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Datasheet for the decision of 6 November 2020

Case Number: T 2077/14 - 3.5.04

Application Number: 06850301.0

Publication Number: 1964401

IPC: H04N7/12

Language of the proceedings: EN

Title of invention:
VIDEO ENCODING FOR SEAMLESS SPLICING BETWEEN ENCODED VIDEO STREAMS

Applicant:
Tut Systems, Inc.

Headword:

Relevant legal provisions:
EPC 1973 Art. 56

Keyword:
Inventive step - main and auxiliary requests (no)

Decisions cited:

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Catchword:

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Case Number: T 2077/14 - 3.5.04

D E C I S I O N
of Technical Board of Appeal 3.5.04
of 6 November 2020

Appellant: (Applicant)	Tut Systems, Inc. 6000 S.W. Meadows Road, Suite 200 Lake Oswego, Oregon 97035 (US)
Representative:	Openshaw & Co. 8 Castle Street Farnham, Surrey GU9 7HR (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 6 June 2014 refusing European patent application No. 06850301.0 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairwoman	T. Karamanli
Members:	B. Willems
	B. Le Guen

Summary of Facts and Submissions

I. The appeal is against the decision of the examining division dated 6 June 2014 refusing European patent application No. 06 850 301.0, which was published as international application WO 2007/111740 A2.

II. The documents cited in the decision under appeal included:

D1: J. Ennis, R. Prodan: "*Proposed Amendment to Recommendation J.189 - Seamless splicing for MPEG-2 bit streams*", International Telecommunication Union, Study Period 2001-2004, Study Group 9 - Delayed Contribution 72, Geneva, 31 March 2003 - 4 April 2003, pages 1-12, XP017415294

D4: N. Hurst, K. Cornog: "*MPEG Splicing - Tutorial and Proposed SMPTE Standard*", Proceedings of the SMPTE Technical Conference, 1 November 1997, pages 105-117, XP002098562

III. The decision under appeal was based on the grounds that claim 1 of the main request then on file did not meet the requirements of Article 84 EPC and that the subject-matter of claim 1 of all requests then on file lacked inventive step over the combined disclosures of documents D1 and D4 (Article 56 EPC).

IV. The applicant (appellant) filed notice of appeal. With the statement of grounds of appeal, the appellant submitted reasons why the subject-matter of claim 1 of each of the requests forming the basis for the decision under appeal met the requirements of Articles 54 and 56 EPC but did not submit any arguments rebutting the

objection raised under Article 84 EPC. The appellant requested that the decision under appeal be set aside and that a European patent be granted on the basis of the claims according to the main request or the claims of one of the first, second or third auxiliary requests, all of which formed the basis for the decision under appeal.

V. On 15 November 2019, the board issued a first summons to oral proceedings to be held on 22 April 2020. In a communication under Article 15(1) RPBA (Rules of Procedure of the Boards of Appeal, OJ EPO 2007, 536), annexed to the summons, the board gave the following provisional opinion.

- Claim 1 of the main request did not meet the requirements of Article 84 EPC 1973.

- The subject-matter of claim 1 of none of the main request or the first, second or third auxiliary requests met the requirements of Article 56 EPC 1973 because it lacked inventive step over the combined disclosures of D1 and D4 and the common general knowledge of the person skilled in the art.

VI. By a communication of the board dated 7 April 2020, the appellant was informed that due to precautionary measures against the spread of the coronavirus (COVID-19), the oral proceedings scheduled for 22 April 2020 could not take place and would have to be postponed.

VII. With its reply dated 1 May 2020, the appellant submitted arguments as to why the claims of all requests met the requirements of Articles 56 and 84 EPC. The appellant requested that the decision under

appeal be set aside and that a European patent be granted on the basis of the claims of the main request or the claims of one of the first, second or third auxiliary requests, all of which formed the basis for the decision under appeal.

VIII. On 8 May 2020, the board issued a second summons to oral proceedings to be held on 6 October 2020.

IX. By letters dated 19 August 2020 and 10 September 2020, the appellant requested that the oral proceedings be held by videoconference.

X. By communication dated 15 September 2020, the registrar of the board informed the appellant that the oral proceedings scheduled for 6 October 2020 would be held by videoconference.

XI. By letter dated 29 September 2020, the appellant informed the board that it would not be attending the oral proceedings scheduled for 6 October 2020. By letter dated 30 September 2020, the appellant withdrew its request for oral proceedings.

XII. By letter dated 5 October 2020, the registrar of the board informed the appellant that the oral proceedings scheduled for 6 October 2020 had been cancelled.

XIII. Claim 1 of the main request reads as follows:

"A method of replacing video content from a first encoded video transport stream (134) with video content from a second encoded video transport stream (120), the first and second streams (134, 120) being transmitted at a peak bit rate R and respectively including video data representing first and second series of coded

pictures, data representing first and second reference clocks interspersed with the coded picture data, and data representing a decoding time for each coded picture, relative to the respective reference clock, the second series of coded pictures beginning with an initial coded picture and ending with a final coded picture, the second series being of duration T relative to the second reference clock, the method comprising:

A) encoding the first video stream (134) by a first video encoder (136) relative to the first reference clock, the encoding of the first video stream (134) being performed such that, while the encoding of the first video stream (134) is being performed, method steps (i) to (v) are performed, wherein:

step (i) comprises maintaining a first virtual buffer for tracking the fullness of a first hypothetical decoder's coded picture buffer (CPB) of size B receiving the first stream (134),

step (ii) comprises at a first time, identifying a splice-out time t_{out} occurring temporally after the first time and occurring in the first stream between video data representing a first coded picture and video data representing an immediately succeeding second coded picture,

step (iii) comprises between the first time and the splice-out time, encoding the first stream such that, at the first coded picture's decode time, the fullness of the first virtual buffer is less than XB, where X is greater than zero and less than 1,

step (iv) comprises at a second time, identifying a splice-in time t_{in} occurring temporally at least T time

after the splice-out time and occurring in the first stream between video data representing a third coded picture and video data representing an immediately succeeding fourth coded picture, and

step (v) comprises between the second time and the splice-in time, encoding the first encoded video transport stream such that, at the third picture's decode time, the fullness of the first virtual buffer is less than XB,

B) encoding the second stream (120) by a second video encoder relative to the second reference clock, the second video encoder having a second CPB of at most size B, the encoding of the second video stream (120) being performed such that, while the encoding of the second video stream (120) is being performed, method steps (vi) to (viii) are performed:

step (vi) comprises maintaining a second virtual buffer for tracking the fullness of a second hypothetical decoder's coded picture buffer of size B receiving the second stream (120),

step (vii) comprises encoding the second stream (120) such that the video data representing the initial coded picture is transmitted in no more than B/(XR) time, and

step (viii) comprises encoding the second stream (120) such that, at the final coded picture's decode time, the fullness of the second virtual buffer is less than XB, and

C) replacing the video data in the first stream (134) from t_{out} through t_{out}+T, relative to the first reference clock, with the video data of the second

stream (120) from the initial picture through the final picture."

XIV. Claim 1 of the first auxiliary request differs from claim 1 of the main request by the following definition of steps (iii), (v), (vii) and (viii):

"step (iii) comprises between the first time and the splice-out time, encoding the first stream such that, at the first coded picture's decode time, the fullness of the first virtual buffer is constrained to be less than XB, where X is a known value greater than zero and less than 1, [...]

step (v) comprises between the second time and the splice-in time, encoding the first encoded video transport stream such that, at the third picture's decode time, the fullness of the first virtual buffer is constrained to be less than XB, [...]

step (vii) comprises encoding the second stream (120) such that the video data representing the initial coded picture is transmitted in no more than XB/R time, and

step (viii) comprises encoding the second stream (120) such that, at the final coded picture's decode time, the fullness of the second virtual buffer is constrained to be less than XB".

XV. Claim 1 of the second auxiliary request differs from claim 1 of the first auxiliary request by the following definition of (iii):

"step (iii) comprises between the first time and the splice-out time, encoding the first stream such that, at the first coded picture's decode time, the fullness

of the first virtual buffer is constrained to be less than XB, where X equals 1/2".

XVI. Claim 1 of the third auxiliary request reads as follows:

"A method of replacing video content from a first encoded video transport stream (134) with video content from a second encoded video transport stream (120), the first and second streams (134, 120) being transmitted at a peak bit rate Rand respectively including video data representing first and second series of coded pictures, data representing first and second reference clocks interspersed with the coded picture data, and data representing a decoding time for each coded picture, relative to the respective reference clock, the second series of coded pictures beginning with an initial coded picture and ending with a final coded picture, the second series being of duration T relative to the second reference clock, the method comprising:

A) encoding the first video stream (134) by a first video encoder (136) relative to the first reference clock, the encoding of the first video stream (134) being performed such that, while the encoding of the first video stream (134) is being performed, method steps (i) to (v) are performed, wherein:

step (i) comprises maintaining a first virtual buffer for tracking the fullness of first hypothetical decoder's coded picture buffer (CPB) of size B receiving the first stream (134),

step (ii) comprises at a first time, identifying a splice-out time t_{out} occurring temporally after the first time and occurring in the first stream between

video data representing a first coded picture and video data representing an immediately succeeding second coded picture,

step (iii) comprises between the first time and the splice-out time, encoding the first stream such that, at the first coded picture's decode time, the fullness of the first virtual buffer is constrained to be less than XB, where X equals 1/2,

step (iv) comprises at a second time, identifying a splice-in time t_{in} occurring temporally at least T time after the splice-out time and occurring in the first stream between video data representing a third coded picture and video data representing an immediately succeeding fourth coded picture, and

step (v) comprises between the second time and the splice-in time, encoding the first encoded video transport stream such that, at the third picture's decode time, the fullness of the first virtual buffer is constrained to be less than XB,

B) encoding the second stream (120) by a second video encoder relative to the second reference clock, the second video encoder having a second CPB of at most size B, the encoding of the second video stream (120) being performed such that, while the encoding of the second video stream (120) is being performed, method steps (vi) to (viii) are performed:

step (vi) comprises maintaining a second virtual buffer for tracking the fullness of a second hypothetical decoder's coded picture buffer of size B receiving the second stream (120),

step (vii) comprises encoding the second stream (120) such that the video data representing the initial coded picture is transmitted in no more than XB/R time, and

step (viii) comprises encoding the second stream (120) such that, at the final coded picture's decode time, the fullness of the second virtual buffer is constrained to be less than XB, and

C) replacing the video data in the first stream (134) from t_{out} through t_{out} + T, relative to the first reference clock, with the video data of the second stream (120) from the initial picture through the final picture;

and wherein the second coded picture is encoded independently of all other coded pictures, all coded pictures subsequent to the second coded picture are encoded independently of all coded pictures that preceded the second coded picture, the fourth coded picture is encoded independently of all other coded pictures, and all coded pictures subsequent to the fourth coded picture are encoded independently of all coded pictures that preceded the fourth coded picture."

XVII. The examining division's arguments relevant to the present decision may be summarised as follows.

(a) D1 did not explicitly disclose that the splice-in time occurred at least T time after the splice-out time and that between the second time and the splice-in time, the first encoded video transport stream was encoded such that at the third picture's decode time the fullness of the first virtual buffer was less than XB (see decision under appeal, page 12, second paragraph).

(b) It was "*self-evident*" that the fullness of a buffer lied between 0 and the buffer size B (see decision under appeal, page 11, "*step (iii)*", and page 13, point 4.2.2).

(c) The feature that the splice-in points were independently coded pictures was independent from the issue of coding constraints limiting the amount of data (see decision under appeal, reasons, point 4.5.1).

XVIII. The appellant's arguments relevant to the present decision may be summarised as follows.

(a) The following features were not disclosed in D1 (see statement of grounds of appeal, page 2, first full paragraph, and letter dated 1 May 2020, page 2, third paragraph):

(i) encoding the first stream such that, at the first coded picture's decode time, the fullness of the first virtual buffer is less than XB, where X is greater than zero and less than 1

(ii) encoding the second stream such that the video data representing the initial coded picture was transmitted in no more than B/(XR) time

(iii) encoding the second stream such that, at the final coded picture's decode time, the fullness of the second virtual buffer was less than XB

(b) The problem solved might be identified as "*[p]roviding an improved yet simple seamless splicing method in which a secondary transport stream can easily be spliced into a previously encoded primary transport stream, moreover in a manner that guarantees that if no splice is taken the output of the video decoder will show no indication of the potential splice points*" (see statement of grounds of appeal, page 2, penultimate paragraph).

(c) The prior art did not suggest the specific constraints implemented in the patent application (see statement of grounds of appeal, page 2, third full paragraph).

(d) D4 did not teach how to implement the constraints in a method of replacing video content from a first encoded video transport stream with video content from a second encoded video transport stream. Thus, D4 lacked specific teaching of how to actually implement the constraints in combination with the teaching of D1. Although the skilled person could have implemented the constraints referred to above, in the absence of hindsight, the skilled person would not have done so given the lack of detail or specific teaching in the disclosure of D4 (see letter dated 1 May 2020, page 2, fourth paragraph).

(e) Setting the value of X to 1/2 enhanced the synergy of the invention's specific constraints applied to both streams (see statement of grounds of appeal, page 3, first paragraph). Ensuring that the decode time is less than or equal to XB was important to ensure that the claimed method worked properly at the splice-out point. Setting the value of X to 1/2

represented a preferred balance between underusing the buffer storage space and ensuring that the buffer had sufficient space remaining at the splice-out point. This helped the claimed method to work efficiently (see letter dated 1 May 2020, page 3, fourth paragraph).

(f) The independent coding of the pictures immediately succeeding the splice-out time and the splice-in time enhanced the synergy of the claimed subject-matter (see statement of grounds of appeal, page 3). It helped to facilitate the coding constraints because it allowed the coding constraints to be implemented easily at desired points in the streams (see letter dated 1 May 2020, the paragraph bridging pages 3 and 4).

Reasons for the Decision

1. The appeal is admissible.

2. *Main request and first auxiliary request – inventive step (Article 56 EPC 1973)*

2.1 The examining division identified D1 as the closest prior art for the assessment of inventive step (see decision under appeal, reasons, point 4.2). The appellant did not contest this, and the board agrees with the examining division's assessment.

2.2 It is common ground that D1 discloses a method of seamless splicing from one MPEG-2 video elementary stream to a second video elementary stream (see "*1 Scope*") and specifies constraints for out points suitable for exiting the first stream and in points

suitable for entering the first stream (see Figures 3 and 4 and points 4.3.2.3.1 and 4.3.2.3.2). D1 further specifies the constraints that the decoder buffer should not underflow or overflow as a result of the splice (see "*1 Scope*") and that the upstream encoder must control the number of encoded bits to put the downstream decoder in a stable buffer state at each out point (see page 6, last paragraph).

2.3 The board has not been persuaded by the appellant's argument that document D1 did not disclose encoding the first stream between the first time and the splice-out time such that, at the first coded picture's decode time, the fullness of the first virtual buffer was less than XB, where X is greater than zero and less than 1 (see point XVIII(a)(i) above). The constraints referred to in the last sentence of point 2.2 above imply that between the first time and the splice-out time, the first stream is encoded such that, at the first coded picture's decode time, the fullness of the first virtual buffer is less than XB, where X is greater than zero and less than 1.

2.4 The board agrees with the examining division's assessment that D1 does not explicitly disclose that the splice-in time occurs at least T time after the splice-out time and that between the second time and the splice-in time, the first encoded video transport stream is encoded such that at the third picture's decode time the fullness of the first virtual buffer is less than XB (see point XVII(a) above).

However, D1 relates to the insertion of adverts into programs. Adverts inserted in programs generally have a defined duration T.

2.5 Thus, the subject-matter of claim 1 of the main request differs from the disclosure of D1 by the following features:

(a) the constraints referred to in point 2.4 above

(b) encoding the second stream such that the video data representing the initial coded picture was transmitted in no more than B/(XR) time (see also XVIII(a)(ii) above)

(c) encoding the second stream such that, at the final coded picture's decode time, the fullness of the second virtual buffer was less than XB (see also XVIII(a)(iii) above)

2.6 The board is not convinced by the appellant's argument that the problem solved by these features might be identified as "*[p]roviding an improved yet simple seamless splicing method in which a secondary transport stream can easily be spliced into a previously encoded primary transport stream, moreover in a manner that guarantees that if no splice is taken the output of the video decoder will show no indication of the potential splice points*" (see point XVIII(b) above).

According to the description (page 16, lines 30 and following), the feature identified in point 2.5(b) above is to be understood as specifying that the initial coded picture of the second stream is small enough such that it will take no more than XB/R time for it to be completely loaded into the decoder's buffer.

This condition together with the condition that the first virtual buffer fullness is less than XB at the

third picture's decode time do not necessarily result in seamless splicing. The former condition means that the initial coded picture of the second stream must be smaller than XB but not necessarily smaller than the actual buffer fullness. This is not sufficient to guarantee seamless splicing because it encompasses cases in which buffer fullness at the third picture's decode time is smaller than the size of the first encoded picture.

Therefore, the problem to be solved is how to implement encoding of the first and second stream to avoid buffer underflow and buffer overflow.

2.7 D4 discusses the following constraints for seamless splicing:

(a) Encoders must construct bitstreams so that the decoder's buffers will neither underflow nor overflow (see page 108, right-had column, first paragraph).

(b) The first frame of the new stream must be decoded one frame after the last frame of the old stream (see also page 110, left-hand column, "***Seamless Splicing: Delay Match.*** *If the first New Stream frame is decoded one frame after the last Old Stream picture and there are no buffer exceptions the splice is called a seamless splice*"). Hence, the time for loading the data of one frame of the new stream into the buffer must be such that the frame of the new stream can be decoded immediately after decoding of the last frame of the old stream.

2.8 The constraints referred to in point 2.5(a)-(c) simply reformulate the constraints listed in point 2.7 above.

Therefore, the board does not agree with the appellant that the prior art does not suggest the specific constraints implemented in the patent application (see point XVIII(c) above).

The implementation of the constraints would have been self-evident for the skilled person before the priority date of the application. Therefore, the person skilled in the art would not have needed any imaginative steps to implement the constraints in the method known from D1 even in the absence of any specific teaching in document D4 (see also appellant's letter dated 1 May 2020, page 2, fourth paragraph: "*there is an imaginative step in devising a specific way of implementing those constraints*"). Thus, even without hindsight, the person skilled in the art would have known how to implement the constraints known from document D4 in the method known from document D1.

2.9 The different wording of steps (iii), (v), (vii) and (viii) in claim 1 of the first auxiliary request (see point XIV above) does not change the board's interpretation of the claim because the board's assessment of inventive step set out above is based on an interpretation according to which the initial coded picture of the second stream is small enough such that it will take no more than XB/R (rather than B/XR) time for it to be completely loaded into the decoder's buffer (see point 2.6 above) and because the method steps were already interpreted as defining constraints (see point 2.8 above). Thus, for claim 1 of the first auxiliary request, the board refers to its analysis in points 2.1 to 2.8 above.

2.10 In view of the above, the subject-matter of claim 1 of the main request and the first auxiliary request does

not meet the requirements of Article 56 EPC 1973 because it lacks inventive step over the combined disclosures of D1 and D4 and the common general knowledge of the person skilled in the art.

3. *Second auxiliary request - inventive step (Article 56 EPC 1973)*

3.1 Claim 1 of the second auxiliary request differs from claim 1 of the first auxiliary request in that it further specifies that X equals 1/2.

3.2 The value X defines the maximum proportion of the virtual buffers that is allowed to be filled. It would have been obvious that decreasing this value decreases the risk of overflow at the encoder (i.e. decreases the risk of underflow at the decoder).

The appellant alleged that setting the value of X to 1/2 technically interacted with the remaining features of the claim to provide the claimed synergistic effect. However, it is neither self-explanatory how this particular value of X provides the claimed synergistic effect, nor did the appellant explain why setting the value of X to 1/2 represented a "*preferred balance*" which helped the claimed method to work efficiently (see point XVIII(e) above). Therefore, the board is of the opinion that setting X to 1/2 would have been an obvious choice among several possible values.

3.3 In view of the above, the subject-matter of claim 1 of the second auxiliary request does not meet the requirements of Article 56 EPC 1973 because it lacks inventive step over the combined disclosures of D1 and

D4 and the common general knowledge of the person skilled in the art.

4. *Third auxiliary request- inventive step (Article 56 EPC 1973)*

4.1 Claim 1 of the third auxiliary request differs from claim 1 of the second auxiliary request in that it specifies that the pictures immediately succeeding the splice-out and splice-in times in the first video streams are independently coded pictures.

4.2 The independent coding of the splice-in and splice-out points is known from D4, page 108, "*In Points and Out Points*". The board agrees with the examining division that this feature is independent from the issue of coding constraints limiting the amount of data (see point XVII(c) above). The appellant did not explain how the independent coding helped the coding constraints to be implemented at the desired points in such a manner that it provided the claimed synergistic effect (see point XVIII(f) above). Therefore, the board is not convinced that this feature enhances the synergy of the claimed subject-matter.

4.3 In view of the above, the subject-matter of claim 1 of the third auxiliary request does not meet the requirements of Article 56 EPC 1973 because it lacks inventive step over the combined disclosures of D1 and D4 and the common general knowledge of the person skilled in the art.

5. Since none of the appellant's requests is allowable, the appeal is to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairwoman:

K. Boelicke T. Karamanli

Decision electronically authenticated