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Datasheet for the decision
of 22 October 2019

Case Number: T 0015/18 - 3.5.05

Application Number: 13819210.9

Publication Number: 2873197

IPC: H04L1/00

Language of the proceedings: EN

Title of invention:
DETERMINISTIC DISTRIBUTED NETWORK CODING

Applicant:
Code on Network Coding, LLC

Headword:
Coding coefficients generation/CODE ON NETWORK CODING Coduing

Relevant legal provisions:
EPC Art. 56, 83, 84, 123(2)

Keyword:
Amendments - added subject-matter (no)
Claims - clarity (yes)
Sufficiency of disclosure - (yes)
Inventive step - (yes)

Decisions cited:

Catchword:

Beschwerdekammern

Boards of Appeal

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Case Number: T 0015/18 - 3.5.05

D E C I S I O N
of Technical Board of Appeal 3.5.05
of 22 October 2019

Appellant: (Applicant)	Code on Network Coding, LLC 15 Lanark Road Wellesley, Massachusetts 02481 (US)
Representative:	Barbaro, Gaetano Società Italiana Brevetti S.p.A. Via G. Carducci, 8 20123 Milano (IT)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 31 July 2017 refusing European patent application No. 13819210.9 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair	A. Ritzka
Members:	P. Cretaine
	G. Weiss

Summary of Facts and Submissions

I.   This appeal is against the decision of the examining division, posted on 31 July 2017, refusing European patent application No. 13819210.9. A main request and first, third and fourth auxiliary requests were refused for not fulfilling the requirements of Articles 123(2), 84 and 83 EPC. A second auxiliary request was refused for not fulfilling the requirements of Articles 84 and 83 EPC. A "new main request" and a fifth auxiliary request were not admitted into the examination proceedings under Rule 116 EPC.

During the course of the examination, the examining division also raised novelty and inventive step objections based on

D1: EP 2 264 930 as the closest prior art.

Further, the following document had been cited in the international preliminary report on patentability issued by KIPO on 23 June 2014:

D3: US 2005/0152391.

II.   The notice of appeal was received on 4 October 2017 and the appeal fee was paid on the same day. The statement setting out the grounds of appeal was received on 5 December 2017. The appellant requested that the decision be set aside and that a patent be granted based on a main request or a first or second auxiliary request. All requests were submitted with the statement setting out the grounds of appeal. Oral proceedings were requested in the event that none of the three requests were allowed.

III.   Claim 1 according to the main request reads as follows:

"A network comprising:
one or more source nodes;
one or more receiver nodes; and
coding nodes, allowing communication of source
processes to each receiver node, the coding nodes being
connected with input links for communication of input
signals to the coding nodes and output links for
communication of output signals from the coding nodes,
wherein the output signals from the coding nodes are a
linear combination of the input signals,
characterized in that a plurality of said coding nodes
are configured to generate coefficients of the linear
combination using local node numbers or alternatively
local link numbers as inputs to a deterministic mapping
from the local node numbers or alternatively from local
link numbers to the coefficients of the linear
combination,
wherein
the linear combination of processes transmitted from
the one or more source nodes present in each signal in
the network is specified as a vector of the
coefficients, each coefficient corresponding to a
process to be transmitted from one or more source
nodes, and
wherein said coding nodes are configured to update and
to transmit the vector of coefficients by applying to
the vector of coefficients linear combinations, wherein
the linear combinations applied to the vector of
coefficients are the same as the linear combinations
applied to data transmitted through the network."

The main request comprises a further independent claim
directed to a corresponding method (claim 9).

Due to the outcome of the appeal, there is no need to give details of the claims of the first and second auxiliary requests.

Reasons for the Decision

1.   Admissibility of the appeal

The appeal complies with Articles 106 to 108 EPC (see point II above) and is therefore admissible.

2.   Main request

The main request is identical to the second auxiliary request on which the decision under appeal was based and which was refused for lack of clarity (Article 84 EPC) and insufficiency of disclosure (Article 83 EPC).

The board however concurs with the appellant that this request satisfies the requirements of the EPC.

3.   Article 123(2) EPC

The board agrees with the decision (see Reasons B3.1) that independent claims 1 and 9 meet the requirements of Article 123(2) EPC.

In that respect, claims 1 and 9 both comprise the features which were considered as essential features by the examining division and which were missing or had been deleted in the independent claims of the then main request and first auxiliary request (see Reasons B1). These features are the features related to the specification, updating and transmission through the

network of a vector of the coefficients, disclosed in
claim 18 as originally filed.

Moreover, the features related to the use of local node
numbers or local link numbers for the generation of the
coefficients, which have otherwise not been objected to
in the decision, find a clear support in paragraphs
[0028] and [0029] of the application as originally
filed.

4.   Article 84 EPC

The board concurs with the appellant that the wording
"deterministic mapping" does not render the subject-
matter of the claims unclear, contrary to what is
stated in the decision (see B3.2 to B3.4). Mapping is a
well-known term having a clear meaning in the technical
field of network coding. A mapping in that context is a
function that maps elements of a first set of values to
elements of a second set of values. Moreover, the
skilled person would undoubtedly know that the word
"deterministic" is the antonym of "random" or
"probabilistic" or "stochastic". Thus, in the context
of the application, the skilled person would clearly
understand that a deterministic mapping from the local
node numbers to the coefficients of the linear
combination represents a function, implemented in a
coding node, which maps local node numbers (i.e. the
node numbers known in the coding node) to the
coefficients used by the node for the linear
combination, these coefficients being definitely
determined from the local node numbers.

Furthermore, the board agrees with the appellant that
the feature defining the generation of the coefficients
by using a deterministic mapping of the local node

numbers, or local link number, to the coefficients is
fully supported by the description, in particular
paragraphs [0028] and [0029] (see the second sentence
in each paragraph).

For these reasons, the board holds that claims 1 and 9
meet the requirements of Article 84 EPC.

5.   Article 83 EPC

The board concurs with the appellant that, as mentioned
in point 4 above, a deterministic mapping is clearly a
deterministic (i.e. non random, non stochastic, non
probabilistic) function and that paragraphs [0028] and
[0029] of the description provide several workable
examples to the skilled person of how to carry out such
a function. In particular the skilled person is able
to implement the choice of weights a and b as
"arbitrary deterministic constant elements from the
code alphabet and q is the alphabet size". As argued by
the appellant the skilled person would immediately
understand that the logical, and sole possible, meaning
of this wording is that weights a and b are chosen,
i.e. drawn from a set of elements, the code alphabet,
in a non-random manner. The skilled person in the field
of network coding is obviously able to choose an
alphabet of size q, i.e. a mathematical set of q
values, to draw weights a and b from this set, and to
implement mod q operations in that alphabet.

For these reasons, the board agrees with the appellant
that the main request meets the requirements of
Article 83 EPC.

6.   Novelty and inventive step

6.1   The decision does not deal with these issues although
        objections had been raised in previous communications.
        based on the disclosure of D1.

        D1 discloses a network coding scheme based on a
        centralised code construction where coefficients to be
        used by each node of the network are first calculated
        using a known topology of the network and then
        transmitted to each of the nodes in a control packet
        and then used for generating the linear combinations of
        the inputs (see paragraphs [0063], [0086], [0087],
        Figure 6a, Packet 450 in Figure 4b, Figure 7a, claim
        8).

        The differences between the subject-matter of claim 1
        and the disclosure of D1 are in substance that the
        coefficients are generated in each node, using a
        mapping from local node numbers, or local link numbers,
        and that a vector of coefficients is updated in each
        node by using the linear combination applied by the
        node and transmitted by each node through the network.

        The technical effect of these differences is that a
        network coding is possible without the need of a
        central entity, having knowledge of the established
        network topology, for generating coding coefficients
        and distributing them to the nodes. The objective
        technical problem can thus be formulated as how to
        perform a network coding which is less resource
        consuming and less dependent on the network topology.

        Starting from D1, the skilled person would not be
        prompted to change the whole system from a centralised
        coding scheme to a distributed one. Even if the skilled

person were to consider such a change, they would not
be able to design without the exercise of inventive
skills, the generation of the coefficients at each
coding node, based on locally available information
such as the local node and link numbers, or the
distribution of the necessary decoding information to
the receivers through the vector of coefficients, as
defined in dependent claims 1 and 9.

Therefore, the board concurs with the appellant that
claims 1 and 9 meet the requirements of Article 56 EPC
having regard to D1.

6.2   The board has also noted that document D3, assigned to
the inventors of the present application and which
comprises as Annex 2 the article cited in paragraph
[0007], discloses a distributed network coding scheme
wherein the coding nodes independently and randomly
choose the coefficients for linear combinations from a
finite field and wherein a vector of coefficients for
each of the source processes is updated and re-
transmitted by each node.

The differences between the subject-matter of claim 1
and the disclosure of D3 are thus that the coefficients
chosen by each node for its linear combinations are not
random but are generated by using a deterministic
mapping from local node numbers, or local link numbers
to an alphabet of coefficients. The technical effect of
these distinguishing features is that the choice of the
coefficients may be changed upon time in a
deterministic manner, by adapting the mapping. It is
plausibly stated in paragraph [0030] that the
deterministic mapping at each node can be influenced by
feedback from receiver nodes, in order to improve the
performance of the network coding, for example in

respect of the transmission rates at the receivers. The objective technical problem can thus be formulated as how to optimise the network coding in terms of network performance.

Starting from D3, the skilled person would not be prompted to change the random generation scheme of the coefficients to a deterministic generation scheme. Even if the skilled person were to consider such a change, they would not be able to design, without the exercise of inventive skills, a generation of the coefficients at each coding node, based on locally available information such as the local node and link numbers, as defined in dependent claims 1 and 9.

Moreover, the skilled person would not consider a combination of D3 with D1 due to the fundamental difference between the centralised scheme of D1 and the distributed scheme of D3. Furthermore, even the combination of D3 with D1 would not lead to the subject-matter of claim 1 since the coefficients in D1, although non-randomly chosen, are not based on information locally available to each coding node, namely the local node numbers, or the local link numbers.

6.3   Thus the board holds that claims 1 and 9, and their dependent claims, meet the requirements of Article 56 EPC, having regard to the prior art on file.

Order

For these reasons it is decided that:

1.   The decision under appeal is set aside.

2.   The case is remitted to the examining division with the
        order to grant a patent on the basis of the claims of
        the main request, filed with the letter of
        5 December 2017, and a description and figures to be
        adapted thereto.

The Registrar: The Chair:

K. Götz-Wein   A. Ritzka

Decision electronically authenticated