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(54) **APPARATUS AND METHOD FOR UPLINK TRANSMISSION IN WIRELESS COMMUNICATION SYSTEM**

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(57) **ABSTRACT**

An apparatus and method for uplink transmission in a wireless communication system are provided. The method comprises detecting an expiry of a time alignment timer in a MAC (Medium Access Control) layer, the time alignment timer being used to control how long the UE is considered uplink time aligned, notifying a release of PUCCH (Physical Uplink Control Channel) resources from the MAC layer to a RRC (Radio Resource Control) layer when the expiry of the time alignment timer is detected and keeping a part of the PUCCH (Physical Uplink Control Channel) resources in the RRC layer.

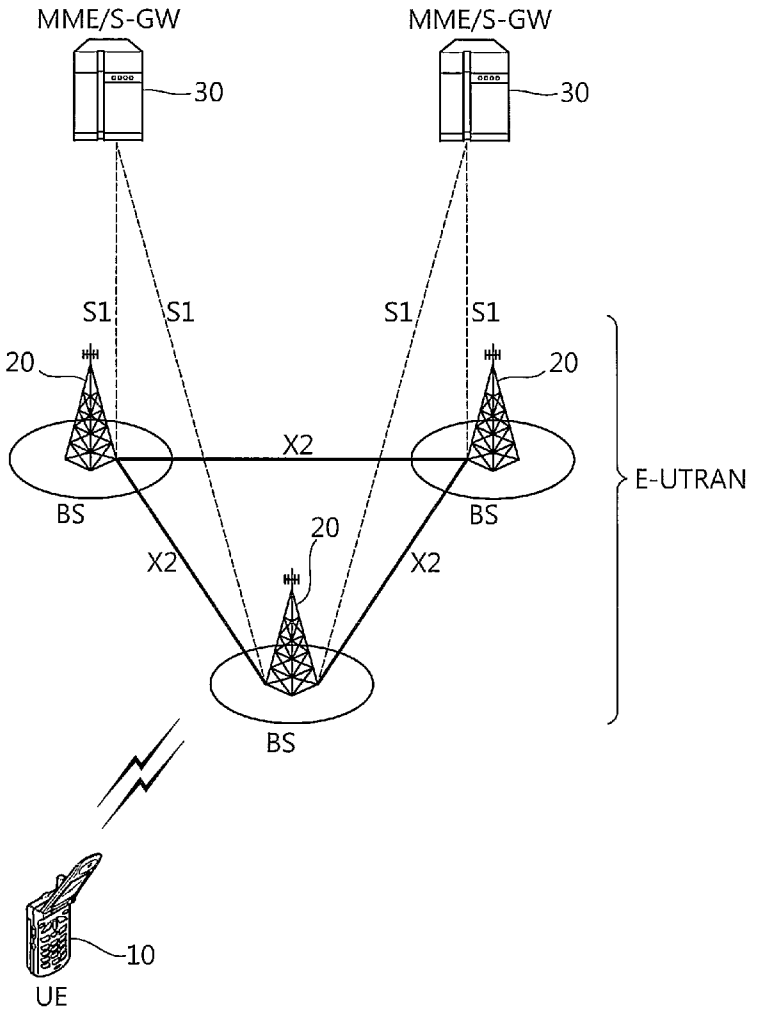


FIG. 1

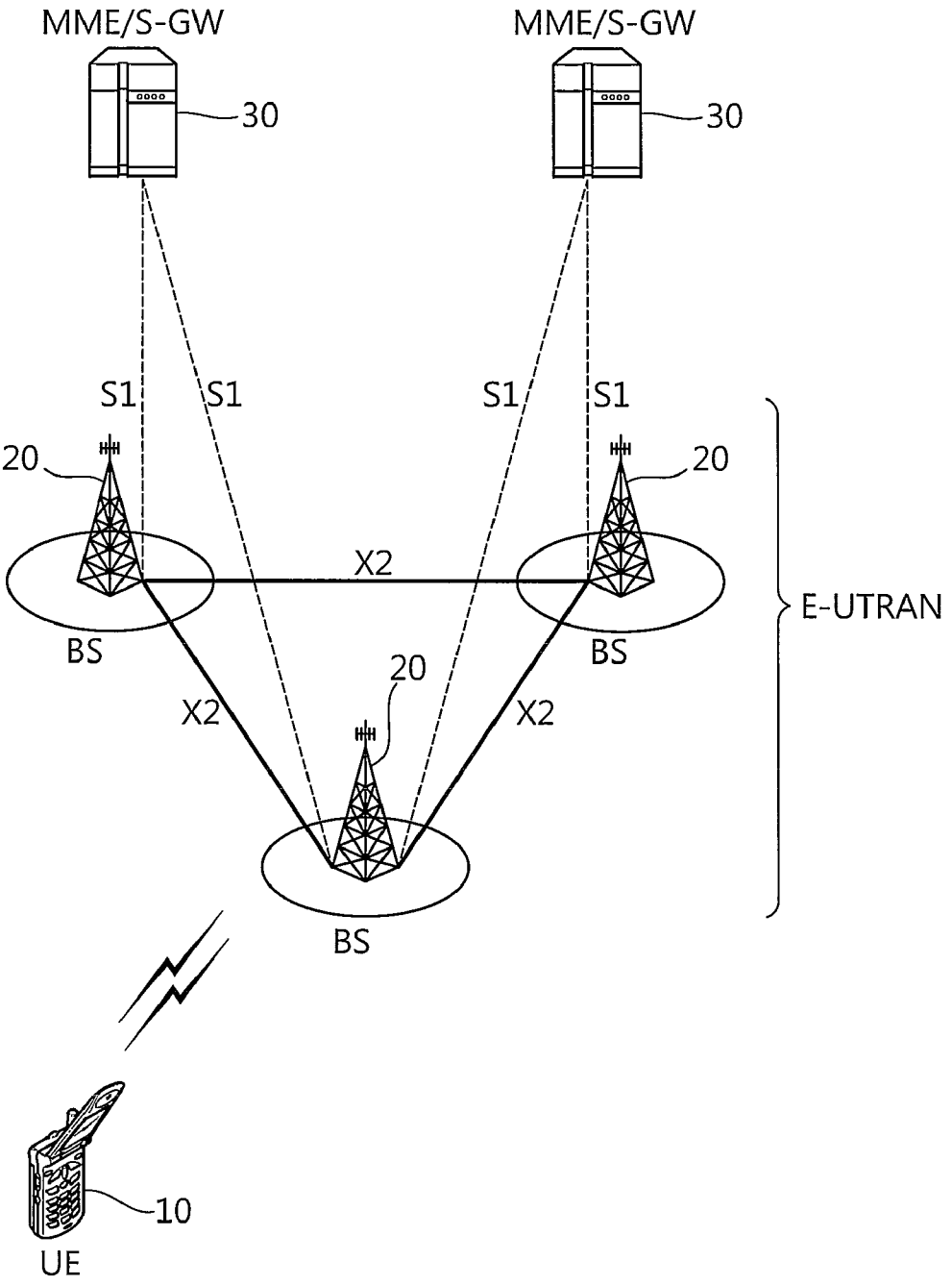

MME/S-GW
MME/S-GW
30
30
S1
S1
S1
S1
20
20
X2
BS
BS
20
X2
X2
BS
E-UTRAN
10
UE

FIG. 2

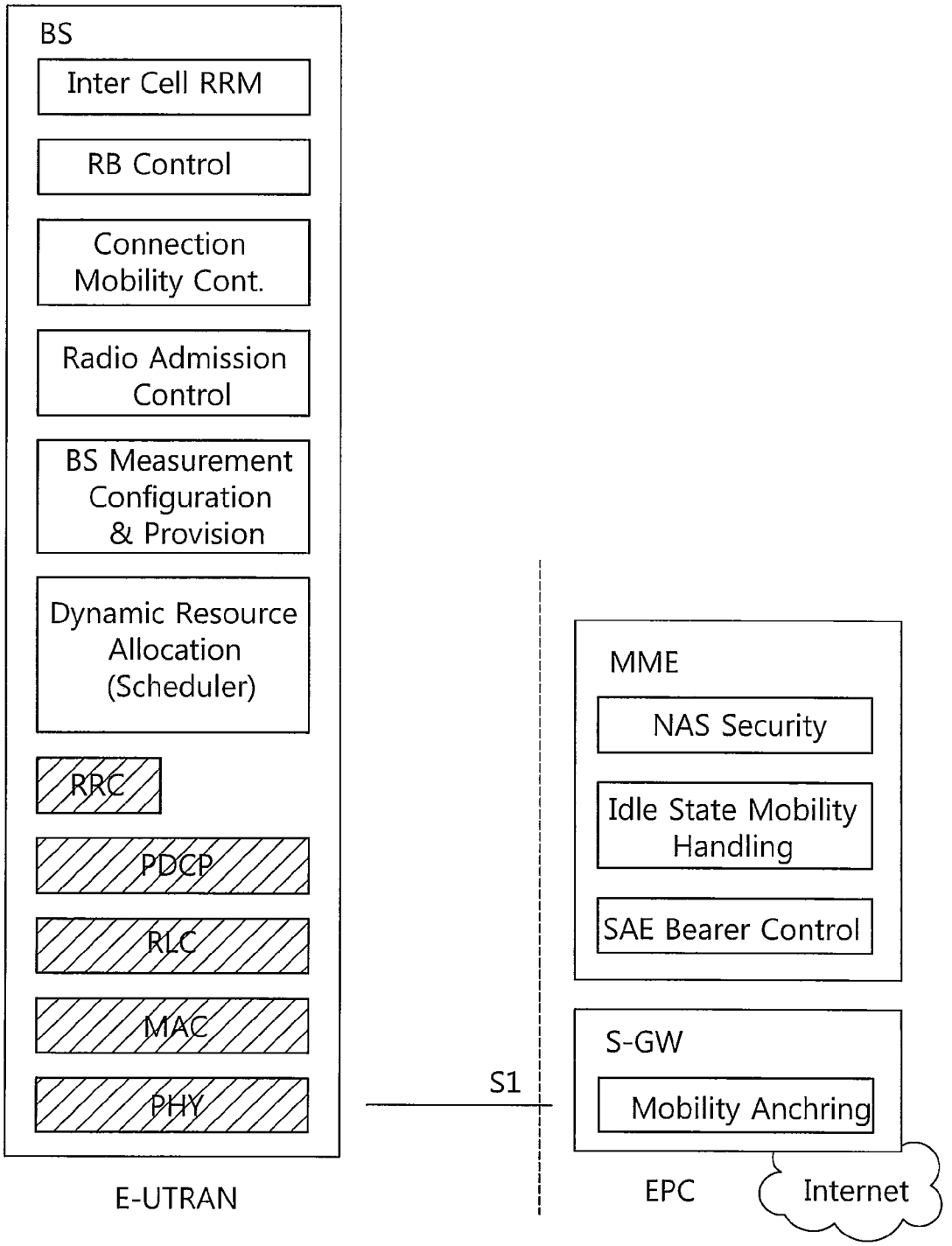

BS
Inter Cell RRM
RB Control
Connection Mobility Cont.
Radio Admission Control
BS Measurement Configuration & Provision
Dynamic Resource Allocation (Scheduler)
RRC
PDCP
RLC
MAC
PHY
E-UTRAN
S1
MME
NAS Security
Idle State Mobility Handling
SAE Bearer Control
S-GW
Mobility Anchring
EPC
Internet

FIG. 3

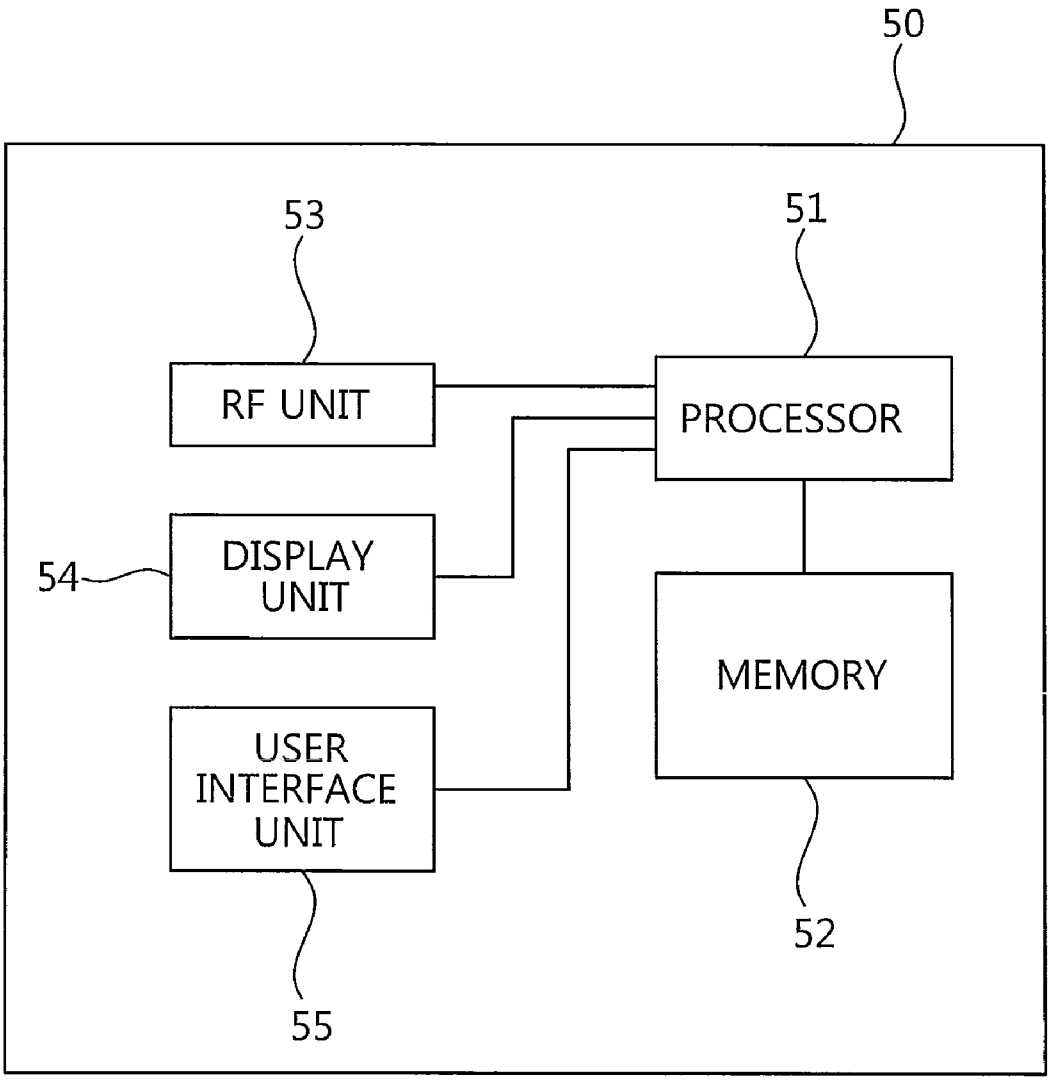

50
53
51
RF UNIT
PROCESSOR
54
DISPLAY UNIT
MEMORY
USER INTERFACE UNIT
52
55

FIG. 4

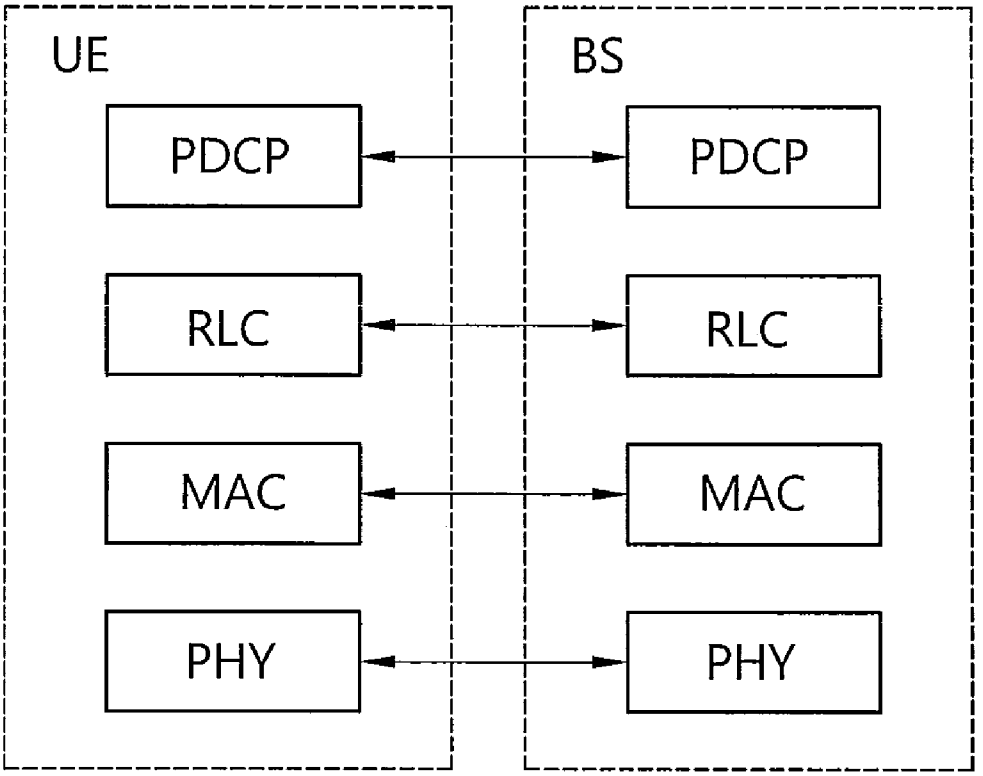


FIG. 5

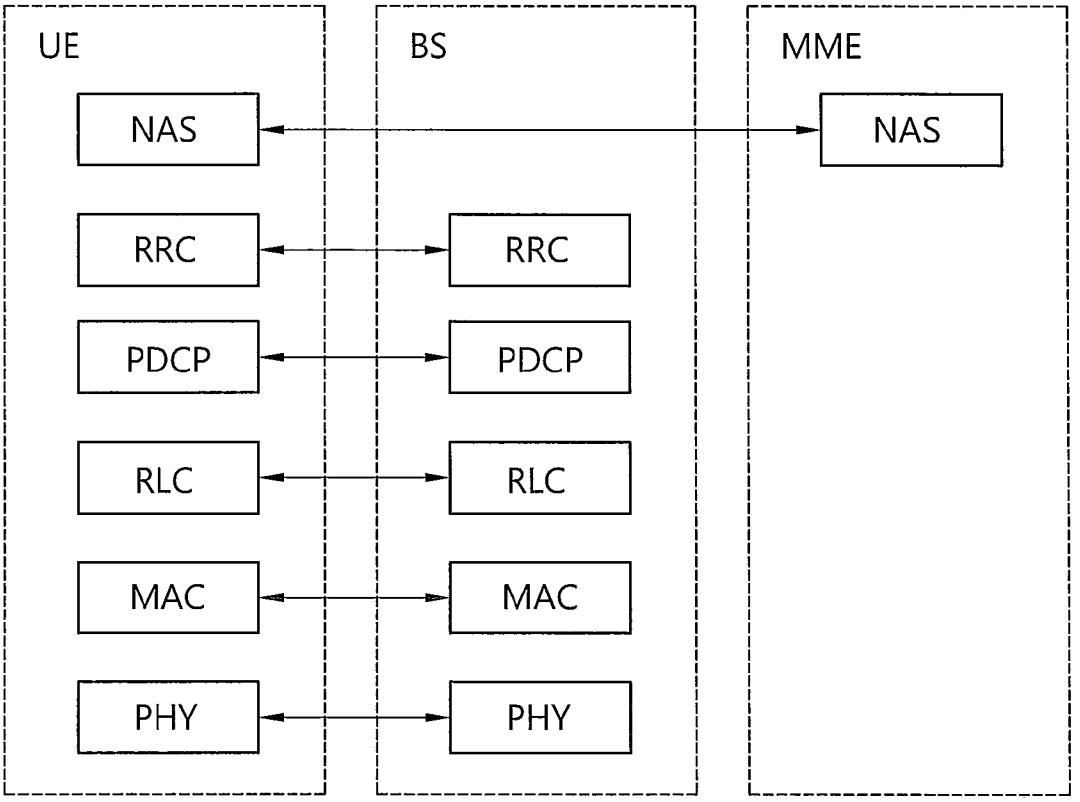


FIG. 6

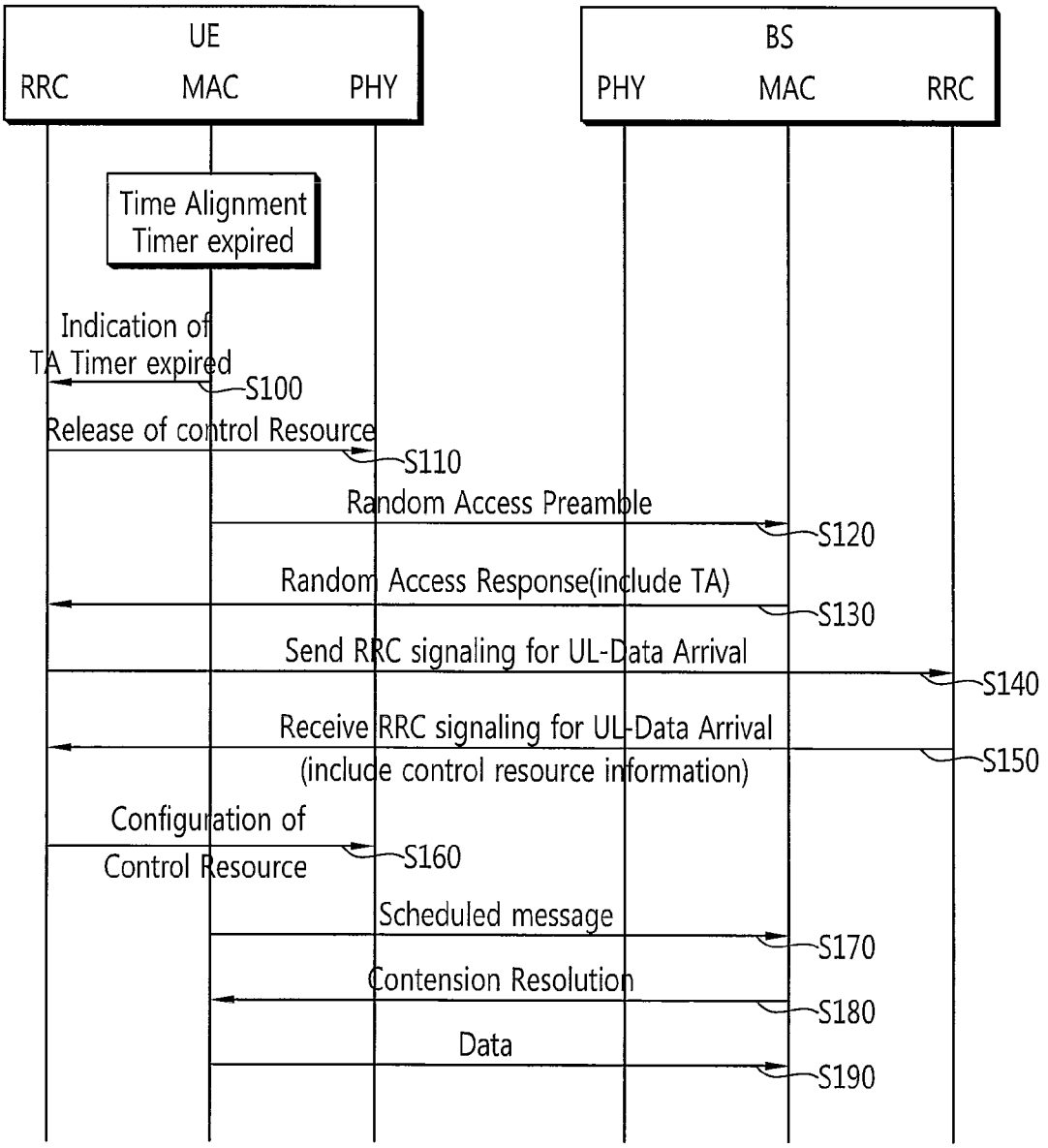

UE
RRC
MAC
PHY
BS
PHY
MAC
RRC
Time Alignment Timer expired
Indication of TA Timer expired
S100
Release of control Resource
S110
Random Access Preamble
S120
Random Access Response(include TA)
S130
Send RRC signaling for UL-Data Arrival
S140
Receive RRC signaling for UL-Data Arrival (include control resource information)
S150
Configuration of Control Resource
S160
Scheduled message
S170
Contension Resolution
S180
Data
S190

FIG. 7

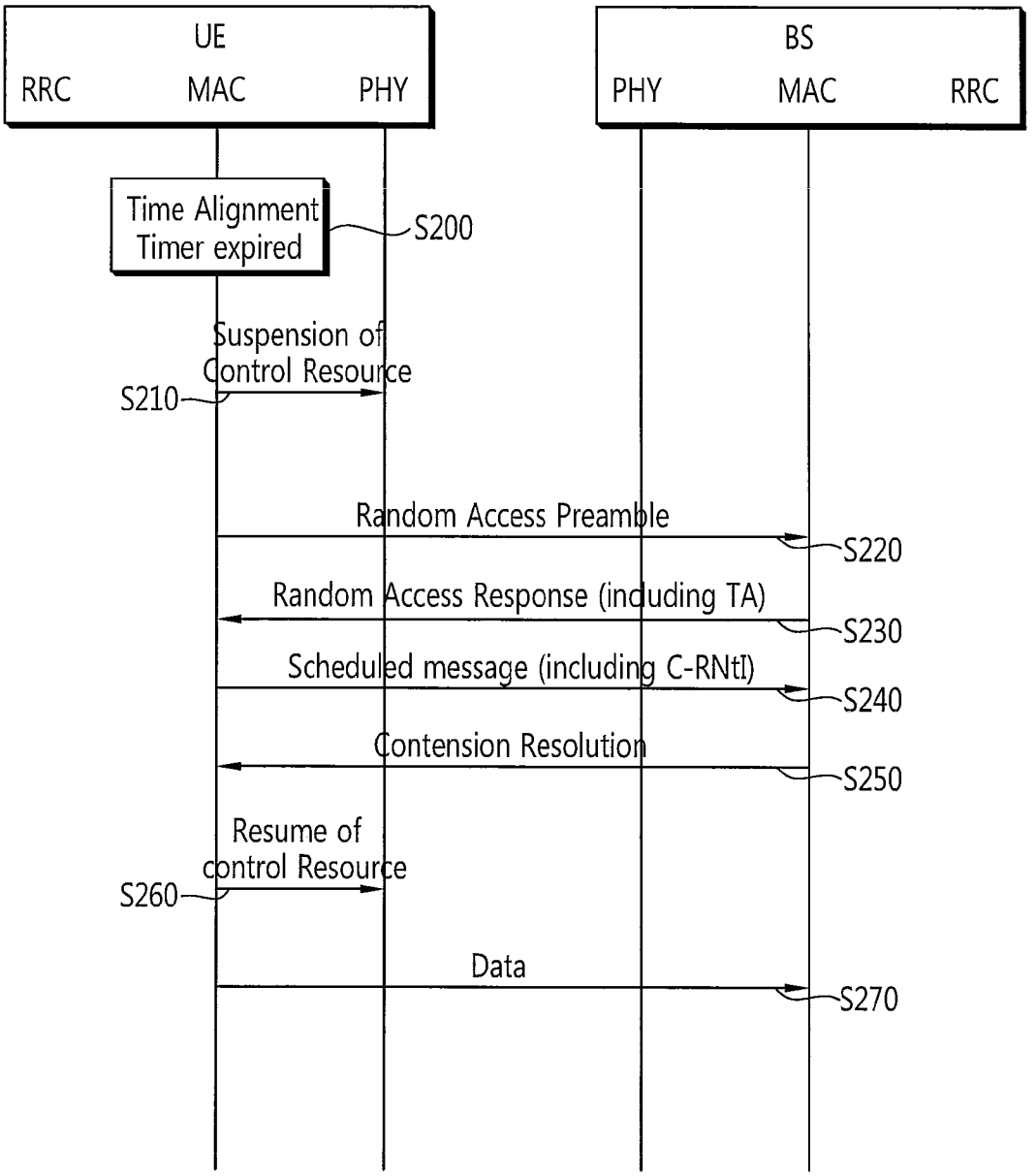
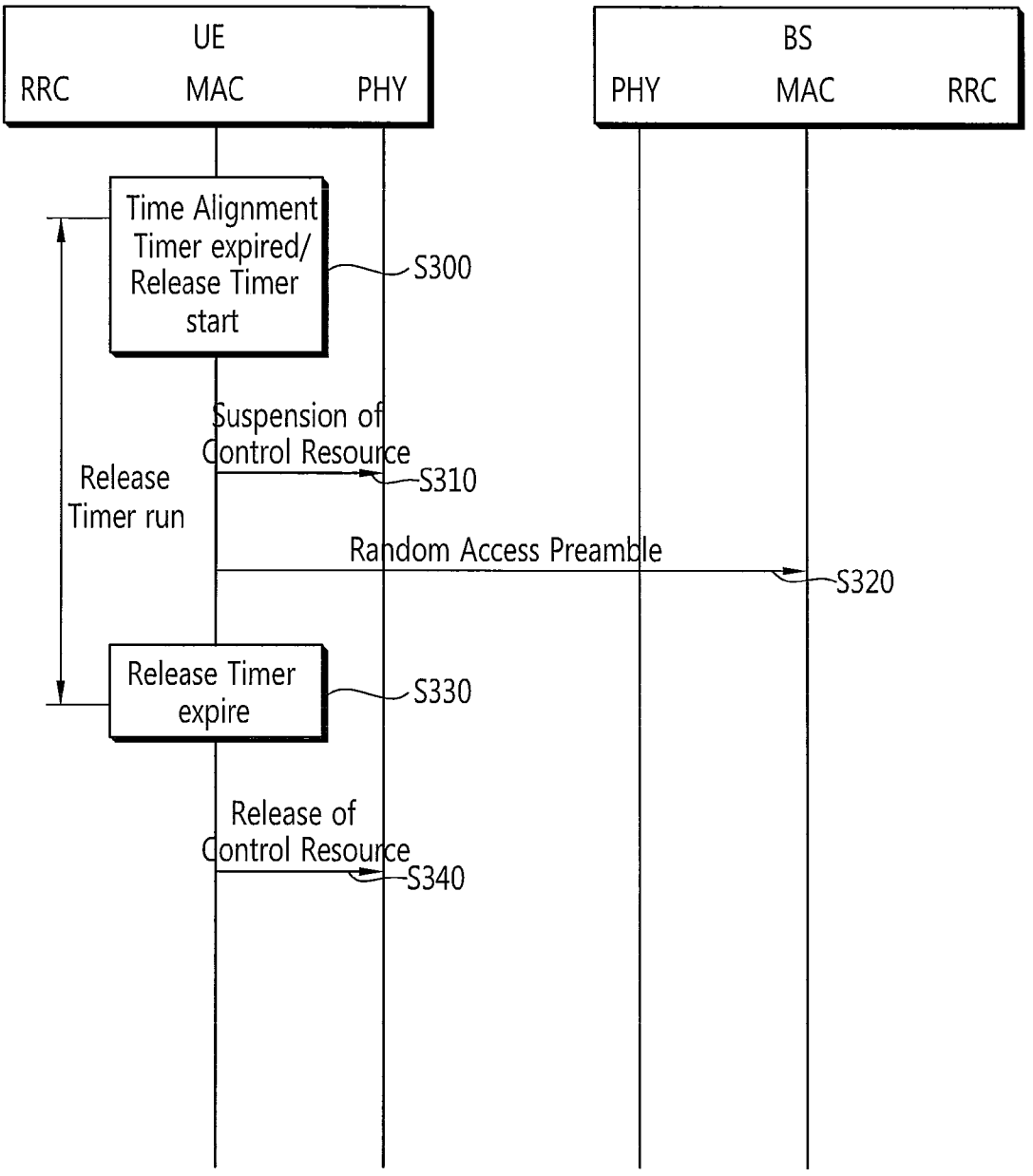

UE
RRC
MAC
PHY
BS
PHY
MAC
RRC
Time Alignment Timer expired
S200
Suspension of Control Resource
S210
Random Access Preamble
S220
Random Access Response (including TA)
S230
Scheduled message (including C-RNTI)
S240
Contension Resolution
S250
Resume of control Resource
S260
Data
S270

FIG. 8


UE
RRC
MAC
PHY
BS
PHY
MAC
RRC
Time Alignment Timer expired/ Release Timer start
S300
Suspension of Control Resource
S310
Release Timer run
Random Access Preamble
S320
Release Timer expire
S330
Release of Control Resource
S340

APPARATUS AND METHOD FOR UPLINK TRANSMISSION IN WIRELESS COMMUNICATION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of priority of U.S. Provisional Application No. 61/050,987 filed on May 6, 2008, and Korean Patent Application No. 10-2008-0066853 filed on Jul. 10, 2008, which are incorporated by reference in their entirety herein.

BACKGROUND

[0002] 1. Technical Field

[0003] The present invention relates to wireless communication and, more particularly, to an apparatus and method for uplink transmission in a wireless communication system.

[0004] 2. Related Art

[0005] A 3GPP (3^{rd} Generation Partnership Project) based on a WCDMA (Wideband Code Division Multiple Access) radio access technique is being extensively developed all over the world. An HSDPA (High Speed Downlink Packet Access), which may be defined as a first evolution of the WCDMA, provides a radio access technique with a highly competitive edge in the mid-term future to the 3GPP. However, as requirements and expectations of users and service providers are continuously increasing and development of competing wireless access techniques is ongoing, a new technical evolution from the 3GPP is requested to ensure competitiveness in the future. The requirements include a reduction in costs per bit, an increase in service availability, the flexible use of frequency bands, a simple structure and an open interface, proper power consumption of terminals (i.e., user equipments (UEs)), and the like.

[0006] One of systems considered in the next generation is an OFDM (Orthogonal Frequency Division Multiplexing) system that can attenuate an inter-symbol interference effect with a low complexity. In the OFDM, serially inputted data symbols are converted into N number of parallel data symbols, which are then included in N number of separated subcarriers, so as to be transmitted. The subcarriers maintain orthogonality in a frequency domain. The respective orthogonal channels experience mutually independent frequency selective fading, and the intervals of transmitted symbols are lengthened to minimize the inter-symbol interference.

[0007] In the OFDM-based wireless communication system, it is important to match time synchronization between a UE and a base station (BS) to minimize interference among users. A random access procedure is performed for uplink synchronization between the UE and the BS. During the random access procedure, the UE matches time synchronization based on a time alignment value transmitted from the BS. When the uplink synchronization is made, the UE runs a time alignment timer. While the time alignment timer is running, the UE and the BS are considered to be in the uplink synchronization. If the time alignment timer expires or does not run, the UE and the BS are not in synchronization, so uplink transmission, except for a random access preamble transmission, is not made.

[0008] In general, when the uplink synchronization has not been made because the time alignment timer expires or does not run, the UE releases control resource and obtains time synchronization, and then reconfigures control resource for uplink transmission.

[0009] In this case, however, if the uplink synchronization has not been made, uplink data could be transmitted only if the uplink synchronization is made. That is, releasing the control resource and reconfiguring it again is ineffective and causes a time delay.

[0010] Thus, a method for effective uplink transmission even when the time alignment timer expires or does not run is required.

SUMMARY

[0011] The present invention provides an apparatus and method for uplink transmission by a UE.

[0012] According to an embodiment of the present invention, there is provided a method for uplink transmission in a wireless communication system, carried by an user equipment, the method comprises detecting an expiry of a time alignment timer in a MAC (Medium Access Control) layer, the time alignment timer being used to control how long the UE is considered uplink time aligned, notifying a release of PUCCH (Physical Uplink Control Channel) resources from the MAC layer to a RRC (Radio Resource Control) layer when the expiry of the time alignment timer is detected and keeping a part of the PUCCH (Physical Uplink Control Channel) resources in the RRC layer.

[0013] The method may further comprise performing a random access for restarting the time alignment timer.

[0014] The method may further comprise resuming the part of PUCCH resource after the time alignment timer is restarted.

[0015] The part of PUCCH resources may be one for transmitting a ACK/NACK (Acknowledgement/Negative-acknowledgement) signal after the time alignment timer is restarted.

[0016] According to another embodiment of the present invention, there is provided a method for uplink transmission in a wireless communication system, carried by an user equipment, the method comprises starting a time alignment timer which is used to control how long the user equipment is considered uplink time aligned, keeping a part of PUCCH resources when the time alignment timer is expired, performing a random access between the user equipment and a base station for restarting the time alignment timer and receiving a message which is used to determine a contention resolution for the random access from the base station.

[0017] The method may further comprise transmitting an ACK/NACK signal for the message, wherein the ACK/NACK signal is transmitted via the part of PUCCH resources.

[0018] Performing the random access may comprise transmitting a random access preamble to the base station after the time alignment timer is expired and restarting the time alignment timer upon receipt of a random access response for the random access preamble, wherein the random access response comprises a timing advance to be applied for restarting the time alignment timer.

[0019] The random access response may further comprise an uplink grant, a random access preamble identifier corresponding to the transmitted random access preamble and a temporary C-RNTI (Cell-Radio Network Temporary Identity).

[0020] Performing the random access may further comprise transmitting a scheduled message indicated by the temporary C-RNTI via the uplink grant to the base station.

[0021] The part of the PUCCH resource may be released if the user equipment does not receive the random access response including the time alignment value within a certain time.

[0022] According to the embodiment of the present invention, when a time alignment timer expires or does not run, uplink time synchronization (uplink time alignment) is quickly made for uplink transmission.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] FIG. **1** illustrates a wireless communication system.

[0024] FIG. **2** illustrates a functional split between an E-UTRAN and an EPC.

[0025] FIG. **3** is a schematic block diagram showing elements of a user equipment (UE).

[0026] FIG. **4** illustrates a radio protocol architecture with respect to a user plane.

[0027] FIG. **5** illustrates a radio protocol architecture with respect to a control plane.

[0028] FIG. **6** illustrates an operation of a UE when a time alignment timer expires.

[0029] FIG. **7** illustrates an operation of a UE when a time alignment timer expires according to an embodiment of the present invention.

[0030] FIG. **8** illustrates an operation of a UE when uplink time alignment is not made within a certain time after the time alignment timer expires.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0031] FIG. **1** illustrates a wireless communication system. The wireless communication system as shown in FIG. **1** may have a network structure of an evolved-universal mobile telecommunications system (E-UMTS). The E-UMTS system may be a long term evolution (LTE) system. The wireless communication system is widely used to provide a variety of communication services such as communication of voice, packet data, etc.

[0032] With reference to FIG. **1**, an E-UTRAN (Evolved-UMTS Terrestrial Radio Access Network) includes a base station (BS) **20** providing a control plane and a user plane.

[0033] A user equipment (UE) **10** may be fixed or mobile and may be referred to by other names such as mobile station (MS), user terminal (UT), subscriber station (SS), wireless device, etc. The BS **20** generally refers to a fixed station that communicates with the UE **10** and may be called by other names such as evolved-Node B (eNB), base transceiver system (BTS), access point, etc. One or more cells may exist in the single BS **20**. An interface for transmission of user traffic or control traffic may be used between BSs **20**. In the following description, downlink may refer to communication from the BS **20** to the UE **10**, and uplink may refer to communication from the UE **10** to the BS **20**.

[0034] The BSs **20** may be connected via an X2 interface. The BSs are connected to evolved packet cores (EPCs), specifically, to mobility management entities (MMEs)/serving gateways (S-GWs) **30** via an S1 interface. The S1 interface supports a many-to-many relation between the BSs **20** and the MME/S-GWs **30**.

[0035] FIG. **2** illustrates a functional split between the E-UTRAN and then EPC.

[0036] With reference to FIG. **2**, shaded blocks (with oblique lines) indicate radio protocol layers, and empty blocks indicate functional entities of the control plane.

[0037] The BSs **20** perform the following functions: (1) Radio resource management (RRM) functions such as radio bearer control, radio admission control, connection mobility control, dynamic resource allocation to a UE; (2) Internet protocol (IP) header compression and encryption of a user data stream; (3) Routing of user plane data to the S-GW; (4) Scheduling and transmission of a paging message; (5) Scheduling and transmission of broadcast information; and (6) Measurement for mobility and scheduling and setting a measurement report.

[0038] The MMEs perform the following functions: (1) Distribution of a paging message to BSs; (2) Security control; (3) Idle state mobility control; (4) SAE bearer control; and (5) Ciphering non-access stratum (NAS) signaling and integrity protection.

[0039] S-GWs perform the following functions: (1) Termination of a user plane packet with respect to paging; and (2) User plane switching to support UE mobility.

[0040] FIG. **3** is a schematic block diagram showing elements of a user equipment. A UE **50** includes a processor **51**, a memory **52**, an RF unit **53**, a display unit **54**, and a user interface unit **55**. The processor **51**, implementing layers of a radio interface protocol, provides a control plane and a user plane. Functions of each layer may be implemented via the processor **51**. The memory **52** is connected to the processor **51** and stores a UE driving system, applications and general files. The display unit **54** displays various information of the UE and may use a well known element such as a liquid crystal display (LCD), an organic light emitting diode (OLED), and the like. The user interface **55** may be a combination of well known user interfaces such as a keypad, a touch screen, and the like. The RF unit **53** is connected to the processor **51** and transmits/receives a radio signal.

[0041] The layers of the radio interface protocol between the UE and a network may be divided into a first layer (L1), a second layer (L2), and a third layer (L3) based on three lower layers of an open system interconnection (OSI) standard model widely known in communication systems. Among them, a physical layer of the first layer provides an information transfer service using a physical channel, and a radio resource control (RRC) layer positioned at the third layer serves to control radio resources between the UE and the network. To this end, the RRC layers exchange an RRC message between the UE and the network.

[0042] FIG. **4** illustrates a radio protocol architecture with respect to the user plane. FIG. **5** illustrates a radio protocol architecture with respect to the control plane, namely, a radio interface protocol architecture between the UE and the E-UTRAN. The data plane is a protocol stack for transmission of user data, and the control plane is a protocol stack for transmission of a control signal.

[0043] With reference to FIGS. **4** and **5**, the physical layer (PHY), the first layer, provides an information transfer service to an upper layer by using a physical channel. The physical layer is connected to an upper medium access control (MAC) layer via a transport channel, and data is transferred between the MAC layer and the physical layer via the transport channel. Meanwhile, between different physical layers, namely, between a physical layer of a transmitting side and

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that of a receiving side, data is transferred via a physical channel. The physical layer may be modulated according to an orthogonal frequency division multiplexing (OFDM) scheme and utilize time and frequency as radio resources.

[0044] The MAC layer of the second layer provides a service to a radio link control (RLC) layer, its upper layer, via a logical channel. The RLC layer of the second layer may support reliable data transmissions. The RLC layer includes three operations modes, namely, a transparent mode (TM), an unacknowledged mode (UM), and an acknowledged mode (AM), according to a data transmission method. The AM RLC provides a bi-directional data transmission service and supports retransmission in the occurrence of a transmission failure of an RLC protocol data unit (PDU).

[0045] A PDCP layer of the second layer performs a header compression function to reduce the size of a header of an IP packet including relatively sizable unnecessary control information, in order to effectively transmit the IP packet such as IPv4 or IPv6 in a radio interface with a relatively small bandwidth.

[0046] A radio resource control (RRC) layer of the third layer is defined only in the control plane. The RRC layer handles the controlling of logical channels, transport channels, and physical channels in relation to configuration, reconfiguration, and release of radio bearers (RBs). The RB refers to a service provided by the second layer (L2) for data transmission between the UE and the E-UTRAN. If there is an RRC connection between the RRC of the UE and that of the network, the UE is in an RRC connected mode, and otherwise, the UE is in an RRC idle mode.

[0047] A non-access stratum (NAS) layer existing at an upper position of the RRC layer serves to perform a function of session management, mobility management, and the like.

[0048] Downlink transport channels for transmitting data from the network to the UE include a broadcast channel (BCH) for transmitting system information, a downlink-shared channel (DL-SCH) for transmitting user traffic or a control message, and the like. Traffic or a control message of a downlink broadcast service may be transmitted via the DL-SCH. Uplink transport channels for transmitting data from the UE to the network include a random access channel (RACH) for transmitting an initial control message and an uplink-shared channel (UL-SCH) for transmitting user traffic or a control message.

[0049] Downlink physical channels mapped to the downlink transport channel include a physical broadcast channel for transmitting information of the BCH, a physical downlink shared channel (PDSCH) for transmitting information of the PCH and the DL-SCH, and a physical downlink control channel (PDCCH) for transmitting control information provided from the first and second layers such as a downlink or uplink radio resource allocation information (i.e., DL/UL Scheduling Grant), and the like. The PDCCH is also called a downlink L1/L2 control channel. Uplink physical channels mapped to the uplink transport channel include a physical uplink shared channel (PUSCH) for transmitting information of the UL-SCH, a physical random access channel (PRACH) for transmitting RACH information, and a physical uplink control channel (PUCCH) for transmitting control information provided by the first and second layers such as an HARQ ACK/NACK signal, a scheduling request signal, a channel quality indicator (CQI), and the like.

[0050] Time alignment will now be described. In the OFDM-based system, time alignment between the UE and the BS is important to minimize interference between users.

[0051] In order for uplink time alignment between the UE and the BS, a random access procedure is performed. Namely, the BS measures a time alignment value (timing advance) via a random access preamble transmitted by the UE, and provides the time alignment value to the UE via a random access response. Upon receipt of the random access response message, the UE applies the time alignment value and starts a time alignment timer. The time alignment timer is used to control how long the UE is considered uplink time aligned. The time alignment timer is valid only in the cell for which it was configured and started. The BS may measure the time alignment value of the UE according to other methods than the random access preamble. In this case, the BS may provide the time alignment value to the UE as necessary.

[0052] With the time alignment timer set, when the UE periodically receives a time alignment command, the UE applies the received time alignment command, then the time alignment timer starts. If the time alignment timer is running, the UE restarts the time alignment timer. If the time alignment timer expired or is not running, the UE performs a random access procedure to obtain uplink time alignment before uplink transmission. When the time alignment timer is expired, the UE shall flush all HARQ buffers, notify RRC to release PUCCH and SRS(Sounding Reference Signal) and clear any configured downlink assignments and uplink grants.

[0053] While the time alignment timer is running, time alignment is maintained between the UE and the BS. If the time alignment timer has expired or is not running, time alignment between the UE and the BS is not maintained. Unless time alignment between the UE and the BS is maintained, the PUCCH resource for scheduling request (SR) and CQI is lost and the UE cannot transmit uplink data except for a random access preamble. Then, the UE starts the random access procedure for time alignment.

[0054] FIG. **6** illustrates an operation of a UE when a time alignment timer expires.

[0055] With reference to FIG. **6**, when the time alignment timer expires, the MAC layer of the UE notifies the RRC layer of the UE of an expiry of the time alignment timer (S**100**). And then, a control resource release command is transmitted from the RRC layer of the UE to the PHY layer of the UE (S**110**). The control resource includes PUCCH, SRS, and the like. In addition, the RRC layer of the UE requests the MAC layer to start the random access procedure.

[0056] The UE transmits a random access preamble to the BS (S**120**). The random access preamble is transmitted from the MAC layer of the UE to the MAC layer of the BS. Upon receipt of the random access preamble, the BS transmits a random access response message to the UE (S**130**). The random access response message includes a time alignment value of the UE, uplink radio resource allocation information, and the like. The random access response message is transmitted from the MAC layer of the BS to the RRC layer of the UE.

[0057] Upon receipt of the random access response message, the UE transmits RRC signaling for uplink transmission from the RRC layer of the UE to the RRC layer of the BS (S**140**). The RRC signaling is transmitted by using the uplink radio resource allocation information included in the random access response message. Upon receipt of the RRC signaling,

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the BS transmits RRC signaling for uplink transmission from its RRC layer to the RRC layer of the UE (S150). In this case, the BS adds control resource information in the RRC signaling and transmits the same. Upon receipt of the control resource information, the UE configures control resource from the RRC layer of the UE to the PHY layer of the UE (S160).

[0058] The UE transmits a scheduling request message to the BS (S170). Upon receipt of the scheduling request message, the BS transmits uplink radio resource allocation information to the UE via the PDCCH (S180). The UE transmits a message including a UE identifier to the BS via allocated uplink radio resource (S190). Steps S180 to S200 are performed between the MAC layer of the UE an the MAC layer of the BS.

[0059] In this manner, when the UE has data to be transmitted to uplink, if the time alignment timer has expired or is not running, the UE obtains time alignment through the random access procedure. However, with reference to FIG. 6, when the time alignment timer has expired, the UE releases the control resource such as PUCCH resource and SRS resource, and receives the newly set control resource from the BS. Here, additional time is required in the process of releasing and reconfiguring the control resource, causing a delay in the uplink data transmission. Thus, a method for quick and effective uplink transmission in case where the time alignment timer expires or is not running is required.

[0060] FIG. 7 illustrates an operation of the UE when the time alignment timer expires according to an embodiment of the present invention.

[0061] With reference to FIG. 7, the time alignment timer of the UE expires (S200). In general, the time alignment timer restarts when a downlink time alignment MAC control element transmitted from the BS to the UE is received. However, if the time alignment MAC control element is not received until the time alignment timer expires, the time alignment timer expires.

[0062] When the time alignment timer expires, the MAC layer of the UE notify the PHY layer to suspend(keep) control resources (S210). The UE notifies RRC of expiry of the time alignment timer and release of the control resource, and transfer keeping the control resource from the RRC layer to PHY layer. The control resources refer to PUCCH resources, SRS resources, and the like. The PUCCH resource may be one for transmitting an ACK/NACK signal. If the uplink time alignment is not obtained, uplink transmission except for the random access preamble, is not made, so the control resource is kept.

[0063] After the control resource is kept, the UE transmits the random access preamble to the BS (S220). This is to obtain uplink time alignment, which corresponds to a contention-based random access procedure. In general, the UE transmits the random access preamble via a selected PRACH resource by using system information received from the BS. The system information includes information regarding an available set of random access preambles, and the UE transmits the random access preamble arbitrarily selected from the set of random access preambles.

[0064] Upon receipt of the random access preamble, the BS transmits a random access response message to the UE (S230). The random access response message includes a time alignment value (timing advance) for uplink alignment, uplink radio resource allocation information (uplink grant), a random access preamble identifier corresponding to the transmitted random access preamble, and a temporary cell-radio network temporary identity (C-RNTI). Upon receipt of the time alignment value, the UE may restart the time alignment timer by applying the time alignment value.

[0065] Upon receipt of the random access response message, the UE transmits a scheduled message including a UE unique identifier by using the uplink radio resource allocation information to the BS (S240). The UE unique identifier may be the C-RNTI or an upper layer identifier. Because the unique identifier is used for a contention resolution, it is also called a contention resolution identifier.

[0066] Upon receipt of the message including the UE unique identifier, the BS transmits a contention resolution message including the uplink radio resource allocation information to the UE (S250). In this case, if the uplink radio resource allocation information is the same as the uplink radio resource allocation information designated by the UE unique identifier which has been transmitted by the UE, the BS determines that the contention has been resolved. Additionally, when a connection release timer expires, the BS releases its connection with the UE. A minimum period of the connection release timer is the sum of the period of the time alignment timer of the UE and time take for performing the random access procedure n number of times.

[0067] Steps S220 and S250 are performed between the MAC layer of the UE and that of the BS. Thus, unlike the related art in which the RRC signaling is performed, uplink alignment can be simply and quickly made.

[0068] After step S250, the control resource which has been kept at the PHY layer of the UE is resumed (S260). The UE receives the time alignment value through the random access procedure, performs uplink alignment, and transmits data to uplink by resuming the control resource which has been kept (S270). The UE transmits the uplink data via the UL-SCH.

[0069] With reference to FIG. 7, if the time alignment timer expires or is not running, the control resource is kept and then the random access procedure for uplink alignment is attempted. Thus, additional time is not required in the process of releasing and reconfiguring the control resource, there is no time delay, and thus, the uplink transmission can be quickly performed.

[0070] FIG. 8 illustrates an operation of the UE when uplink time alignment is not made within a certain time after the time alignment timer expires.

[0071] With reference to FIG. 8, when the time alignment timer expires, the UE starts a release timer (S300). The period of the release timer may be set as time generally taken for performing the random access procedure n times. In addition, the period of the release timer is shorter than that of the connection release timer of the BS.

[0072] Next, the MAC layer of the UE notifies the PHY layer to suspend(keep) the control resource (S310). The control resource includes PUCCH, SRS, and the like.

[0073] After the control resource is kept, the UE transmits the random access preamble to the BS (S320). This is to obtain uplink time alignment, which corresponds to a contention-based random access procedure.

[0074] Next, after the release timer expires (S330), the kept control resource is released (S340). This corresponds to a case where no response message with respect to the transmitted random access preamble is received until when the release timer expires or a case where the random access procedure

fails. When the release timer expires and the kept control resource is released, the BS may release its connection with the UE.

[0075] With reference to FIG. **8**, when the time alignment is not obtained as the time alignment timer expires, the random access procedure is attempted to obtain the uplink alignment. If the random access procedure is not successful within a certain time, the kept resource in the UE may be released and the BS may release its connection with the UE.

[0076] The present invention may be implemented by hardware, software, or their combination. In implementing hardware, hardware may be implemented by ASIC (application specific integrated circuit), DSP (digital signal processing), PLD (programmable logic device), FPGA (field programmable gate array), processor, controller, microprocessor, other electronic unit which have been designed to perform the above-described functions, or their combination. In implementing software, software may be implemented by a module that performs the above-described functions. The software may be stored in the memory unit and executed by the processor. As the memory unit or the processor, various units well known to the person in the art can be employed.

[0077] The preferred embodiments of the present invention have been described with reference to the accompanying drawings, and it will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope of the invention. Thus, it is intended that any future modifications of the embodiments of the present invention will come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A method for uplink transmission in a wireless communication system, carried by an user equipment, the method comprising:

detecting an expiry of a time alignment timer in a MAC (Medium Access Control) layer, the time alignment timer being used to control how long the UE is considered uplink time aligned;

notifying a release of PUCCH (Physical Uplink Control Channel) resources from the MAC layer to a RRC (Radio Resource Control) layer when the expiry of the time alignment timer is detected; and

keeping a part of the PUCCH (Physical Uplink Control Channel) resources in the RRC layer.

2. The method of claim **1**, further comprising performing a random access for restarting the time alignment timer.

3. The method of claim **2**, further comprising resuming the part of PUCCH resource after the time alignment timer is restarted.

4. The method of claim **2**, wherein the part of PUCCH resources are one for transmitting a ACK/NACK (Acknowledgement/Negative-acknowledgement) signal after the time alignment timer is restarted.

5. A method for uplink transmission in a wireless communication system, carried by an user equipment, the method comprising:

starting a time alignment timer which is used to control how long the user equipment is considered uplink time aligned;

keeping a part of PUCCH resources when the time alignment timer is expired;

performing a random access between the user equipment and a base station for restarting the time alignment timer; and

receiving a message which is used to determine a contention resolution for the random access from the base station.

6. The method of claim **5**, further comprising transmitting an ACK/NACK signal for the message, wherein the ACK/NACK signal is transmitted via the part of PUCCH resources.

7. The method of claim **5**, wherein performing the random access comprises transmitting a random access preamble to the base station after the time alignment timer is expired; and

restarting the time alignment timer upon receipt of a random access response for the random access preamble, wherein the random access response comprises a timing advance to be applied for restarting the time alignment timer.

8. The method of claim **7**, wherein the random access response further comprises an uplink grant, a random access preamble identifier corresponding to the transmitted random access preamble and a temporary C-RNTI (Cell-Radio Network Temporary Identity).

9. The method of claim **8**, wherein performing the random access further comprises transmitting a scheduled message indicated by the temporary C-RNTI via the uplink grant to the base station.

10. The method of claim **6**, the part of the PUCCH resource is released if the user equipment does not receive the random access response including the time alignment value within a certain time.

11. An user equipment comprising:

a radio frequency (RF) unit; and

a processor operatively connected with the RF unit and configured to:

detect an expiry of a time alignment timer in a MAC (Medium Access Control) layer, the time alignment timer being used to control how long the UE is considered uplink time aligned;

notify a release of PUCCH (Physical Uplink Control Channel) resources from the MAC layer to a RRC (Radio Resource Control) layer when the expiry of the time alignment timer is detected; and

keep a part of the PUCCH (Physical Uplink Control Channel) resources in the RRC layer.

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