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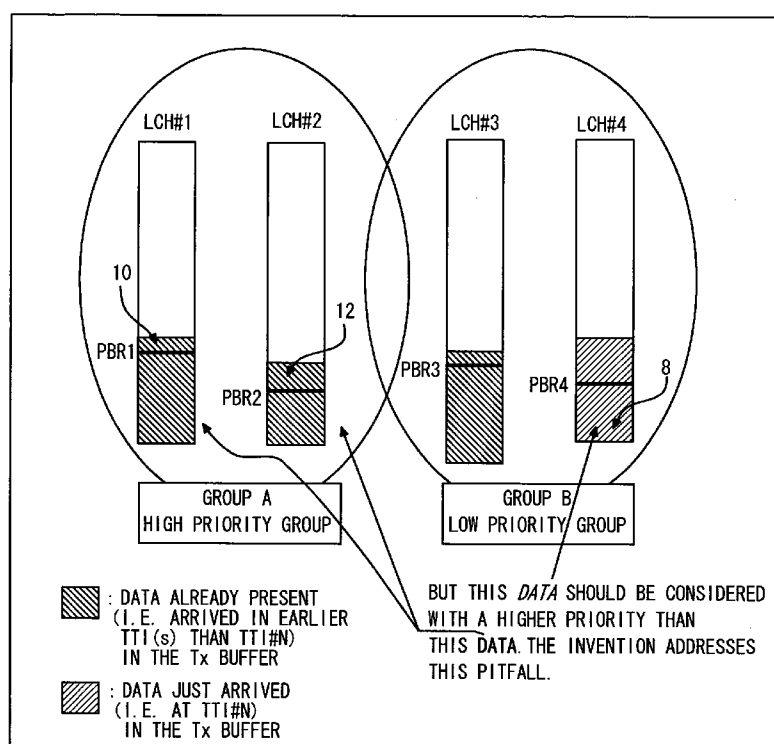
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(54) Title: METHOD FOR OPTIMIZING THE TRIGGERING OF THE TRANSMISSION OF BUFFER STATUS REPORTING (BSR) INFORMATION

Fig. 2



(57) Abstract: The invention concerns a method for optimizing the transmission of Buffer Status Reporting (BSR) information from a User Equipment (UE) to a Base Station (BS) in a wireless telecommunication network wherein the transmission of Buffer Status Reporting information is triggered if new uplink data arrive in the UE transmission buffer of said UE and said new uplink data belong to a logical channel for which a positive PBR (Prioritized Bit Rate) parameter is defined and for which no data already existed in the UE transmission buffer.



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DESCRIPTION**METHOD FOR OPTIMIZING THE TRIGGERING OF THE TRANSMISSION OF
BUFFER STATUS REPORTING (BSR) INFORMATION****5 Technical Field**

[0001]

The present invention pertains to telecommunication fields and concerns a method for optimizing the estimation by a Base Station of the resource to allocate to a User Equipment for transmitting uplink data in a wireless telecommunication network.

[0002]

More precisely, the invention concerns a method for optimizing the triggering of the transmission of Buffer Status Reporting (BSR) information from a User Equipment (UE) to a Base Station (BS) in a wireless telecommunication network, said UE comprising a transmission buffer for storing data to be transmitted via a plurality of logical channels, each logical channel being provided with a priority level and a specific Prioritized Bit Rate parameter indicating the minimum resource level to allocate to the UE for transmitting the stored data, said BSR information allowing said Base Station to schedule the amount of resource to allocate to the UE.

25 [0003]

The invention concerns also a User Equipment (UE) comprising means for optimizing the triggering of the transmission of Buffer Status Reporting (BSR) information to a Base Station (BS) in a wireless telecommunication network.

5

Background Art

[0004]

In a mobile communication network such as UMTS, UE (User Equipment) is provided with a Limited amount of power for transmitting different class of logical traffic channels during an uplink communication. Each logical channel transporting different services and/or signalling data which necessitates specific rate and/or QoS (Quality of Service).

[0005]

At each elementary transmission time interval (TTI), the UE selects a sub-rate for each channel by selecting a TFC (Transport Format Combination).

[0006]

The selection of the TFC (Transport Format Combination) to be used in the uplink during each TTI is under the control of the MAC (Medium Access Control) layer of the UE which selects the TFC according not only to the data available to be sent and the priority of the flows to which the data belongs, but also to a maximum transport block size communicated by the Base Station, which depends on the

25

conditions of the radio channel.

[0007]

According to the current selection scheme, a User Equipment must report to the Base Station the reporting is
5 properly defined both in terms of content and triggering.

[0008]

Since the mobile may have several data flows running at the same time (i.e. several radio bearers) it is important that the content of the BSR takes into account the data
10 queues associated to each bearers, but at the same time tries to reduce the amount of information sent to the network in order to reduce the signaling overhead. Hence there is a compromise between the level of detail contained in the BSR and the amount of resources needed to send this BSR.

15 [0009]

Moreover, in order to reduce signaling overhead, it is felt sensible not to send the BSR at each transmitting occasion (each TTI). Instead, a number of triggers are defined in order to send the BSR when really needed.

20 [0010]

It is to be noted that the current 3GPP standard specification requires that a BSR is triggered in the following conditions:

[0011]

25 a-If the UE has no resource to transmit, and some data

arrives in one of the queues, the BSR is triggered,

[0012]

b-If data with higher priority than the data already in the transmission buffer arrives, the BSR is triggered,

5 [0013]

d-A BSR is triggered when a serving cell change occurs,

[0014]

e-Periodic trigger of the BSR may also be configured by higher layers.

10 [0015]

Moreover, in the current LTE MAC specification (36.321 v2.0.0 Dec 2007), a BSR shall be reported if uplink data arrive in the UE transmission buffer and the data belong to a logical channel, group with higher priority than those for which data already existed in the UE transmission buffer.

[0016]

As it is, this condition does not take into account the PBR (Prioritized Bit Rate) concept introduced in LTE over HSUPA to avoid starvation of lower priority radio bearers.

20 [0017]

Specifically, this PBR concept means that some part of the data possibly queued in a LCH (logical channel) of less priority (or in a LCH group of less priority) than another LCH (or LCH group) must actually be treated with a higher priority than the part of the data exceeding the PBR of

higher priority LCH's (or LCH groups).

[0018]

Consequently, there is no warranty that enough resource will be left by the Base Station to ensure the transmission
5 of data queued in a LCH (logical channel) of less priority.

[0019]

It is therefore desirable to add additional trigger(s) to take into account the PBR concept to avoid starvation of lower priority radio bearers problems.

10 [0020]

Document US 2007/0177536 A1 discloses a method for scheduling uplink resource for uplink transmission in which a timing for collection of metrics regarding resource consumption is decoupled from a timing for generating
15 scheduling grants to allow a scheduler to collect the received data information from a plurality of users that have sent E-DCH data within one transmission time interval (TTI) in order to get information of the sum of all users to make a correct decision.

20 [0021]

Document EP 1 643 690 A1 discloses a method for scheduling in a mobile communication system a plurality of priority flows data transmitted by a plurality of mobile terminals via a plurality of dedicated uplink channels to a
25 base station.

[0022]

The method described in this document consists in providing the scheduling base station with QoS information of respective uplink priority flows.

5

Disclosure of Invention

[0023]

The object of the invention is achieved by means of a method for optimizing the transmission of Buffer Status
10 Reporting (BSR) information from a User Equipment {UE} to a Base Station (BS) in a wireless telecommunication network, said UE comprising a transmission buffers for storing data to be transmitted via a plurality of logical channels, each logical channel being provided with a priority level and a
15 specific Prioritized Bit Rate parameter indicating the minimum resource level to allocate to the UE for transmitting the stored data, said BSR information allowing said Base Station to schedule the amount of resource to allocate to the UE.

20 [0024]

According to the invention, the transmission of the BSR (Buffer Status Reporting) information is triggered if new uplink data arrive in the UE transmission buffer and said new uplink data belong to a logical channel for which a strictly
25 positive PBR is defined and for which no data already existed

in the UE transmission buffer.

[0025]

In a second embodiment of the invention, the transmission of the BSR information is triggered if said new
5 uplink data belong to a logical channel (respectively to a channel of a group of logical channels) having a non null PBR value and a priority level lower than that of a logical channel (respectively than that of a group of logical
10 channels) for which the buffer already contains data to transmit, and for which sufficient resources have already been allocated by the Base Station to the UE.

[0026]

In a third embodiment of the invention, the transmission of Buffer Status Reporting information is
15 triggered if new uplink data arrive in the UE transmission buffer and the data belongs to a logical channel for which difference between the PBR token bucket status and the data that already existed in the UE transmission buffer of the same logical channel was strictly positive.

20 [0027]

In a fourth embodiment of the invention the transmission of Buffer Status Reporting information is triggered if new uplink data arrive in the UE transmission buffer and said new uplink data belong to a logical channel
25 for which the PBR would not be satisfied even by sending the

data already existing in the UE transmission buffer of the same logical channel.

[0028]

In a fifth embodiment of the invention the transmission
5 of Buffer Status Reporting information is triggered if on one
hand new uplink data arrive in the UE transmission buffer and
the data belongs to a logical channel for which the PBR would
not be satisfied even by sending the data already existing in
the UE transmission buffer of the same logical channel, and
10 on the other hand any other logical channel having a higher
priority than the said logical channel satisfies its PBR
criteria.

[0029]

The method according to the invention is implemented by
15 means of a User Equipment configured for systematically
transmitting Buffer Status Reporting information to the Base
Station if new uplink data arrive in the UE transmission
buffer and if said new uplink data belong to a logical
channel for which a positive PBR is defined, and for which no
20 data already existed in the UE transmission buffer.

[0030]

In a second embodiment of the invention, said User
Equipment is configured for systematically transmitting the
BSR information to said Base Station if new uplink data
25 arrive in the UE transmission buffer and said new uplink data

belong to a logical channel having a non null PBR value and a priority level lower than that of a logical channel for which the buffer already contains data to transmit, and for which sufficient resources have already been allocated by the Base
5 Station to the UE.

[0031]

In a third embodiment of the invention, said User Equipment is configured for systematically transmitting the BSR information to said Base Station if new uplink data
10 arrive in the UE transmission buffer and the data belongs to a logical channel for which difference between the PBR token bucket status and the data that already existed in the UE transmission buffer of the same logical channel was strictly positive.

15 [0032]

In a fourth embodiment of the invention, said User Equipment is configured for systematically transmitting BSR information to said Base Station if new uplink data arrive in the UE transmission buffer and the data belongs to a logical
20 channel for which the PBR would not be satisfied even by sending the data which the PBR would not be satisfied even by sending the data already existing in the UE transmission buffer of the same logical channel.

[0033]

25 In a fifth embodiment of the invention, said User

Equipment is configured for systematically transmitting BSR information to said Base Station if on one hand new uplink data arrive in the UE transmission buffer and the data belongs to a logical channel for which the PBR would not be
5 satisfied even by sending the data already existing in the UE transmission buffer of the same logical channel, and on the other hand any other logical channel having a higher priority than the said logical channel satisfies its PBR criteria.

10 **Brief Description of Drawings**

[0034]

Other features and advantages of the invention will appear from the following description taken as a non limiting example with reference to the following drawings in which
15 figures 1 and 2 illustrate schematically the BSR triggering mechanism as currently specified in the MAC specification, in two different situations.

Explanation of Reference

20 [0035]

2, 4, 6, 8, 10, 12 Data

Best Mode for Carrying Out the Invention

[0036]

25 In the example of figure 1, four radio bearers, or

logical channels are grouped into 2 groups of 2 Radio Bearers (RB). Each group contains radio bearers assumed to have the same priority class, i.e. similar QoS requirements. Group A contains the RB's of highest priority, and Group B contains
5 the RB's of lower priority.

[0037]

Each logical channel is provided with a PBR#x horizontal line representing the amount of data that should be sent at a TTI#N in order for the PBR to be satisfied in
10 average for this Radio Bearer. For example, if a token/bucket mechanism is implemented to average the PBR, the line corresponds to the amount of tokens present in the bucket at TTI#N for this Radio Bearer.

[0038]

15 It is to be noted that instead of reporting the Buffer Occupancy (B.O.) for each of the RB's separately, the specification allows that the UE reports only 2 values, Report A and Report B, consisting of the sum of all the data queued in the RB's of groups A and B, respectively.

20 [0039]

The specification also allows that the UE reports the buffer status of one group only (short report) or of all the groups together (long report). Hence, in the case illustrated by figure 1, a short report would consist of
25 either Report A or Report B, and a long report would consist

of Report A and Report B together. However, the specification still does not clearly states what are the conditions to decide whether a long or a short report should be made.

5 [0040]

In the situation of figure 1, according to trigger as defined in the current 3GPP standard specification, a BSR will be triggered because data 2 arrive in LCH#2 which belongs to Group A, which is the high priority group compared
10 to Group B, and the data (4,6) existing before the current TTI was in Group B.

[0041]

In the situation of figure 2, no BSR is triggered, because the arriving data 8 is in Group B, and it is
15 considered that the data (10,12) in Group A is of higher priority. Since the data (10,12) in Group A arrived in previous TTI(s), it has been notified to the network by previous BSR(s) and since the network has already been made aware of this status, it is assumed that the current
20 allocated resource is enough to accommodate with the data present in Group A and not transmitted yet.

[0042]

However, according to the invention, in order to avoid starvation of LCH#4, a BSR is notified to the network because
25 the data 8 that just arrived in Group B is objectively

regarded as having a higher priority than the data (10,12)
present in Group A.

[0043]

While the invention has been particularly shown and
5 described with reference to exemplary embodiments thereof,
the invention is not limited to these embodiments. It will be
understood by those of ordinary skill in the art that various
changes in form and details may be made therein without
departing from the spirit and scope of the present invention
10 as defined by the claims.

[0044]

This application is based upon and claims the benefit
of priority from European patent application No.08100193.5,
filed on January 8, 2008, the disclosure of which is
15 incorporated herein in its entirety by reference.

Industrial Applicability

[0045]

The present invention provides a method for optimizing
20 the estimation by a Base Station of the resource to allocate
to a User Equipment for transmitting uplink data in a
wireless telecommunication network.

CLAIMS

1. Method for optimizing the transmission of Buffer Status Reporting (BSR) information from a User Equipment (UE) to a Base Station (BS) in a wireless telecommunication network, said UE comprising a transmission buffer for storing data to be transmitted via a plurality of logical channels, each logical channel being provided with a priority level and a specific Prioritized Bit Rate parameter indicating the minimum resource level to allocate to the UE for transmitting the stored data, said BSR information allowing said Base Station to schedule the amount of resource to allocate to the UE, method characterized in that, the transmission of Buffer Status Reporting information is triggered if new uplink data arrive in the UE transmission buffer and said new uplink data belong to a logical channel for which a positive PBR is defined and for which no data already existed in the UE transmission buffer.

2. Method according to claim 1 wherein the transmission of the BSR information is triggered if said new uplink data belong to a logical channel (respectively to a channel of a group of logical channels) having a non null PBR value and a priority level lower than that of a logical channel (respectively than that of a group of logical channels) for

which the buffer already contains data to transmit, and for which sufficient resources have already been allocated by the Base Station to the UE.

5 3. Method according to claim 1 wherein the transmission of Buffer Status Reporting information is triggered if new uplink data arrives in the UE transmission buffer and the data belongs to a logical channel for which difference between the PBR token bucket status and the data that already
10 existed in the UE transmission buffer of the same logical channel was strictly positive.

 4. Method according to claim 1 wherein the transmission of Buffer Status Reporting information is triggered if new
15 uplink arrive in the UE transmission buffer and said new uplink data belong to a logical channel for which the PBR would not be satisfied even by sending the data already existing in the UE transmission buffer of the same logical channel.

20

 5. Method according to claim 4 wherein the transmission of Buffer Status Reporting information is triggered if any other logical channel having a higher priority than the said logical channel satisfies its PBR criteria.

25

6. User Equipment comprising means for transmitting Buffer Status Reporting (BSR) information to a Base Station (BS) in a wireless telecommunication network, a transmission buffer for storing data to be transmitted via a plurality of logical channels, each logical channel being provided with a priority level and a specific Prioritized Bit Rate parameter indicating the minimum resource level to allocate to the UE for transmitting the stored data, said BSR information allowing said Base Station to schedule the amount of resource to allocate to the UE, wherein said User Equipment characterized in that it is configured for systematically transmitting Buffer Status Reporting information to said Base Station if new uplink data arrive in the UE transmission buffer and if said new uplink data belong to a logical channel for which a positive PBR is defined, and for which no data already existed in the UE transmission buffer.

7. User Equipment according to claim 6 configured for systematically transmitting Buffer Status Reporting information to said Base Station if new uplink data arrive in the UE transmission buffer and said new uplink data belong to a logical channel having a non null PBR value and a priority level lower than that of a logical channel for which the buffer already contains data to transmit, and for which sufficient resources have already been allocated by the Base

Station to the UE.

8. User Equipment according to claim 6 configured for systematically transmitting Buffer Status Reporting information to said Base Station if new uplink data arrive in the UE transmission buffer and the data belongs to a logical channel for which difference between the PBR token bucket status and the data already existed in the UE transmission buffer of the same logical channel was strictly positive.

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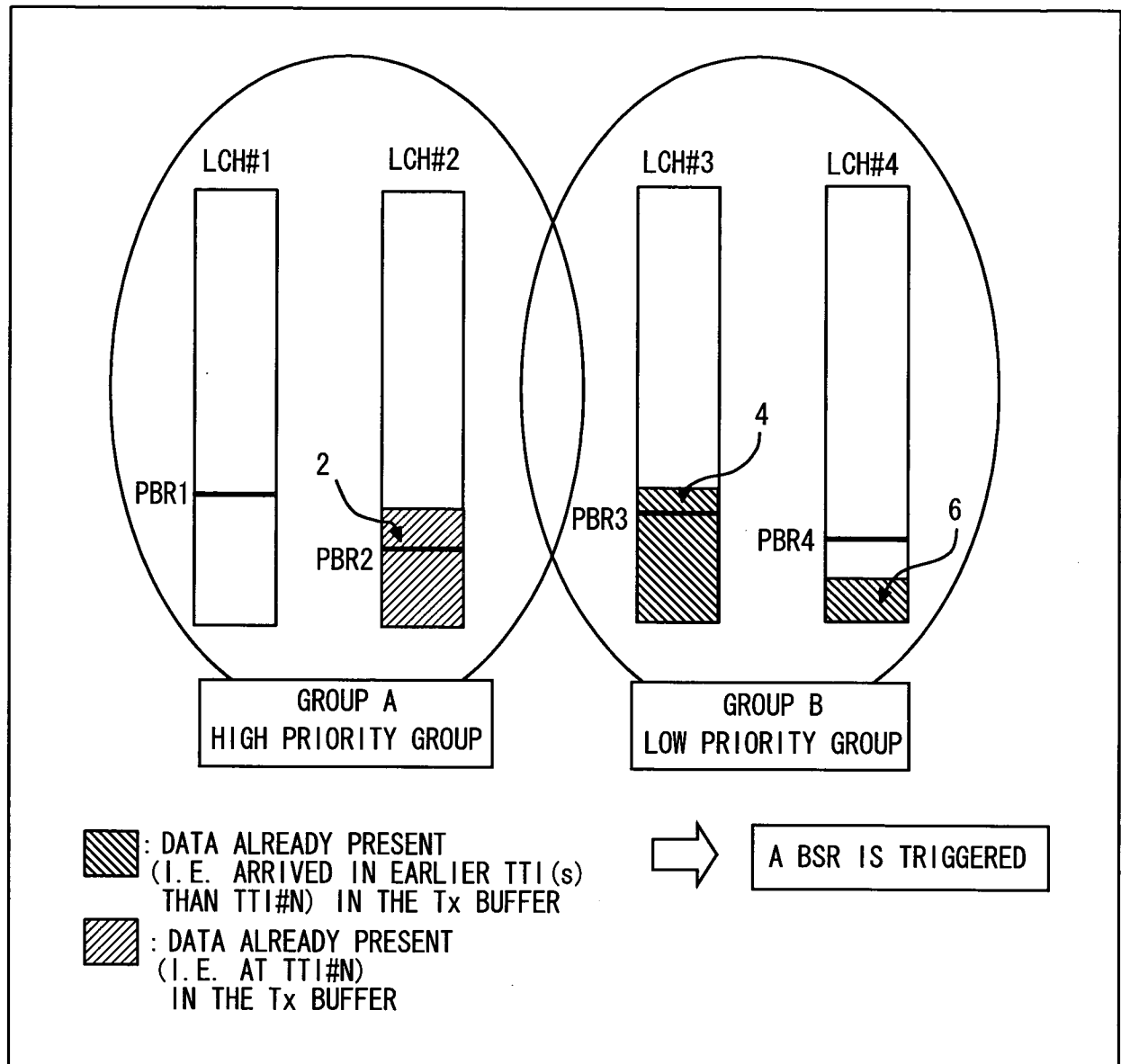
9. User Equipment according to claim 6 configured for systematically transmitting Buffer Status Reporting information to said Base Station if new uplink arrive in the UE transmission buffer and the data belongs to a logical channel for which the PBR would not be satisfied even by sending the data already existing in the UE transmission buffer of the same logical channel.

15

10. User Equipment according to claim 9 configured for systematically transmitting Buffer Status Reporting information to said Base Station if any other logical channel having a higher priority than the said logical channel satisfies its PBR criteria.

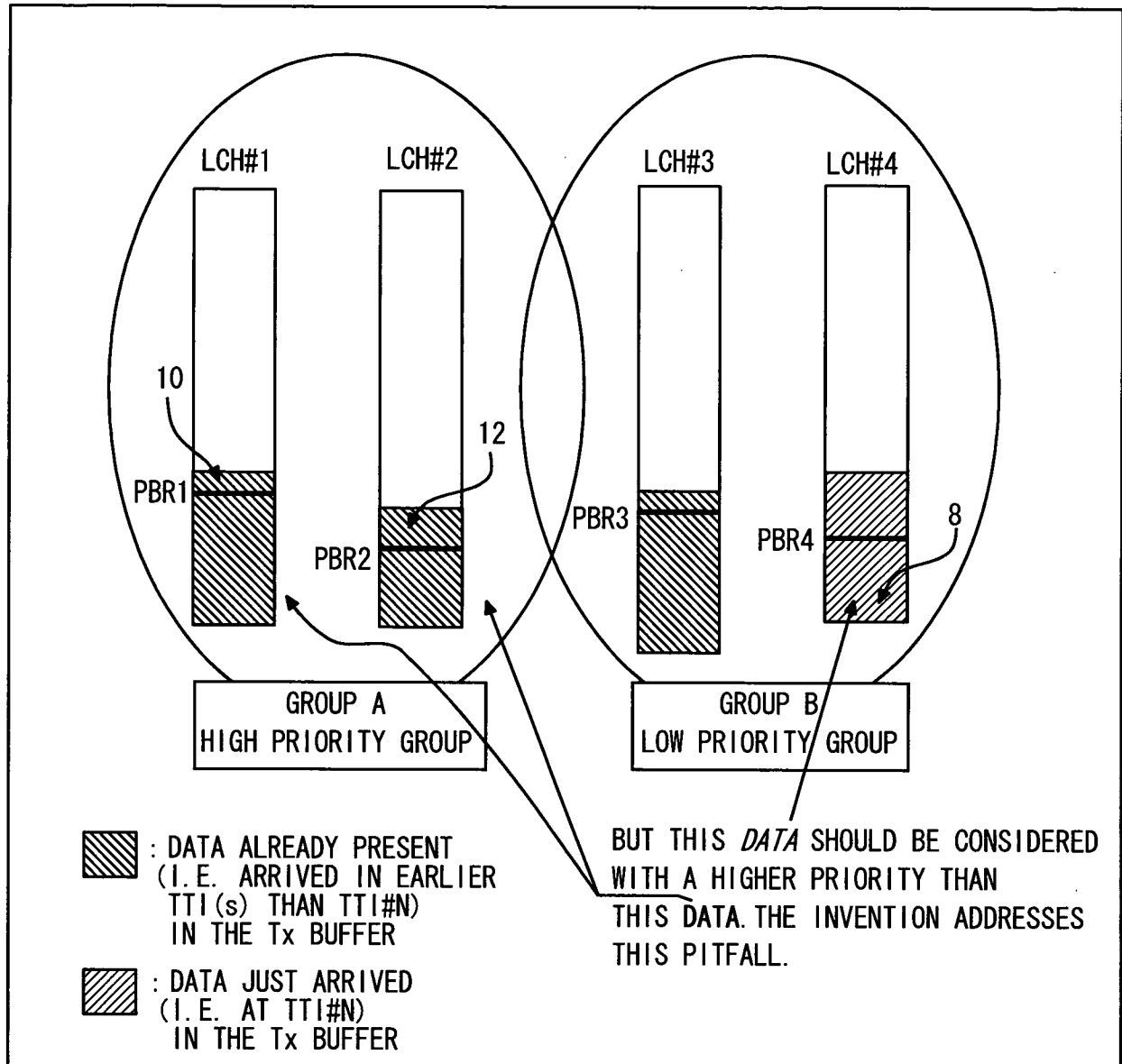
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Fig. 1



2/2

Fig. 2



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/073678

A. CLASSIFICATION OF SUBJECT MATTER

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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)

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

Published examined utility model applications of Japan 1922-1996
 Published unexamined utility model applications of Japan 1971-2009
 Registered utility model specifications of Japan 1996-2009
 Published registered utility model applications of Japan 1994-2009

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	3GPP TSG RAN WG2 Meeting #59bis R2-074173, "Buffer Status Report and Scheduling Request triggers," NTT DoCoMo and NEC, 12 th October 2007	1-10
T	3GPP TSG RAN WG2 Meeting #60bis R2-080095, "Triggers for Buffer Status Report," NEC, 18 th January 2007	1-10



Further documents are listed in the continuation of Box C.



See patent family annex.

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