main 12 profile
   •   the Main 4:2:2 10 and Main 4:2:2 12 profiles
   •   the Main 4:4:4, Main 4:4:4 10, and Main 4:4:4 12 profiles
   •   the Main 4:4:4 Still Picture and Main 4:4:4 16 Still Picture profiles
   •   the Main Intra, Main 10 Intra, Main 12 Intra, Main 4:2:2 10 Intra, Main 4:2:2 12 Intra, Main 4:4:4 Intra, Main 4:4:4 10 Intra, Main 4:4:4 12 Intra, and Main 4:4:4 16 Intra profiles
   •   the High Throughput 4:4:4 16 Intra profile
–   SHM software: Support for the Scalable Main, the Scalable Main 10, Scalable Monochrome, Scalable Monochrome 12, Scalable Monochrome 16, and Scalable Main 4:4:4 profiles
–   HTM software: Support for the Multiview Main and 3D Main profiles
–   HM+SCC software: Support for the following profiles:
   •   Screen-Extended Main and Screen-Extended Main 10 profiles
   •   Screen-Extended Main 4:4:4 and Screen-Extended Main 4:4:4 10 profiles
   •   Screen-Extended High Throughput 4:4:4, Screen-Extended High Throughput 4:4:4 10, and Screen-Extended High Throughput 14 profiles

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