US 20200214079A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2020/0214079 A1**

Huang (43) **Pub. Date: Jul. 2, 2020**

(54) **BASE STATION AND RESOURCE ALLOCATION METHOD BASED ON SEMI-PERSISTENT SCHEDULING**

(71) Applicant: **Industrial Technology Research Institute**, Hsinchu (TW)

(72) Inventor: **Jen-Feng Huang**, Kaohsiung City (TW)

(73) Assignee: **Industrial Technology Research Institute**, Hsinchu (TW)

(21) Appl. No.: **16/233,124**

(22) Filed: **Dec. 27, 2018**

Publication Classification

(51) **Int. Cl.**

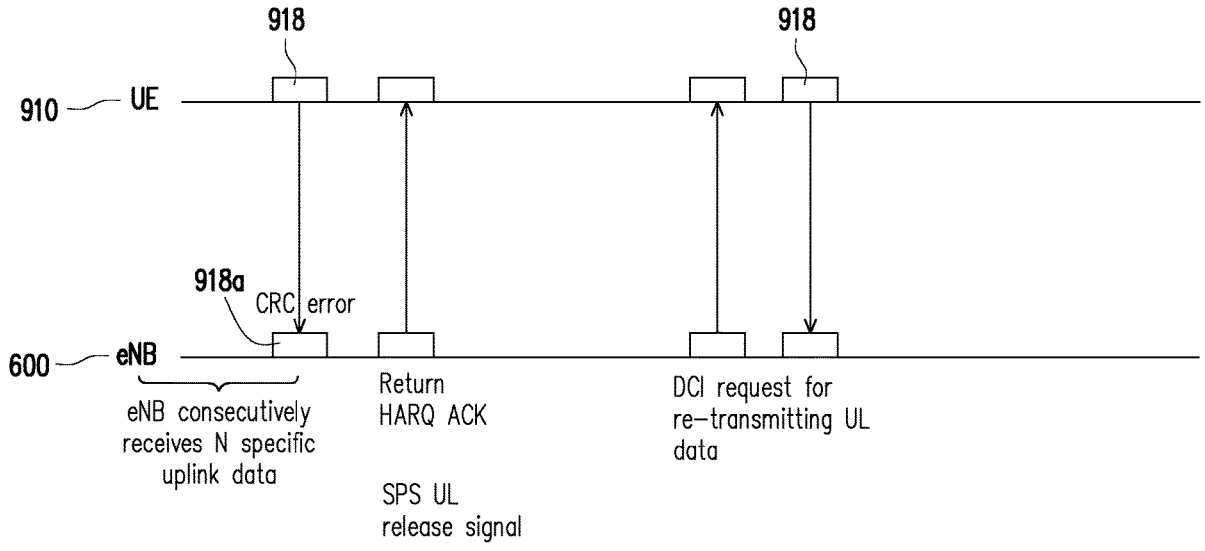
H04W 76/30	(2006.01)
H04L 1/18	(2006.01)
H04L 5/00	(2006.01)
H04W 72/04	(2006.01)
H04L 1/00	(2006.01)

(52) **U.S. Cl.**

CPC ***H04W 76/30*** (2018.02); ***H04L 1/1819*** (2013.01); ***H04L 1/0061*** (2013.01); ***H04W 72/042*** (2013.01); ***H04L 5/0053*** (2013.01)

(57) **ABSTRACT**

The disclosure provides a base station and a resource allocation method based on semi-persistent scheduling (SPS). The method includes: periodically receiving a plurality of uplink data corresponding to a user equipment (UE) on a wireless resource assigned to the UE; in response to consecutively receiving a predetermined number of specific uplink data, performing a release SPS operation to cease receiving other uplink data corresponding to the UE on the wireless resource, wherein the specific uplink data consist of pending data and error data or consist of the error data.



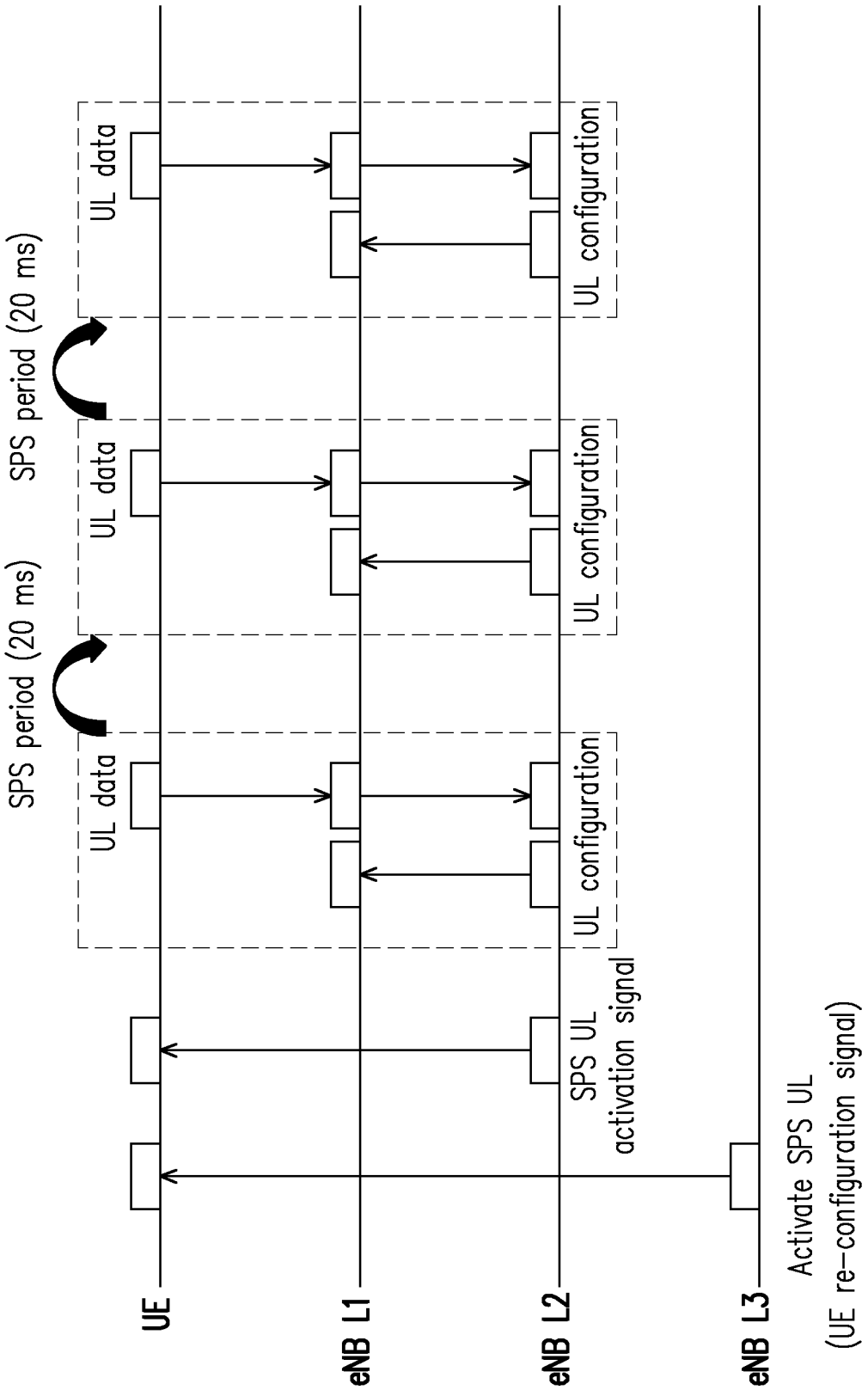

UE
eNB L1
eNB L2
eNB L3
SPS period (20 ms)
SPS period (20 ms)
UL data
UL data
UL data
UL configuration
UL configuration
UL configuration
SPS UL activation signal
Activate SPS UL (UE re-configuration signal)

FIG. 1

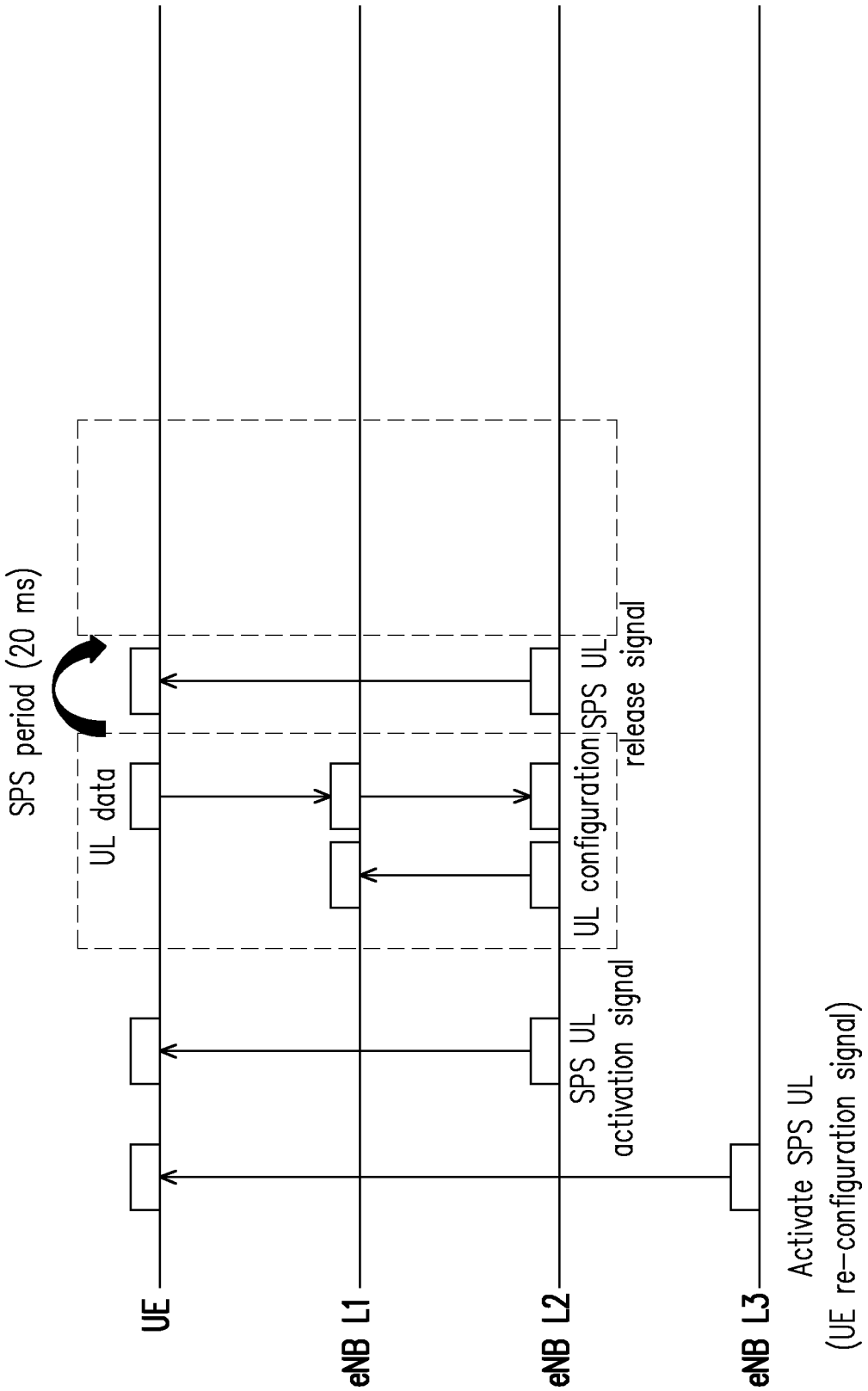

UE
eNB L1
eNB L2
eNB L3
SPS period (20 ms)
UL data
UL configuration
SPS UL release signal
SPS UL activation signal
Activate SPS UL
(UE re-configuration signal)

FIG. 2

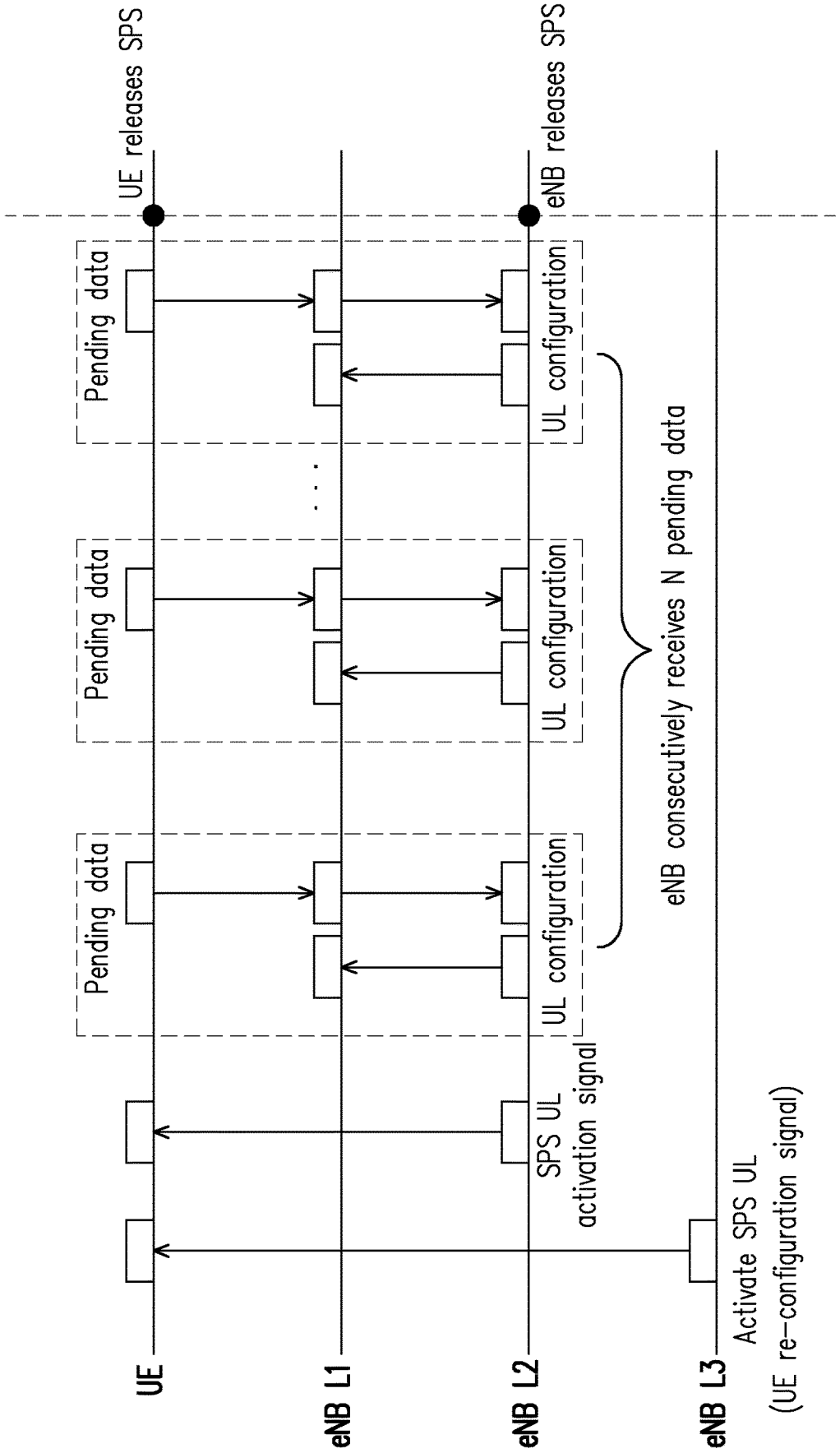

UE releases SPS
eNB releases SPS
Pending data
Pending data
Pending data
UL configuration
UL configuration
UL configuration
eNB consecutively receives N pending data
SPS UL activation signal
Activate SPS UL (UE re-configuration signal)
UE
eNB L1
eNB L2
eNB L3

FIG. 3

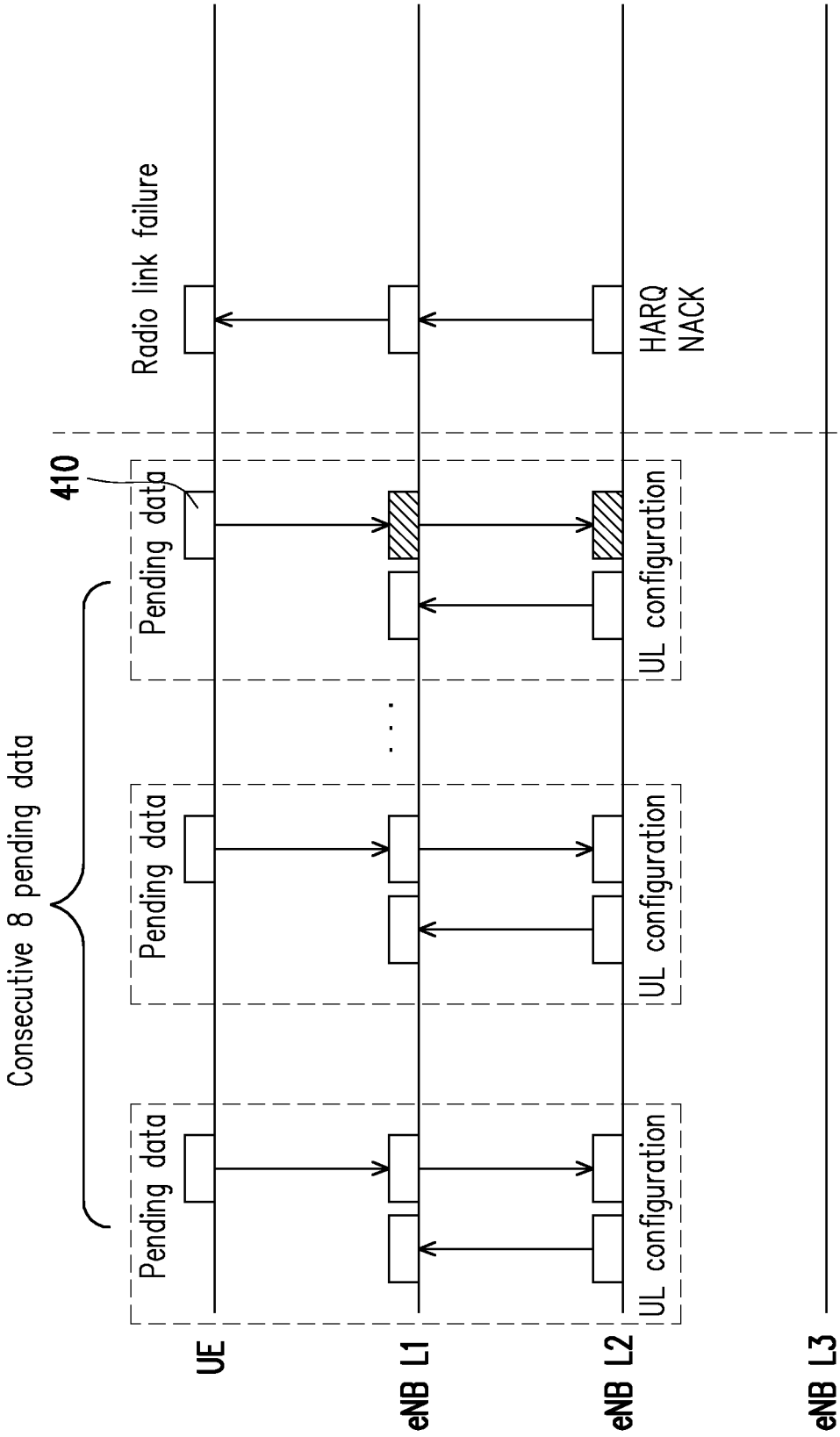

UE
eNB L1
eNB L2
eNB L3
Radio link failure
HARQ NACK
410
Pending data
UL configuration
Consecutive 8 pending data

FIG. 4

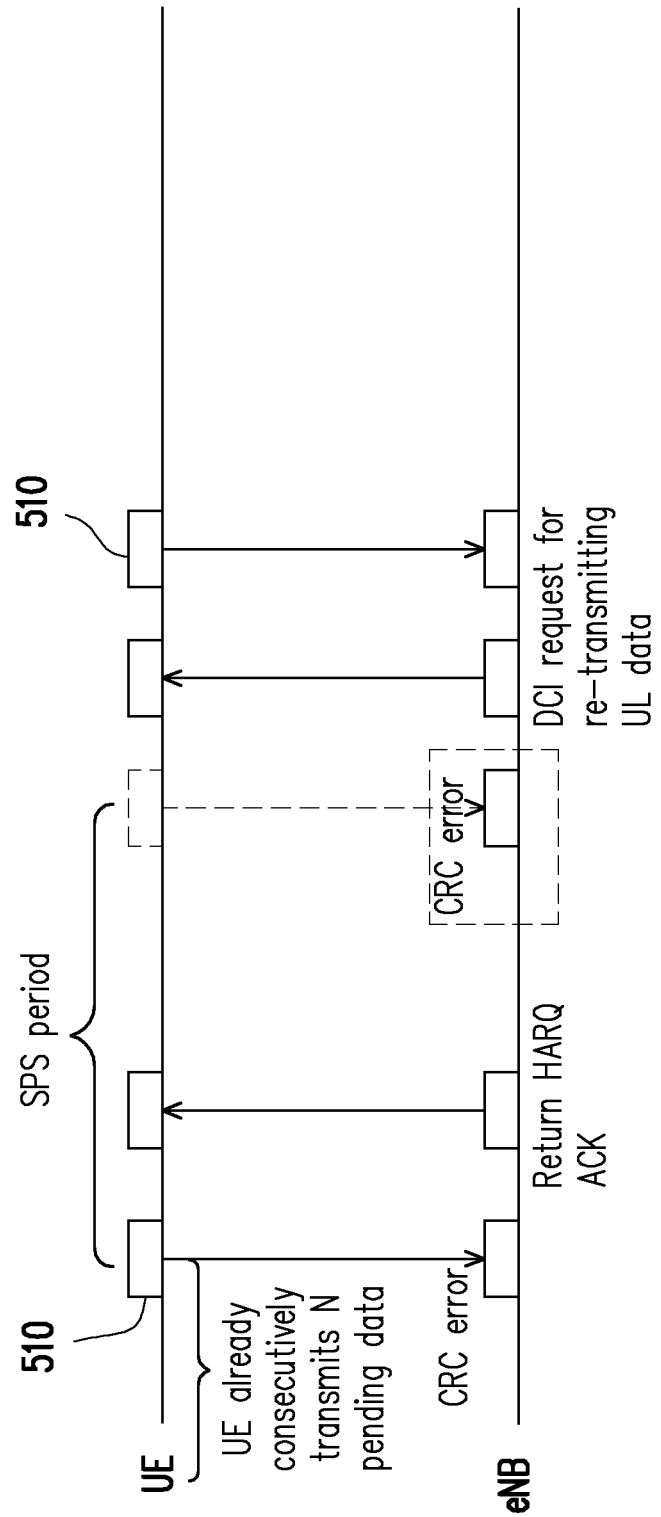

510
510
SPS period
UE already consecutively transmits N pending data
CRC error
Return HARQ ACK
CRC error
DCI request for re-transmitting UL data
UE
eNB

FIG. 5

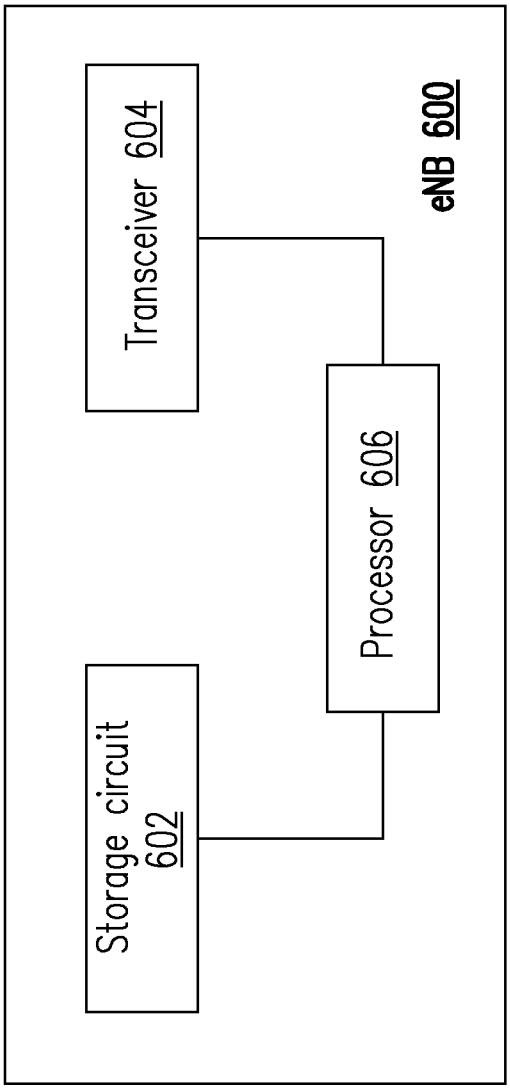


FIG. 6

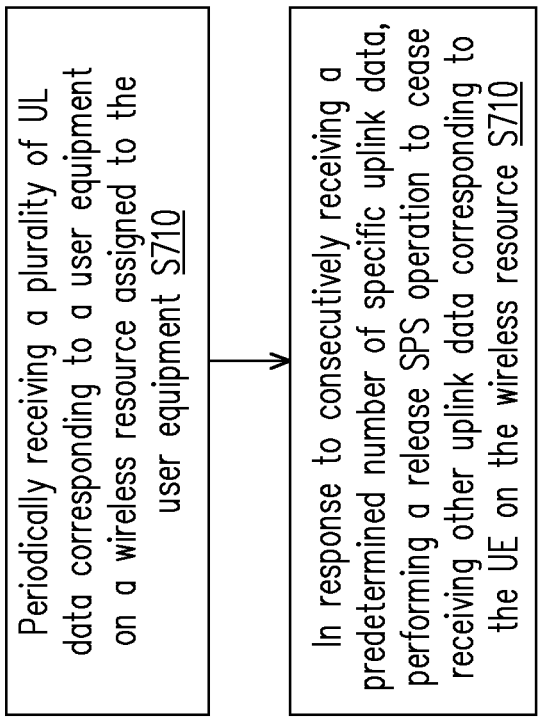

Periodically receiving a plurality of UL data corresponding to a user equipment on a wireless resource assigned to the user equipment S710
In response to consecutively receiving a predetermined number of specific uplink data, performing a release SPS operation to cease receiving other uplink data corresponding to the UE on the wireless resource S710

FIG. 7

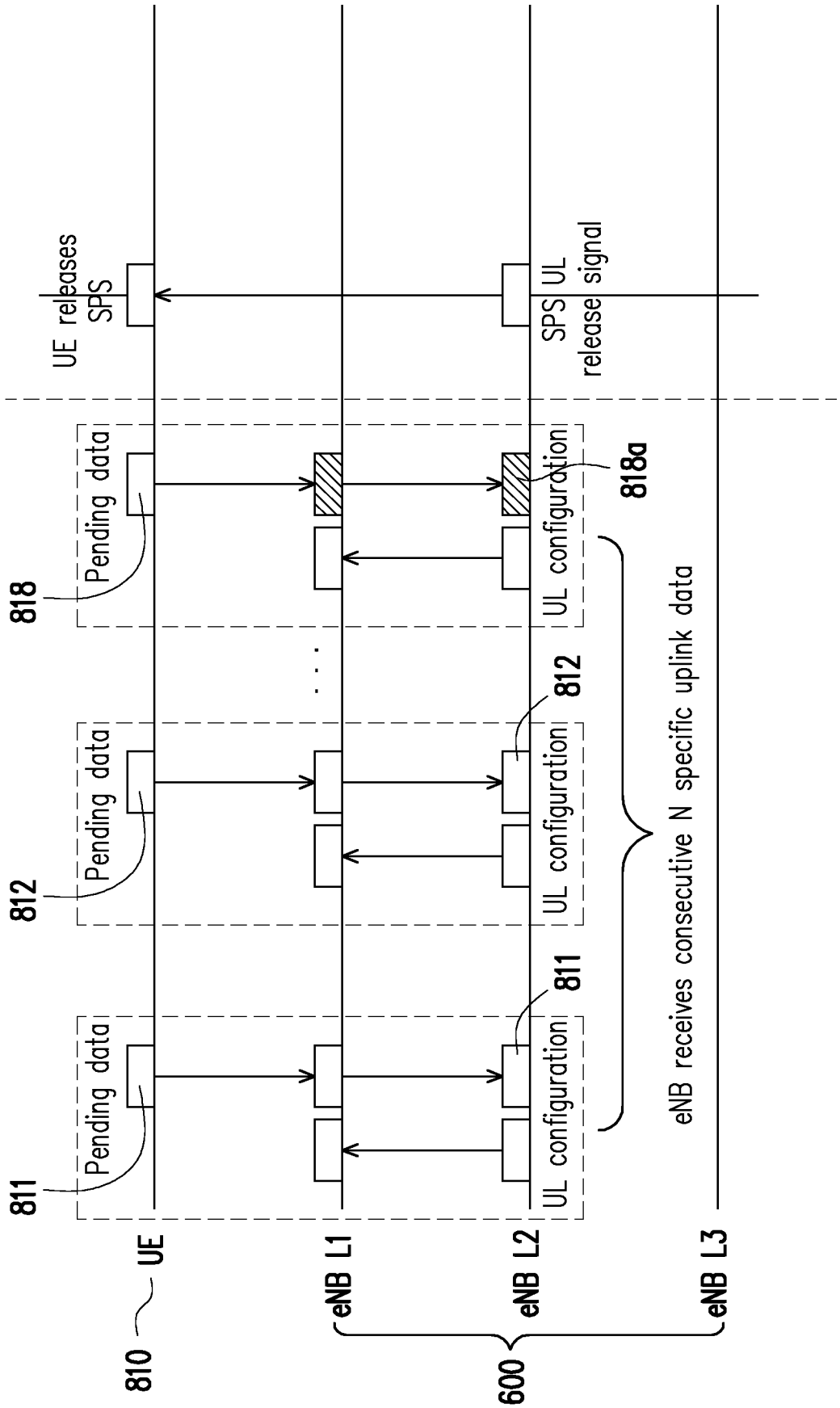

UE releases SPS
SPS UL release signal
Pending data
UL configuration
818
818a
812
811
eNB receives consecutive N specific uplink data
UE
eNB L1
eNB L2
eNB L3
810
600

FIG. 8

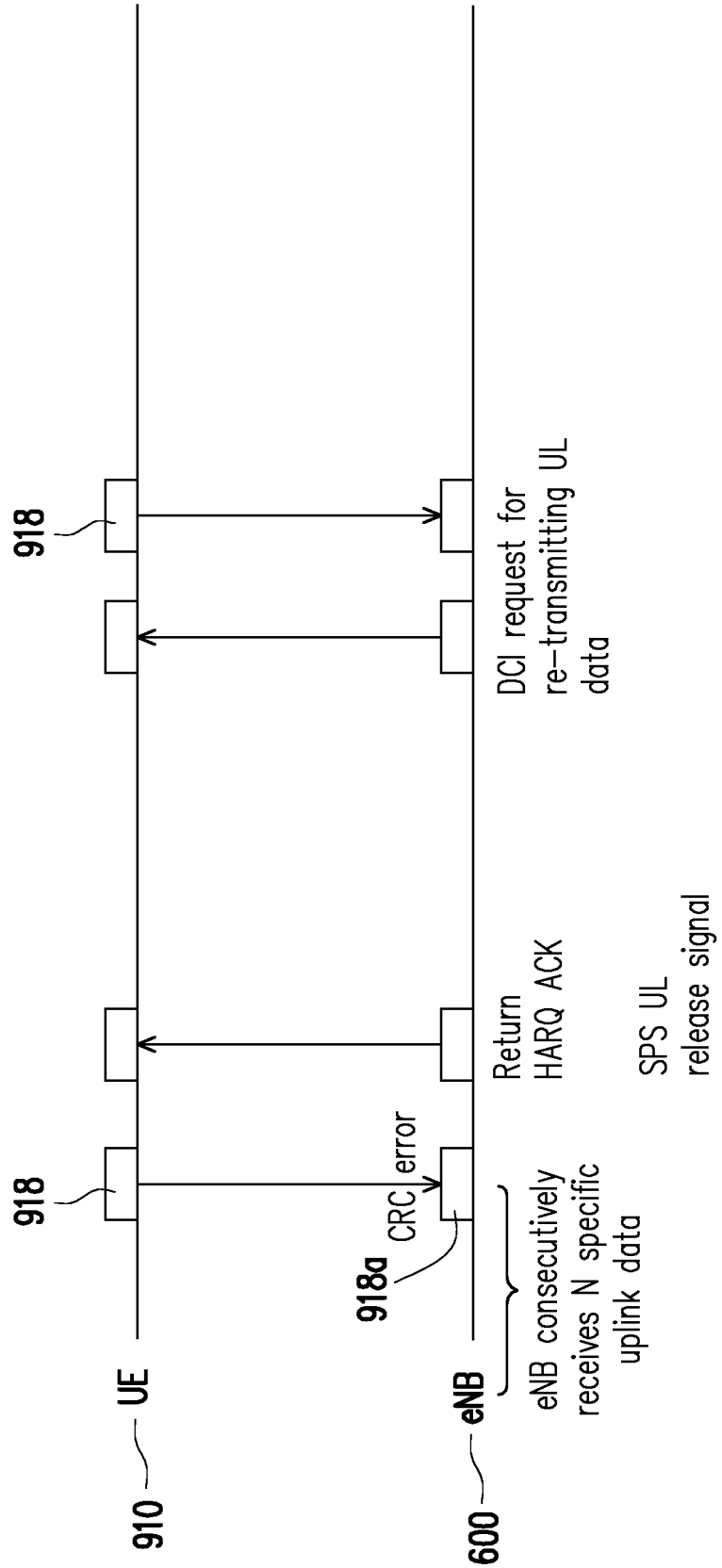

910
UE
600
eNB
918
918
918a
CRC error
eNB consecutively receives N specific uplink data
Return HARQ ACK
SPS UL release signal
DCI request for re-transmitting UL data

FIG. 9

BASE STATION AND RESOURCE ALLOCATION METHOD BASED ON SEMI-PERSISTENT SCHEDULING

TECHNICAL FIELD

[0001] The disclosure relates to a base station and a resource allocation method, and more particularly, relates to a base station and a resource allocation method based on semi-persistent scheduling (SPS).

BACKGROUND

[0002] Usually, a packet transmission is performed by using a dynamic scheduling in a mobile network. The dynamic scheduling may be interpreted as to request for a wireless resource used to transmit data only when the transmission is about to start. In general, uplink data transmitted by a user equipment (UE) requests for the wireless resource based on a scheduling request.

[0003] Unlike the dynamic scheduling mechanism described above, SPS allows an enhanced node B (eNB) to semi-statically allocate the wireless resources, so as to periodically assign the wireless resource to one specific UE. Since SPS is characterized by its capability of continuous and stable scheduling as well as reduction on needs for control packets (e.g., a downlink control information (DCI) packet), SPS can be used in a Voice over LTE (VoLTE) transmission of an LTE network in a cellular system or other future communication systems such as 5G system. Because the SPS can achieve multiple transmissions with only one scheduling, an SPS mechanism is quite important for the cellular system in which the VoLTE is to be performed.

[0004] According to the regulation in the specification of 3GPP TS 36.321, the eNB will periodically assign a resource to the UE when the SPS mechanism is adopted between the UE and the eNB. Correspondingly, the UE also periodically transmits data to the eNB through uplink. If the assigned resource is no longer required when the UE intends to end the VoLTE, the UE will transmit a predetermined number of pending data.

[0005] However, in some cases, if the eNB cannot successfully receive the pending data, a situation in which the wireless resource is wasted may occur.

SUMMARY

[0006] The disclosure provides a resource allocation method based on SPS, which is adapted for a base station and includes: periodically receiving a plurality of uplink (UL) data corresponding to a user equipment on a wireless resource assigned to the user equipment; in response to consecutively receiving a predetermined number of specific uplink data, performing a release SPS operation to cease receiving other uplink data corresponding to the user equipment on the wireless resource, wherein the specific uplink data consist of at least one pending data and at least one error data or consist of the at least one error data.

[0007] The disclosure provides a base station, which includes a storage circuit, a transceiver and a processor. The storage unit stores a plurality of modules. The processor is coupled to the transceiver and the storage circuit, and accesses the modules to perform steps of: controlling the transceiver to periodically receive a plurality of uplink (UL) data corresponding to a user equipment on a wireless resource assigned to the user equipment; in response to consecutively receiving a predetermined number of specific uplink data from the user equipment, performing a release semi-persistent scheduling (SPS) operation to cease receiving other uplink data corresponding to the user equipment on the wireless resource, wherein the specific uplink data consist of at least one pending data and at least one error data or consist of the at least one error data.

[0008] Based on the above, the base station and the resource allocation method based on SPS thereof proposed by the disclosure can allow the base station to correspondingly release the wireless resource assigned to the UE after consecutively receiving the predetermined number of specific uplink data (which are consist of the pending data and at least one error data). As a result, unnecessary waste of the wireless resources due to the CRC error may be avoided and the communication efficiency may also be improved.

[0009] To make the above features and advantages of the disclosure more comprehensible, several embodiments accompanied with drawings are described in detail as follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. **1** is a schematic diagram illustrating a SPS mechanism according to an embodiment of the disclosure.

[0011] FIG. **2** is a schematic diagram illustrating how the SPS mechanism is ended according to an embodiment of the disclosure.

[0012] FIG. **3** is a schematic diagram illustrating how the SPS mechanism is ended according to another embodiment of the disclosure.

[0013] FIG. **4** is a schematic diagram illustrating how the resource is wasted according to an embodiment of the disclosure.

[0014] FIG. **5** is a schematic diagram illustrating an implicit release in a C-RAN architecture according to an embodiment of the disclosure.

[0015] FIG. **6** is a functional block diagram illustrating an eNB according to an embodiment of the disclosure.

[0016] FIG. **7** is a flowchart illustrating a resource allocation method based on SPS according to an embodiment of the disclosure.

[0017] FIG. **8** is a schematic diagram illustrating a release SPS mechanism according to an embodiment of the disclosure.

[0018] FIG. **9** is a schematic diagram illustrating a release SPS mechanism according to another embodiment of the disclosure.

DETAILED DESCRIPTION

[0019] In the following detailed description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

[0020] With reference to FIG. **1**, FIG. **1** is a schematic diagram illustrating a SPS mechanism according to an embodiment of the disclosure, in which a horizontal axis represents time. In this embodiment, an eNB may have a

physical layer (referred to as L**1**), a medium access control layer (referred to as L**2**), and a radio link control layer (referred to as L**3**).

[0021] As shown by FIG. **1**, when the eNB intends to communicate with a UE by adopting SPS, the eNB L**3** can transmit a UE re-configuration signal to the UE to enable SPS UL. After the UE re-configuration signal is received by the UE, the UE can learn that UL data is about to be transmitted to the eNB based on the SPS mechanism.

[0022] Next, the eNB L**2** can transmit an SPS UL activation signal to the UE to formally activate the SPS mechanism. Afterwards, the UE can periodically use a wireless resource assigned by the eNB L**2** to transmit the UL data. Correspondingly, based on a UL configuration signal, the eNB L**2** can control the eNB L**1** to periodically listen to the UL data transmitted by the UE on the wireless resource assigned to the UE. In this embodiment, an SPS period of the UE for transmitting the UL data is, for example, 20 ms, but the disclosure is not limited thereto. In other embodiments, the SPS period may also be adjusted to other values regulated in the specification, such as **160** ms. In this embodiment, taking the LTE system as an example, the SPS UL activation signal is a DCI (downlink control information) packet, but is not limited thereto. The SPS UL activation signal is determined according to the instructions or packets for controlling the SPS in various communication systems.

[0023] In different embodiments, the SPS mechanism may be terminated by methods shown by FIG. **2** and FIG. **3**.

[0024] With reference to FIG. **2**, FIG. **2** is a schematic diagram illustrating how the SPS mechanism is ended according to an embodiment of the disclosure, in which a horizontal axis represents time. In this embodiment, when the eNB intends to terminate the SPS mechanism, the eNB L**2** can transmit as SPS UL release signal to the UE. Correspondingly, the UE will not continue to periodically transmit the UL data, and the eNB L**2** will no longer control the eNB L**1** to periodically listen to the UL data transmitted by the UE on the wireless resource assigned to the UE based on the UL configuration signal either. In this embodiment, taking the LTE system as an example, the SPS UL release signal is a DCI (downlink control information) packet, but is not limited thereto. The SPS UL release signal is determined according to the instructions or packets for controlling the SPS in various communication systems.

[0025] With reference to FIG. **3**, FIG. **3** is a schematic diagram illustrating how the SPS mechanism is ended according to another embodiment of the disclosure, in which a horizontal axis represents time. In this embodiment, if the UE intends to end the SPS mechanism, the UE can consecutively transmit a predetermined number of (hereafter, referred to as N) pending data to the eNB L**2**. Here, the pending data is, for example, data that includes a header and no payload, but not limited thereto. Afterwards, the UE can release the SPS. That is to say, the UE will no longer (periodically) transmit the UL data to the eNB. Correspondingly, after the predetermined number of pending data are consecutively received by the eNB L**2**, the eNB L**2** can also release the SPS. In other words, the eNB L**2** will no longer control the eNB L**1** to periodically listen to the UL data transmitted by the UE on the wireless resource assigned to the UE based on the UL configuration signal, i.e., the wireless resource is not longer assigned to the UE. In this embodiment, the predetermined number is, for example, 8, which may be designated by the eNB L**3** in the enabled SPS UL signal, but the disclosure is not limited thereto.

[0026] In the present disclosure, the mechanism shown by FIG. **3** may also be referred to as an implicit release. However, in the implicit release mechanism, if some pending data cannot be successfully received by the eNB, the UE and the eNB may not be able to successfully release the SPS, which may cause waste of the resource.

[0027] With reference to FIG. **4**, FIG. **4** is a schematic diagram illustrating how the resource is wasted according to an embodiment of the disclosure, in which a horizontal axis represents time. In this embodiment, it is assumed that the predetermined number of (i.e., 8) pending data are consecutively transmitted by the UE, and yet pending data **410** (i.e., the 8^{th} pending data) is not correctly received by the eNB due to poor channel conditions or other similar reasons. Specifically, after the pending data **410** is received by the eNB, the eNB may first perform a cyclic redundancy check (CRC) operation or the like on the pending data **410** to confirm whether a checksum calculated based on the pending data **410** is correct. However, in the case of poor channel conditions, the eNB may determine that a CRC error occurs due to the inability to successfully complete the CRC operation for the pending data **410**. In this case, the eNB can request the UE to re-transmit the pending data **410** based on a hybrid automatic repeat request (HARQ) mechanism.

[0028] Yet, before the pending data **410** is successfully received by the eNB (e.g., the CRC operation is completed for the pending data **410** and the content of the pending data **410** is successfully analyzed), the eNB is unable to confirm whether the pending data **410** really belongs to the pending data. At the time, if the pending data **410** still cannot be successfully received due to overly poor channel conditions, the eNB may need to repeatedly request the UE to re-transmit the pending data based on HARQ. In this case, the wireless resource will be occupied unnecessarily, namely, wasted.

[0029] In addition, after consecutively transmitting the predetermined number of pending data, it is also possible that the UE will directly perform the release SPS operation without transmitting other data. However, if the eNB mistakenly determines that the unsuccessfully received pending data **410** is the UL data, the eNB L**2** will still control the eNB L**1** to listen to the UL data transmitted by the UE on the wireless resource assigned to the UE based on the UL configuration signal. Because the SPS is already released by the UE, the eNB L**1** will not receive the UL data transmitted by the UE so the wireless resource is wasted.

[0030] In addition, it is assumed that, the UE transmits one UL data after consecutively transmitting (N−1) pending data, and somehow that UL data cannot be successfully analyzed by the eNB. In this case, if the eNB mistakenly determines that the unsuccessfully received UL data is the pending data, the eNB may perform the release SPS operation in response to determining that the N pending data are consecutively received. That is to say, the eNB L**1** will no longer listen to the UL data transmitted on the wireless resource assigned to the UE. Accordingly, data subsequently transmitted by the UE will not be successfully transmitted to the eNB.

[0031] Further, after the SPS is released by the eNB, it is also possible that the eNB will assign the wireless resource originally assigned to the UE to another UE. In this case, the

two UEs may encounter a collision caused by conducting transmissions using the same wireless resource.

[0032] In an embodiment, when a radio link failure between the UE and the eNB occurs, the eNB may also need to activate a corresponding connection recovery mechanism. However, this recovery mechanism may consume up to 10000 ms at most, and thus reduce the overall system performance.

[0033] In addition, problems similar to the above may also occur in a centralized radio access network (C-RAN) architecture. Specifically, because the eNB L**1** and the eNB L**2** in the C-RAN may be respectively disposed in different machines, there may have a certain degree of latency in the transmission between the eNB L**1** and the eNB L**2**. In this case, when the eNB L**2** receives data re-transmitted by the UE in response to the HARQ mechanism, regardless of whether such data is correctly received by the eNB L**1**, the eNB L**2** will first transmit a HARQ acknowledge (ACK) signal. However, in the case of the implicit release, the mechanism above may cause waste of the wireless resource.

[0034] With reference to FIG. **5**, FIG. **5** is a schematic diagram illustrating an implicit release in a C-RAN architecture according to an embodiment of the disclosure, in which a horizontal axis represents time. In this embodiment, it is assumed that, the UE already consecutively transmits the N pending data and releases the SPS, and yet the CRC error occurs when the eNB is analyzing pending data **510** (i.e., an N^{th} pending data). As described in the previous embodiment, the eNB L**2** may first return the HARQ ACK signal at the time. However, because the pending data **510** is not correctly analyzed, the eNB may still attempt to listen to the data from the UE again after the SPS period so the wireless resource is wasted. Meanwhile, because the UE does not transmit any data after the SPS period, the eNB may again determine that the CRC error occurs. In addition, when the eNB L**2** finds that the pending data **510** is not correctly analyzed, the eNB L**2** may further request the UE to re-transmit the pending data **510** through a DCI request.

[0035] Accordingly, the disclosure proposes a base station and a scheduling method thereof, which can solve the technical problems described above.

[0036] With reference to FIG. **6**, FIG. **6** is a functional block diagram illustrating an eNB according to an embodiment of the disclosure. In this embodiment, an eNB **600** may be widely interpreted as a general base station, a macro-cell base station, a pico-cell base station or a remote radio head (RRH), but not limited thereto.

[0037] As shown by FIG. **6**, the eNB **600** may include a storage circuit **602**, a transceiver **604** and a processor **606**. The storage circuit **602** is, for example, any forms of fixed or movable random access memory (RAM), read only memory (ROM), flash memory, hard disk or other similar devices, or a combination of above-said devices, which can be used to record a plurality of program codes or modules.

[0038] The transceiver **604** may include (but not limited to) a transmitter circuit, a receiver circuit, an analog-to-digital (A/D) converter, a digital-to-analog (D/A) converter, a low noise amplifier (LNA), a mixer, a filter, a matching circuit, a transmission line, a power amplifier (PA), one or more antenna units and a local storage media component, which can provide a wireless transmission function for the eNB **600** of FIG. **6**.

[0039] The transmitter circuit may include functional units for performing operations like low noise amplifying, impedance matching, frequency mixing, lower frequency converting, filtering, amplifying and so on. The receiver circuit may include functional units for performing operations like amplifying, impedance matching, frequency mixing, upper frequency converting, filtering, power amplifying and so on. The A/D converter or the D/A converter are configured to convert an analog signal format into a digital signal format during uplink signal processing, and convert the digital signal format into the analog signal format during downlink signal processing.

[0040] The processor **606** is coupled to the storage circuit **602** and the transceiver **604**, and may be a processor for general purposes, a processor for special purposes, a conventional processor, a digital signal processor, a plurality of microprocessors, one or more microprocessors, controllers and microcontrollers which are combined with a core of the digital signal processor, an application specific integrated circuit (ASIC), a field programmable gate array (FPGA), any other integrated circuits, a state machine, a processor based on advanced RISC machine (ARM) and the like.

[0041] In the embodiments of the disclosure, the processor **606** can load in the program codes or the modules recorded in the storage circuit **602** in order to execute a resource allocation method based on the SPS proposed by the disclosure, which will be described in detail below.

[0042] With reference to FIG. **7**, FIG. **7** is a flowchart illustrating a resource allocation method based on SPS according to an embodiment of the disclosure. The method of this embodiment may be executed by the eNB **600** of FIG. **6**, and each step of FIG. **7** will be described in detail with reference to each element shown in FIG. **6**.

[0043] First of all, in an embodiment, the processor **606** can arrange the wireless resource for the UE based on the SPS mechanism. In an embodiment, the processor **606** can transmit the SPS UL activation signal shown in FIG. **1** to FIG. **3** to the UE, so as to inform the UE of its assigned wireless resource. Correspondingly, the UE can periodically transmit the uplink data to the eNB **600** by using the assigned wireless resource. In this embodiment, taking the LTE system as an example, the SPS UL activation signal is a DCI (downlink control information) packet, but is not limited thereto. The SPS UL activation signal is determined according to the instructions or packets for controlling the SPS in various communication systems.

[0044] In step S**710**, the processor **606** can control the transceiver **604** to periodically receive a plurality of UL data corresponding to the UE on a wireless resource assigned to the UE. In an embodiment, the processor **606** can control the transceiver **604** to periodically receive the uplink data transmitted by the UE on the wireless resource according to the UL configuration signal shown in FIG. **1** to FIG. **3**. Details regarding how the wireless resource is arranged for the UE based on the SPS mechanism and details regarding step **5710** may refer to related descriptions in the foregoing embodiments, which are not repeated hereinafter.

[0045] Then, in step **5720**, in response to consecutively receiving a predetermined number of specific uplink data, the processor **606** can perform a release SPS operation to cease receiving other uplink data corresponding to the UE on the wireless resource. In the embodiments of the disclosure, the predetermined number of specific uplink data may consist of at least one pending data and at least one error data

or consist of the at least one error data. Here, the error data is, for example, CRC error data, but the disclosure is not limited thereto.

[0046] In an embodiment, the processor **606** may initialize a count value to 0, and such count value may represent the number of specific uplink data consecutively received. Afterwards, each time when the processor **606** receives one of uplink data, the processor **606** can determine whether that uplink data belongs to the pending data or the error data. If so, the processor **606** can increment the count value. On the other hand, if the uplink data does not belong to the pending data or the error data, it means that this uplink data is normal uplink data with the payload. In this case, the processor **606** can reset the count value to 0. When the count value is accumulated to the predetermined number, it means that the processor **606** already consecutively receives the predetermined number of specific uplink data from the UE. Therefore, the processor **606** can correspondingly perform the release SPS operation, so as to release the wireless resource, but the disclosure is not limited thereto.

[0047] To make the concept of step **5720** clearer, further description is provided below with reference to FIG. **8**. With reference to FIG. **8**, FIG. **8** is a schematic diagram illustrating a release SPS mechanism according to an embodiment of the disclosure, in which a horizontal axis represents time. In this embodiment, it is assumed that the predetermined number is 8 (i.e., N is 8) and a UE **810** consecutively transmits 8 pending data **811**, **812**, . . . , and **818**. However, the CRC error occurs when the eNB **600** is analyzing the pending data **818**. That is to say, after successfully analyzing 7 pending data **811** to **817**, the eNB **600** determines that 1 error data **818***a* occurs.

[0048] At the time, when determining that the predetermined number of specific uplink data are already consecutively received (i.e., 7 pending data **811** to **817** and 1 error data, wherein the pending data **813** to **817** are not shown in the drawing), the eNB **600** can perform the release SPS operation to cease receiving the other uplink data corresponding to the UE **810** on the wireless resource assigned to the UE **810**. In addition, the eNB **600** may also control the UE **810** through the SPS UL release signal to also perform the release SPS operation. In this embodiment, taking the LTE system as an example, the SPS UL release signal is a DCI (downlink control information) packet, but is not limited thereto. The SPS UL release signal is determined according to the instructions or packets for controlling the SPS in various communication systems.

[0049] That is to say, in response to consecutively receiving the predetermined number of specific uplink data as determined by the eNB **600**, both the eNB **600** and the UE **800** can perform the release SPS operation. In this way, various mentioned situations where the wireless resource is wasted in the previous embodiments can be avoided so the overall system performance can be improved.

[0050] It should be understood that, the specific uplink data shown in FIG. **8** are illustrative only, instead of limiting possible embodiments of the disclosure. In other embodiments, the data with the CRC error may also be one or more of the pending data **811** to **817**, rather than being limited to the pending data **818**. In brief, as long as the eNB **600** determines that the consecutive N specific uplink data consist of the pending data and the error data are already received, both the eNB and the UE **810** can perform the release SPS operation to achieve the effectiveness of saving unlink resource.

[0051] Further, as compared to the approach of FIG. **4** that consumes up to 10000 ms at most, the method proposed by the disclosure will almost take no extra time, and thus the overall system performance can be improved.

[0052] In addition, in an embodiment, after the release SPS operation is performed by each the eNB **600** and the UE **810**, the eNB **600** can transmit the SPS UL activation signal to the UE **810** again, so as to re-activate the SPS mechanism between the eNB **600** and the UE **810**. Afterward, the eNB **600** can communicate with the UE **810** again based on the method shown by FIG. **1**, and details regarding the same are not repeated hereinafter. In this embodiment, taking the LTE system as an example, the SPS UL activation signal is a DCI (downlink control information) packet, but is not limited thereto. The SPS UL activation signal is determined according to the instructions or packets for controlling the SPS in various communication systems.

[0053] In addition, in an embodiment, the method proposed by the disclosure is also adapted to the eNB **600** belonging to the C-RAN.

[0054] With reference to FIG. **9**, FIG. **9** is a schematic diagram illustrating a release SPS mechanism according to another embodiment of the disclosure, in which a horizontal axis represents time. In this embodiment, it is assumed that, the predetermined number is **8** (i.e., N is 8), and pending data **918** is the 8^{th} pending data being transmitted after 7 pending data (not illustrated) are consecutively transmitted by a UE **910**. However, as shown by FIG. **9**, the CRC error occurs when the eNB **600** is analyzing the pending data **918**. That is to say, after successfully analyzing 7 pending data, the eNB **600** determines that 1 error data **918***a* occurs.

[0055] As described in the previous embodiment, before specifically knowing that the CRC error occurs, the L**2** of the eNB **600** will first return the HARQ ACK signal to the UE. However, as already determined that the predetermined number of specific uplink data are consecutively received at the time (i.e., 7 pending data and 1 error data), the eNB **600** can perform the release SPS operation to cease receiving other uplink data corresponding to the UE **910** on the wireless resource assigned to the UE **910**. In addition, the eNB **600** may also control the UE **910** through the SPS UL release signal to also perform the release SPS operation. In this embodiment, taking the LTE system as an example, the SPS UL release signal is a DCI (downlink control information) packet, but is not limited thereto. The SPS UL release signal is determined according to the instructions or packets for controlling the SPS in various communication systems.

[0056] That is to say, in response to consecutively receiving the predetermined number of specific uplink data as determined by the eNB **600**, both the eNB **600** and the UE **910** can perform the release SPS operation. In this way, various mentioned situations where the wireless resource is wasted in the previous embodiments can be avoided so the overall system performance can be improved.

[0057] Next, after the L**2** of the eNB **600** finds that the CRC error occurs, the eNB **600** can request the UE **910** to re-transmit the pending data **918** through the DCI request again, so as to complete the transmission with the UE **910**.

[0058] In summary, the base station and the resource allocation method based on SPS thereof proposed by the disclosure can allow the base station to correspondingly

release the wireless resource assigned to the UE after consecutively receiving the predetermined number of specific uplink data (which are consist of the pending data and at least one error data). As a result, unnecessary waste of the wireless resources due to the CRC error may be avoided and the communication efficiency may also be improved. In addition, for the base station belonging to the C-RAN, the method of the disclosure may also be used to avoid unnecessary waste of the wireless resources due to the CRC error and improve the communication efficiency.

[0059] It will be apparent to those skilled in the art that various modifications and variations can be made to the disclosed embodiments. It is intended that the specification and examples be considered as exemplary only, with a true scope of the disclosure being indicated by the following claims and their equivalents

1. A resource allocation method based on semi-persistent scheduling (SPS), adapted for a base station, and comprising:

periodically receiving a plurality of uplink (UL) data corresponding to a user equipment on a wireless resource assigned to the user equipment;

in response to consecutively receiving a predetermined number of specific uplink data from the user equipment, performing a release SPS operation to cease receiving other uplink data corresponding to the user equipment on the wireless resource, wherein the specific uplink data consist of at least one pending data and at least one error data or consist of the at least one error data.

2. The method according to claim **1**, wherein each of the error data is cyclic redundancy check error data.

3. The method according to claim **1**, wherein each of the pending data includes a header and no payload.

4. The method according to claim **1**, further comprising:

initializing a count value to 0;

in response to receiving first uplink data from the user equipment, determining whether the first uplink data belongs to the at least one pending data or the at least one error data;

in response to determining that the first uplink data belongs to the at least one pending data or the at least one error data, incrementing the count value;

in response to determining that the first uplink data does not belong to the at least one pending data or the at least one error data, resetting the count value to **0**.

5. The method according to claim **4**, wherein in response to the count value being equal to the predetermined number, determining that the predetermined number of specific uplink data are consecutively received from the user equipment.

6. The method according to claim **1**, further comprising:

controlling the user equipment to perform the release SPS operation, so as to control the user equipment to cease transmitting the other uplink data on the wireless resource.

7. The method according to claim **1**, further comprising:

arranging the wireless resource for the user equipment based on an SPS mechanism.

8. The method according to claim **7**, wherein before the step of arranging the wireless resource for the UE based on the SPS mechanism, the method further comprises:

transmitting an SPS UL activation signal to the user equipment, so as to activate the SPS mechanism between the base station and the user equipment.

9. The method according to claim **8**, wherein after the step of performing the release SPS operation, the method further comprises:

re-transmitting the SPS UL activation signal to the user equipment, so as to re-activate the SPS mechanism between the base station and the user equipment.

10. The method according to claim **8**, wherein the base station belongs to a centralized radio access network.

11. A base station, comprising:

a storage circuit, storing a plurality of modules;

a transceiver; and

a processor, coupled to the transceiver and the storage circuit, and accessing the modules to perform steps of:

controlling the transceiver to periodically receive a plurality of uplink (UL) data corresponding to a user equipment on a wireless resource assigned to the user equipment;

in response to consecutively receiving a predetermined number of specific uplink data from the user equipment, performing a release semi-persistent scheduling (SPS) operation to cease receiving other uplink data corresponding to the user equipment on the wireless resource, wherein the specific uplink data consist of at least one pending data and at least one error data or consist of the at least one error data.

12. The base station according to claim **11**, wherein each of the error data is cyclic redundancy check error data.

13. The base station according to claim **11**, wherein each of the pending data includes a header and no payload.

14. The base station according to claim **11**, wherein the processor is further configured for:

initializing a count value to 0;

in response to receiving first uplink data from the user equipment, determining whether the first uplink data belongs to the at least one pending data or the at least one error data;

in response to determining that the first uplink data belongs to the at least one pending data or the at least one error data, incrementing the count value;

in response to determining that the first uplink data does not belong to the at least one pending data or the at least one error data, resetting the count value to 0.

15. The base station according to claim **14**, wherein in response to the count value being equal to the predetermined number, the processor is further configured for determining that the predetermined number of specific uplink data are consecutively received from the user equipment.

16. The base station according to claim **11**, wherein the processor is further configured for:

controlling the user equipment to perform the release SPS operation, so as to control the user equipment to cease transmitting the other uplink data on the wireless resource.

17. The base station according to claim **11**, wherein the processor is further configured for:

arranging the wireless resource for the user equipment based on an SPS mechanism.

18. The base station according to claim **17**, wherein the processor is further configured for:

controlling the transceiver to transmit an SPS UL activation signal to the user equipment, so as to activate the SPS mechanism between the base station and the user equipment.

19. The base station according to claim **18**, wherein the processor is further configured for:

controlling the transceiver to re-transmit the SPS UL activation signal to the user equipment, so as to re-activate the SPS mechanism between the base station and the user equipment.

20. The base station according to claim **18**, wherein the base station belongs to a centralized radio access network.

* * * * *