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**Datasheet for the decision
of 9 March 2017**

Case Number: T 2370/11 - 3.5.04

Application Number: 03700321.7

Publication Number: 1479245

IPC: H04N7/50

Language of the proceedings: EN

Title of invention:

Grouping of image frames in video coding

Applicant:

Nokia Technologies Oy

Headword:

Relevant legal provisions:

EPC 1973 Art. 84

EPC Art. 123(2)

Keyword:

Claims - clarity - main request (no) - clarity - first and
second auxiliary requests (no)
Amendments - added subject-matter - third auxiliary request
(yes)

Decisions cited:

Catchword:



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Case Number: T 2370/11 - 3.5.04

D E C I S I O N
of Technical Board of Appeal 3.5.04
of 9 March 2017

Appellant: Nokia Technologies Oy
(Applicant) Karaportti 3
02610 Espoo (FI)

Representative: Berggren Oy, Tampere
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted on 12 July 2011
refusing European patent application
No. 03700321.7 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman C. Kunzelmann
Members: R. Gerdes
T. Karamanli

Summary of Facts and Submissions

- I. The appeal is directed against the decision to refuse European patent application No. 03 700 321.7, published as international application WO 03/063505 A1.
- II. The patent application was refused on the grounds that claim 1 of the main request had been amended in such a way that it contained subject-matter extending beyond the content of the application as filed (Article 123(2) EPC) and that claim 15 of the main request and claim 1 of the auxiliary request did not comply with Article 84 EPC.
- III. The applicant appealed against this decision and with the statement of grounds of appeal submitted claims of an amended (first) auxiliary request.
- IV. The board issued a summons to oral proceedings and indicated in an annex to the summons that it doubted that the claims of the appellant's main and first auxiliary requests fulfilled the requirements of Article 123(2) EPC and Article 84 EPC 1973.
- V. In response, with a letter dated 8 February 2017, the appellant submitted amended claims of a main and a first auxiliary request, replacing the claims of all previous requests.
- VI. Oral proceedings were held before the board on 9 March 2017.

After the discussion on the main and first auxiliary requests, the appellant filed claims 1 to 5 according to a new second auxiliary request. After the discussion on the second auxiliary request, the appellant filed

claims 1 to 5 according to a new third auxiliary request.

The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the claims according to the main request filed with letter dated 8 February 2017, or, in the alternative, according to the first auxiliary request filed with letter dated 8 February 2017, or the second and third auxiliary requests, both filed during the oral proceedings of 9 March 2017.

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

"A method for coding video frames for the purpose of forming a scalable, compressed, bit rate controllable video sequence comprising video frames coded according to at least a first and a second frame format, the video frames of the first frame format being independent of the other video frames, and the video frames of the second frame format being predicted from at least one of the other video frames, encoding at least one video frame onto a first scalability layer, and encoding at least one other video frame predicted from the at least one video frame onto a second scalability layer, characterized by comprising the steps of

forming into the video sequence at least a first sub-sequence on the second scalability layer, comprising one or more video frames each being associated with information indicative of the first sub-sequence and image numbers; and

forming into the video sequence at least a second sub-sequence on the second scalability layer comprising one

or more video frames, the second sub-sequence comprising temporally different video frames than the video frames included in the first sub-sequence, each video frame of the second sub-sequence being associated with information indicative of the second sub-sequence and image numbers;

wherein the information indicative of the sub-sequences comprises a sub-sequence identifier and a scalability layer identifier;

wherein the first and the second sub-sequences comprise information of all sub-sequences that have been directly used for predicting the image frames comprised by the first and the second sub-sequence, correspondingly, said information indicating that the first sub-sequence is removable from the video sequence without affecting decodability of the second sub-sequence and the second sub-sequence is removable from the video sequence without affecting decodability of the first sub-sequence."

VIII. Claim 1 of the first auxiliary request reads as follows:

"A method for coding video frames for the purpose of forming a scalable, compressed video sequence comprising video frames coded according to at least a first and a second frame format, the video frames of the first frame format being independent of the other video frames, and the video frames of the second frame format being predicted from at least one of the other video frames, the method comprising

encoding at least one video frame onto a first scalability layer,

encoding at least one other video frame temporally predicted from the at least one video frame onto a second scalability layer,

forming into the video sequence a first sub-sequence comprising one or more video frames on a same scalability layer of the video sequence;

forming into the video sequence at least a second sub-sequence on the same scalability layer as the first sub-sequence, said same scalability layer having been formed by coding at least video frames of the second frame format;

characterized by the first and the second sub-sequences comprising information of all sub-sequences that have been directly used for predicting the image frames comprised by the first and the second sub-sequence, correspondingly, said information indicating that the first sub-sequence is removable from the video sequence without affecting decodability of the second sub-sequence, and the second sub-sequence is removable from the video sequence without affecting decodability of the first sub-sequence;

determining a first scalability layer number and a first value of a sub-sequence identifier for video frames belonging to the first sub-sequence;

determining a second scalability layer number and a second value of a sub-sequence identifier for video frames belonging to the second sub-sequence, the first scalability layer number being the same as the second scalability layer number and the first value of the

sub-sequence identifier being different from the second value of the sub-sequence identifier; and

encoding the first sub-sequence with the first scalability layer number and the first value of the sub-sequence identifier and the second sub-sequence with the second scalability layer number and the second value of the sub-sequence identifier into the video sequence."

IX. Claim 1 of the second auxiliary request reads as follows:

"A method for controlling bit rate of a video sequence transmission in a network element of a telecommunications system, the video sequence comprising video frames coded according to at least a first and a second frame format, the video frames of the first frame format being independent of the other video frames, and the video frames of the second frame format being predicted from at least one of the other video frames, characterized by

receiving, in the network element, said video sequence further comprising

- a first sub-sequence comprising one or more video frames on a same scalability layer of the video sequence, the video frames belonging to the first sub-sequence being associated with a first scalability layer number and a first value of a sub-sequence identifier; and
- at least a second sub-sequence on the same scalability layer as the first sub-sequence, the same scalability layer having been formed by coding at least

video frames of the second frame format, the video frames belonging to the second sub-sequence being associated with a second scalability layer number and a second value of a sub-sequence identifier;

obtaining information indicative of dependencies of the sub-sequences in the received video sequence, said information comprising information of all sub-sequences that have been directly used for predicting the image frames comprised by the first and the second sub-sequence, correspondingly, the method comprising

deducing on the basis of the information indicative of the sub-sequence that either the first sub-sequence or the second sub-sequence is removable from the video sequence without affecting decodability of the remaining of said first and second sub-sequence;

controlling, in response to the first scalability layer number being the same as the second scalability layer number and the first value of the sub-sequence identifier being different from the second value of the sub-sequence identifier, the bit rate of at least one transmission of said video sequence from said network element on the basis of a maximum value of a bandwidth available for data transfer and/or a decoding rate of a terminal device by

removing either of said first or second sub-sequence from the video sequence to be transmitted."

- X. Claim 1 of the third auxiliary request differs from claim 1 of the second auxiliary request in the following features (additions indicated by underlining, deletions by strike-through):

"...

deducing on the basis of the information indicative of the sub-sequence, said deducing comprising checking that the first scalability layer number is the same as the second scalability layer number and the first value of the sub-sequence identifier is different from the second value of the sub-sequence identifier, that either the first sub-sequence or the second sub-sequence is removable from the video sequence without affecting decodability of the remaining of said first and second sub-sequence;

~~controlling, in response to the first scalability layer number being the same as the second scalability layer number and the first value of the sub-sequence identifier being different from the second value of the sub-sequence identifier,~~ the bit rate of at least one transmission of said video sequence from said network element on the basis of a maximum value of a bandwidth available for data transfer and/or a decoding rate of a terminal device by

removing either of said first or second sub-sequence from the video sequence to be transmitted."

- XI. In the decision under appeal the examining division argued *inter alia* that the wording of claim 15 of the then pending main request was unclear. It was not clear whether the "information indicative of dependencies of sub-sequences" was obtained from the "sub-sequence identifier", the "scalability identifier" or the "image numbers" mentioned in the claim or whether it was represented by a separate syntax element (see Reasons, point 2.3).

XII. The appellant's arguments, as far as relevant for the present decision, may be summarised as follows:

Claim 1 of the main request implicitly required that sub-sequences on the same scalability layer were independently decodable, because the image frames of the sub-sequences were not dependent on other sub-sequences of the same scalability layer. A new sub-sequence identifier of a frame therefore indicated that the reference frame for that frame was to be found at least one layer higher up (see also paragraph [0062] of the application and figure 2 of the application).

The "information indicative of the sub-sequences" of claim 1 related to the numbering scheme of the invention including the scalability layer number and the sub-sequence identifier. As disclosed in paragraph [0083], a streaming server might obtain various information about the different sub-sequences of a video sequence such as their average bit rate, location in relation to the entire video sequence, duration and their inter-dependencies. The "information indicative of dependencies of sub-sequences" of claim 12 of the main request and the "information of all sub-sequences that have been directly used for predicting the image frames" of claim 1 was not limited to the "information indicative of the sub-sequences" but comprised in addition these other information items. According to the application, dependencies of sub-sequences could be determined in different ways and thus the information indicative of dependencies could also be determined in different ways (see statement of grounds, page 3, point 2).

Claim 1 of the first auxiliary request specified that the scalability layer numbers and sub-sequence

identifiers were encoded with the corresponding sub-sequences. The claim made it clear that different sub-sequence identifiers designate independently removable sub-sequences.

With respect to claim 1 of the second auxiliary request the appellant stated that the feature relating to "deducing on the basis of the information indicative of the sub-sequence ..." should read "deducing on the basis of the information indicative of dependencies of the sub-sequences ..." (underlining added by the board). The duration of a sub-sequence was one example of an information item indicative of dependencies of a sub-sequence. Controlling the bit rate was effected on the basis of the scalability layer numbers and the sub-sequence identifiers but also depended on the further parameters such as the duration of the sub-sequences and/or the available bandwidth.

The feature relating to the "checking that the first scalability layer number is the same as the second scalability layer number ..." of claim 1 of the third auxiliary request was implicitly disclosed in the application as originally filed. In particular, paragraphs [0017], [0033], [0053] and [0083] provided a basis for this feature.

Reasons for the Decision

1. The appeal is admissible.

The present application

2. The application relates to a method for forming a scalable, compressed video sequence and to bit rate control of the video sequence so as to adapt the video data rate to the available bandwidth and/or a decoding rate of a terminal device.

To allow for flexible streaming of video data, many video coding systems employ scalable coding in which some elements of a video sequence can be removed without affecting the reconstruction of other parts of the video sequence. Scalability is typically implemented by grouping the image frames into a number of hierarchical layers such as a base and one or more enhancement layers. The enhancement layers can be removed from the sequence at the expense of image quality (see abstract and paragraphs [0001] to [0010] and [0060]).

In order to adapt the data rate, the present application provides rough adjustment by specifying the number of scalability layers, and finer adjustment by removing specific sub-sequences of images from the video sequence. Sub-sequences are identified by a scalability layer number together with a sub-sequence identifier. The application aims at providing a numbering scheme for the images of a sub-sequence such that the corresponding images can be easily identified and removed from the video sequence without affecting

decodability of the remaining video sequence (see paragraphs [0011] to [0020], [0033] and [0083]).

Main request - clarity (Article 84 EPC 1973)

3. According to Article 84 EPC 1973, the claims shall define the matter for which protection is sought. They shall be clear and concise and be supported by the description.

3.1 Claim 1 according to the appellant's main request specifies "information indicative of the first sub-sequence" and "information indicative of the second sub-sequence". The "information indicative of the sub-sequences" comprises a sub-sequence identifier and a scalability layer identifier.

In addition, claim 1 refers to "information of all sub-sequences that have been directly used for predicting the image frames comprised by the first and the second sub-sequence". This information is not further specified in the claim except for its function, which is to indicate "that the first sub-sequence is removable from the video sequence without affecting decodability of the second sub-sequence and the second sub-sequence is removable from the video sequence without affecting decodability of the first sub-sequence."

3.2 The relationship between these information items is not clear. In particular, it is not clear whether they are identical or whether one of them comprises the other. It is also not clear of which information items the "information of all sub-sequences that have been directly used for predicting the image frames" consists, and how the information is obtained. Hence,

the latter expression is considered unclear per se and in its relationship to the "information indicative of the sub-sequences" comprising the scalability layer identifiers and sub-sequence identifiers. The claims and the description do not provide any explanation of these information items.

3.3 The appellant's arguments do not convince the board.

The appellant referred to paragraph [0083], according to which a streaming server might obtain various information about the different sub-sequences of a video sequence such as their average bit rate, location in relation to the entire video sequence, duration and their interdependencies "regarding the layers". The "information indicative of the dependencies of sub-sequences" of claim 12 and the corresponding "information of all sub-sequences that have been directly used for predicting the image frames" of claim 1 was not limited to the "information indicative of the sub-sequences" but comprised in addition these other information items.

This may be correct, but is not specified in claim 1 and also not apparent from the cited paragraph, partly because the description does not use the terminology employed in the claims. More importantly, paragraph [0083] does not explain how the "information indicative of the dependencies of sub-sequences" of claim 12 and the "information of all sub-sequences that have been directly used for predicting the image frames" of claim 1 are obtained and by which syntax elements they are represented (see also point XI above).

According to the appellant, dependencies of sub-sequences could be determined in different ways and thus the information indicative of dependencies could also be determined in different ways. However, the appellant did not specify any of these different ways, or the kind of information describing the dependencies. It is also noted that in the present case the step of determining "the sub-sequences each sub-sequence is dependent on" is characterised in the application as an essential aspect of the invention (see paragraphs [0017] and [0033]). Hence, a mere functional definition of the information describing the dependencies is not considered clear.

- 3.4 It follows from the above that claim 1 of the appellant's main request does not meet the requirements of Article 84 EPC 1973.

First auxiliary request - clarity (Article 84 EPC 1973)

4. Claim 1 of the first auxiliary request differs from claim 1 of the main request essentially in that it refers to two sub-sequences on a "same scalability layer" instead of on a "second scalability layer". In addition, it specifies that "the first scalability layer number" (of the first sub-sequence) is the same as the "second scalability layer number" (of the second sub-sequence) and that "the first value of the sub-sequence identifier" is different from "the second value of the sub-sequence identifier". It is also specified that the scalability layer numbers and sub-sequence identifiers are encoded with the corresponding sub-sequences.
- 4.1 The claim does not refer to "information indicative of the sub-sequences" but to "scalability layer numbers"

and "sub-sequence identifiers" which correspond to the "scalability layer identifiers" and "sub-sequence identifiers" of claim 1 of the main request.

4.2 These modifications do not change the reasoning concerning the lack of clarity of the expression "information of all sub-sequences that have been directly used for predicting the image frames comprised by the first and the second sub-sequence" and the "scalability layer identifiers" and "sub-sequence identifiers" of claim 1 of the main request (see section 3 above). As is the case for the main request, the relationship between these pieces of information is not clear. The above features distinguishing the claims do not provide any clarification of the information items.

4.3 Hence, claim 1 of the first auxiliary request does not meet the requirements of Article 84 EPC 1973.

Second auxiliary request - clarity (Article 84 EPC 1973)

5. Claim 1 of the second auxiliary request is directed to "A method for controlling bit rate of a video sequence transmission in a network element of a telecommunications system". This method corresponds to the method of claim 10 of the first auxiliary request, with the following additional features:

(a) obtaining information indicative of dependencies of the sub-sequences in the received video sequence, said information comprising information of all sub-sequences that have been directly used for predicting the image frames comprised by the first and the second sub-sequence, correspondingly, the method comprising

(b) deducing on the basis of the information indicative of the sub-sequence that either the first sub-sequence or the second sub-sequence is removable from the video sequence without affecting decodability of the remaining of said first and second sub-sequence.

5.1 The appellant confirmed during the oral proceedings before the board that the expression "deducing on the basis of the information indicative of the sub-sequence" was to be interpreted as meaning "deducing on the basis of the information indicative **of dependencies of the sub-sequences**" (emphasis added by the board). The board accepts this interpretation.

5.2 Like claim 1 of both the main and the first auxiliary request, present claim 1 fails to specify the relationship of the scalability layer numbers and the sub-sequence identifiers to the "information indicative of dependencies of the sub-sequences". Hence, the same reasoning as in section 3 above applies.

5.3 Claim 1 specifies third and fourth steps relating to the control of the bit rate:

(c) controlling, in response to the first scalability layer number being the same as the second scalability layer number and the first value of the sub-sequence identifier being different from the second value of the sub-sequence identifier, the bit rate of at least one transmission of said video sequence from said network element on the basis of a maximum value of a bandwidth available for data transfer and/or a decoding rate of a terminal device by

(d) removing either of said first or second sub-sequence from the video sequence to be transmitted.

5.4 The controlling step (c) and the removing step (d) are dependent on the values of the first and second scalability layer numbers, the first and second sub-sequence identifiers and a maximum value of a bandwidth available for data transfer and/or a decoding rate of a terminal device. Due to the absence of any definition of the relationship of these parameters to the "information indicative of dependencies of the sub-sequences" of steps (a) and (b), it is not clear whether and how the information deduced in step (b) is used in the controlling and removing steps (c) and (d).

5.5 Hence, also claim 1 of the second auxiliary request does not meet the requirements of Article 84 EPC 1973.

Third auxiliary request - added subject-matter (Article 123(2) EPC)

6. The deducing-step (b') of claim 1 of the third auxiliary request has been reformulated as follows (underlining added by the board to indicate the amended passages):

(b') deducing on the basis of the information indicative of the sub-sequence, said deducing comprising checking that the first scalability layer number is the same as the second scalability layer number and the first value of the sub-sequence identifier is different from the second value of the sub-sequence identifier, that either the first sub-sequence or the second sub-sequence is removable from the video

sequence without affecting decodability of the remaining of said first and second sub-sequence.

6.1 As in the case of claim 1 of the second auxiliary request, the wording "deducing on the basis of the information indicative of the sub-sequence" is interpreted as meaning "deducing on the basis of the information indicative **of dependencies** of the sub-sequences" (see point 5.1 above).

6.2 Step (b') specifies a test in order to determine whether either the first sub-sequence or the second sub-sequence is removable from the video sequence. It was undisputed that carrying out such a test was not explicitly disclosed in the application as originally filed.

The application discloses in paragraph [0062] that "sub-sequences can be independently decoded on each scalability layer, because the image frames of a sub-sequence are not dependent on other sub-sequences of the same scalability layer." This is understood as defining a rule determining the grouping of image frames to a sub-sequence. This rule requires that all sub-sequences on the same scalability layer are predicted from image frames on a higher scalability layer. Hence, the sub-sequences on the same scalability layer are only dependent on sub-sequences on a higher layer. As a consequence, any two sub-sequences having the same scalability layer numbers and different sub-sequence numbers, i.e. any two sub-sequences on the same scalability layer, are independent of one another and can be removed without affecting decodability of the other. However, there is no direct and unambiguous disclosure in the application as filed of the use of that information for deducing whether a sub-sequence

can be removed. There is also no direct and unambiguous disclosure of the evaluation of scalability layer numbers and sub-sequence identifiers in the context of the information indicative (of dependencies) of sub-sequence(s).

- 6.3 The appellant argued that paragraphs [0017], [0033] and [0053] together with [0083] provided a basis for this feature.

The board is not convinced by these arguments. The cited passages do not disclose how the information indicative of dependencies of sub-sequences, the scalability layer numbers and the sub-sequence identifiers are inter-related. Nor do they disclose a rule governing how the scalability layer numbers and sub-sequence identifiers may be used to check whether two sub-sequences on the same scalability layer are independent. Paragraph [0053] together with figure 3b discloses an example of two sub-sequences on the same scalability layer which are dependent on image frames of a higher layer. Hence, the sub-sequences can be considered to have been set up in accordance with the above rule. However, establishing a rule determining the grouping of image frames to sub-sequences is not the same as specifying a rule for checking dependencies.

- 6.4 Hence, the test formulated in step (b') is not directly and unambiguously disclosed in the application as originally filed. It follows that the subject-matter of claim 1 of the third auxiliary request extends beyond the content of the application as filed. Hence, the requirements of Article 123(2) EPC are not met.

7. Since none of the appellant's requests is allowable, the appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



L. Malécot-Grob

C. Kunzelmann

Decision electronically authenticated