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**Datasheet for the decision
of 14 June 2016**

Case Number: T 0889/11 - 3.5.04

Application Number: 00966849.2

Publication Number: 1222823

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H04N7/68

Language of the proceedings: EN

Title of invention:
VIDEO COMMUNICATION USING MULTIPLE STREAMS

Applicant:
Hewlett-Packard Development Company, L.P.

Headword:

Relevant legal provisions:
EPC 1973 Art. 56

Keyword:
Inventive step (no - all requests)

Decisions cited:

Catchword:



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Case Number: T 0889/11 - 3.5.04

D E C I S I O N
of Technical Board of Appeal 3.5.04
of 14 June 2016

Appellant: Hewlett-Packard Development Company, L.P.
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted on 10 February
2011 refusing European patent application
No. 00966849.2 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman B. Müller
Members: M. Paci
R. Gerdes

Summary of Facts and Submissions

- I. The appeal is against the decision of the examining division refusing European patent application No. 00966849.2 published as international patent application WO 01/22735 A1.
- II. In the decision under appeal *inter alia* the following prior-art documents were cited:
 - D4: N. Färber et al., "Robust H.263 Compatible Video Transmission over Wireless Channels", Proceedings of the Picture Coding Symposium (PCS) 1996, March 1996, pages 575-578, XP001091405 and
 - D5: Y. Wang et al., "Error Control and Concealment for Video Communication: A Review", Proceedings of the IEEE, Vol. 86, No. 5, May 1998, pages 974-997, XP011044024.
- III. The application was refused on the grounds that independent claims 1, 12, 22 and 23 according to the sole request did not meet the requirements of Articles 123(2) and 84 EPC because of the term "additional information" in these claims. The examining division also observed *obiter* that the subject-matter of these independent claims did not involve an inventive step (Article 56 EPC) in view of document D5.
- IV. With the statement of grounds of appeal the appellant filed amended claims 1 to 23 replacing all previous claims on file and requested the grant of a patent on the basis of these amended claims. As a precaution, the appellant also requested oral proceedings.
- V. In a communication under Article 15(1) RPBA (Rules of Procedure of the Boards of Appeal, OJ EPO 2007, 536)

annexed to the summons to oral proceedings, the board informed the appellant of its preliminary opinion that

- the amended claims filed with the statement of grounds of appeal had overcome the objections of added subject-matter and lack of clarity raised in the reasons for the decision;
- however, the claims still did not meet the requirements of Article 84 EPC 1973 for several other reasons; and
- the subject-matter of claim 1 did not involve an inventive step in view of D5 alone or in view of D5 in combination with D4.

VI. With a letter of reply dated 13 May 2016, the appellant filed amended claims 1 to 22 according to a main request and amended claims 1 to 17 according to an auxiliary request, which replaced all the previous claims on file. When compared to the claims of the main request, claims 8 and 9, claims 19 and 20 and claim 22 were cancelled; otherwise, the claims of the auxiliary request corresponded to the claims of the main request.

VII. The board held oral proceedings on 14 June 2016. The appellant was represented. The appellant's final requests at the end of the oral proceedings were that the decision under appeal be set aside and that a patent be granted on the basis of the claims of the main request or the auxiliary request, both requests filed with a letter of 13 May 2016. Before closing the oral proceedings, the chairman announced the board's decision.

VIII. Claim 1 of the main request and claim 1 of the auxiliary request have identical wording, which reads as follows:

"A video communication system for communicating a series of original video frames (40) from a sender (30) to a receiver (32), wherein

the sender (30) has means (14, 16; 70) for separating the series of original video frames (40) into multiple encoded streams (54, 56), each encoded stream (54, 56) having a series of encoded frames (I, P) that depend from a previous encoded frame in the corresponding encoded stream (54, 56), and each frame of the series of original video frames (40) being present only in one of the multiple encoded streams (54, 56);

the receiver (32) has means for reconstructing a stream of video frames in response to the multiple encoded streams (54, 56) such that errors in one or more of the multiple encoded streams (54, 56) do not prevent reconstruction of remaining ones of the multiple encoded streams (54, 56);

in case a communication error caused the loss of a frame at the receiver (32), the receiver (32) is configured to recover the lost frame in accordance with a selected method to generate a recovered frame, and to signal to the sender that the communication error occurred and the method selected for frame recovery, and

wherein the sender (30) is configured to determine a recovered frame on the basis of the signaled recovery method, compare the recovered frame to the lost frame, and, in case it is determined that the quality of the recovered frame is not sufficient, transmit to the receiver a frame that is intra for the entire recovered frame or for an area of the recovered frame for reinitializing a decoder (22) in the receiver (32)."

Reasons for the Decision

1. The appeal is admissible.

The invention

2. The invention relates to video communication from a sender to a receiver. In particular, it relates to how to deal with errors caused by a loss of frame(s) during video communication.

Main and auxiliary requests

Inventive step - Article 56 EPC 1973

3. Closest prior art

Document D5, published approximately one year before the priority date of the present application, provides a review of known techniques for error control and concealment for video communication. It is thus squarely in the same technical field as the present invention and is a suitable starting point for assessing inventive step of the subject-matter of claim 1 according to both requests (the wording of claim 1 is exactly the same in both requests).

The appellant did not dispute that document D5 represented the closest prior art for the subject-matter of claim 1 according to both requests.

4. Disclosure of D5

D5 reviews various techniques for addressing the same general problem as in the present application, i.e. how to ensure that the display of digital video is affected

as little as possible by errors during the transmission of digital video streams, in particular streams containing P-frames as these tend to propagate errors to successive frames and thus make the errors visible to a human eye. The known techniques for addressing this problem include **signal reconstruction** (i.e. attempting to obtain a close approximation of the original) and **error concealment** (i.e. attempting to make the output signal at the decoder/receiver least objectionable to the human eye): see D5, section "I. Introduction" on pages 974 to 976, in particular the last paragraph.

According to one of the known techniques of **forward-error concealment** (see D5, section IV starting on page 978) the sender separates a series of original video frames into **multiple encoded streams**, each encoded stream having a series of encoded frames that depend on a previous encoded frame in the corresponding encoded stream, and each frame of the series of original video frames being present only in one of the multiple encoded streams (see D5, subsection IV.D.2 bridging pages 982 and 983). As a result, if a transmission error affects one of the multiple streams, the receiver can still reconstruct and display the video error-free from the remaining streams, albeit at a reduced frame rate.

D5 further discloses that error concealment can be further improved by **post-processing at the receiver** (see section V starting on page 985) and by **interactivity between sender and receiver** (see section VI starting on page 990).

According to the former (post-processing at the receiver), **the receiver performs reconstruction and**

error concealment of the damaged/lost frame according to one of several known methods in order to generate a recovered frame which is as similar as possible to the lost frame in order to minimize the visual impact of the lost frame (see, for instance, the first paragraph of section V of D5).

According to the latter (interactivity between sender and receiver), a **backward channel** is used by the receiver for transmitting information as to the location of the damaged blocks (sub-areas of a frame) to the sender (see page 990, left and right columns). The sender then makes sure that the next transmitted frame is coded in intra-mode (I-frame or at least I-block in the frame) so that the decoder is re-initialised and the propagation of the error via P-frames at the decoder is stopped (see page 990, right column). Error concealment is performed on the damaged block(s)/frame(s) at the decoder until the next intra-coded frame is received. It is also disclosed in D5 that **the reconstruction and error concealment performed at the receiver can be repeated at the sender** so that the sender knows how the damaged frame was reconstructed at the receiver and how the reconstruction affected the subsequent frames (see page 991, left column).

It should be noted that D5 states unambiguously (see, for instance, section VI.E "Summary" on page 994) that the error concealment techniques based on the **interactivity between sender and receiver** (disclosed in section VI starting on page 990) may be used in conjunction with the error concealment techniques based on **forward-error concealment** (disclosed in section IV starting on page 978) and those based on **error**

concealment by post-processing at the decoder

(disclosed in section V starting on page 985).

5. Distinguishing features

In view of the above, the video communication system of claim 1 of both requests differs from that of D5 by the following features:

- (a) the receiver is configured to signal to the sender the method selected for frame recovery;
and
- (b) the sender is configured to determine a recovered frame on the basis of the signalled recovery method, compare the recovered frame to the lost frame, and, in case it is determined that the quality of the recovered frame is not sufficient, transmit to the receiver a frame that is intra for the entire recovered frame or for an area of the recovered frame for re-initialising a decoder in the receiver.

6. Objective technical problem

The technical effect of the above distinguishing features is to avoid unnecessary (re)transmission of video data from the sender to the receiver. The objective technical problem can thus be formulated as how to avoid unnecessary (re)transmission of video data from the sender to the receiver.

7. Arguments of the appellant

- 7.1 The appellant stated in its letter of 13 May 2016 (see point 2, second paragraph, of that letter) and

confirmed during the oral proceedings that it basically agreed with the board's analysis, as now set out in sections 3 to 6 *supra* (i.e. the steps of the problem and solution approach up to and including the formulation of the objective technical problem).

However, the appellant disagreed with the board's preliminary opinion that distinguishing features (a) and (b), in particular the determination of the quality of the recovered frame at the sender and the retransmission of the recovered frame depending on that determination, were obvious in view of D5 alone or in combination with D4. These arguments of the appellant will be discussed in detail in section 8 *infra*.

8. Obviousness

Re distinguishing feature (a)

It is undisputed that, before the priority date, there were several known error-concealment and reconstruction methods which could be performed at the receiver/decoder, each having pros and cons (see, for instance, D5, page 977, paragraph bridging the left and right columns, and page 985, the first paragraph of section V). It is also undisputed that it was known to repeat at the sender/encoder the same error-concealment and reconstruction method as was performed by the receiver/decoder on the damaged frame (see D5, paragraph bridging pages 990 and 991 in section VI).

In view of the above, the board regards it as obvious for the skilled person that, if different decoders use different frame-reconstruction methods, in order to repeat the reconstruction performed at the receiver the sender would have had to be informed by the receiver,

not only of the identity of the damaged frame, but also of which frame-reconstruction method was used in the receiver.

The appellant did not submit counter-arguments thereto regarding distinguishing feature (a).

Re distinguishing feature (b)

The arguments of the appellant regarding distinguishing feature (b) may be summarised as follows:

The paragraph bridging pages 990 and 991 of D5 discloses performing at the sender/encoder the same error-concealment and reconstruction method as was performed at the receiver/decoder side on the damaged frame. However, in contrast to the system of claim 1, there is no suggestion in D5 that the quality of the reconstruction could be determined by the sender and that, if it is determined that the quality is not sufficient, part or all of the recovered frame is retransmitted to the receiver/decoder as intra-coded. In D5, in the technique disclosed in the paragraph bridging pages 990 and 991, not only is there no quality determination at the sender, but there is also no retransmission of the recovered frame to the receiver/decoder. Instead of a retransmission, a frame which was due for transmission is adapted by intra-coding part or all of it before transmission. Hence the skilled person would not have arrived at distinguishing feature (b) without an inventive step when starting from D5.

The board was not persuaded by the above arguments for the following reasons:

The board concurs with the appellant that in the technique disclosed in the paragraph bridging pages 990 and 991 of D5 the quality of the frame reconstruction is not determined and there is no retransmission of the damaged (lost) frame.

However, the next subsection "VI.B. Adaptive Transport for Error Concealment" in the next column of the same page 991 of D5 discusses the pros and cons of retransmitting critical information that is lost. In that subsection, it is explained that retransmission had been used very successfully for non-real-time data transmission, but it had been generally considered as unacceptable for real-time video applications because of the delay incurred. However, this viewpoint had changed slightly in the few years preceding the publication of D5 (itself published approximately one year before the priority date of the present application). It had been realized that even for a coast-to-coast interactive service in the United States, one retransmission added only about 70 ms of delay, which was acceptable. For one-way real-time video applications such as Internet video streaming and broadcasting, the delay allowance could be further relaxed to a few seconds so that several retransmissions were possible. In the same subsection of D5 it is concluded that although retransmission adds more traffic on the network, if retransmission is controlled appropriately, the end-to-end quality can be improved.

In other words, subsection VI.B of D5 teaches that, in real-time video applications such as Internet video streaming and broadcasting, video frames are buffered at the receiver for a time ("a few seconds") which is

sufficiently long to allow the following sequence of steps to be performed:

- the receiver informs the sender via a backward channel of the identity of the damaged/lost frame,
- the sender retransmits the damaged/lost frame and
- the receiver replaces the damaged/lost frame by the retransmitted frame.

The advantage of retransmitting a damaged/lost frame is apparent to the skilled person: a retransmitted original frame is flawless, whereas a reconstructed frame may substantially differ from the original frame.

The following drawbacks of a retransmission are known or obvious to the skilled person:

- (1) the retransmission of a frame creates a bit-rate overhead in a communication channel which has a maximum bit rate and
- (2) the retransmitted frame may not always arrive sufficiently quickly (no more than "a few seconds") to replace the damaged/lost frame before the time when the receiver must start decoding that frame.

D5 explains that the above drawback (1) can be minimised if "retransmission is controlled appropriately", which the skilled person would understand to mean that a retransmission should only occur if really necessary. As to drawback (2), the skilled person would inevitably come to the conclusion that error concealment and frame reconstruction must still be performed at the receiver in case the retransmitted frame does not arrive on time.

As explained in D5 (on page 991, right column), in real-time video applications such as Internet video streaming and broadcasting, "if retransmission is

controlled appropriately, the end-to-end quality can be improved". The board thus considers that for such applications the skilled person would have had a strong incentive to apply the above teachings about retransmission (described on page 991, right column) to improve the technique described in the immediately preceding subsection of D5 (on page 991, left column). Since according to this technique the error concealment and frame reconstruction procedure performed at the receiver is repeated at the sender, it would have been obvious to assess the quality of the reconstruction at the server in order to decide if a retransmission of the damaged/lost frame was necessary, which would have only been the case if the quality was insufficient.

Hence the skilled person would have arrived at distinguishing feature (b) without an inventive step.

9. Conclusion on inventive step

For the above reasons, the subject-matter of claim 1 according to each of the main and auxiliary requests does not involve an inventive step in view of prior-art document D5.

10. Conclusion

Since the subject-matter of claim 1 of each of the main and auxiliary requests does not involve an inventive step (Article 56 EPC 1973), these requests are not allowable.

Since neither 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:



K. Boelicke

B. Müller

Decision electronically authenticated