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H.241

Amendment 2

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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Communication procedures

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Extended video procedures and control signals for H.300-series terminals

Amendment 2: New clause 8.3.2.14, H.264 MaxFPS frame rate parameter, and revisions to Appendix II "Examples of the set submode procedure"

Recommendation ITU-T H.241 (2006) – Amendment 2

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Recommendation ITU-T H.241

Extended video procedures and control signals for H.300-series terminals

Amendment 2

New clause 8.3.2.14, H.264 MaxFPS frame rate parameter, and revisions to Appendix II "Examples of the set submode procedure"

Summary

This Recommendation defines the use of advanced video codecs, including ITU-T Rec. H.264, in ITU-T Recs H.310, H.320, H.321, H.322, H.323 and H.324 terminals. It also defines generic extended signalling for use with all video codecs in the H.300-series terminals.

This revised version adds clarifications regarding H.264 VCL HRD (Type I HRD) versus NAL HRD (Type II HRD) bit rate usage, sample aspect ratio capabilities for H.264, signalling for Reduced Complexity Decoding Operation (RCDO) for H.264 bitstreams, and a new Annex B, "RCDO for H.264 Baseline Profile bitstreams". Annex A has been replaced with an inclusion by reference of the recently approved RFC 3984 (without actual change in content). New Annex B specifies a reduced-complexity decoding process to be applied to H.264 Baseline profile bitstreams when such use has been negotiated using ITU-T Rec. H.241.

Amendment 1 to this Recommendation provides a new clause 6.2.5 allowing for the negotiation of particular video submodes of H.264 encoding along with associated additions to Appendix I. It also includes a new Appendix II which contains non-normative examples describing the use of this new clause.

Amendment 2 to this Recommendation provides a new clause 8.3.2.14 defining a new optional H.264 capability parameter (MaxFPS). It also includes revised text for Appendix II.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T H.241	2003-07-14	16
1.1	ITU-T H.241 (2003) Cor. 1	2004-03-15	16
1.2	ITU-T H.241 (2003) Amend. 1	2005-01-08	16
2.0	ITU-T H.241	2005-09-13	16
3.0	ITU-T H.241	2006-05-29	16
3.1	ITU-T H.241 (2006) Amend. 1	2008-06-13	16
3.2	ITU-T H.241 (2006) Amend. 2	2009-12-14	16

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/.

Recommendation ITU-T H.241

Extended video procedures and control signals for H.300-series terminals

Amendment 2

New clause 8.3.2.14, H.264 MaxFPS frame rate parameter, and revisions to Appendix II "Examples of the set submode procedure"

Modifications introduced by this amendment are shown in revision marks. Unchanged text is replaced by ellipsis (…). Some parts of unchanged text (clause numbers, etc.) may be kept to indicate the correct insertion points.

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8.3.1.1 Optional parameters

For each H.264 capability, optional parameters may be signalled. These parameters permit a terminal to signal that, in addition to meeting the support requirements for the signalled Profile and Level, the terminal has additional capabilities~~. Such additional capabilities in decoders may permit encoders to send a video stream which takes advantage of these capabilities~~ or constraints.

• • •

10) AdditionalDisplayCapabilities – If present, indicates one or more additional display capabilities (see 8.3.2.13).

11) MaxFPS – If present, indicates the maximum picture rate that can be efficiently received or the maximum picture rate that can be sent (see 8.3.2.14).

• • •

8.3.2.14 H.264 MaxFPS frame rate parameter

The value of this parameter in a receive capability indicates the maximum picture frame rate that the receiver can efficiently handle. Any encoder that understands the parameter semantics shall constrain the frame rate to rates up to that specified. A receiver should have the ability to process video from a sender that does not understand this parameter.

If the parameter is absent, the encoder is free to choose any value for the frame rate that satisfies the other parameters.

When included in an **openLogicalChannel** message or a transmit capability, the value of this parameter indicates the maximum picture rate that shall be sent. For example, when encoding an NTSC 480p source, the value of MaxFPS in the **openLogicalChannel** message would be 5994 (59.94 pictures per second). When encoding an NTSC 480i source, the value of MaxFPS would be 2997 (29.97 pictures per second).

Table 8-14a – H.264 Capability Parameter – MaxFPS

Parameter name	MaxFPS
Parameter description	MaxFPS is the maximum picture rate at which frames should be sent, in units of hundredths of frames per second.
Parameter identifier value	13
Parameter status	Optional
Parameter type	unsignedMin
Supersedes	This field shall not be included

…

Appendix II

Examples of the set submode procedure

(This appendix does not form ~~a~~an integral part of this Recommendation)

This appendix provides informative guidance and examples illustrating the use of the set submode procedure defined in clause 6.2.5.

The H.264 capabilities defined by clause 8.3 ~~generally~~usually allow more than one set of encoding parameters to be used by the video source.

For instance, the capabilities specify the ability to receive a maximum picture size of CustomMaxFS macroblocks. The video source may choose to send any picture height and width combination that does not exceed that total. Although the receiver is required by this Recommendation to be capable of rendering these picture sizes, it is frequently desirable to negotiate further constraints on the picture size. For example, an MCU that can control the picture height and width sent from each terminal can create a more functional picture composition.

There are ~~at least~~ four ~~general~~common cases where constraining the encoding with the set submode procedure is useful:

– To optimize the picture aspect ratio for a specific display or a sub-picture in a composition.

– To limit the picture frame rate to match the frame rate of a specific picture composition.

– To eliminate the adverse effects of rescaling on the picture quality.

– To improve bandwidth utilization by negotiating a picture size that does not exceed the limits of a display or the size of a sub-picture in a composition.

The use of the set submode procedure is illustrated for each of these cases by the following clauses.

II.1 Optimization of the picture aspect ratio

~~The~~ In this example, the video channel is constrained to carry a picture which has a specific picture aspect ratio. The sample aspect ratio and the picture size are not constrained.

The video source indicates which SAR and PAR combinations can be carried on this video channel in a setSubmodeIndication message.

The video receiver requests a specific PAR which is included in ~~the~~that indication by sending a setSubmodeRequest.

The video source selects an image height and SAR that it can send using the requested PAR.

The video source positively acknowledges the request, including the SAR, PAR and the image height by sending a setSubmodeResponse. It then switches to the new submode, sending the SAR in the H.264 VUI message per Table E-1/H.264.

→ setSubmodeIndication: channelID, list of (SAR, list of (PAR), [allowAnyHeight])
← setSubmodeRequest: channelID, PAR
→ setSubmodeResponse: channelID, acknowledge, SAR, PAR, height

II.2 Limiting the picture frame rate

The setSubmode procedure does not allow the picture frame rate to be directly constrained. However, it does allow macroblocks per second (submodeMaxMBPS) to be limited. Therefore, in order to limit frame rate, the video stream ~~is~~must be constrained to carry a picture of a specific ~~SAR, PAR,~~ size and also limited to a maximum macroblocks-per-second rate. This results in a constrained picture frame rate.

~~The~~ First, the video source indicates which SAR and PAR combinations can be carried on this video channel by sending a setSubmodeIndication.

The video receiver ~~requests a specific SAR and PAR combination which is included in the indication. The selected SAR and PAR include the allowAnyHeight designation. The video receiver~~ then requests a specific height, and a submodeMaxMBPS value that achieves the desired frame rate for the requested picture size~~.~~ by sending a setSubmodeRequest. It may also request any specific SAR and PAR combination that is included in the indication message.

The video source positively acknowledges the request~~, including~~ by sending a setSubmodeResponse that includes the SAR, PAR and the image height. It then switches to the new submode, sending the SAR in the H.264 VUI message per Table E-1/H.264.

→ setSubmodeIndication: channelID, list of (SAR, list of (PAR), [allowAnyHeight])
← setSubmodeRequest: channelID, SAR, PAR, height, submodeMaxMBPS
→ setSubmodeResponse: channelID, acknowledge, SAR, PAR, height

II.3 Eliminating the adverse effects of picture rescaling

~~The~~In order to eliminate the adverse effects of scaling, the video channel is constrained to carry a picture of specific PAR, SAR and picture size. Three different examples are presented. The first example describes the case where the video source is capable of re-scaling its image to any requested size. The second and third examples describe cases where the video source does not have this capability.

II.3.1 Video source is capable of arbitrary scaling

The video source first indicates which SAR and PAR combinations can be carried on this video channel by sending a setSubmodeIndication.

The video receiver sends a setSubmodeRequest to requests a specific SAR and PAR combination which is included in the indication. Since the selected SAR and PAR include the allowAnyHeight designation, the video receiver also requests a specific height.

The video source positively acknowledges the request~~, including~~ by sending a setSubmodeResponse that includes the SAR, PAR and the image height. It then switches to the new submode, sending the SAR in the H.264 VUI message per Table E-1/H.264.

→ setSubmodeIndication: channelID, list of (SAR, list of (PAR), [allowAnyHeight])
← setSubmodeRequest: channelID, SAR, PAR, height (SAR and PAR have allowAnyHeight set)
→ setSubmodeResponse: channelID, acknowledge, SAR, PAR, height

II.3.2 Video source is not capable of arbitrary scaling

The video source first indicates which SAR and PAR ~~and SAR~~ combinations can be carried on this video channel by sending a setSubmodeIndication.

The video receiver requests a specific PAR and SAR combination which is included in the indication by sending a setSubmodeRequest. Since the selected PAR and SAR does not include the allowAnyHeight designation, the video receiver offers a list of acceptable heights, in preference order.

The video source selects the first height on the list that it is capable of sending.

The video source then positively acknowledges the request, including the PAR, SAR and the image height in its setSubmodeResponse. It then switches to the new submode, sending the SAR in the H.264 VUI message per Table E-1/H.264.

→ setSubmodeIndication: channelID, list of (SAR, list of (PAR))
← setSubmodeRequest: channelID, SAR, PAR, list of (height)
→ setSubmodeResponse: channelID, acknowledge, SAR, PAR, height

~~If~~However, if the video source does not find a height in the request that it is capable of sending, it responds with a ~~reject message~~rejection in its setSubmodeResponse, which includes the list of heights it can send with the requested SAR and PAR combination.

The video receiver then selects one of those specific heights and ~~re-issues the request~~sends a new setSubmodeRequest.

The video source then positively acknowledges the request, including the PAR, SAR and the image height in its setSubmodeResponse. It then switches to the new submode, sending the SAR in the H.264 VUI message per Table E-1/H.264.

→ setSubmodeIndication: channelID, list of (SAR, list of (PAR))
← setSubmodeRequest: channelID, SAR, PAR, list of (height)
→ setSubmodeResponse: channelID, reject, list of (height) (requested heights were not supported)
← setSubmodeRequest: channelID, SAR, PAR, height ~~(this height is from the list received in response)~~
→ setSubmodeResponse: channelID, acknowledge, PAR, SAR, height

II.4 Improving bandwidth utilization by limiting maximum picture size

~~The video channel is constrained to carry a picture of specific PAR, SAR and a maximum picture size.~~Reducing the picture size frequently improves the picture quality by reducing compression artefacts. It ~~could be~~can also reduce the bandwidth required to send the picture. In this case, it is often useful to further ~~constrained~~ constrain the video channel through the use of flow control.

The video source sends a setSubmodeIndication which indicates which PAR and SAR combinations can be carried on this video channel.

The video receiver ~~requests~~then sends a setSubmodeRequest message choosing a specific PAR and SAR combination which is included in the indication, and also ~~requests a~~the maximum image height.

The video source selects an image height that it is capable of sending that is less than or equal to the maximum.

The video source then positively acknowledges the request, including the PAR, SAR and the image height in its setSubmodeResponse message. The image height is less than the requested maximum

height. It then switches to the new submode, sending the SAR in the H.264 VUI message per Table E-1/H.264.

→ setSubmodeIndication: channelID, list of (SAR, list of (PAR))
← setSubmodeRequest: channelID, [SAR], [PAR], maximumHeight
~~→ Response:~~ → setSubmodeResponse: channelID, acknowledge, SAR, PAR, height ~~(where height <= maximumHeight)~~

If the smallest height that the video source can send exceeds the maximum height requested, the video source rejects the request, including the smallest height it can send in the reject message.

The video ~~sink~~receiver then ~~re-issues the request~~sends a new setSubmodeRequest with a new maximum height that can be accommodated by the video source.

The video source then positively acknowledges the second request, including the PAR, SAR and the image height in its setSubmodeResponse. It then switches to the new submode, sending the SAR in the H.264 VUI message per Table E-1/H.264.

~~→~~ Finally, the video receiver constrains the channel bandwidth using the H.245 flowControlCommand

→ setSubmodeIndication: channelID, list of (SAR, list of (PAR))
~~← Request:~~ ← setSubmodeRequest channelID, [SAR], [PAR], maximumHeight
→ setSubmodeResponse: channelID, reject, minimumHeight (~~where minimunHeight > maximumHeight~~requested height was too large)
← setSubmodeRequest: channelID, [SAR], [PAR], maximumHeight ~~(where maximumHeight >= minimumHeight)~~
→ setSubmodeResponse: channelID, acknowledge, SAR, PAR, height ~~(where height <= maximumHeight)~~
← flowControlCommand: channelID, maximumBitRate

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