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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Coding of moving video

Reference software for ITU-T H.264 advanced video coding

Recommendation ITU-T H.264.2

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

Recommendation ITU-T H.264.2

Reference software for ITU-T H.264 advanced video coding

Summary

Recommendation ITU-T H.264.2 provides accompanying reference software for Rec. ITU-T H.264 | ISO/IEC 14496-10 as an electronic attachment. The software is an integral part of Rec. ITU-T H.264.2.

The purpose of this Recommendation is to provide the following.

- Reference decoder software capable of decoding bitstreams that conform to Rec. ITU-T H.264 | ISO/IEC 14496-10 in a manner that conforms to the decoding process specified in Rec. ITU-T H.264 | ISO/IEC 14496-10.
- Reference encoder software capable of producing bitstreams that conform to Rec. ITU-T H.264 | ISO/IEC 14496-10.

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.264 | ISO/IEC 14496-10. Requirements established in Rec. ITU-T H.264 | ISO/IEC 14496-10 take precedence over the behaviour of the reference software.

The edition approved in 2009-05 incorporated changes made to the reference software for Rec. ITU-T H.264 | ISO/IEC 14496-10 advanced video coding. The changes contain improvements of encoder compression capability, bug fixes, speed and memory resource usage improvements, restructuring of the software for readability and ease of software maintenance, and the addition of support for new profiles of ITU-T H.264. The new profiles are from the set of profiles targeting professional applications that were added to Rec. ITU-T H.264 | ISO/IEC 14496-10 in 2007. No changes were made to the text of the Recommendation.

The edition approved in 2010-06 contained improvements of encoder compression capability, bug fixes, speed and memory resource usage improvements, restructuring of the software for readability and ease of software maintenance. In addition, this edition includes support for the Scalable Baseline, Scalable High, Scalable High Intra, Multiview High, and Stereo High profiles. The support for the scalable profiles specified in Annex G of Rec. ITU-T H.264 | ISO/IEC 14496-10 (Scalable Baseline, Scalable High, and Scalable High Intra) and the support for the multiview profiles specified in Annex H of Rec. ITU-T H.264 | ISO/IEC 14496-10 (Multiview High and Stereo High) are provided in separate software solutions.

The edition approved in 2012-01 only introduced changes to the reference software of Recommendation ITU-T H.264.2 (the text is the same as of the edition approved 2010-06). The changes in the reference software improve the encoder compression capability, fix bugs, and improve speed and memory resource usage. The software was also restructured for better readability and ease of maintenance.

The edition approved in 2014-07 contains bug fixes for the profiles specified in Annex A of Rec. ITU-T H.264 | ISO/IEC 14496-10. In addition, the edition includes support for the MFC High profile specified in Annex H of Rec. ITU-T H.264 | ISO/IEC 14496-10, support for the Multiview Depth High profile specified in Annex I of Rec. ITU-T H.264 | ISO/IEC 14496-10, and support for the Enhanced Multiview Depth High profile specified in Annex J of Rec. ITU-T H.264 | ISO/IEC 14496-10, which are provided in separate software packages.

This edition includes support for the MFC Depth High profile, which was included in the MFC plus Depth extension in ITU-T H.264 V10. It also includes miscellaneous minor improvements and bug fixes relative to the prior approved version. This Recommendation was developed jointly with ISO/IEC JTC 1/SC 29/WG 11 (MPEG) and corresponds to part of ISO/IEC 14496-5, up to and including ISO/IEC 14496-5:2001 Amendment 39.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T H.264.2	2005-03-01	16	11.1002/1000/7826
1.1	ITU-T H.264.2 (2005) Cor. 1	2005-10-22	16	11.1002/1000/8574
2.0	ITU-T H.264.2	2008-06-13	16	11.1002/1000/9487
3.0	ITU-T H.264.2	2010-06-22	16	11.1002/1000/10637
4.0	ITU-T H.264.2	2012-01-13	16	11.1002/1000/11468
5.0	ITU-T H.264.2	2015-02-20	16	11.1002/1000/12295
6.0	ITU-T H.264.2	2016-02-13	16	11.1002/1000/12644

* 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 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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Introduction*

This Recommendation provides accompanying reference software for Rec. ITU-T H.264 | ISO/IEC 14496-10 advanced 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.264 | ISO/IEC 14496-10 advanced video coding.

The software has been jointly developed by ITU-T Video Coding Experts Group (VCEG) and the ISO/IEC Moving Picture Experts Group (MPEG).

0.1 Purpose

The purpose of this Recommendation is to provide the following:

- Reference decoder software capable of decoding bitstreams that conform to Rec. ITU-T H.264 | ISO/IEC 14496-10 in a manner that conforms to the decoding process specified in Rec. ITU-T H.264 | ISO/IEC 14496-10.
- Reference encoder software capable of producing bitstreams that conform to Rec. ITU-T H.264 | ISO/IEC 14496-10.

0.2 Examples of use

Some examples of uses 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.264 | ISO/IEC 14496-10.
- As the starting basis for the implementation of a decoder that conforms to Rec. ITU-T H.264 | ISO/IEC 14496-10.
- For testing the conformance of a decoder implementation with the decoding process specified in Rec. ITU-T H.264 | ISO/IEC 14496-10 (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.264 | ISO/IEC 14496-10).
- For testing the conformance of a bitstream to the constraints specified for bitstream conformance in Rec. ITU-T H.264 | ISO/IEC 14496-10, 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.264 | ISO/IEC 14496-10.

Some examples of uses 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.264 | ISO/IEC 14496-10.
- As the starting basis for the implementation of an encoder that conforms to Rec. ITU-T H.264 | ISO/IEC 14496-10.
- As a means of generating bitstreams for testing the conformance of a decoder implementation with the decoding process specified in Rec. ITU-T H.264 | ISO/IEC 14496-10.
- 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.264 | ISO/IEC 14496-10.

  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.264 | ISO/IEC 14496-10, as the conformance of an encoder to Rec. ITU-T H.264 | ISO/IEC 14496-10 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.264 | ISO/IEC 14496-10, it provides neither an assurance of minimum guaranteed video encoding quality nor maximum achievable video encoding quality.

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* This introduction does not form an integral part of this Recommendation.

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 disclaims any and all warranties, whether express, implied, or statutory, including any implied warranties of merchantability or of fitness for a particular purpose.
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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.264.2

Reference software for ITU-T H.264 advanced video coding

1 Scope

This Recommendation provides accompanying reference software for Rec. ITU-T H.264 | ISO/IEC 14496-10 as an electronic attachment. The software is an integral part of this Recommendation.

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.264 | ISO/IEC 14496-10. Requirements established in Rec. ITU-T H.264 | ISO/IEC 14496-10 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.264 (2007), *Advanced video coding for generic audiovisual services*.

ISO/IEC 14496-10:2008, *Information technology – Coding of audio-visual objects – Part 10: Advanced 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.264 | ISO/IEC 14496-10 (particularly in clause 3) apply. Definitions 3.1, 3.2, and 3.3 below replace the corresponding definitions in Rec. ITU-T H.264 | ISO/IEC 14496-10. Definitions 3.4 and 3.5 are additional definitions.

3.1 **bitstream**: A sequence of bits that may conform to Rec. ITU-T H.264 | ISO/IEC 14496-10. A bitstream that conforms to Rec. ITU-T H.264 | ISO/IEC 14496-10 will contain one or more IDR slices, and may contain additional I, P, B, SI, SP, EI, EP or EB 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.264 | ISO/IEC 14496-10. The scope of decoder, as considered herein, does not include a display process, which is outside the scope of this Recommendation.

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

3.4 **reference software decoder**: The decoding software accompanying this Recommendation.

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

4 Abbreviations

For the purposes of this Recommendation, relevant abbreviations are specified in clause 4 of Rec. ITU-T H.264 | ISO/IEC 14496-10.

5 Conventions

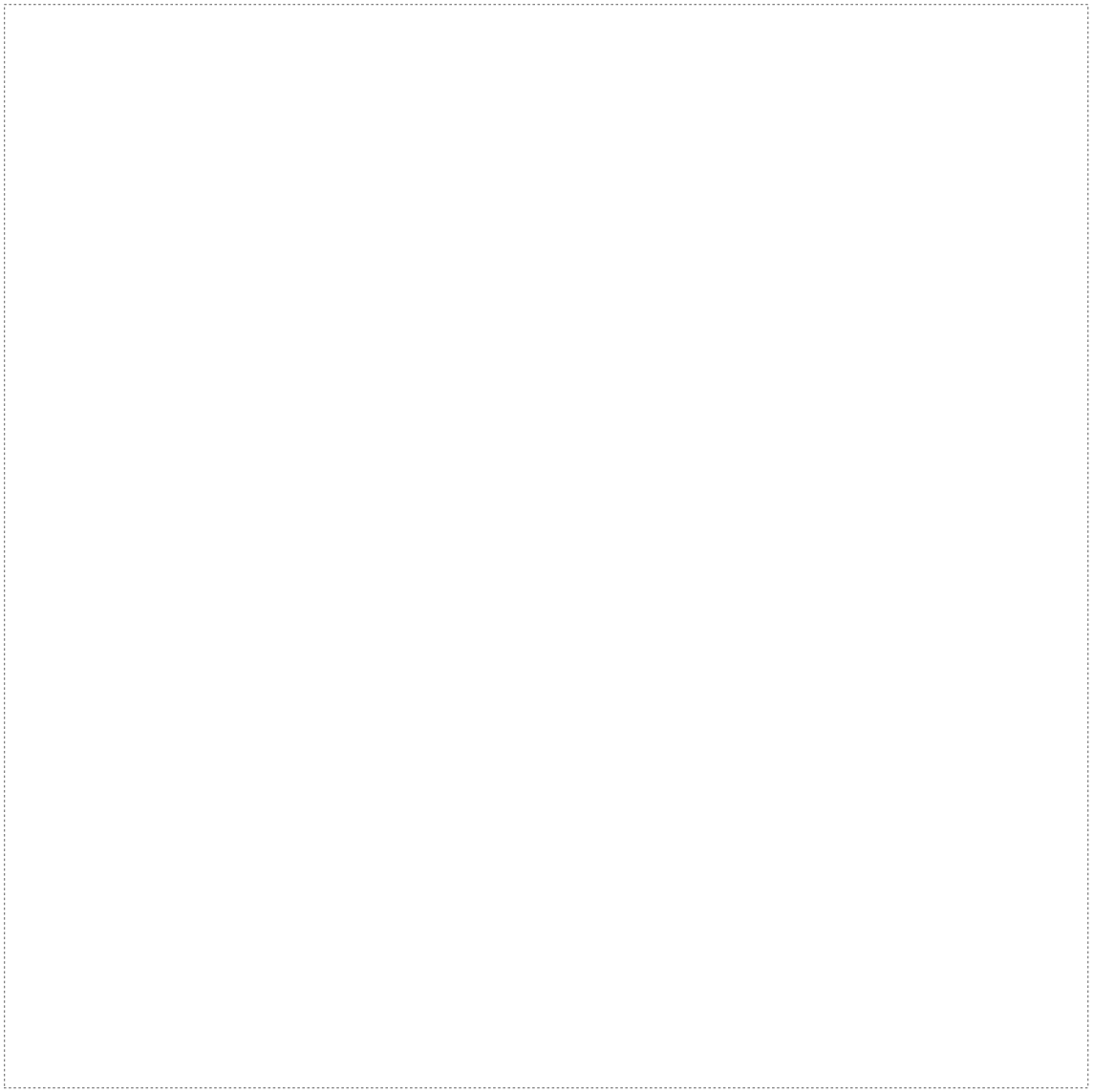
For the purposes of this Recommendation, relevant conventions are specified in clause 5 of Rec. ITU-T H.264 | ISO/IEC 14496-10.

6 Reference software for Rec. ITU-T H.264 | ISO/IEC 14496-10

The reference software for Rec. ITU-T H.264 | ISO/IEC 14496-10 is found in the electronic attachment to this Recommendation.

The attached software package contains six separate parts:

- JM software: Support for the Baseline, Constrained Baseline, Main, Extended, High, High 10, High 4:2:2, High 4:4:4 Predictive, High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, and CAVLC 4:4:4 Intra profiles.
- JSVM software: Support for the Scalable Baseline, Scalable High, and Scalable High Intra profiles.
- JMVC software: Support for the Multiview High and Stereo High profiles.
- MFC software: Support for the MFC High profile.
- MVCD and 3D-AVC software: Support for the Multiview Depth High and Enhanced Multiview Depth High profiles.
- MFCD software: Support for the MFC Depth High Profile



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