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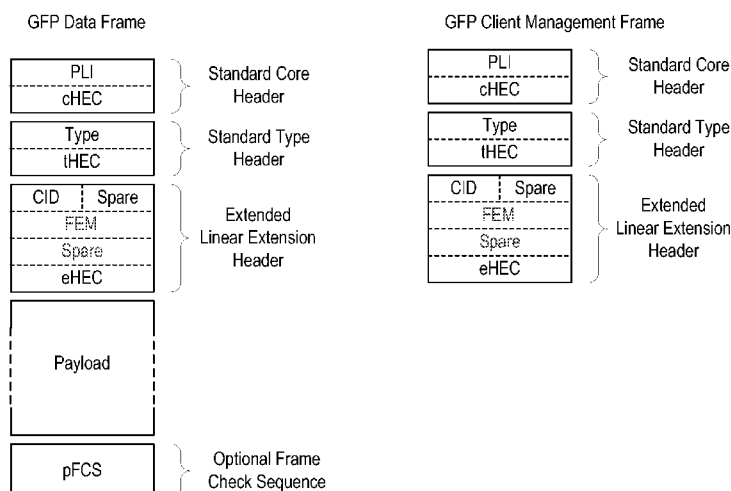
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(54) Title: METHOD AND DEVICE FOR DATA PROCESSING VIA A GENERIC FRAMING PROCEDURE

Fig.2



(57) Abstract: A method and a device are provided for data processing via a Generic Framing Procedure (GFP), wherein a monitoring information regarding at least one GFP channel is conveyed with a GFP frame. Furthermore, a communication system is suggested comprising said device.

Description

Method and device for data processing via a Generic Framing Procedure

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The invention relates to a method and to a device for data processing via a Generic Framing Procedure.

10

In transmission systems for telecommunication applications various approaches of wrapping and conveying data are utilized. One example is defined as Generic Framing Procedure (GFP) according to ITU-T Recommendation G.7041.

15

GFP is in particular used to wrap different, in particular packet-oriented data formats in an SDH frame or in an OTH frame. According to a transparent version of GFP (GFP-T), incoming data streams are evenly distributed into GFP-T packets. This results in a constant utilization of an available bandwidth depending on the user signal. According to a frame-based version of GFP (GFP-F), the data packets are distributed among single GFP-F packets, in particular each single data packet is assigned to a GFP-F packet.

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GFP allows conveying several data streams via a single SDH or a single OTH stream. In such case, channel numbers are assigned to individual GFP packets. A GFP channel may extend across several separate SDH or OTN stages.

30

It is also possible to mix various data streams on different sections of a path or connection. **Fig.1** shows a sequence of network elements NE0, NE1, NE2, NE3 and NE4, which are connected via SDH or OTH. GFP channels are conveyed within the SDH or OTH data streams. Said SDH or OTH data connections are totally terminated, thus GFP channels can be freely mixed at each network element. Each GFP channel may start or terminate at any network element. For example, according to Fig.1, GFP channel A starts at network element NE0 and ends at network element NE3, GFP channel B starts at network element NE1 and

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terminates at network element NE4, GFP channel C starts at network element NE2 and ends at network element NE4 and GFP channel D starts at network element NE0 and terminates at network element NE2. For each GFP channel a corresponding
5 channel may exist in opposite direction.

SDH or OTH provide monitoring functionality. Such monitoring can be divided into near-end monitoring and far-end monitoring. Near-end monitoring provides performance data regarding
10 a received signal conveyed from an source to its destination. Far-end monitoring, however, provides performance data for the transmitted signal from the source to the signal's destination. SDH and/or OTH provide feedback of performance values via an overhead channel towards a monitoring function.

15 Disadvantageously, such monitoring does not work in combination with GFP channels if these channels span several network elements and the SDH/OTH layer is terminated in each network element. Hence, error recognition and error correction are
20 not feasible in a fast and efficient manner utilizing GFP.

The **problem** to be solved is to overcome the disadvantages set forth above and in particular to allow an efficient monitoring of GFP channels even if complex overlapping GFP channels
25 are mixed throughout a network.

This problem is solved according to the features of the independent claims. Further embodiments result from the depending
30 claims.

In order to overcome this problem, a method for data processing via a Generic Framing Procedure (GFP) is provided, wherein a monitoring information regarding at least one GFP channel is conveyed with a GFP frame.
35

Such monitoring information may in particular comprise error conditions and/or performance data. The monitoring informa-

tion may be provided in particular in opposite direction to the data monitored, e.g., as an in-band feedback channel.

It is noted that said GFP is based on a definition set forth in ITU-T Recommendation G.7041. However, the approach suggested herein extends said standard in a way to efficiently utilize conveying and utilizing monitoring information regarding at least one GFP channel. In particular, all GFP channels may carry monitoring information.

It is further noted that the monitoring information may comprise far-end monitoring information that is fed back to its origin via a feedback channel. This can be done by utilizing the GFP approach accordingly in a way that both directions of a connection are similarly covered by such monitoring capabilities.

The approach provided herein is applicable for GFP-T as well as for GFP-F.

In an embodiment, the GFP frame comprises or is associated with a GFP data frame and/or a GFP client management frame.

In another embodiment, the monitoring information of each GFP channel is conveyed with the GFP frame of said GFP channel.

In a further embodiment, an extension header identifier of the GFP frame is utilized for conveying said monitoring information.

In a next embodiment, an extension header type is introduced for conveying said monitoring information, said extension header type in particular comprising a far-end monitoring field.

According to a subsequent embodiment, said far-end monitoring field comprises at least one of the following:

- a backward defect indication;

- a far-end dropped frames information;
- a far-end frame check sequence error information;
- a backward error indication.

5 It is also an embodiment that said monitoring information is processed in particular by a management component, by a management function or by a network element.

10 Thus, a monitoring, surveillance, management function in particular located at or with a network element may utilize the monitoring information to trigger further activities.

Pursuant to another embodiment, said monitoring information is conveyed in a feedback channel, in particular in an opposite direction to the monitored data.

15 The problem stated above is also solved by a device comprising a and/or being associated with a processor unit and/or a hard-wired circuit and/or a logic device that is arranged such that the method as described herein is executable on said processor unit.

20 According to an embodiment, the device is a communication device, in particular a or being associated with a network component or any element within a network starting and/or terminating GFP traffic.

25 The problem stated supra is further solved by a communication system comprising the device as described herein.

30 Embodiments of the invention are shown and illustrated in the following figures:

Fig.2 shows an adapted GFP frame structure for a GFP data frame and for a GFP client management frame;

Fig.3 shows a type-field of a standard type GFP header;

Fig.4 shows a Far-End Monitoring (FEM) field type comprising information regarding far-end monitoring;

Fig.5 shows the series of network elements according to Fig.1, wherein the connection between two network elements NE1 and NE2 is subject to signal disturbances thereby deteriorating several GFP channels.

This approach in particular is based on the GFP standard as defined in ITU-T G.7041. This GFP is extended as suggested herein in particular to provide monitoring and surveillance functionality.

GFP allows according to ITU-T G.7041 an extension header identifier (EXI) parameter to be used to select the type of extension header. This EXI parameter is utilized herein to convey additional information in an overhead portion of each data frame.

The EXI parameter is a 4bit field allowing 16 different values to be assigned, wherein ITU-T G.7041 yet only uses 3 values. The remaining 13 values are labeled "reserved".

This approach in particular defines an extension header type by introducing an according value for the EXI parameter. This extension header type is utilized for far-end monitoring purposes, in particular for conveying information that can be used for far-end monitoring. Advantageously, the extension header type for the EXI parameter is selected such that there is no collision with upcoming changes of the standard.

Fig.2 shows as how a GFP frame structure for a GFP data frame as well as for the GFP client management frame may be adapted to convey the monitoring information.

The core header corresponds to the definition set forth in standard ITU-T G.7041. The standard type header as shown in **Fig.3** corresponds to the structure as defined in ITU-T G.7041

comprising the fields Payload Type Identifier (PTI), Payload FCS Identifier (PFI), Extension Header Identifier (EXI) and User Payload Identifier (UPI).

- 5 The **Extended Linear Extension Header** comprises unlike the Linear Extension Header according to ITU-T G.7041 an additional field comprising a **Far End Monitoring** (FEM) information. This additional field FEM results in an adaptation of the length of the Extension Header compared to the yet defined Linear Extension Header. This is in particular possible
10 as an additional 4 bytes per GFP frame are without significant impact on a maximum data rate.

- Advantageously, a Channel ID (CID) and an extended HEC (eHEC)
15 are used as suggested by ITU-T G.7041. Utilizing eHEC allows for supervision and error correction of the Extended Linear Extension Header.

- The remaining portion of the GFP packet comprising in particular payload data and a frame check sequence may remain
20 unchanged and/or correspond to the specification set forth in ITU-T G.7041. This maintains the protection mechanisms set forth in the standard.

- 25 The FEM field comprising information regarding far-end monitoring is shown in more detail in **Fig.4**. The FEM field may in particular comprise the following parameters:

- (a) Backward Defect Indication (BDI):
30 This indication comprises in particular an information bit for conveying signal errors within a GFP section (e.g., between two GFP network elements). Error states can be marked by a value "1", fault-free information can be marked by a value "0".
35
- (b) Far-end Dropped Frames (FDF):
This field comprises at least one information bit used

for transmitting information relating to GFP packets that were not received properly.

(c) Far-end Frame Check Sequence Errors (FFE):

5 This field comprises at least one information bit used for transmitting information relating to errors detected based on a Frame Check Sequence (FCS) according to ITU-T Recommendation G.7041.

10 (d) Backward Error Indication (BEI):

This field comprises at least one information bit used for transmitting information relating to errors detected based on CRC super-block errors according to ITU-T Recommendation G.7041 GFP-T transmission.

15

The approach provided herein is applicable for GFP-T as well as for GFP-F.

Advantageously, the number of bits per user information is
20 selected such that a maximum number of errors per time interval can be shown. In particular with regard to GFP-T comprising constant data blocks in both directions, the number of information bits per direction can be kept at a low scale, which is beneficial as with GFP-T a same amount of packets
25 are conveyed in both directions with substantially similar time patterns. The length of a packet may be decisive to provide BEI with a given number of bits.

Utilizing GFP-F may require a larger amount of information
30 bits used as counters in order to balance the uneven distribution of packets conveyed in both directions.

Advantageously, the number of GFP client management frames to be sent per time interval can be adjusted such that their
35 data rate substantially equals a data rate for conveying GFP data frames. Otherwise it can be beneficial to increase the number of bits required for displaying purposes.

The number of bits for error counting can be increased in order to easily avoid packet jitter. This allows transmitting the cumulated counter value with the subsequent frame without taking into consideration any counter overflow.

5

The approach is not limited to this particular adaptation of the GFP frame. It is rather directed to the possibility conveying information for monitoring of error conditions and/or performance data in an adjusted or modified GFP frame.

10

According to the example shown in Fig.4, the number of bits used for GFP-T transmission utilizes 8 superblocks per frame considering packet jitter.

15 Further Advantages:

The approach provided allows for an efficient and fast error recognition and error correction. **Fig.5** shows the series of network elements according to Fig.1. The connection between the network element NE1 and the network element NE2 is subject to signal disturbances thereby deteriorating GFP channels A, B and D.

The error is primarily detected in network element NE3 for GFP channel A, in network element NE4 for GFP channel B and in network element NE2 for GFP channel D.

Fig.5 visualizes the approach presented herein for GFP channel A. For each of the GFP channels the respective information is inserted in the feedback channel thereby allowing the origin of a particular path or sub-section to become aware of any deterioration or disturbance.

Monitoring a connection from one network element to a subsequent network element, the disturbance may only be detected in network element NE2. In addition, utilizing far-end monitoring on an SDH/OTH level may reveal disturbances for network element NE1. Without the solution suggested herein, how-

ever, it would not be possible to become aware of such disturbance at the source of GFP channel A or D, i.e. in network element NE0.

- 5 Conveying monitoring information via said feedback channel in addition allows becoming aware of the correlation between the disturbance and GFP channels affected.

10 In-band signaling provided does thus not require any additional monitoring network. It is hence an efficient approach to individually monitor incoming as well as outgoing GFP channels at each network element. This in particular gains in importance regarding mixed overlapping GFP channels with different origin or termination points.

15

List of Abbreviations:

	BDI	Backward Defect Indication
	BEI	Backward Error Indication
5	cHEC	HEC for core header
	CID	Channel ID
	eHEC	HEC for extension header
	EXI	Extension Header Identifier
	FCS	Frame Checking Sequence
10	FDF	Far-End Dropped Frames
	FEM	Far-End Monitoring
	FFE	Far-End Frame Check Sequence Errors
	GFP	Generic Framing Procedure
	GFP-F	frame-based GFP
15	GFP-T	transparent GFP
	HEC	Header Error Check
	OTH	Optical Transport Hierarchy
	PFI	Payload FCS Indicator
	PLI	Payload Length Indicator
20	PTI	Payload Type Identifier
	SDH	Synchronous Digital Hierarchy
	tHEC	HEC for type header
	UPI	User Payload Identifier

Claims:

1. A method for data processing via a Generic Framing Procedure, wherein a monitoring information regarding at least one GFP channel is conveyed with a GFP frame.
2. The method according to claim 1, wherein the monitoring information comprises a far-end monitoring information.
3. The method according to any of the preceding claims, wherein the GFP frame comprises or is associated with a GFP data frame and/or a GFP client management frame.
4. The method according to any of the preceding claims, wherein the monitoring information of each GFP channel is conveyed with the GFP frame of said GFP channel.
5. The method according to any of the preceding claims, wherein an extension header identifier of the GFP frame is utilized for conveying said monitoring information.
6. The method according to any of the preceding claims, wherein an extension header type is introduced for conveying said monitoring information, said extension header type in particular comprising a far-end monitoring field.
7. The method according to claim 6, wherein said far-end monitoring field comprises at least one of the following:
 - a backward defect indication;
 - a far-end dropped frames information;
 - a far-end frame check sequence error information;
 - a backward error indication.
8. The method according to any of the preceding claims, wherein said monitoring information is processed in par-

ticular by a management component, by a management function or by a network element.

- 5 9. The method according to any of the preceding claims,
 wherein said monitoring information is conveyed in a
 feedback channel, in particular in an opposite direction
 to the monitored data.
- 10 10. The method according to any of the preceding claims,
 wherein said Generic Framing Procedure comprises GFP-T
 and/or GFP-F.
- 15 11. A device comprising a and/or being associated with a
 processor unit and/or a hard-wired circuit and/or a
 logic device that is arranged such that the method ac-
 cording to any of the preceding claims is executable
 thereon.
- 20 12. The device according to claim 11, wherein said device is
 a communication device, in particular a or being associ-
 ated with a network component.
- 25 13. Communication system comprising the device according to
 any of claims 11 or 12.

Fig.1

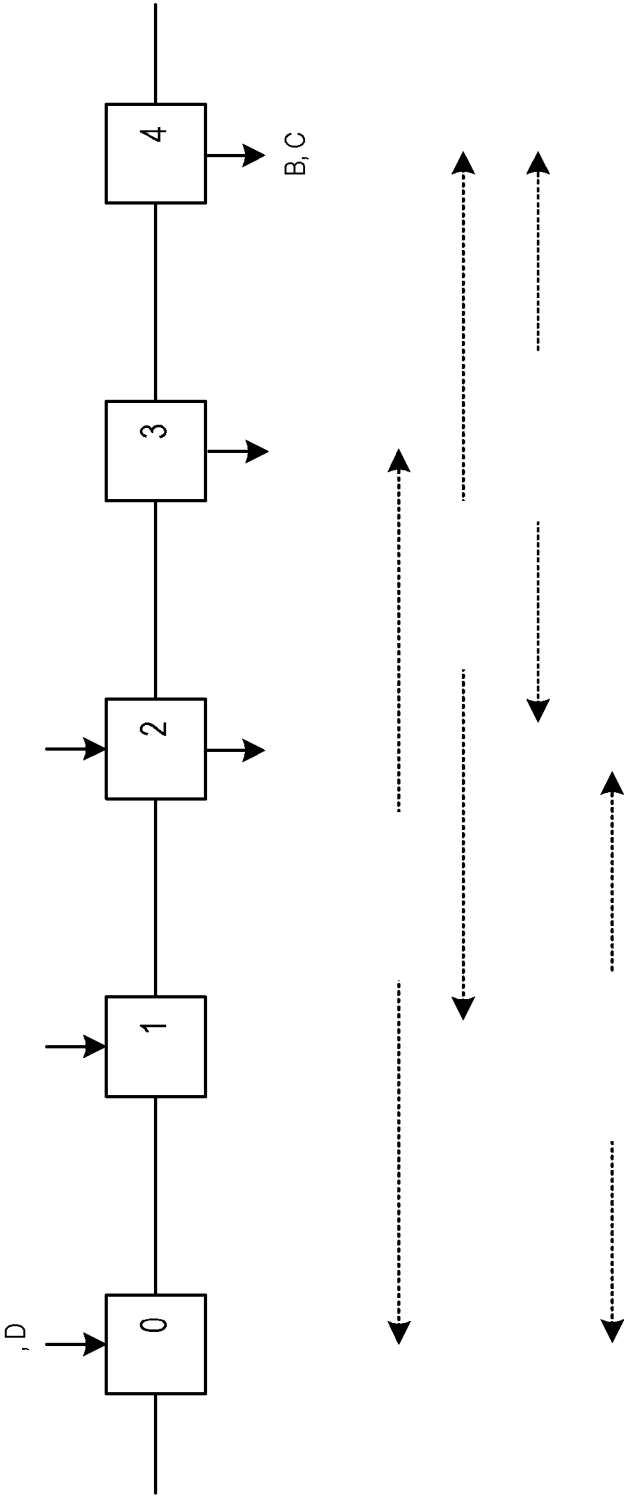


Fig.2

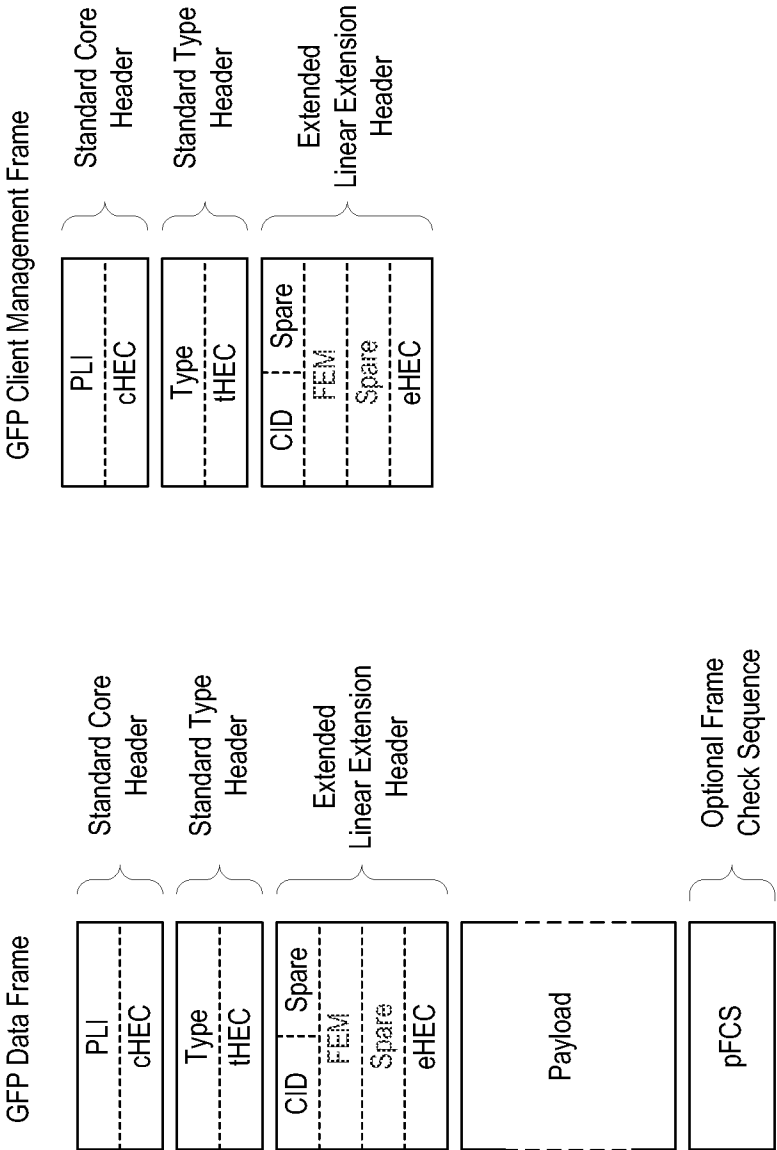
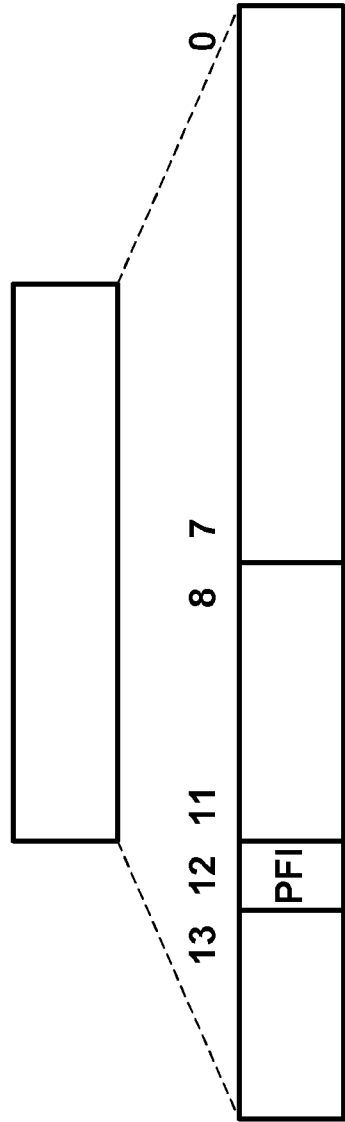
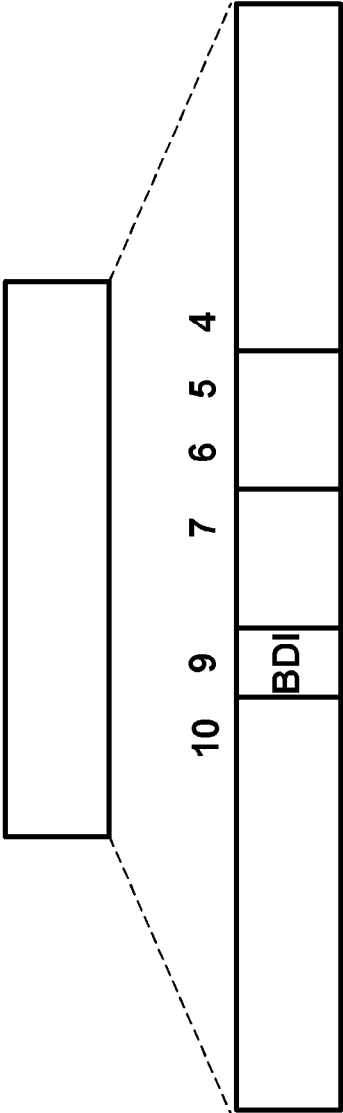


Fig.3



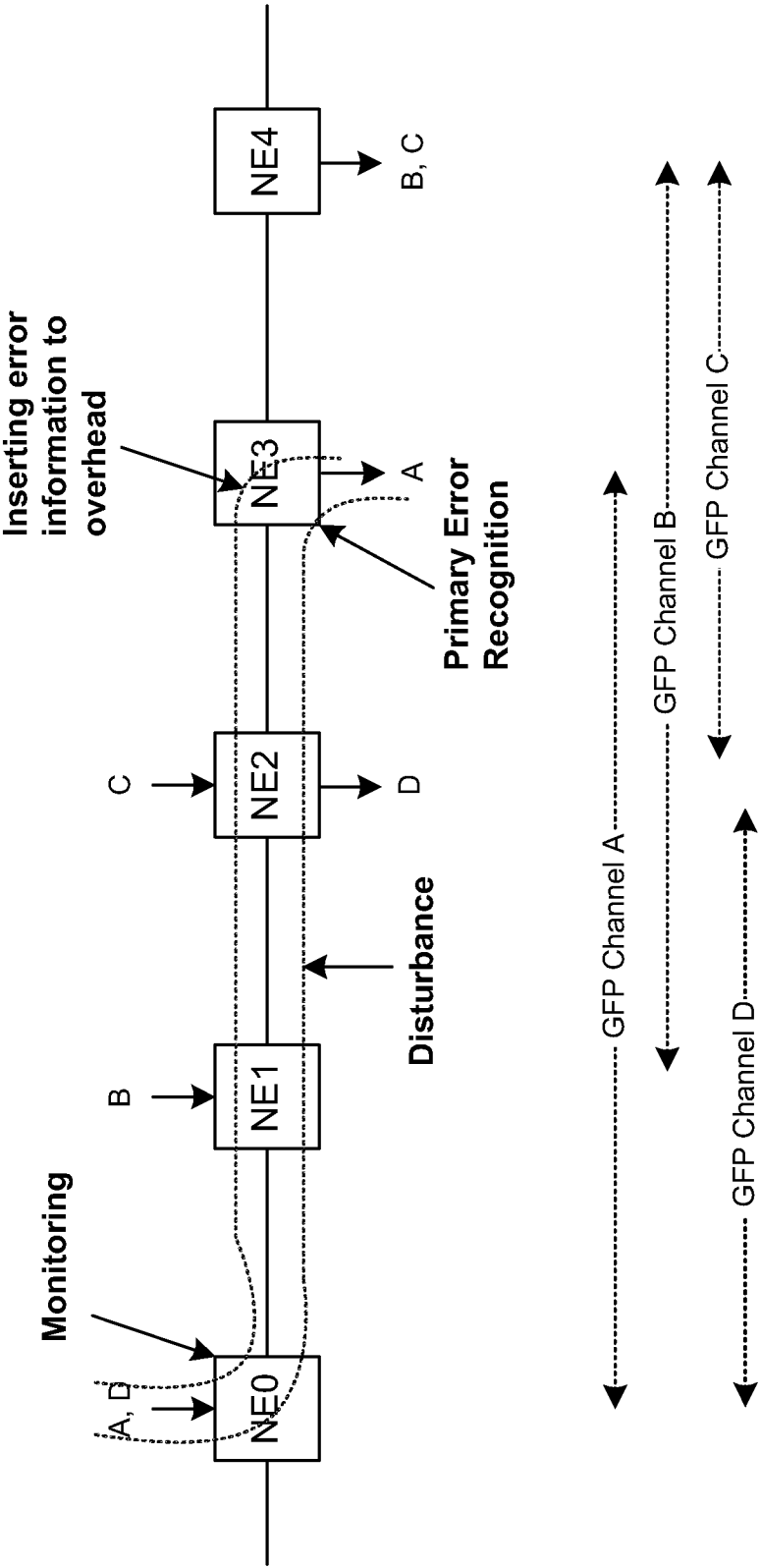
PTI ... Payload Type Identifier
PFI ... Payload FCS Identifier
EXI ... Extension Header Identifier
UPI ... User Payload Identifier

Fig.4



... Far End Monitoring
BDI Backward Defect Indication
FDF Far end Dropped Frames
FFE Far End FCS Errors
BEI Backward Error Indication

Fig.5



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/060640

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04J3/16 H04L12/56

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04J H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/085904 A1 (BORDOGNA MARK A [US] ET AL) 6 May 2004 (2004-05-06)	1-4,8-13
Y	abstract paragraph [0008] paragraph [0018] - paragraph [0025] figure 3	5-7
X	----- "Generic framing procedure (GFP); G.7041/Y.1303 (08/05)" ITU-T STANDARD IN FORCE (I), INTERNATIONAL TELECOMMUNICATION UNION, GENEVA, CH, no. G.7041/Y.1303 (08/05, 22 August 2005 (2005-08-22), XP017404569 cited in the application page 9 - page 17 page 20 - page 21 ----- -/--	1,3-4,7, 10-13

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2002/083190 A1 (KAMIYA SATOSHI [JP] ET AL) 27 June 2002 (2002-06-27) figure 10 abstract paragraph [0067] - paragraph [0069] -----	5
Y	US 2006/002304 A1 (ASHWOOD-SMITH PETER [CA]) 5 January 2006 (2006-01-05) abstract figure 6B paragraph [0012] - paragraph [0013] paragraph [0038] paragraph [0046] - paragraph [0047] -----	6-7

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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