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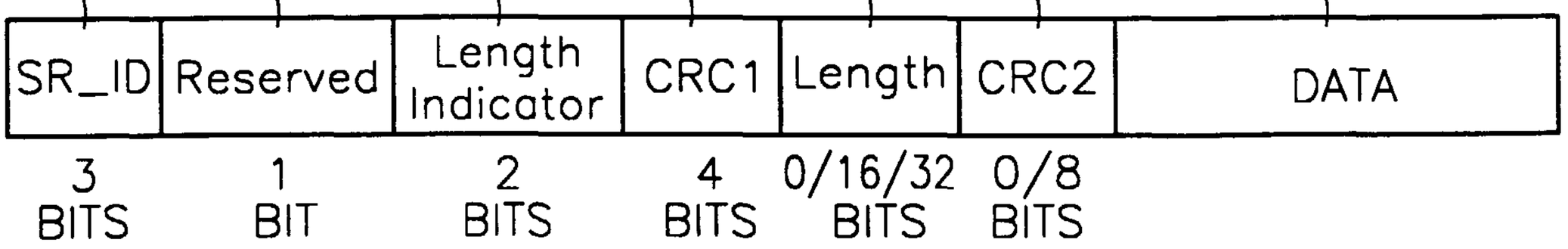
(54) Title: METHOD AND APPARATUS FOR TRANSMITTING AND RECEIVING WIRELESS PACKET



(57) Abrégé/Abstract:
A wireless packetization apparatus for transmitting/receiving multimedia data including video data in a radio transmitting/receiving system, and a method thereof are provided. According to the present invention, error resilience can be increased by adding error protection codes to one portion and a plurality of portions of multimedia-related header information, respectively, when multimedia data such as video data requiring real time or low delay are transmitted and received in a wireless environment, and a packet drop rate can be thereby reduced. Also, information can be more precise recovered by inserting length identifier and length information on an information region into the header.

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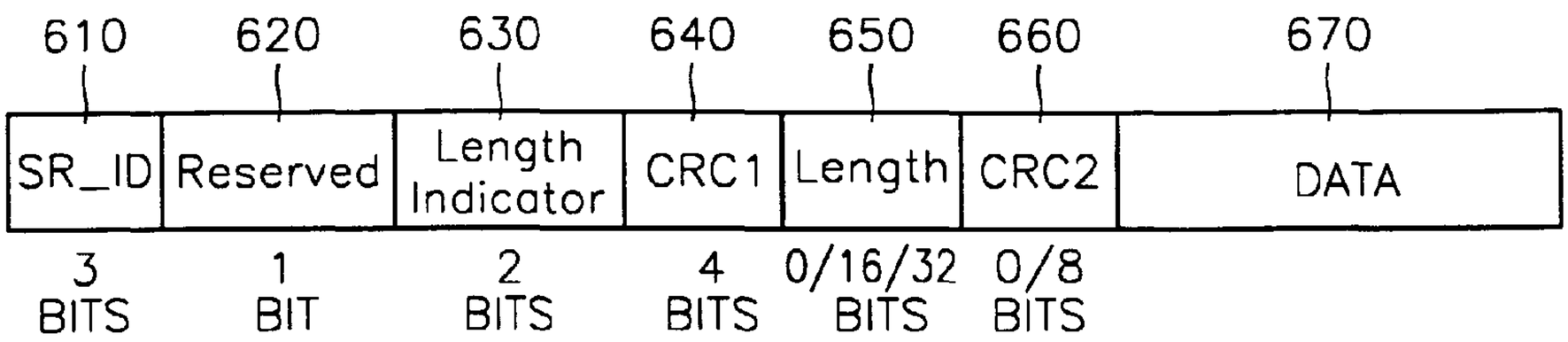
(54) Title: METHOD AND APPARATUS FOR TRANSMITTING AND RECEIVING WIRELESS PACKET



(57) Abstract: A wireless packetization apparatus for transmitting/receiving multimedia data including video data in a radio transmitting/receiving system, and a method thereof are provided. According to the present invention, error resilience can be increased by adding error protection codes to one portion and a plurality of portions of multimedia-related header information, respectively, when multimedia data such as video data requiring real time or low delay are transmitted and received in a wireless environment, and a packet drop rate can be thereby reduced. Also, information can be more precise recovered by inserting length identifier and length information on an information region into the header.

WO 01/73974 A1

METHOD AND APPARATUS FOR TRANSMITTING AND RECEIVING WIRELESS PACKET

Technical Field

The present invention relates to a radio transmitting/receiving system, and more particularly, to a wireless packetization apparatus for transmitting/receiving multimedia data including video data in a radio transmitting/receiving system, and a method thereof.

Background Art

In general, a radio transmitter and a radio receiver employing a phase 1 standard in cdma 2000 are formed of high-level layers as shown in FIG. 1. Codec-related standards such as H.324M. H.323, and T.120 correspond to an application layer. A physical layer performs channel coding, PN spreading, and modulation. A media access control (MAC) layer includes a signaling unit (not shown) and a radio link protocol (hereinafter referred to as RLP) (not shown), and the RLP converts payload on the application layer transmitted through a radio path into an input format on the physical layer. The physical layer among the three layers is mainly realized by hardware, and its flexibility is small when its hardware is determined by a standard. However, flexibility can be given to the application layer considering its network-independent portion.

Referring FIG. 2, one RLP corresponds to each of a number N of applications (*application* 1, *application* 2, . . . , and *application* N). The RLP is connected to a physical layer 240 through a multiplex (MUX) sub-layer 230.

The MUX sub-layer 230 multiplexes a number N of received RLPs adaptively to a protocol data unit (PDU). Here, a multiplex-protocol data unit (MUX-PDU) is available in a case where a channel bit error rate is less than 10^{-6}.

In the frame of RLP type 3 of FIG. 3, a reference numeral 310 denotes a service reference identification (ID), and a reference numeral 320

denotes an arbitrary user region, and a reference numeral 330 denotes payload, which is received from an application layer. However, in a conventional radio transmitting/receiving system employing the frame structure of FIG. 3, when even a part of header portions 310 and 320 is damaged, it is impossible for a recipient to know the exact length of the DATA field, and then, RLP decoding is not possible.

Disclosure of the Invention

To solve the above problems, it is a first object of the present invention to provide a wireless packetization method for increasing error-robustness while reducing overhead so that multimedia data including video data may be suitable in a wireless environment.

It is a second object of the present invention to provide a wireless packetization apparatus in which the wireless packetization method is implemented.

It is a third object of the present invention to provide a method for decoding a wireless packet in which the packetized frame data are decoded by the wireless packetization method.

It is a fourth object of the present invention to provide an apparatus for receiving a wireless packet in which the method for decoding a wireless packet is implemented.

Accordingly, to achieve the first object, there is provided a wireless packetization method in a radio transmitting and receiving system for transmitting and/or receiving multimedia data in a wireless environment. The method comprises the steps of: dividing multimedia data-related header information into one portion and a plurality of portions, respectively; and adding error checking or protection codes to each of the divided header information.

According to another aspect of the first object, there is provided a wireless packetization method in a radio transmitting and receiving system for transmitting and/or receiving multimedia data in a wireless environment. The method comprises the steps of: adding a length field for indicating the

length of data in a data region and a length indicator field for identifying the length of the length field on a multiplex (MUX) layer where the multimedia data are multiplexed into predetermined units to header information.

According to still another aspect of the first object, there is provided a wireless packetization method in a radio transmitting and receiving system for transmitting and/or receiving multimedia data in a wireless environment. The method comprises the steps of: adding a length field for indicating the length of data in a data region and a length indicator field for identifying the length of the length field on a multiplex (MUX) layer where the multimedia data are multiplexed into predetermined units to header information; and forming a predetermined protocol frame by adding error checking or protection codes to each of the length field and the length indicator field.

In order to achieve the second object, there is provided a wireless packetization apparatus in a radio transmitting apparatus for transmitting multimedia data on a multiplex (MUX) sub-layer in a wireless environment. The apparatus includes a header information-creating unit for creating a first field indicating the numbers of potential bits of the length of data and a second field indicating the length of the data and for adding error protection codes to each of header information which are divided into one portion and a plurality of portions, respectively, and a frame-forming unit for forming a frame having the unit of protocol data by multiplexing the header information formed in the header information-creating unit and the data.

In order to achieve the third object, there is provided a method for decoding a wireless packet by receiving a packet in which error protection codes are added to one portion and a plurality of portions of header information, respectively, on a wireless multiplex (MUX) sub-layer in a multimedia data transmitting system. The method comprises the steps of: discarding the previous frame in a case where there is some error and checking a second error protection code added to the next header information in a case where there is no error, when a first error protection code added to the initial header information is checked; and transmitting

data to an upper layer in a case where there is no error and transmitting a blank data block to the upper layer in a case where there is some error, when the second error protection code is checked in the step.

In order to achieve the fourth object, there is provided an apparatus for receiving a wireless packet in an apparatus for decoding data by receiving a packet in which error protection codes are added to one portion and a plurality of portions of header information, respectively, on a wireless multiplex (MUX) sub-layer in a multimedia data transmitting system. The apparatus includes a means for discarding the previous frame in a case where there is some error and checking a second error protection code added to the next header information in a case where there is no error, when a first error protection code added to the initial header information is checked, and a means for transmitting data to an upper layer in a case where there is no error and transmitting a blank data block to the upper layer in a case where there is some error, when the second error protection code is checked in the step.

Brief Description of the Drawings

FIG. 1 is a block diagram of a conventional radio transmitter/receiver employing a phase 1 in cdma 2000;

FIG. 2 illustrates relations between RLP and a MUX sub-layer;

FIG. 3 is a format diagram of a frame of MUX-PDU type 3 in CDMA version 2000;

FIG. 4 is a conceptual diagram of MUX-PDU framing according to the present invention;

FIG. 5 is a flow chart illustrating a method for encoding the MUX-PDU framing according to the present invention;

FIG. 6 is a format diagram of a new MUX-PDU frame according to the present invention; and

FIG. 7 is a flow chart illustrating a preferred embodiment for decoding the encoded MUX-PDU frame.

Best mode for carrying out the Invention

Referring to FIG. 4, a header information-creating unit 410 denotes a SR_ID field for indicating a service reference identification (ID) and creates a length indicator field for identifying the length field indicating the length of data and a length field for indicating the length of the data and divides header information into one portion and a plurality of portions, respectively, and adds error protection codes to each of the divided header information.

A MUX-PDU frame-forming unit 420 forms a MUX-PDU frame by multiplexing header information formed in the header information-creating unit 410 and payload.

Referring to FIG. 5, video and audio data, which are generated from an application layer, are transmitted to a MUX sub-layer through a RLP layer (step 510).

Next, the MUX sub-layer creates a SR_ID field for indicating a service reference identification (ID) and a Reserved field for indicating an arbitrary user region (step 520).

Next, the MUX sub-layer creates a Length field for indicating the length of data and a Length Indicator field for identifying the length of the Length field, and adds the length indicator field and the length field to the header information (step 530).

Next, the MUX sub-layer creates a first cyclic redundancy code (CRC1) and a second cyclic redundancy code (CRC2), which correspond to error detection codes, by checksumming bits of each of the Length Indicator field and the Length field, and adds CRC1 and CRC2 to the Length Indicator field and the Length field (step 540).

Next, the MUX sub-layer forms a MUX-PDU frame of payload and header information including the SR_ID field, the Reserved field, the Length Indicator field, the first CRC field (CRC1), the Length field, and the second CRC field (CRC2) (step 550).

A MUX-PDU frame shown in FIG. 6 is formed of a header portion comprising a SR_ID field 610, a Reserved field 620, a Length Indicator field

630, a first CRC field (CRC1) 640, a Length field 650, and a second CRC field (CRC2) 660, and a DATA field 670. The Length Indicator field 630 and the Length field 650 are added to the SR_ID field 610 and the Reserved field 620, which are contained in the conventional header (see FIG. 3). Also, the first CRC field (CRC1) 640 for error-protecting the SR_ID field 610, the Reserved field 620, and the Length Indicator 630, is added to the Length Indicator field 630, and a second CRC field (CRC2) 660 for error-protecting the Length field 650 is added to the Length field 650. Here, preferably, the Length Indicator field 630 is comprised of three potential Length field 650, that is, 2 bits for indicating "0", "1 ~ 2^{16}-1", and "2^{16} ~ 2^{32}-1". Preferably, the Length field 650 is indicated as one of 0, 16, 32 bits. The first CRC field 640 is calculated by checksumming the bits of the SR-ID field 610, the Reserved field 620, and the Length Indicator field 630 and preferably comprised of 4 bits. The second CRC field 650 is calculated by checksumming the bits of the Length Indicator field 630 and preferably comprised of one of 0, 8 bits.

Also, people skilled in the art can properly select a polynomial operator p(x) for the CRC of the specific length. For example, in case of 4-bit CRC, the polynomial operator $p(x) = x^4 + x^2 + x + 1$ can be used, and in case of 8-bit CRC, the polynomial operator $p(x) = x^8 + x^2 + x + 1$ can be used.

In this way, a preferred embodiment when decoding the encoded MUX_PDU frame will be described with reference to FIG. 7.

First, a receiver performs error-checking, because error protection codes are added to one portion and a plurality of portions of header information in packet received through radio channel, respectively (step 710). That is, the receiver checks a first CRC 640 on a DeMUX sub-layer (steps 720 and 730), and when there is some error, the previous frame is discarded (step 770), and when there is no error , a second CRC 660 is checked (step 740). Also, the receiver checks the second CRC 660 on the DeMUX sub-layer (steps 740), and when there is no error (step 750), data is transmitted to an upper layer (step 760), and when there is some error

(step 750), a blank data block is transmitted to the upper layer (step 780). Also, since the Length Indicator field 630 and the Length field 650 are error-checked by the first CRC 640 and the second CRC 660 even though there is some error during their transmission, the reliability of the length of the data is increased.

The above encoding and decoding methods can be embodied in a computer program. Codes and code segments encompassing the program can be easily inferred to by a skilled computer programmer in the art. Also, the program can be realized in media used in a computer and in a common digital computer for operating the program. The program can be stored in computer readable media. The media can include magnetic media such as a floppy disk or a hard disk and optical media such as a CD-ROM or a digital video disc(DVD). Also, the program can be transmitted by carrier waves such as the Internet.

While this invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

Industrial Applicability

As described above, error resilience can be increased by adding error protection codes to one portion and a plurality of portions of header information in MUX-PDU, respectively, when multimedia data such as video data requiring real time or low delay are transmitted and received in a wireless environment, and a packet drop rate can be thereby reduced. Also, the reliability of the length of an information region is increased by inserting length identifier and length information on an information region into the header.

What is claimed is:

1. A wireless packetization method in a radio transmitting and receiving system for transmitting and/or receiving multimedia data in a wireless environment, comprising the steps of:

dividing multimedia data-related header information into one portion and a plurality of portions, respectively; and

adding error checking or protection codes to each of the divided header information.

2. The wireless packetization method according to claim 1, wherein the error checking or protection codes are cyclic redundancy codes (CRC).

3. A wireless packetization method in a radio transmitting and receiving system for transmitting and/or receiving multimedia data in a wireless environment, wherein the method comprises the steps of adding a length field for indicating the length of data in a data region and a length indicator field for identifying the length of the length field on a multiplex (MUX) layer where the multimedia data are multiplexed into predetermined units to header information.

4. A wireless packetization method in a radio transmitting and receiving system for transmitting and/or receiving multimedia data in a wireless environment, comprising the steps of:

adding a length field for indicating the length of data in a data region and a length indicator field for identifying the length of the length field on a multiplex (MUX) layer where the multimedia data are multiplexed into predetermined units to header information; and

forming a predetermined protocol frame by adding error checking or protection codes to each of the length field and the length indicator field.

5. The wireless packetization method according to claim 4,

wherein the error protection codes comprising:

a first error protection code for error-protecting the length indicator field in the header information; and

a second error protection code for error-protecting the length field.

6. The method for transmitting a wireless packet according to claim 5, wherein the first error protection code and the second error protection code are comprised of 4 bits or 8 bits for controlling an error of the header-divided region.

7. A method for decoding a wireless packet by receiving a packet in which error protection codes are added to one portion and a plurality of portions of header information, respectively, on a wireless multiplex (MUX) sub-layer in a multimedia data transmitting system, comprising the steps of:

discarding the previous frame in a case where there is some error and checking a second error protection code added to the next header information in a case where there is no error, when a first error protection code added to the initial header information is checked; and

transmitting data to an upper layer in a case where there is no error and transmitting a blank data block to the upper layer in a case where there is some error, when the second error protection code is checked in the step.

8. A wireless packetization apparatus in a radio transmitting apparatus for transmitting multimedia data on a multiplex (MUX) sub-layer in a wireless environment, comprising:

a header information-creating unit for creating a first field indicating the numbers of potential bits of the length of data and a second field indicating the length of the data and for adding error protection codes to each of header information which are divided into one portion and a plurality of portions, respectively; and

a frame-forming unit for forming a frame having the unit of protocol data by multiplexing the header information formed in the header information-creating unit and the data.

9. An apparatus for receiving a wireless packet in an apparatus for decoding data by receiving a packet in which error protection codes are added to one portion and a plurality of portions of header information, respectively, on a wireless multiplex (MUX) sub-layer in a multimedia data transmitting system, comprising:

a means for discarding the previous frame in a case where there is some error and checking a second error protection code added to the next header information in a case where there is no error, when a first error protection code added to the initial header information is checked; and

a means for transmitting data to an upper layer in a case where there is no error and transmitting a blank data block to the upper layer in a case where there is some error, when the second error protection code is checked in the step.

FIG. 1

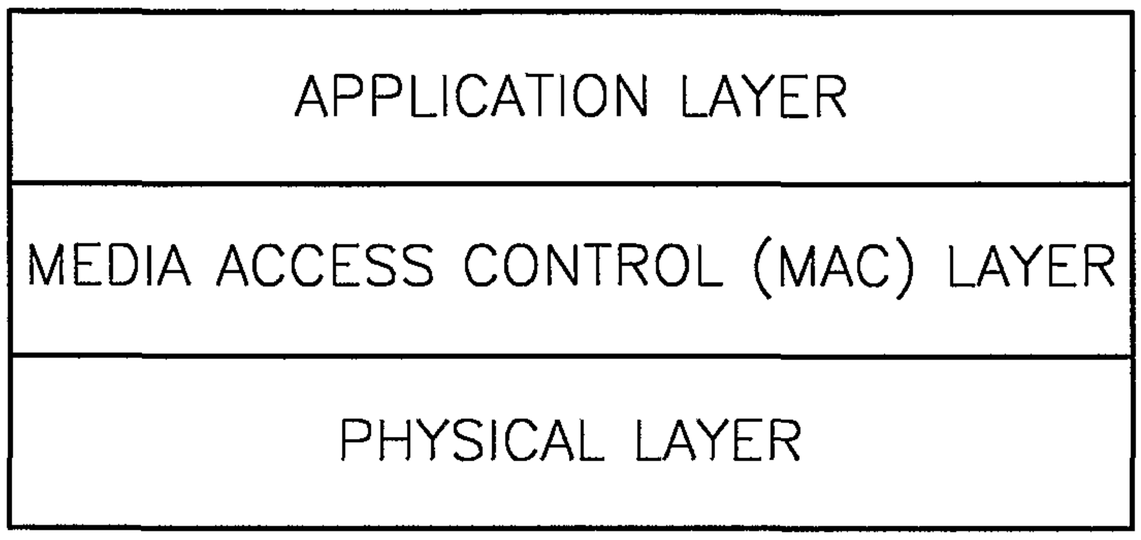


FIG. 2

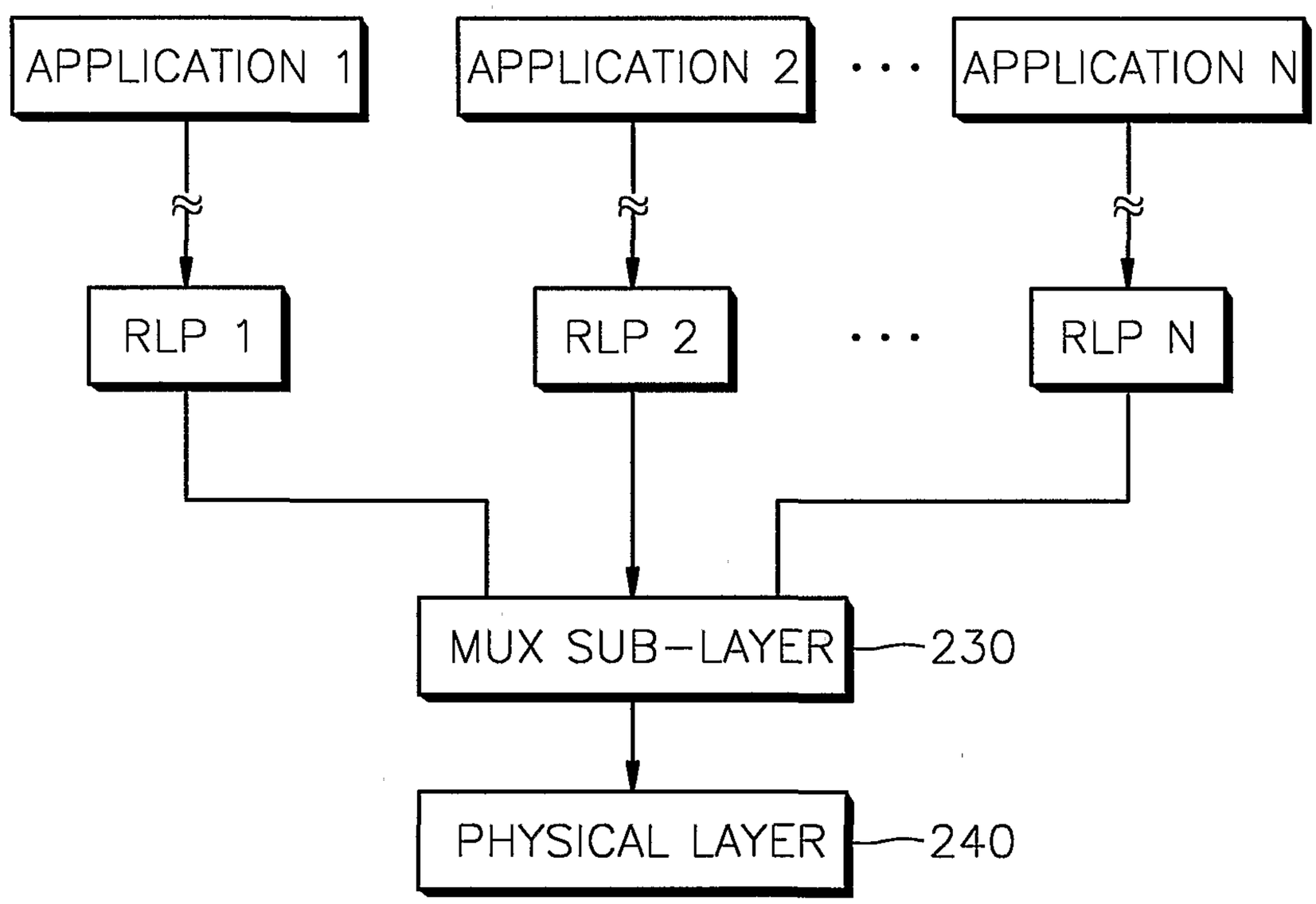


FIG. 3

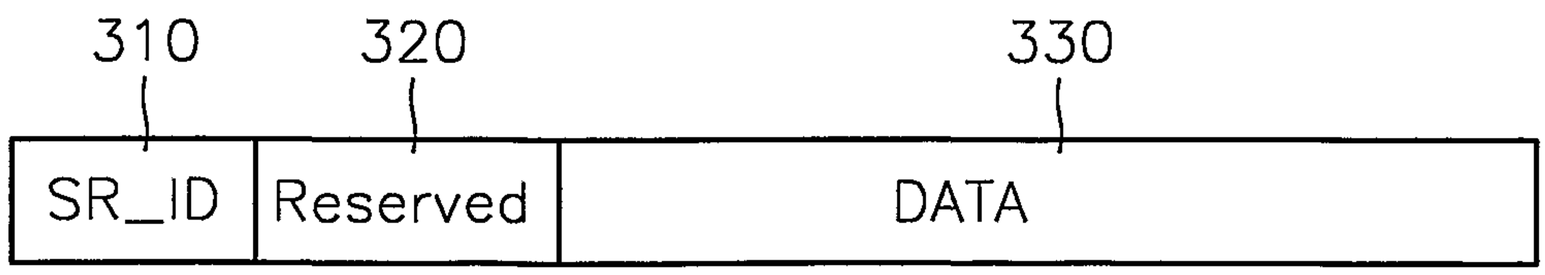


FIG. 4

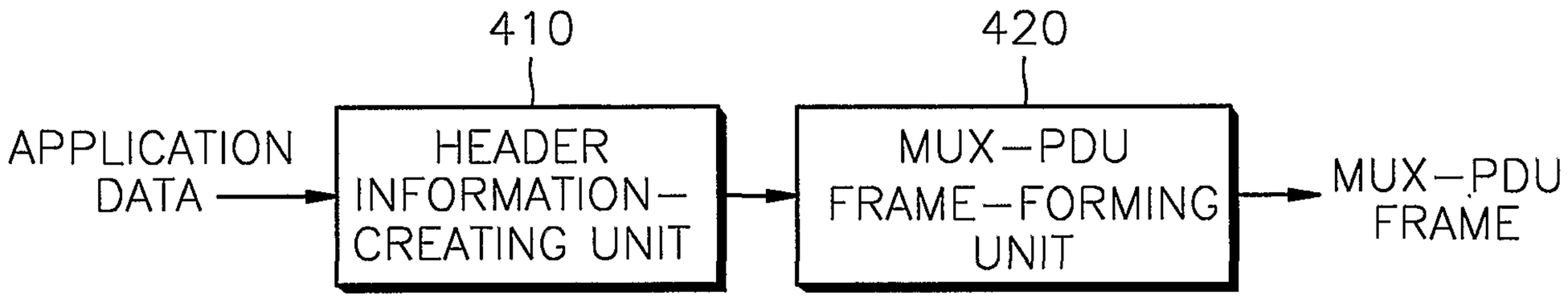

410
420
APPLICATION DATA
HEADER INFORMATION-CREATING UNIT
MUX-PDU FRAME-FORMING UNIT
MUX-PDU FRAME

FIG. 5

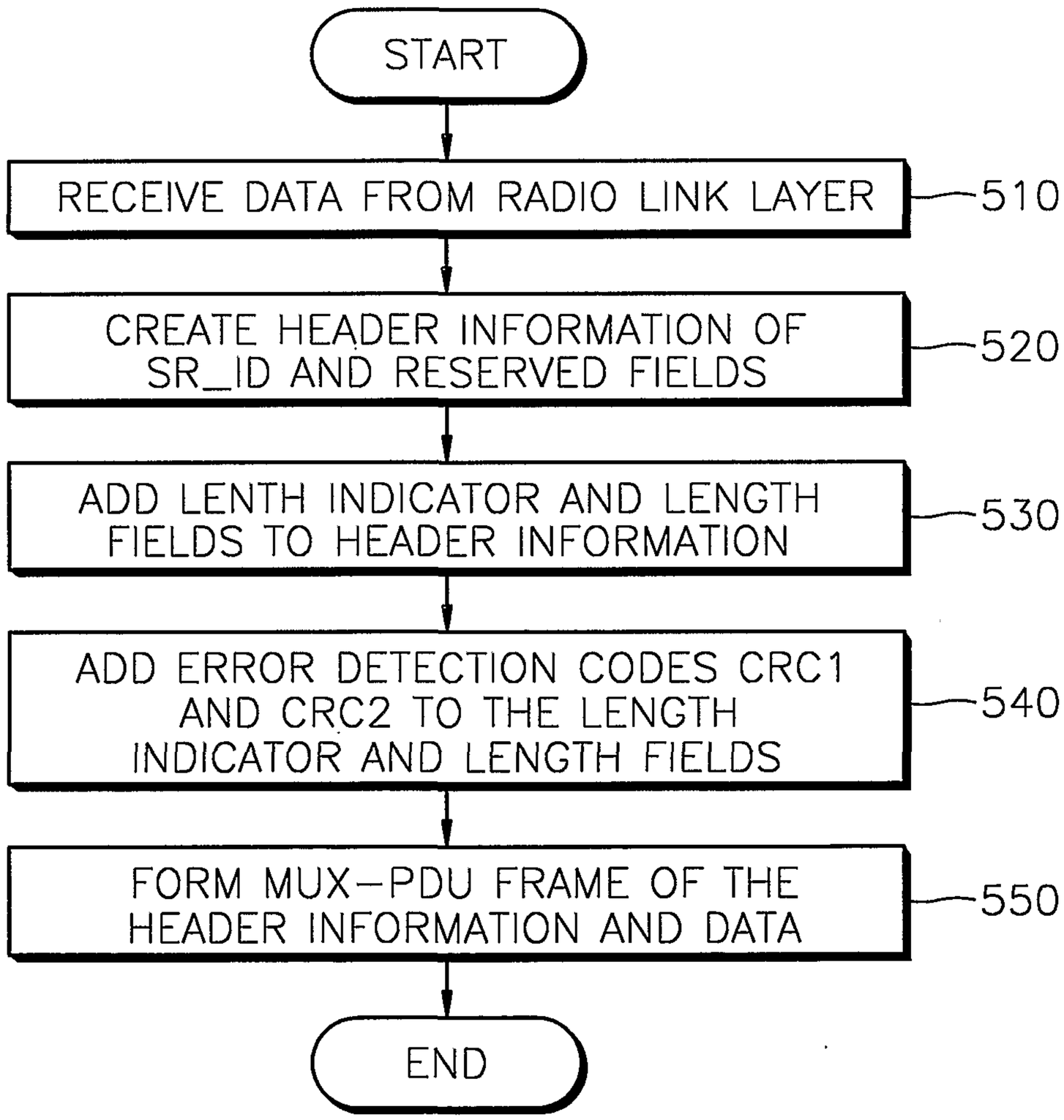

START
RECEIVE DATA FROM RADIO LINK LAYER
510
CREATE HEADER INFORMATION OF SR_ID AND RESERVED FIELDS
520
ADD LENTH INDICATOR AND LENGTH FIELDS TO HEADER INFORMATION
530
ADD ERROR DETECTION CODES CRC1 AND CRC2 TO THE LENGTH INDICATOR AND LENGTH FIELDS
540
FORM MUX-PDU FRAME OF THE HEADER INFORMATION AND DATA
550
END

FIG. 6

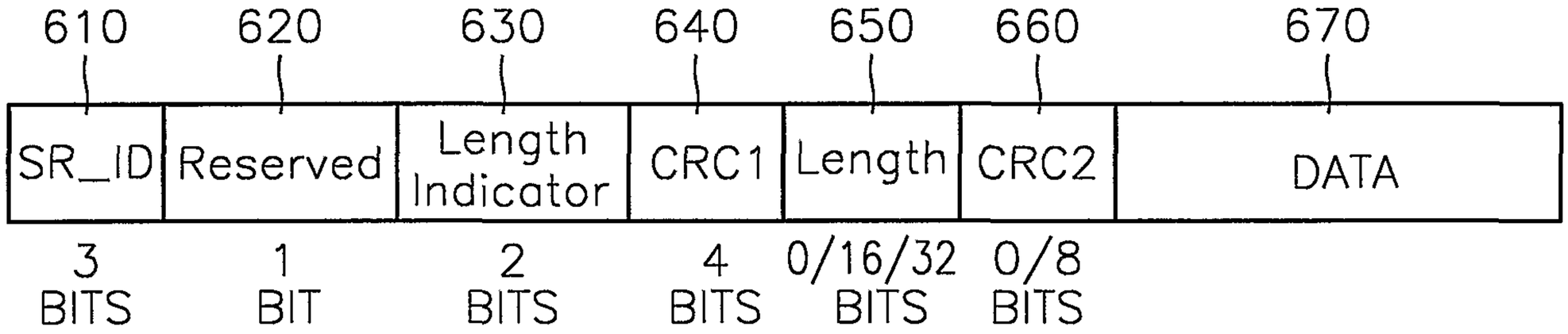
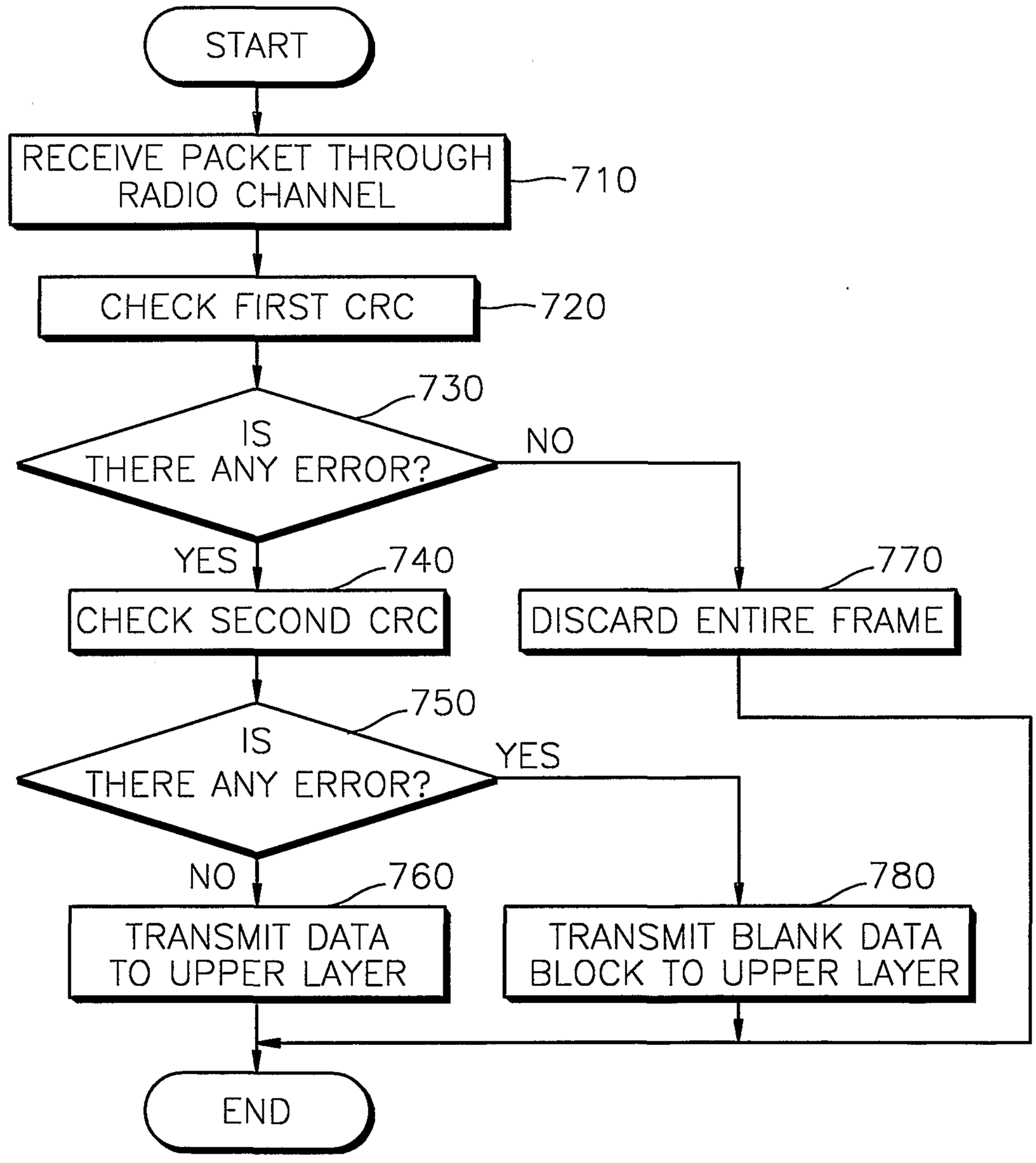
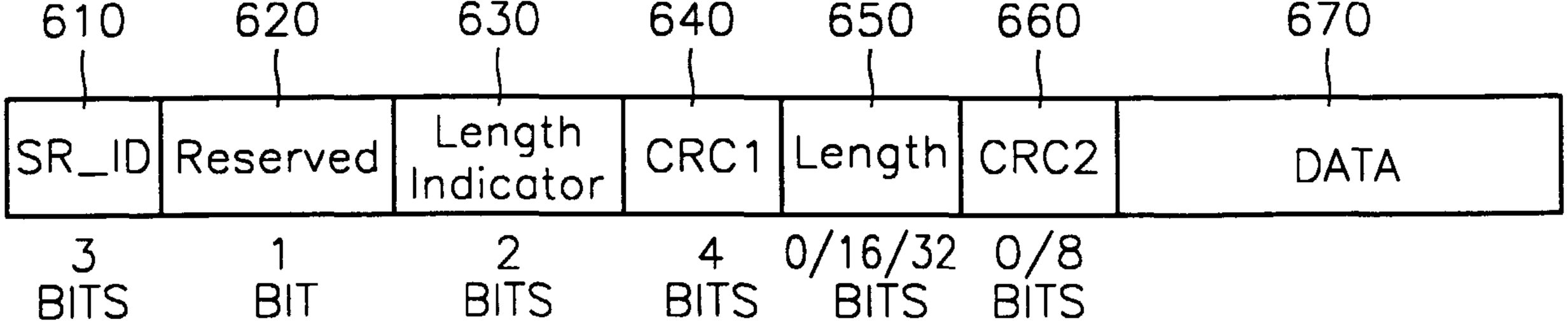

610
620
630
640
650
660
670
SR_ID
Reserved
Length Indicator
CRC1
Length
CRC2
DATA
3 BITS
1 BIT
2 BITS
4 BITS
0/16/32 BITS
0/8 BITS

FIG. 7


START
RECEIVE PACKET THROUGH RADIO CHANNEL
710
CHECK FIRST CRC
720
730
IS THERE ANY ERROR?
NO
YES
740
CHECK SECOND CRC
770
DISCARD ENTIRE FRAME
750
IS THERE ANY ERROR?
YES
NO
760
TRANSMIT DATA TO UPPER LAYER
780
TRANSMIT BLANK DATA BLOCK TO UPPER LAYER
END


610
620
630
640
650
660
670
SR_ID
Reserved
Length Indicator
CRC1
Length
CRC2
DATA
3 BITS
1 BIT
2 BITS
4 BITS
0/16/32 BITS
0/8 BITS