International Telecommunication Union

ITU-T H.264

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

(08/2021)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Coding of moving video

Advanced video coding for generic audiovisual services

Recommendation ITU-T H.264

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

Recommendation ITU-T H.264

Advanced video coding for generic audiovisual services

Summary

Recommendation ITU-T H.264 | International Standard ISO/IEC 14496-10 represents an evolution of the existing video coding standards (ITU-T H.261, ITU-T H.262, and ITU-T H.263) and it was developed in response to the growing need for higher compression of moving pictures for various applications such as videoconferencing, digital storage media, television broadcasting, Internet streaming, and communication. It is also designed to enable the use of the coded video representation in a flexible manner for a wide variety of network environments. The use of this Recommendation | International Standard allows motion video to be manipulated as a form of computer data and to be stored on various storage media, transmitted and received over existing and future networks and distributed on existing and future broadcasting channels.

The 1st edition of Rec. ITU-T H.264 was approved in 2003-05.

Corrigendum 1 to the 1st version of Rec. ITU-T H.264, approved in 2004-05, included various minor corrections and clarifications. This corrigendum was never published independently, its content having been included in the 1st published edition.

The 2nd edition of ITU-T H.264, approved in 2005-03, contained modifications of the video coding standard to add four new profiles, referred to as the High, High 10, High 4:2:2, and High 4:4:4 profiles, to improve video quality capability and to extend the range of applications addressed by the standard (for example, by including support for a greater range of picture sample precision and higher-resolution chroma formats). Additionally, a definition of new types of supplemental data was specified to further broaden the applicability of the video coding standard. Finally, a number of corrections to errors in the published text were included.

Corrigendum 1 to the 2nd edition of Rec. ITU-T H.264, approved in 2005-09, corrected and updated various minor aspects to bring the ITU-T version of the text up to date relative to the 2005-04 output status approved as a new edition of the corresponding jointly-developed and technically-aligned text ISO/IEC 14496-10. It additionally fixed a number of minor errors and needs for clarification and defined three previously-reserved sample aspect ratio indicators. This corrigendum was never published independently, its content having been included in the 2nd published edition, which was published in 2005-11.

Amendment 1, "Support of additional colour spaces and removal of the High 4:4:4 Profile", approved in 2006-06, contained alterations to Rec. ITU-T H.264 | ISO/IEC 14496-10, Advanced Video Coding, to specify the support of additional colour spaces and to remove the definition of the High 4:4:4 profile.

Amendment 2, "New profiles for professional applications", approved in 2007-04, contained extensions to Rec. ITU-T H.264 | ISO/IEC 14496-10 Advanced Video Coding to specify the support of five additional profiles intended primarily for professional applications (the High 10 Intra, High 4:2:2 Intra, High 4:4:4 Intra, CAVLC 4:4:4 Intra, and High 4:4:4 Predictive profiles) and two new types of supplemental enhancement information (SEI) messages (the post-filter hint SEI message and the tone mapping information SEI message).

Amendment 3, "Scalable video coding", approved in 2007-11 in an integrated 3rd ITU-T H.264 edition, contained extensions to Rec. ITU-T H.264 | ISO/IEC 14496-10, Advanced Video Coding, to specify a scalable video coding extension in three profiles (the Scalable Baseline, Scalable High, and Scalable High Intra profiles).

ITU-T H.264 (2005) Amd.2 (2007) was available only as pre-published text since it was superseded by ITU-T H.264 Amd.3 (2007-11) before its publication. Furthermore, ITU-T H.264 Amd.3 was not published separately. The changes introduced by the three amendments were integrated into the 3rd ITU-T H.264 edition, which was approved in 2007-11.

Corrigendum 1 to the 2nd edition, approved in 2009-01, provided a significant number of minor corrections, clarifications, consistency improvements and formatting improvements drafted in response to accumulated errata reports collected since publication of the 2nd edition (dated 2005-03, which included a Cor.1 approved in 2005-09).

The 4th edition of ITU-T H.264, approved in 2009-05, contained enhancement extensions to support multiview video coding (MVC), specification of a "Constrained Baseline Profile", and some miscellaneous corrections and clarifications.

The 5th edition of ITU-T H.264, approved in 2010-03, contained the specification of a new profile (the Stereo High profile) for two-view video coding with support of interlaced coding tools, the specification a new SEI message (the frame packing arrangement SEI message), and some miscellaneous corrections and clarifications.

The 6th edition of ITU-T H.264, approved in 2011-07, contained the specification of a new level (Level 5.2) supporting higher processing rates in terms of maximum macroblocks per second, a new profile (the Progressive High profile) to enable implementation of decoders supporting only the frame coding tools of the previously specified High profile, and included miscellaneous corrections and clarifications.

The 7th edition of Rec. ITU-T H.264, approved in 2012-01, contained the specification of three additional profiles intended primarily for communication applications (the Constrained High, Scalable Constrained Baseline, and Scalable Constrained High profiles).

The 8th edition of Rec. ITU-T H.264, approved in 2013-04, contained an additional profile for multiview video coding with depth information (the Multiview Depth High profile), and contained additional SEI message enhancements, additional colorimetry identifiers, and corrections and clarifications.

The 9th edition of Rec. ITU-T H.264 approved in 2014-02 specified multi-resolution frame-compatible (MFC) enhancement for stereoscopic video coding, including the specification of an additional profile, the MFC High profile, an enhanced profile for combined multiview video coding with depth information (the Enhanced Multiview Depth High profile), and includes miscellaneous minor corrections and clarifications.

The 10th edition of Rec. ITU-T H.264 approved in 2016-02 specified MFC stereoscopic video with depth maps, including the specification of an additional profile, the MFC Depth High profile, and the mastering display colour volume SEI message, additional colour-related video usability information codepoint identifiers, and miscellaneous minor corrections and clarifications.

The 11th edition of Rec. ITU-T H.264, approved in 2016-10, specified additional levels of decoder capability supporting larger picture sizes (Levels 6, 6.1, and 6.2), the green metadata SEI message, the alternative depth information SEI message, additional colour-related video usability information codepoint identifiers, and miscellaneous minor corrections and clarifications.

The 12th edition of Rec. ITU-T H.264, approved in 2017-04, specified the Progressive High 10 profile; support for additional colour-related indicators including the hybrid log-gamma transfer characteristics indication, the alternative transfer characteristics SEI message, the ICTCP colour matrix transformation, chromaticity-derived constant luminance and non-constant luminance colour matrix coefficients, the colour remapping information SEI message; and miscellaneous minor corrections and clarifications.

The 13th edition of Rec. ITU-T H.264, approved in 2019-06, specified additional SEI messages for ambient viewing environment, content light level information, content colour volume, equirectangular projection, cubemap projection, sphere rotation, region-wise packing, omnidirectional viewport, SEI manifest, and SEI prefix, and miscellaneous minor corrections and clarifications

This 14th edition of Rec. ITU-T H.264, approved in 2021-08, specifies additional SEI messages for annotated regions and shutter interval information, and miscellaneous minor corrections and clarifications.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T H.264	2003-05-30	16	11.1002/1000/6312
1.1	ITU-T H.264 (2003) Cor. 1	2004-05-07	16	11.1002/1000/7255
2.0	ITU-T H.264	2005-03-01	16	11.1002/1000/7825
2.1	ITU-T H.264 (2005) Cor. 1	2005-09-13	16	11.1002/1000/8572
2.2	ITU-T H.264 (2005) Amd. 1	2006-06-13	16	11.1002/1000/8811
2.3	ITU-T H.264 (2005) Amd. 2	2007-04-06	16	11.1002/1000/9036
3.0	ITU-T H.264	2007-11-22	16	11.1002/1000/9226
3.1	ITU-T H.264 (2007) Cor. 1	2009-01-13	16	11.1002/1000/9519
4.0	ITU-T H.264	2009-03-16	16	11.1002/1000/9710
5.0	ITU-T H.264	2010-03-09	16	11.1002/1000/10635
6.0	ITU-T H.264	2011-06-29	16	11.1002/1000/11293
7.0	ITU-T H.264	2012-01-13	16	11.1002/1000/11466
8.0	ITU-T H.264	2013-04-13	16	11.1002/1000/11830
9.0	ITU-T H.264 (V9)	2014-02-13	16	11.1002/1000/12063
10.0	ITU-T H.264 (V10)	2016-02-13	16	11.1002/1000/12641
11.0	ITU-T H.264 (V11)	2016-10-14	16	11.1002/1000/12904
12.0	ITU-T H.264 (V12)	2017-04-13	16	11.1002/1000/13189
13.0	ITU-T H.264 (V13)	2019-06-13	16	11.1002/1000/13903
14.0	ITU-T H.264 (V14)	2021-08-22	16	11.1002/1000/14659

* 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.

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents/software copyrights, 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 appropriate ITU-T databases available via the ITU-T website at http://www.itu.int/ITU-T/ipr/.