BESCHWERDEKAMMERN　　BOARDS OF APPEAL OF　　CHAMBRES DE RECOURS
DES EUROPÄISCHEN　　　THE EUROPEAN PATENT　DE L'OFFICE EUROPEEN
PATENTAMTS　　　　　　OFFICE　　　　　　　　DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [ ] To Chairmen
(D) [X] No distribution

**Datasheet for the decision
of 3 September 2008**

Case Number:　　　　　　　T 1563/05 - 3.5.02

Application Number:　　　02007488.6

Publication Number:　　　1241795

IPC:　　　　　　　　　　　H03M 13/00

Language of the proceedings:　EN

Title of invention:
Method and system for transmitting and receiving information
using chain reaction codes

Applicant:
Digital Fountain

Headword:
-

Relevant legal provisions:
EPC Art. 76(1), 54, 56, 123(2)

Relevant legal provisions (EPC 1973):

Keyword:
"Amendments - added subject matter (no)"
"Inventive step - (yes, after amendment)"

Decisions cited:
-

Catchword:
-

Europäisches
Patentamt

European
Patent Office

Office européen
des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Case Number: T 1563/05 - 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 3 September 2008

Appellant:

Digital Fountain
Suite 236,
2201 Broadway
Oakland, CA 94612
US

Representative:

Doble, Richard George Vivian
Lagner Parry
52-54 High Holborn
London, WC1V 6RR
GB

Decision under appeal: **Decision of the Examining Division of the**
European Patent Office posted 2 August 2005
refusing European application No. 02007488.6
pursuant to Article 97(1) EPC 1973.

Composition of the Board:

Chairman: M. Ruggiu
Members: G. Flyng
              E. Lachacinski

Summary of Facts and Submissions

I.   The applicant appealed against the decision of the
        examining division to refuse the European patent
        application No. 02 007 488.6.

II.   The present application is a divisional application
        divided from earlier Euro-PCT application 99 949 717.5
        which was published as international publication number
        WO 00/18017 A1 (hereinafter the "parent").

III.   In the contested decision, the examining division
        essentially held that claim 1 of all three requests
        then on file lacked an inventive step over the prior
        oral disclosure, in the early afternoon session on
        2 September 1998 at the SIGCOMM'98 Conference in
        Vancouver, of the content of the later published
        document:

        Dl: J. Byers, M. Luby et al. "A Digital Fountain
             approach to Reliable Distribution of Bulk Data",
             ACM SIGCOMM'98, Vancouver, 2-4 Sept. 1998,
             Computer Communications Review, Association for
             Computing Machinery, New-York (US), October 1998,
             vol. 28, Nr. 4, pages 56 to 67,

        and that the subject-matter of claim 1 of all three
        requests had been extended over the content of the
        earlier application 99 949 717.5 as originally filed,
        Article 76(1) EPC.

        The examining division added various further remarks,
        applicable to all requests, including inter alia that:

        –   the remaining independent claims 18, 28, 37 and 53
                gave rise to objections under Articles 56 and
                76(1);

-     claim 37 lacked novelty Article 54 EPC; and

-     claim 48 was not clear.

IV.   Oral proceedings were held before the Board on
      3 September 2008. The appellant requested that the
      decision under appeal be set aside and that a patent be
      granted in the following version:

      Description:

-     Pages 1 to 5, 8, 9 and 11 to 49 as originally
      filed;

-     Pages 6, 6a, 7, 10 and 10a received during the
      oral proceedings of 3 September 2008;

      Claims:

-     Nos. 1 and 2 received during the oral proceedings
      of 3 September 2008;

      Drawings:

-     Sheets 1/18 to 18/18 as originally filed.

V.   Claim 1 reads as follows:

      "A method of transmitting data from a source to a
      destination over a packet communication channel, the
      method comprising:

a)   arranging the data to be transmitted into an
      ordered set of input symbols representing an input
      file, wherein each of the input symbols is a
      symbol from an input alphabet and each of the
      input symbols represents a sequence of bits at a
      particular position in the input file;

b)   selecting keys I from a key alphabet, wherein the
      key alphabet is such that the number of possible

keys in the key alphabet is much larger than the number of input symbols in the ordered set of input symbols such that an effectively unbounded number of output symbols that are generally independent of each other can be generated;

c) generating a plurality of output symbols from the input symbols, wherein each output symbol is generated by the steps of:

  i)   selecting, from the key alphabet, a key I for the output symbol being generated;

  ii)   determining, according to a predetermined function of I, a list AL(I) that indicates W(I) associated input symbols to be associated with the output symbol, wherein weights W are positive integers that vary over the plurality of keys and are greater than one for at least some keys in the key alphabet; and

  iii) generating an output symbol value B(I) from a predetermined function of the W(I) associated input symbols indicated by AL(I), wherein B(I) is a value from an output alphabet;

d) packetizing the plurality of output symbols into a plurality of packets; and

e) transmitting the plurality of packets over the packet communication channel, such that a recipient can decode the input file from a number of output symbols equal to, or slightly greater than, the number of input symbols representing the input file, assuming that input symbols and output symbols represent the same number of bits of data."

VI.   Claim 2 reads as follows (the changes with respect to
        claim 1 have been underlined by the Board):

        "A <u>system</u> of transmitting data from a source to a
        destination over a packet communication channel, the
        <u>system</u> comprising:
        a)   <u>means for</u> arranging the data to be transmitted
               into an ordered set of input symbols representing
               an input file, wherein each of the input symbols
               is a symbol from an input alphabet and each of the
               input symbols represents a sequence of bits at a
               particular position in the input file;
        b)   <u>means for</u> selecting keys I from a key alphabet,
               wherein the key alphabet is such that the number
               of possible keys in the key alphabet is much
               larger than the number of input symbols in the
               ordered set of input symbols such that an
               effectively unbounded number of output symbols
               that are generally independent of each other can
               be generated;
        c)   <u>means for</u> generating a plurality of output symbols
               from the input symbols, wherein each output symbol
               is generated by the steps of:
               i)   selecting, from the key alphabet, a key I
                      for the output symbol being generated;
               ii)   determining, according to a predetermined
                      function of I, a list AL(I) that indicates
                      W(I) associated input symbols to be
                      associated with the output symbol, wherein
                      weights W are positive integers that vary
                      over the plurality of keys and are greater
                      than one for at least some keys in the key
                      alphabet; and

iii)   generating an output symbol value B(I) from
        a predetermined function of the W(I)
        associated input symbols indicated by AL(I),
        wherein B(I) is a value from an output
        alphabet;

d) <u>means for</u> packetizing the plurality of output
    symbols into a plurality of packets; and

e) <u>means for</u> transmitting the plurality of packets
    over the packet communication channel, such that a
    recipient can decode the input file from a number
    of output symbols equal to, or slightly greater
    than, the number of input symbols representing the
    input file, assuming that input symbols and output
    symbols represent the same number of bits of
    data."

VII.   The arguments of the appellant can be summarised as
        follows. In the present invention, an effectively
        unbounded number of output symbols could be generated
        which effectively overcame some of the shortcomings of
        Tornado codes, which were the subject of D1. With
        Tornado codes, the number of output symbols was fixed
        by the number of input symbols divided by a code rate
        that was fixed by the graph being used to generate the
        particular Tornado code.

Reasons for the Decision

1.   The appeal is admissible.

Admissibility of the amendments

2.   The Board is satisfied that the claims and the
        description according to the current request meet the
        requirements of Article 84 EPC and do not contravene
        Article 76(1) EPC or Article 123(2) EPC.

2.1   Independent claim 1 is directed to a method of
        transmitting data from a source to a destination over a
        communication channel. It is based to a large extent on
        independent claim 19 as filed for the parent, the text
        of which was repeated in the description of the present
        application as filed (see paragraph [0028] of the
        published application, EP 1 241 795 A2).

2.2   The changes made with respect to parent claim 19 are
        considered to have been disclosed in the original
        filings of the parent and divisional application as
        detailed below (page and line references refer to the
        published parent application WO 00/18017; paragraph
        references in square brackets refer to the published
        divisional application EP 1 241 795 A2).

2.2.1   The additional feature of the "*ordered set of input
        symbols representing an input file*" was disclosed at
        page 12, lines 7 to 10 of the parent and in paragraph
        [0035] of the divisional.

2266.D

2.2.2   The additional feature of "*each input symbol comprising a sequence of bits*" has a basis from page 12, lines 16 and 17, of the parent and paragraph [0036] of the divisional.

2.2.3   Considering feature b), the step of selecting keys from a key alphabet was outlined in feature b)1) of parent claim 19 and the further definition that "*the number of possible keys in the key alphabet is much larger than the number of input symbols in the ordered set of input symbols*" was set out in parent claim 1. The expression "*much larger*" has been qualified by the statement "*such that an effectively unbounded number of output symbols that are generally independent of each other can be generated*" which originates from page 6, lines 28 to 30 and page 7, lines 24 to 27 of the parent and paragraphs [0020] and [0023] of the divisional. The Board considers this qualification adequately clear in the present context.

2.2.4   Feature c)ii) has a basis in features b)2) and b)3) of parent claim 19 and in lines 8 to 12 of parent claim 1. The removal of the phrase "between at least two values" does not introduce fresh subject-matter because an integer that varies must necessarily vary "between at least two values". Hence the variation "between at least two values" is implicit from the remaining wording.

2.2.5   Feature c)iii) has a basis in lines 13 and 14 of parent claim 1 and feature b) of parent claim 19.

2.2.6   Feature d) has a basis in feature c) of parent claim 19. The amendment to the wording serves to remove the

interpretation, possible from the original wording, that one of the plurality of output symbols is packetized into every packet, an interpretation which is not supported by the description.

2.2.7   In feature e), the feature "*such that a recipient can decode the input file from a number of output symbols equal to, or slightly greater than, the number of input symbols representing the input file, assuming that input symbols and output symbols represent the same number of bits of data*" was not specified in the corresponding feature d) of parent claim 19. This additional feature originates from page 7, lines 3 to 6 of the parent and paragraph [0021] of the divisional.

2.3   Independent claim 2 defines a system which corresponds to the method of claim 1 and hence has the same basis in the parent and divisional applications as filed.

2.4   The description has been amended for conformity with the claims and to acknowledge the disclosure at the ACM SIGCOMM '98 conference. No fresh subject-matter has been added by these amendments.

Novelty and Inventive Step

3.   The Board considers that the subject-matter of present claims 1 and 2 is novel and involves an inventive step within the meaning of Articles 54 and 56 EPC.

3.1   The disclosure which is most relevant to the subject-matter of the present claims is that contained in document D1. The most relevant part of document D1 is the discussion of so called "Tornado codes" in section

2266.D

5. There it is explained that (emphasis added by the Board):

– Erasure *codes are considered in the discussion "that take a set of **k source data packets** and produce a set of **l redundant packets** for a total of **n = k + l encoding packets** all of a fixed length **P"** (page 58, right column, third paragraph)*.

– "We *think of the ith **source data packet** as containing the value of a variable x_i, and we think of the jth **redundant packet** as containing the value of a variable y_j"* (section 5.1 Theory, page 58, right column, fourth paragraph).

– "*For Tornado codes, the equations have the form y_3 = x_1 XOR x_4 XOR x_7, where XOR is bitwise exclusive- or. Tornado codes also use equations of the form y_{53} = y_3 XOR y_7 XOR y_{13}; that is, redundant packets may be derived from other redundant packets"* (page 59, left column, second paragraph).

3.2   From these explanations in D1 it is clear to the Board that when Tornado codes are used, the transmitted packets include source data packets, which each contain a source data variable x_i, and redundant packets, which contain a variable y_j derived by combining a plurality of source data variables x_i using the XOR operator. These source data variables x_i and transmitted packets correspond to the input symbols and output symbols referred to in the present claims.

3.3   Document D1 does not explain in detail how, for the generation of any given redundant packet, the particular source data variables x_i are to be selected.

2266.D

However the example described in section 5.2 and shown
in figure 1 gives some insight. The left side of figure
1 shows how two levels of redundant packets l are
generated from the source data k using bipartite graphs.
The right side of Figure 1 shows the source data k and
the first level of redundant packets l in more detail.
Variables a to h of the source data are depicted as
solid circles and variables of the redundant packets
are depicted as shaded circles. A graph is drawn
between the source data and the redundant packets to
show which variables a to h of the source data are
combined to form each of four redundant packets, in
particular:

    a + b + f
    a + b + c + d + g
    c + e + g + h
    c + d + e + f + h
    (where + denotes the XOR operator)

It is evident from this example that D1 contemplates
forming redundant packets from differing numbers of
input variables (e.g. 3, 4 or 5 input variables) and
from diverse combinations of the input variables.

According to D1 (page 60, left column, second
paragraph), the code is specified by specifying the
random graphs to place between consecutive levels of
figure 1.

3.4   In the contested decision (see reasons for the decision,
paragraph 10a) the examining division held that the
list of input symbols indicated in figure 1 of D1
constituted a key which must be made available to the
generating step for it to be able to determine which

input symbols should be exclusive-ORed. In the Board's
view, however, the lists of input symbols indicated in
figure 1 of D1 correspond not to the claimed keys, but
rather to the claimed lists AL(I) that indicate W(I)
associated input symbols. Document D1 does not disclose
how the lists of input symbols (or in other terms the
graphs between consecutive levels) are generated. In
particular, D1 does not disclose the claimed features
that:

- for each output symbol a list AL(I) of associated
  input symbols is determined according to a
  predetermined function of a key I; and

- the keys (I) are selected from a key alphabet,
  wherein the key alphabet is such that the number
  of possible keys in the key alphabet is much
  larger than the number of input symbols in the
  ordered set of input symbols such that an
  effectively unbounded number of output symbols
  that are generally independent of each other can
  be generated.

The Board therefore considers claims 1 and 2 to be new,
Article 54 EPC.

3.5   By having a number of keys available that is much
        larger than the number of input symbols, the method and
        system according to the invention is able to generate
        an effectively unbounded number of generally
        independent output symbols. This reduces the chance
        that output symbols will be generated that do not
        contribute to the later process of decoding the
        transmitted data.

3.6   There is no suggestion in D1 or in any of the other
        available prior art to use such a key alphabet with a

number of keys that is much larger than the number of
input symbols to be coded. For this reason the Board
does not consider it obvious for the skilled person to
come to the subject-matter of claims 1 and 2. The Board
therefore considers the invention according to claims 1
and 2 to involve an inventive step, Article 56 EPC.

3.7   The Board notes that questions may remain as to whether
        or not the content of document D1 formed part of the
        state of the art in the sense of Article 54(2) EPC.
        The D1 document itself appears to have been published
        in October 1998, i.e. after the filing of the first of
        the present application's two priority documents
        (US 60/101473) on 23 September 1998.
        It has not been proven whether or to what extent the
        content of document D1 was made available to the
        public, orally or in written form, at SIGCOMM'98
        Conference in Vancouver on 2 September 1998, i.e.
        before the earliest priority date of the present
        application. Conversely, it has not been established
        whether or not this first priority document was filed
        in respect of the same invention in the sense of
        Article 87(1) EPC and hence whether or not this
        earliest priority date counts as the date of filing for
        the present application (Article 87 EPC). The Board did
        not consider it necessary to decide upon these
        questions since the content of D1 was anyway found not
        to be prejudicial to novelty and inventive step.

Order

For these reasons it is decided that:

1.   The decision under appeal is set aside.

2.   The case is remitted to the department of first
        instance with the order to grant a patent in the
        following version:

        Description:
        –   Pages 1 to 5, 8, 9 and 11 to 49 as originally
                filed;
        –   Pages 6, 6a, 7, 10 and 10a received during the
                oral proceedings of 3 September 2008;

        Claims:
        –   Nos. 1 and 2 received during the oral proceedings
                of 3 September 2008;

        Drawings:
        –   Sheets 1/18 to 18/18 as originally filed.

The Registrar: The Chairman:

U. Bultmann   M. Ruggiu