IPR2025-00762
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Page 1



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10863573 **15/935626**12/08/20

7590

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1918 18th St., Unit 4, NW
Washington DC 20009

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To Promote the Progress of Science and Useful Arts

The Director

of the United States Patent and Trademark Office has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this United States

Patent

grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America, and if the invention is a process, of the right to exclude others from using, offering for sale or selling throughout the United States of América, products made by that process, for the term set forth in 35 U.S.C. 154(a)(2) or (c)(1), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b). See the Maintenance Fee Notice on the inside of the cover.

Director of the United States Patent and Trademark Office

ARTIFACT SHEET

Enter artifact number below. Artifact number is application number + artifact type code (see list below) + sequential letter (A, B, C …). The first artifact folder for an artifact type receives the letter A, the second B, etc.. Examples: 59123456PA, 59123456PB, 59123456ZA, 59123456ZB

15935626ZA

Indicate quantity of a single type of artifact received but not scanned. Create individual artifact folder/box and artifact number for each Artifact Type.

☐ CD(s) containing:

- computer program listing — ☐ Doc Code: Artifact — Artifact Type Code: P
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- content unspecified or combined — ☐ Doc Code: Artifact — Artifact Type Code: U
- voluntary electronic submission — ☐ Doc Code: Artifact — Artifact Type Code: T

☐ Stapled Set(s) Color Documents or B/W Photographs
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☐ Confidential Information Disclosure Statement or Other Documents marked Proprietary, Trade Secrets, Subject to Protective Order, Material Submitted under MPEP 724.02, etc.
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1 Other, description: **PATENT GRANT**
Doc Code: Artifact Artifact Type Code: Z

August 31, 2016

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United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/935,626	12/08/2020	10863573	PPA0002US	8564

167455 7590 11/18/2020

Capitol IP Law Group, PLLC
1918 18th St., Unit 4, NW
Washington, DC 20009

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Myung Cheul JUNG, Seoul, KOREA, REPUBLIC OF;
Pantech Corporation, Seoul, KOREA, REPUBLIC OF;
Kang Suk HUH, Seoul, KOREA, REPUBLIC OF;
Jae Hyun AHN, Seoul, KOREA, REPUBLIC OF;
Ki Bum KWON, Seoul, KOREA, REPUBLIC OF;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

PART B – FEE(S) TRANSMITTAL

Complete and send this form, together with the applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

By fax, send to: (571) 273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate " FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Capitol IP Law Group, PLLC
1918 18th St., Unit 4, NW
Washington DC 20009

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO	CONFIRMATION NO
15/935,626	03/26/2018	Myung Cheul JUNG	PPA0002US	8564

TITLE OF INVENTION: METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
NONPROVISIONAL	UNDISCOUNTED	$1000	$0	$0	$1000	11/03/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
KIM, HARRY H	2411	370-328000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363)

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1. Capitol IP Law Group, PLLC
2.
3.

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: PANTECH CORPORATION

(B) RESIDENCE: (CITY and STATE or COUNTRY): SEOUL, KOREA, REPUBLIC OF

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees Submitted: ☑ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment (*Please first reapply any previously paid fee shown above*):

☑ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 603320

5. Change of Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29. NOTE: Absent a valid Certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

☐ Applicant asserting small entity status. See 37 CFR 1.27. NOTE: If the application was previously under micro entity status, checking this box will be taken as a notification of loss of entitlement to micro entity status.

☑ Applicant changing to regular undiscounted fee status. NOTE: Checking this box will be taken as a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Yeasun Yoon, Reg.# 73663/ Date 2020-11-02

Typed or printed name Yeasun Yoon Registration No. 73663

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	15935626
Filing Date:	26-Mar-2018
Title of Invention:	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM
First Named Inventor/Applicant Name:	Myung Cheul JUNG
Filer:	Yeasun Yoon
Attorney Docket Number:	PPA0002US

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1000	1000

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1000**

Electronic Acknowledgement Receipt	
EFS ID:	41016938
Application Number:	15935626
International Application Number:	
Confirmation Number:	8564
Title of Invention:	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM
First Named Inventor/Applicant Name:	Myung Cheul JUNG
Customer Number:	167455
Filer:	Yeasun Yoon
Filer Authorized By:	
Attorney Docket Number:	PPA0002US
Receipt Date:	02-NOV-2020
Filing Date:	26-MAR-2018
Time Stamp:	23:04:45
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1000
RAM confirmation Number	E2020A2N05240761
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Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	PPA0002US-IssueFeeTransmittal.pdf	315369 00e7e1130472ef22e15b2c06b95b22af50687d63	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30279 539c95cb872ee16c2c5c554329698416dd00a388	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	345648		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/935,626	03/26/2018	Myung Cheul JUNG	PPA0002US	8564

7590 09/16/2020

Capitol IP Law Group, PLLC
1918 18th St., Unit 4, NW
Washington, DC 20009

EXAMINER	
KIM, HARRY H	
ART UNIT	PAPER NUMBER
2411	

DATE MAILED: 09/16/2020

PRIORITY ACKNOWLEDGMENT

☑ 1. Receipt is acknowledged of priority papers submitted under 35 U.S.C. 119. The papers have been placed of record in the file.

☐ 2. Applicant's claim for priority, based on papers filed in parent Application Number _____ submitted under 35 U.S.C. 119, is acknowledged.

☐ 3. The priority papers, submitted _____, after payment of the issue fee are

- ☐ acknowledged
  While the priority claim or certified copy filed will be placed in the file record, neither will be reviewed and the patent when published will not include the priority claim.
  See 37 CFR 1.55(a)(2).
- ☐ not acknowledged since the processing fee in 37 CFR 1.17(i) has not been received.

☐ 4. For utility and plant applications filed on or after November 29, 2000, the priority claim is not entered because the claim was not presented within the time limit required by 37 CFR 1.55(a)(1). A petition to accept a delayed claim for priority under 35 U.S.C. 119(a) - (d) or (f), or 365(a) may be filed. See 37 CFR 1.55(c) and MPEP 201.14(a).

/Joe Boris/ for

571-272-4200 or 1-888-786-0101
Application Assistance Unit
Office of Data Management

PTOL-147 (Rev. 03/08)

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NOTICE OF ALLOWANCE AND FEE(S) DUE

167455 7590 08/03/2020

Capitol IP Law Group, PLLC
1918 18th St., Unit 4, NW
Washington, DC 20009

EXAMINER	
KIM, HARRY H	
ART UNIT	PAPER NUMBER
2411	

DATE MAILED: 08/03/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/935,626	03/26/2018	Myung Cheul JUNG	PPA0002US	8564

TITLE OF INVENTION: METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	11/03/2020

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

167455 7590 08/03/2020
Capitol IP Law Group, PLLC
1918 18th St., Unit 4, NW
Washington, DC 20009

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

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(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/935,626	03/26/2018	Myung Cheul JUNG	PPA0002US	8564

TITLE OF INVENTION: METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	11/03/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
KIM, HARRY H	2411	370-328000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required) ❑Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

PTOL-85 Part B (08-18) Approved for use through 01/31/2020 OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/935,626	03/26/2018	Myung Cheul JUNG	PPA0002US	8564

167455 7590 08/03/2020

Capitol IP Law Group, PLLC
1918 18th St., Unit 4, NW
Washington, DC 20009

EXAMINER	
KIM, HARRY H	
ART UNIT	PAPER NUMBER
2411	

DATE MAILED: 08/03/2020

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 02/11)

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 15/935,626	Applicant(s) JUNG et al.	
	Examiner HARRY H KIM	Art Unit 2411	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to 07/08/2020.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-12 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☑ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/H.H.K./ Examiner, Art Unit 2411	/ANDREW LAI/ Supervisory Patent Examiner, Art Unit 2411

5DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Reasons for Allowance

Claims 1-12 are allowed.

The following is an examiner's statement of reasons for allowance:

Regarding claim 1, this claim contains the following underlined features which, when combined with other features of the claim, prior art of record failed to anticipate or render obvious at the time of instant invention was filed:

A method for user equipment receiving multi-flow data with respect to one evolved packet system (EPS) bearer through a macro base station (macro eNB) and a small base station (small eNB) serving a single cell in a wireless communication system supporting dual connectivity,

the method comprising:

receiving packet data convergence protocol (PDCP) packet data units (PDUs) through the macro base station and the small base station;

obtaining PDCP service data units (SDUs) corresponding to the PDCP PDUs; and

receiving from the macro base station information related to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message,

wherein the PDCP SDUs are indicated by a predefined PDCP sequence number (SN),

wherein the RRC message includes a PDCP-configuration information element (IE), and the PDCP-configuration IE includes a field indicating a value of the in-sequence timer.

Note that the closest prior art Ohta et al. (US 2012/0182971, "Ohta") discloses a base station, a mobile station, a communication system, a transmission method and a reordering method. Ohta's disclosure comprises receiving a multi-user packet with a physical layer packet header where a short ID is assigned to each user and the physical layer packet header is followed by physical layer payload. However, the claimed

invention discloses evolved packet system bearer through a wireless communication system supporting dual connectivity. A user equipment (UE) receives packet data convergence protocol (PDCP) packet data units (PDUs) and obtains corresponding PDCP service data units (SDUs) which are indicated by a predefined PDCP sequence number. The UE receives an in-sequence timer for the PDCP SDUs from a macro base station through a radio resource control (RRC) message which includes a PDCP-configuration information element (IE) that includes a field indicating a value of the in-sequence number. In particular, Ohta fails to disclose or render obvious the received in-sequence timer for the PDCP SDUs and how the in-sequence timer is delivered as claimed.

Note that the second closest prior art Yi et al. (US 2010/0304733, "Yi") discloses a method of detecting and handling and endless RLC retransmission. Yi's disclosure describes how to avoid endless RLC re-transmission occurring between a terminal and a network. However, the claimed invention discloses evolved packet system bearer through a wireless communication system supporting dual connectivity. A user equipment (UE) receives packet data convergence protocol (PDCP) packet data units (PDUs) and obtains corresponding PDCP service data units (SDUs) which are indicated by a predefined PDCP sequence number. The UE receives an in-sequence timer for the PDCP SDUs from a macro base station through a radio resource control (RRC) message which includes a PDCP-configuration information element (IE) that includes a field indicating a value of the in-sequence number. In particular, Yi fails to disclose or render obvious the received in-sequence timer for the PDCP SDUs and how the in-sequence timer is delivered as claimed.

Regarding claims 6 and 8, the claims contain similar features as recited in claim 1, thus are allowed for the same reason as stated above.

Regarding claims 2-5, 7 and 9-12, these claims depend from one of claim 1, 6 and 8 and thus are allowed for the same reason stated above for claim 1.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry Kim whose telephone number is 571-272-5009. The examiner can normally be reached on Monday to Friday, 8 A.M to 5 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Andrew Lai can be reached on 571-272-9741. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Harry H. Kim/
Examiner, Art Unit 2411

/ANDREW LAI/
Supervisory Patent Examiner, Art Unit 2411

Notice of References Cited	Application/Control No. 15/935,626	Applicant(s)/Patent Under Reexamination JUNG et al.	
	Examiner HARRY H KIM	Art Unit 2411	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20150373559-A1	12-2015	HONG; Sung-pyo	H04W52/0206	370/329
*	B	US-20120182971-A1	07-2012	OHTA; Yoshiaki	H04W36/023	370/331
*	C	US-20100304733-A1	12-2010	Yi; Seung-June	H04L1/188	455/422.1
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/935,626	JUNG et al.
	Examiner	Art Unit
	HARRY H KIM	2411

CPC - Searched*		
Symbol	**Date**	**Examiner**
H04W76/27 or H04W76/15 or H04W48/20 or H04L47/34 or H04W76/00 or H04L5/00 or H04B7/2612 or H04W16/32 or H04W84/045	05/23/2019	hhk
same as above	11/07/2019	hhk
same as above	04/02/2020	hhk
same as above	07/25/2020	hhk

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
EAST string searched and IDS, Inventors searched	05/23/2019	hhk
EAST string searched	11/07/2019	hhk
EAST string searched and Google searched with keywords of in-sequence timer RRC	04/02/2020	hhk
PE2E string searched and Google searched with keywords of timer in RRC	07/25/2020	hhk

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/935,626	JUNG et al.
	Examiner	Art Unit
	HARRY H KIM	2411

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	US-PGPUB, USPAT	07/25/2020	hhk

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/935,626	JUNG et al.
	Examiner	**Art Unit**
	HARRY H KIM	2411

CPC						
Symbol					**Type**	**Version**
H04W	/	76	/	27	F	2018-02-01
H04B	/	7	/	2612	I	2013-01-01
H04L	/	5	/	00	I	2013-01-01
H04L	/	47	/	34	I	2013-01-01
H04W	/	76	/	15	I	2018-02-01
H04W	/	76	/	00	I	2013-01-01
H04W	/	48	/	20	I	2013-01-01
H04W	/	84	/	045	A	2013-01-01
H04W	/	16	/	32	A	2013-01-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

/HARRY H KIM/ Examiner, Art Unit 2411	25 July 2020	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/ANDREW LAI/ Supervisory Patent Examiner, Art Unit 2411	27 July 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	Fig. 7

U.S. Patent and Trademark Office — Part of Paper No.: 20200724

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Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/935,626	JUNG et al.
	Examiner	**Art Unit**
	HARRY H KIM	2411

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04W	/	76	/	27
H04W	/	76	/	15
H04W	/	76	/	00
H04W	/	48	/	20
H04W	/	84	/	04
H04W	/	16	/	32
H04B	/	7	/	26
H04L	/	5	/	00
H04L	/	12	/	801

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

/HARRY H KIM/ Examiner, Art Unit 2411	25 July 2020	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/ANDREW LAI/ Supervisory Patent Examiner, Art Unit 2411	27 July 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	Fig. 7

U.S. Patent and Trademark Office — Part of Paper No.: 20200724

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Page 25

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/935,626	JUNG et al.
	Examiner	**Art Unit**
	HARRY H KIM	2411

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	10	10												
2	2	11	11												
3	3	12	12												
5	4														
4	5														
6	6														
7	7														
8	8														
9	9														

/HARRY H KIM/ Examiner, Art Unit 2411	25 July 2020	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/ANDREW LAI/ Supervisory Patent Examiner, Art Unit 2411	27 July 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	Fig. 7

U.S. Patent and Trademark Office — Part of Paper No.: 20200724

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/935,626	JUNG et al.
	Examiner	**Art Unit**
	HARRY H KIM	2411

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	05/23/2019	11/07/2019	04/02/2020	07/25/2020					
1	1	✓	✓	✓	=					
2	2				=					
3	3				=					
5	4				=					
4	5				=					
6	6				=					
7	7				=					
8	8				=					
9	9				=					
10	10				=					
11	11				=					
12	12				=					

Bibliographic Data

Application No: 15/935,626

Foreign Priority claimed: (•) Yes ( ) No

35 USC 119 (a-d) conditions met: [✓] Yes [ ] No | [ ] Met After Allowance

Verified and Acknowledged: /HARRY H KIM/ | Examiner's Signature | Initials

Title: METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
03/26/2018	370	2411	PPA0002US
RULE			

APPLICANTS

Pantech Corporation, Seoul, KOREA, REPUBLIC OF

INVENTORS

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Kang Suk HUH, Seoul, KOREA, REPUBLIC OF

Jae Hyun AHN, Seoul, KOREA, REPUBLIC OF

Ki Bum KWON, Seoul, KOREA, REPUBLIC OF

CONTINUING DATA

This application is a CON of 14890407 11/10/2015 PAT 9930720

14890407 is a 371 of PCT/KR2014/004189 05/09/2014

FOREIGN APPLICATIONS

KOREA, REPUBLIC OF 10-2013-0053408 05/10/2013

IF REQUIRED, FOREIGN LICENSE GRANTED**

04/19/2018

STATE OR COUNTRY

KOREA, REPUBLIC OF

ADDRESS

Capitol IP Law Group, PLLC
1918 18th St., Unit 4, NW
Washington, DC 20009
UNITED STATES

FILING FEE RECEIVED

$1,720

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L5	32	(receiv$3 obtain$4) near5 ((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit))) near9 (((macro source primary) adj (BS (base adj station) enb enodeb))) near7 (((micro target small femto pico) adj (BS (base adj station) enb enodeb)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/05/22 03:54 PM
L7	5	L5 same ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/05/22 03:57 PM
L8	24	L5 and (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/05/22 03:59 PM
L9	59	(receiv$3 obtain$4) near5 ((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit))) same ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/05/22 04:16 PM
L11	225	(EPS (evoved adj packet adj system)) same ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/05/22 04:24 PM
L12	57	L11 and (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/05/22 04:24 PM
L13	2	L12 and ((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/05/22 04:28 PM
L14	343	((PDCP (packet near	US-PGPUB; USPAT;	OR	ON	ON	2019/05/22

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Page 29

		data near convergence near protocol)) near3 (PDU (packet near data near unit))) same ((dual double multiple) adj (connection connectivity))	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB				04:54 PM
L15	947	((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit))) and ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/05/22 04:54 PM
L16	77	L15 and (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/05/22 04:55 PM
L18	776	(determin$3 obtain$3 identif$5) near5 (SDU (service adj data adj unit)) near5 (PDU (packet adj data adj unit))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/05/23 08:08 AM
L19	90	(determin$3 obtain$3 identif$5) near5 (SDU (service adj data adj unit)) near5 (accord$3 based correspond$3) near3 (PDU (packet adj data adj unit))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/05/23 08:10 AM
L20	54	L19 and (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/05/23 08:11 AM
L21	147	L18 and (H04W76/27 or H04W76/15 or H04W48/20 or H04L47/34 or H04W76/00 or H04L5/00 or H04B7/2612 or H04W16/32 or H04W84/045).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/05/23 08:11 AM
L22	87	(receiv$3 acquir$3 obtain$3) near7 (PDCP packet near data near convergence near protocol) near3 (PDU packet near data near unit) near7 (master macro primary source) near7 (small target micro secondary pico femto)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/11/07 11:26 AM

L23	35	L22 same (SDU service near data near unit)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/11/07 11:27 AM
L24	7	L22 same (SDU service near data near unit) same (SN sequence near number) same (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/11/07 11:28 AM
L26	20	L23 and (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/11/07 11:28 AM
L27	260	(SDU service near data near unit) with (SN sequence near number) with (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/11/07 11:29 AM
L28	163	L27 and ((master macro primary source) with (small target micro secondary pico femto))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/11/07 11:30 AM
L29	80	L28 and (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/11/07 11:31 AM
L30	4	(receiv$3 obtain$3 acquir$4) near9 (sequence near timer) near9 (SDU service near data near unit) near9 (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/11/07 11:57 AM
L36	4	(sequence near timer) near9 (SDU service near data near unit) near9 (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/11/07 05:54 PM
L37	10	(sequence near timer) near9 (SDU service near data near unit)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/11/07 05:56 PM
L38	2	L37 and (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/11/07 05:56 PM
L41	4	(sequence near timer) with (SDU service near data near unit data near	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2019/11/07 05:58 PM

		unit DU) with (RRC radio near resource near control)	IBM_TDB				
L42	256	(sequence near timer timer) with (SDU service near data near unit data near unit) with (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/11/07 06:05 PM
L43	38	L42 and (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2019/11/07 06:06 PM
L44	2067	(delay near3 backhaul (in near sequence in$1sequence in-sequence) near timer)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/04/02 07:06 PM
L45	54	L44 with (SDU service near data near unit PDU packet near data near unit DU data near unit)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/04/02 07:08 PM
L46	13	L45 same (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/04/02 07:09 PM
L48	5	L45 and (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/04/02 07:09 PM
L49	437	L44 with (SDU service near data near unit PDU packet near data near unit DU data near unit frame data)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/04/02 07:14 PM
L50	16	L49 same (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/04/02 07:15 PM
L52	237	L49 and (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/04/02 07:16 PM
L53	65	L49 same3 (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/04/02 07:16 PM
L54	20	L53 and (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2020/04/02 07:17 PM

			IBM_TDB				
L55	14	L54 and (H04W76/27 or H04W76/15 or H04W48/20 or H04L47/34 or H04W76/00 or H04L5/00 or H04B7/2612 or H04W16/32 or H04W84/045).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/04/02 09:13 PM
L57	41	(receiv$4 acquir$4 obtain$4 transmit$3 send$3 deliver$3) near5 ((sequenc$3 order succession progress$5) NEAR (timer counter clock)) WITH (RRC radio NEAR resource NEAR control)	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/07/23 01:02 AM
L60	17	(receiv$4 acquir$4 obtain$4 transmit$3 send$3 deliver$3) near9 ((sequenc$3 order succession progress$5) NEAR (timer counter clock)) WITH (SDU service NEAR data NEAR unit data NEAR unit packet data frame) WITH (RRC radio NEAR resource NEAR control)	US-PGPUB; USPAT; USOCR; FIT (CN, FR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/07/23 01:04 AM
L61	12	L60 AND (H04W76/27 OR H04W76/15 OR H04W48/20 OR H04L47/34 OR H04W76/00 OR H04L5/00 OR H04B7/2612 OR H04W16/32 OR H04W84/045).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/07/23 01:08 AM
L62	0	L60 AND (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/07/23 01:08 AM
L63	24	L57 AND (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/07/23 01:09 AM
L64	27	L57 AND (H04W76/27 OR H04W76/15 OR H04W48/20 OR H04L47/34 OR H04W76/00 OR H04L5/00 OR H04B7/2612 OR	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	ON	2020/07/24 07:37 PM

		H04W16/32 OR H04W84/045).cpc.					

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N1	27	(receiv$4 acquir$4 obtain$4 transmit$3 send$3 deliver$3) near5 ((sequenc$3 order succession progress$5) NEAR (timer counter clock)) WITH (RRC radio NEAR resource NEAR control)	US-PGPUB; USPAT	OR	ON	ON	2020/07/24 07:36 PM
N2	10	(receiv$4 acquir$4 obtain$4 transmit$3 send$3 deliver$3) near9 ((sequenc$3 order succession progress$5) NEAR (timer counter clock)) WITH (SDU service NEAR data NEAR unit data NEAR unit packet data frame) WITH (RRC radio NEAR resource NEAR control)	US-PGPUB; USPAT	OR	ON	ON	2020/07/24 07:37 PM
N3	26	N1 AND (H04W76/27 OR H04W76/15 OR H04W48/20 OR H04L47/34 OR H04W76/00 OR H04L5/00 OR H04B7/2612 OR H04W16/32 OR H04W84/045).cpc.	US-PGPUB; USPAT	OR	ON	ON	2020/07/24 07:37 PM
N4	23	N3 AND (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT	OR	ON	ON	2020/07/24 07:38 PM

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Examiner: KIM, HARRY H.
Myung Cheul JUNG *et al.*	Group Art Unit: 2411
Application No.: 15/935,626	Confirmation No.: 8564
Filing Date: March 26, 2018	Attorney Docket No.: PPA0002US

Title: METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REPLY AND AMENDMENT UNDER 37 C.F.R. § 1.111

Sir or Madam:

In response to the Non-Final Office Action dated April 8, 2020 ("Office Action"), Applicant respectfully requests reconsideration of the application in view of the following Amendments and Remarks.

Amendments to the Claims begin on page 2.

Remarks begin on page 6.

No extensions of time are required at this time. If extensions of time are necessary to prevent abandonment of this application, then they are petitioned for under 37 C.F.R. § 1.136(a). No fees for net addition of claims are required at this time. Any fees required for extensions of time or for the net addition of claims may be charged to our Deposit Account No. 603320.

AMENDMENTS TO THE CLAIMS LIST

Please **AMEND** claim 1, and **ADD** claims 2-11 as shown below.

This claim list replaces all prior claim lists in the application.

1. (Currently Amended) A method for user equipment receiving multi-flow data with respect to one evolved packet system (EPS) bearer through a macro base station (macro eNB) and a small base station (small eNB) serving a single cell in a wireless communication system supporting dual connectivity, the method comprising:

receiving packet data convergence protocol (PDCP) packet data units (PDUs) through the macro base station and the small base station;

obtaining PDCP service data units (SDUs) corresponding to the PDCP PDUs; and

receiving from the macro base station information related to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message,

wherein the PDCP SDUs are indicated by a predefined PDCP sequence number (SN),

wherein the RRC message includes a PDCP-configuration information element (IE), and the PDCP-configuration IE includes a field indicating a value of the in-sequence timer.

2. (New) The method of claim 1, further comprising:

confirming the respective PDCP SNs of the obtained PDCP SDUs and performing in sequence delivery of the PDCP SDUs to an upper layer from a PDCP entity according to the PDCP SN.

3.(New) The method of claim 2, further comprising:

confirming whether there is a PDCP SDU of PDCP SN #n−1 which is missed notwithstanding obtaining a PDCP SDU of PDCP SN #n; and

driving the in-sequence timer with respect to the PDCP SDU of PDCP SN#n when there is the PDCP SDU of PDCP SN#n−1 which is missed.

4.(New) The method of claim 2, wherein when the in-sequence timer for the PDCP SDU of PDCP SN#n has expired, the PDCP SDU of PDCP SN#n is delivered to the upper layer of the PDCP entity even though there is no PDCP SDU of PDCP SN #n−1.

5.(New) The method of claim 3, wherein before the in-sequence timer for the PDCP SDU of PDCP SN#n has expired, when the PDCP SDU of PDCP SN#n−1 is obtained, the PDCP SDU of PDCP SN#n−1 and the PDCP SDU of PDCP SN#n are delivered to the upper layer according to the order of the PDCP SN.

6.(New) A method for transmitting multi-flow data for one evolved packet system (EPS) bearer to user equipment (UE) from a macro base station (macro eNB) and a small base station (small eNB) serving a single cell in a wireless communication system supporting dual connectivity, the method comprising:

generating packet data convergence protocol (PDCP) packet data units (PDUs) in a PDCP entity with respect to packets received by the macro base station according to a PDCP sequence number (SN) of a PDCP service data unit (SDU);

distributing the PDCP PDUs to radio link control (RLC) entities of the macro base station and RLC entities of the small base station according to a predetermined rule and transmitting the distributed PDCP PDUs to the UE; and

transmitting to the UE a radio resource control (RRC) message including information related to an in-sequence timer for the PDCP SDUs;

wherein the RRC message includes a PDCP-configuration information element (IE), and the PDCP-configuration IE includes a field indicating a value of the in-sequence timer.

7.(New) The method of claim 6, wherein the RRC message including the information related to the in-sequence timer is an RRC connection reconfiguration message.

8.(New) A user equipment (UE) for receiving multi-flow data with respect to one evolved packet system (EPS) bearer through a macro base station (macro eNB) and a small base station (small eNB) serving a single cell in a wireless communication system supporting dual connectivity, the UE comprising:

a receiving unit receiving packet data convergence protocol (PDCP) packet data units (PDUs) through the macro base station and the small base station and receiving from the macro base station information related to in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message; and

a processor obtaining PDCP service data units (SDUs) corresponding to the PDCP PDUs,

wherein the PDCP SDUs are indicated by a predefined PDCP sequence number (SN),

wherein the RRC message includes a PDCP-configuration information element (IE), and

the processor determines the value of in-sequence timer based on the PDCP-configuration IE.

9.(New) The UE of claim 8, wherein the processor confirms the processor confirms the respective PDCP SNs of the obtained PDCP SDUs and performs in-sequence delivery of the PDCP SDUs to an upper layer from a PDCP entity according to the PDCP SN.

10.(New) The UE of claim 9, wherein the processor confirms whether there is a PDCP SDU of PDCP SN #n−1 which is missed notwithstanding obtaining a PDCP SDU of PDCP SN #n; and

drives the in-sequence timer with respect to the PDCP SDU of PDCP SN #n when there is the PDCP SDU of PDCP SN#n−1 which is missed.

11.(New) The UE of claim 10, wherein the processor delivers, when the in-sequence timer for the PDCP SDU of PDCP SN #n has expired, the PDCP SDU of PDCP SN #n to the upper layer of the PDCP entity even though there is no PDCP SDU of PDCP SN #n-1.

12. (New) The UE of claim 10, wherein the processor delivers, before the in-sequence timer for the PDCP SDU of PDCP SN #n has expired, when the PDCP SDU of PDCP SN#n−1 is obtained, the PDCP SDU of PDCP SN#n−1 and the PDCP SDU of PDCP SN #n to the upper layer according to the order of the PDCP SN.

REMARKS

Claim 1 has been amended and claims 2-12 are added. Accordingly, claims 1-12 are currently pending in the Application, of which claims 1, 6 and 8 are independent.

Applicants respectfully submit that the above amendments do not add new matter to the Application and are fully supported by the specification.

In view of the above amendments and the following Remarks, Applicants respectfully request reconsideration and timely withdrawal of the pending objections and rejections for the reasons discussed below.

Rejections Under 35 U.S.C. § 103

Claim 1 is rejected under pre-AIA 35 U.S.C. 103 as being unpatentable over Ohta (Pub. No. US 2012/0182971 A1; hereinafter "Ohta") in view of Yi et al. (Pub. No. US 2010/0304733 A1; hereinafter "Yi") and in view of Hong et al (Pub. No. US 2015/0373559 A1: hereinafter "Hong"). Applicant respectfully travers this rejection for at least the following reasons.

To establish an obviousness rejection under 35 U.S.C. § 103, four factual inquires must be examined. The four factual inquires include (a) determining the scope and contents of the prior art; (b) ascertaining the differences between the prior art and the claims in issue; (c) resolving the level of ordinary skill in the pertinent art; and (d) evaluating evidence of secondary consideration. Graham v. John Deere, 383 U.S. 1, 17-18 (1966).

In view of these four factors, the analysis supporting a rejection under 35 U.S.C. § 103 should be made explicit, and should "identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the [prior art] elements" in the manner claimed. KSR

Int'l. Co. v. Teleflex, Inc., 127 S. Ct. 1727, 82 USPQ2d 1385, 1396(2007). The Federal Circuit requires that "rejections on obviousness cannot be sustained with mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." In re Kahn, 441 F.3d 977,988,78 USPQ2d 1329, 1336(Fed. Cir. 2006).

Finally, even if the prior art may be combined, there must be a reasonable expectation of success, and the reference or references, when combined, must disclose, or suggest every claimed feature. See In re Vaeck, 947 F.2d 488,20 USPQ2d 1438(Fed. Cir. 1991).

Without conceding to the correctness of the Examiner's assertions, independent claim 1 has been amended

The Office Action fails to establish a prima facie case of obviousness of claim 1 at least because even if combined, Ohta, Yi and Hong fail to disclose or suggest every claimed feature.

Claim 1 recites, inter alia, wherein: **" wherein the RRC message includes a PDCP-configuration information element (IE), and the PDCP-configuration IE includes a field indicating a value of the in-sequence timer**" Applicant respectfully submit these elements are not disclosed or fairly suggested in the asserted art.

The Office Action admits:

Ohta as modified by Yi does not specifically disclose the recited claim feature of a timer through a RRC message. Office Action, Page 4.

To address this admitted deficiency, the Office Action cites to Hong, FIG. 7 and paragraphs [0183]-[0184] to allegedly a disclosure "Method for Activating or Deactivating Small Cell and Apparatus Therefore"(Title) as follows : receiving from the macro base station

information relates to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message.

Applicant respectfully disagrees.

As disclosed in Applicant's specification, an in-sequence timer (see, e.g. ¶ ¶ [0109]-[0111] and [0114]-[0119]) takes into account a transmission delay time to pass PDCP SDU to the upper layer with respect to one evolved packet system bearer through a macro base station and a small base station. This is different from a cell activation/deactivation timer which is used for a configured second BS-associated cell.

The disclosed timer of Hong relates to a controlling activation or deactivation a cell that is different than a predetermined cell configured to be activated from among second BS-associated cells, not an in-sequence timer as presently claimed. As disclosed in Hong:

> The generated activation-related indication information is transmitted to the UE 703 through a MAC signaling in step S730, and **the UE 703 activates or deactivates a second BS-associated cell based on the received activation-related indication information** in step S740. **The UE 703 maintains a second BS-associated cell deactivation timer, for a configured second BS-associated cell**. When the second BS-associated cell deactivation timer expires, the UE 703 may deactivate a second BS-associated cell that is associated with the expiration. **The second BS-associated cell deactivation timer may be configured by an RRC**. The first BS 701 may not quickly acknowledge information associated with an activated state of a second BS secondary cell due to a non-ideal backhaul delay, and thus, the deactivation timer may define and configure a field that is different from a secondary cell deactivation timer (sCellDeactivationTimer-r10) of the first BS 701.

Hong, ¶¶ [0184]~[01845] (emphasis added). As such, Applicant respectfully submits that Hong discloses a cell activation/deactivation timer.

Hong disclose that "the second BS-associated cell deactivation timer may be configured by an RRC." Hong¶¶[0185].

However, Hong does not disclose "**the RRC message includes a PDCP-configuration information element (IE), and the PDCP-configuration IE includes a field indicating a value of the in-sequence timer.**"

Accordingly, for at least the reasons noted above, the office action fails to establish a prima facie case of obviousness of claim 1 at least because even if combined, Ohta in view of Yi and in view of Hong fail to disclose or suggest every claimed feature.

Since none of the alleged prior art of record, whether taken alone or in any combination, discloses or suggests all the features of the claimed subject matter, Applicants respectfully submit that independent claim 1 is allowable.

Accordingly, Applicant respectfully request withdrawal of the 35 U.S.C § 103 rejection of claim 1.

Added New Claims

Added claims 2-12 are directed to additional features [aspects] of the invention, which are not disclosed or suggested in the art of record. As each of these claims reflect the features discussed above, these claims are allowable for reasons similar to claim 1.

Specifically, independent claims 6 and 8 include similar features as recited above with respect to claim 1 should be deemed allowable for similar reason.

Claims 2-5 depend from claim 1, claim 7 depends from 6, and claims 9-12 depend from 8, respectively, and are allowable at least for the following reason: since none of the alleged prior art of record, whether taken alone or in any combination, discloses or suggests all the features of the claimed subject matter, Applicants respectfully submit that independent claims 1, 6, 8 and all the claims that depend therefrom, are allowable.

CONCLUSION

A full and complete response has been made to the pending Office Action, and all of the stated objections and grounds for rejection have been overcome or rendered moot. Accordingly, all pending claims are allowable, and the application is in condition for allowance.

The Examiner is invited to contact Applicant's undersigned representative at the number below if it would expedite prosecution. Prompt and favorable consideration of this Reply is respectfully requested.

Respectfully submitted,

/Yeasun Yoon, Reg.# 73663/

Yeasun Yoon
Reg. No. 73,663

Date: July 8, 2020

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Electronic Acknowledgement Receipt	
EFS ID:	39946909
Application Number:	15935626
International Application Number:	
Confirmation Number:	8564
Title of Invention:	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM
First Named Inventor/Applicant Name:	Myung Cheul JUNG
Customer Number:	167455
Filer:	Yeasun Yoon
Filer Authorized By:	
Attorney Docket Number:	PPA0002US
Receipt Date:	08-JUL-2020
Filing Date:	26-MAR-2018
Time Stamp:	16:35:40
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		PPA0002US-nfoareply_.pdf	2101071 2268ec30449a8d24e53f211bf53b0a05ec5ed28b	yes	10

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	10
Warnings:			
Information:			
	Total Files Size (in bytes):	2101071	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/935,626	Filing Date 03/26/2018	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	07/08/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 12	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $460 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	SLIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/DIANIECE M JACOBS/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
15/935,626	03/26/2018	2411	1720	PPA0002US	1	1

CONFIRMATION NO. 8564

CORRECTED FILING RECEIPT

167455
Capitol IP Law Group, PLLC
1918 18th St., Unit 4, NW
Washington, DC 20009

OC000000117401048

Date Mailed: 06/03/2020

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Myung Cheul JUNG, Seoul, KOREA, REPUBLIC OF;
Kang Suk HUH, Seoul, KOREA, REPUBLIC OF;
Jae Hyun AHN, Seoul, KOREA, REPUBLIC OF;
Ki Bum KWON, Seoul, KOREA, REPUBLIC OF;

Applicant(s)

Pantech Corporation, Seoul, KOREA, REPUBLIC OF;

Power of Attorney: The patent practitioners associated with Customer Number 167455

Domestic Priority data as claimed by applicant

This application is a CON of 14/890,407 11/10/2015 PAT 9930720
which is a 371 of PCT/KR2014/004189 05/09/2014

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2013-0053408 05/10/2013 No Access Code Provided

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 04/19/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/935,626**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Title

METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

Preliminary Class

370

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign

patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/935,626	03/26/2018	Myung Cheul JUNG	PPA0002US

CONFIRMATION NO. 8564

167455
Capitol IP Law Group, PLLC
1918 18th St., Unit 4, NW
Washington, DC 20009

POA ACCEPTANCE LETTER

OC000000117400908

Date Mailed: 06/03/2020

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/01/2020.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/ggasgedom/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/935,626	03/26/2018	Myung Cheul JUNG	P6672USC1

CONFIRMATION NO. 8564

58027
H.C. PARK & ASSOCIATES, PLC
1894 PRESTON WHITE DRIVE
RESTON, VA 20191

POWER OF ATTORNEY NOTICE

OC000000117400883

Date Mailed: 06/03/2020

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/01/2020.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/ggasgedom/

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Examiner: KIM, HARRY H
Myung Cheul JUNG et al.	Group Art Unit: 2411
Application No.: 15/935,626	Confirmation No.: 8564
Filing Date: March 26, 2018	Attorney Docket No.: PPA0002US

Title: METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR CORRECTED OFFICIAL FILING RECEIPT

Sir or Madam:

Applicant respectfully request for a corrected Official Filing Receipt for the above-identified patent application. In particular, it is requested that the Applicant name be changed to "Pantech Corporation", as indicated in the accompanying marked-up Application Data Sheet, marked-up Official Filing Receipt, and Request to Change The Applicant Under 37 CFR 1.46(c)(2) (PTO/AIA/41). Applicant also requests that the Attorney Docket Number be updated to "PPA0002US" and Customer Number to "167455".

Respectfully submitted,

/Yeasun Yoon, Reg.# 73663/

Yeasun Yoon
Reg. No. 73,663

Date: June 1, 2020

CUSTOMER NO. 167455
Capitol IP Law Group, PLLC

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
15/935,626	03/26/2018		1720	~~P6672USC1~~ PPA0002US	1	1

CONFIRMATION NO. 8564

58027
H.C. PARK & ASSOCIATES, PLC
1894 PRESTON WHITE DRIVE
RESTON, VA 20191

FILING RECEIPT

OC000000098922237

Date Mailed: 04/20/2018

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Myung Cheul JUNG, Seoul, KOREA, REPUBLIC OF;
Kang Suk HUH, Seoul, KOREA, REPUBLIC OF;
Jae Hyun AHN, Seoul, KOREA, REPUBLIC OF;
Ki Bum KWON, Seoul, KOREA, REPUBLIC OF;

Applicant(s)

Pantech Corporation ~~PANTECH INC.~~, Seoul, KOREA, REPUBLIC OF;

Power of Attorney: The patent practitioners associated with Customer Number ~~58027~~ 167455

Domestic Priority data as claimed by applicant

This application is a CON of 14/890,407 11/10/2015 PAT 9930720
which is a 371 of PCT/KR2014/004189 05/09/2014

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2013-0053408 05/10/2013

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 04/19/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/935,626**

Projected Publication Date: 07/26/2018

Non-Publication Request: No

Early Publication Request: No

Title

METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop

technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

ONEPLUS - EX. 1002
Page 58

Electronic Acknowledgement Receipt

EFS ID:	39592937
Application Number:	15935626
International Application Number:	
Confirmation Number:	8564
Title of Invention:	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM
First Named Inventor/Applicant Name:	Myung Cheul JUNG
Customer Number:	58027
Filer:	Yeasun Yoon
Filer Authorized By:	
Attorney Docket Number:	P6672USC1
Receipt Date:	01-JUN-2020
Filing Date:	26-MAR-2018
Time Stamp:	22:07:04
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	PPA0002US-poa.pdf	1663292 54c40996e6a8b302268ab82387297eadbce ca29b	no	2

Warnings:

Information:					
2	Assignee showing of ownership per 37 CFR 3.73	PPA0002US-373.pdf	162669 00c8191ec14ff0c34751357f559b10743e7caf02	no	3
Warnings:					
Information:					
3	Miscellaneous Incoming Letter	PPA0002US-requestchangeapplicant.pdf	215032 81485715e91fee392a8ad0418b1f09e17d19ef4d	no	2
Warnings:					
Information:					
4	Application Data Sheet	PPA0002US-markedupads.pdf	998187 462b2169339e7fd2637a93b937b28ef429452a29	no	9
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
5	Request for Corrected Filing Receipt	PPA0002US-reqeustcfr_.pdf	163539 dcb73e79ead92d33686f55ca5c5f66b526b72a34	no	1
Warnings:					
Information:					
6	Request for Corrected Filing Receipt	PPA0002US-markedupofr_.pdf	4092325 cced103dc0e5101a708fc9b28e8f68ac22c0e0c4	no	4
Warnings:					
Information:					
		Total Files Size (in bytes):	7295044		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/AIA/80 (07-17)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no person is required to respond to a collection of information unless it displays a valid OMB control number

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

☑ Practitioners associated with Customer Number: 167455

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

☑ The address associated with Customer Number: 167455

OR

☐

Firm or individual name		
Address		
City	State	Zip
Country		
Telephone	Email	

Assignee name and address: Pantech Corporation
8 Yangjaecheonmo-21gil, Suite 402, Seocho-gu
Seoul 06748 Republic of Korea

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee.

Signature	Date 4/24/2020
Name YangWon Jung	Telephone 82-10-2250-9592
Title Vice President	

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 18 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PTO/AIA/96 (08-12)
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

Application No./Patent No.: 15/935,626 Filed/Issue Date: 03-26-2018

Titled: METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

Pantech Corporation, a Corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: JUNG, MYUNG CHEUL et al. To: PANTECH CO., LTD.

   The document was recorded in the United States Patent and Trademark Office at Reel 037006, Frame 0013, or for which a copy thereof is attached.

2. From: JUNG, MYUNG CHEUL et al. To: PANTECH INC.

   The document was recorded in the United States Patent and Trademark Office at Reel 044786, Frame 0742, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450**.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/96 (08-12)
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STATEMENT UNDER 37 CFR 3.73(c)

3. From: PANTECH INC. To: PANTECH CORPORATION

The document was recorded in the United States Patent and Trademark Office at
Reel 052662, Frame 0609, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Yeasun Yoon, Reg.# 73663/	2020-06-01
Signature	Date
Yeasun Yoon	73663
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
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8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Doc Code: R46C.REQ
Document Description: Request under 37 CFR 1.46(c) to correct, update or change the applicant.

PTO/AIA/41 (04-15)
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REQUEST TO CORRECT OR UPDATE THE NAME OF THE APPLICANT UNDER 37 CFR 1.46(c)(1), OR CHANGE THE APPLICANT UNDER 37 CFR 1.46(c)(2)

(FOR USE ONLY IN APPLICATIONS FILED ON OR AFTER SEPTEMBER 16, 2012)

Application Number	15/935,626
Filing Date	03-26-2018
First Named Inventor	Myung Cheul JUNG
Art Unit	2411
Examiner Name	KIM, HARRY H
Practitioner Docket Number	PPA0002US

To: Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Applicant hereby **requests that the name of the applicant be corrected or updated under 37 CFR 1.46(c)(1), or that the applicant be changed under 37 CFR 1.46(c)(2),** in the above-identified application. **Requests under 37 CFR 1.46(c)(1) or (c)(2) cannot be submitted after payment of the issue fee or if the application has been patented.**

Please check the applicable box(es) below.

☐ 1. This request is to **correct or update the name of the applicant** (**under 37 CFR 1.46(c)(1)**) and includes:

☐ An application data sheet (ADS) in accordance with 37 CFR 1.76(c) with the corrected or updated information shown with markings (*e.g.*, underlining for insertions, strikethrough for deletions). A Corrected Web-based ADS may be used.

Note: Requests under 37 CFR 1.46(c)(1) may be filed to correct typographical errors in the name of the § 1.46 applicant, or for updating the name of the § 1.46 applicant (*i.e.*, where there is no change in the applicant itself but just in the applicant's name). See the Manual of Patent Examining Procedure (MPEP) section 605.01.

■ 2. This request is to **change the applicant** (**under 37 CFR 1.46(c)(2)**) and includes:

■ An application data sheet (ADS) in accordance with 37 CFR 1.76(c) that identifies the changes with proper markings (underlining for insertions and strikethrough for deletions). A Corrected Web-based ADS may be used.

■ A Statement Under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent). See MPEP 325.

I am the

☐ applicant* ■ attorney or agent of record Registration number 73663 ☐ attorney or agent acting under 37 CFR 1.34 Registration number _____

Signature /Yeasun Yoon, Reg.# 73663/

Typed or printed name Yeasun Yoon

Date 2020-06-01

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. *Juristic entities must be represented by a patent practitioner (See 37 CFR 1.31, applicable to any paper filed on or after September 16, 2012 that is presented on behalf of a juristic entity, regardless of application filing date). Submit multiple forms if more than one signature is required, see below**.

☐ ** Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.36. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	~~P6672USC1~~ PPA0002US
	Application Number	15/935,626
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Myung Cheul		JUNG	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence [i]	KR

Mailing Address of Inventor:

Address 1	(Pantech R&D Center Bldg., Sangam-dong)		
Address 2	179 Seongam-ro, Mapo-gu		
City	Seoul	**State/Province**	
Postal Code	121-904	**Country** [i]	KR

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Kang Suk		HUH	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence [i]	KR

Mailing Address of Inventor:

Address 1	(Pantech R&D Center Bldg., Sangam-dong)		
Address 2	179 Seongam-ro, Mapo-gu		
City	Seoul	**State/Province**	
Postal Code	121-904	**Country** [i]	KR

Inventor 3 Remove

Legal Name

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	~~P6672USC1~~ PPA0002US
	Application Number	15/935,626
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

Prefix	Given Name	Middle Name	Family Name	Suffix
	Jae Hyun		AHN	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence [i]	KR

Mailing Address of Inventor:

Address 1	(Pantech R&D Center Bldg., Sangam-dong)		
Address 2	179 Seongam-ro, Mapo-gu		
City	Seoul	**State/Province**	
Postal Code	121-904	**Country** [i]	KR

Inventor 4 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Ki Bum		KWON	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence [i]	KR

Mailing Address of Inventor:

Address 1	(Pantech R&D Center Bldg., Sangam-dong)		
Address 2	179 Seongam-ro, Mapo-gu		
City	Seoul	**State/Province**	
Postal Code	121-904	**Country** [i]	KR

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	~~58027~~ 167455		
Email Address	patent@capitoliplaw.com	Add Email	Remove Email

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	~~P6672USC1~~ PPA0002US
	Application Number	15/935,626
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

Application Information:

Title of the Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM		
Attorney Docket Number	~~P6672USC1~~ PPA0002US	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	15	**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	~~58027~~ 167455		

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	Application Number	15/935,626
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15/935,626	Continuation of	14890407	2015-11-10
Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14890407	a 371 of international	PCT/KR2014/004189	2014-05-09

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

			Remove
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2013-0053408	KR	2013-05-10	

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	~~P6672USC1~~ PPA0002US
	Application Number	15/935,626
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	~~P6672USC1~~ PPA0002US
	Application Number	15/935,626
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

(◉) Assignee	( ) Legal Representative under 35 U.S.C. 117	( ) Joint Inventor
( ) Person to whom the inventor is obligated to assign.	( ) Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name: ~~PANTECH I INC.~~ Pantech Corporation

Mailing Address Information For Applicant:

Address 1	~~179 Seongam-ro Mapo-gu~~ 8 Yangjaecheonro-21gil, Suite 402, Seocho-gu		
Address 2			
City	Seoul	**State/Province**	06748
Country KR		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button.

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	~~P6672USC1~~ PPA0002US
	Application Number	15/935,626
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	**/Yeasun Yoon, Reg.# 73663/**			Date (YYYY-MM-DD)	**2020-06-01**
First Name	**Yeasun**	Last Name	**Yoon**	Registration Number	**73663**

Additional Signature may be generated within this form by selecting the Add button.

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	~~P6672USC1~~ PPA0002US
	Application Number	15/935,626
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent CooperationTreaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT6106526

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
PANTECH INC.	05/06/2020

RECEIVING PARTY DATA

Name:	PANTECH CORPORATION
Street Address:	8 YANGJAECHEONRO-21GIL, SUITE 402, SEOCHO-GU
City:	SEOUL
State/Country:	KOREA, REPUBLIC OF
Postal Code:	06748

PROPERTY NUMBERS Total: 208

Property Type	Number
Patent Number:	8811268
Patent Number:	8995372
Patent Number:	9246841
Patent Number:	9554341
Patent Number:	9961648
Patent Number:	10299224
Patent Number:	10074345
Patent Number:	9491210
Patent Number:	9152479
Patent Number:	9101047
Patent Number:	9763283
Patent Number:	9930720
Patent Number:	9236993
Patent Number:	8665982
Patent Number:	8908490
Patent Number:	8867655
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Patent Number:	8953553
Patent Number:	8855002
Patent Number:	8892122

Property Type	Number
Patent Number:	10050754
Patent Number:	10090903
Patent Number:	9042881
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Patent Number:	8284975
Patent Number:	7738669
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Patent Number:	7088772
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Patent Number:	9686160
Patent Number:	10140014
Patent Number:	9448652

Property Type	Number
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Patent Number:	7020495
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Patent Number:	6810071
Patent Number:	6692275
Patent Number:	6788028
Patent Number:	6549761
Patent Number:	6393280
Patent Number:	6993329
Patent Number:	7020194
Patent Number:	6754667
Application Number:	15935626
Application Number:	14890409
Application Number:	14473451
Application Number:	14300525
Application Number:	14245884
Application Number:	16135571
Application Number:	13594023

CORRESPONDENCE DATA

Fax Number:	(703)643-9789

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Phone:	5712064847
Email:	patent@capitoliplaw.com
Correspondent Name:	CAPITOL IP LAW GROUP, PLLC
Address Line 1:	1918 18TH ST., UNIT 4, NW
Address Line 4:	WASHINGTON, D.C. 20009

ATTORNEY DOCKET NUMBER:	PA02PANTECHINCTOCORP
NAME OF SUBMITTER:	YEASUN YOON
SIGNATURE:	/yoon/
DATE SIGNED:	05/14/2020
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 23

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CONFIRMATORY ASSIGNMENT OF PATENT RIGHTS

This CONFIRMATORY ASSIGNMENT OF PATENT RIGHTS (this "**Assignment**") is made this 6 day of May 2020, by **Pantech Inc.**(Registration No. 110111-5868736), a Korean company ("**Assignor**"), in favor of **Pantech Corporation.**(Registration No. 110111-7302063), a Korean company ("**Assignee**").

WHEREAS, Assignor and Assignee are party to that certain Patent Sale and Purchase Agreement of even date herewith (as in effect from time to time, the "**Intellectual Property Sale and Purchase Agreement**"); capitalized terms used but not otherwise defined in this Assignment shall have the respective meaning assigned thereto in the Patent Sale and Purchase Agreement; and

WHEREAS, pursuant to the Patent Sale and Purchase Agreement, Assignor has agreed to sell, convey, transfer, assign and deliver to Assignee all right, title and interest, including, without limitation, Patent Rights, in and to the patents, provisional patent applications, and patent applications listed on listed on Schedule A hereto (collectively, the "**Patents**").

NOW, THEREFORE, for good and valuable consideration, receipt of which is hereby acknowledged by Assignor, Assignor hereby sells, conveys, transfers, and assigns to Assignee, its successors, legal representatives and assigns all right, title and interest in the United States and throughout the world in and to:

The Patents and any and all letters patent that are or may be granted thereon, and any legal equivalent and counterpart thereof that may be granted in any country or countries foreign to the United States, in each case including without limitation any extensions, substitutes, continuations, continuations-in-part, divisions, reissues, reexaminations, and renewals thereof, or other equivalents thereof, and further, all rights and privileges pertaining to the Patents and any and all letters patent that are or may be granted thereon, and any legal equivalent thereof that may be granted in any country or countries foreign to the United States as well as all inventions, invention disclosures, and discoveries described in any of the foregoing and including, without limitation, the right, if any, to petition, sue or otherwise seek and recover damages, profits and any other remedy (monetary, injunctive, declaratory or other relief or remedy of any kind) in the United States and anywhere throughout the world for any past, present and future infringement thereof, conversion or misappropriation of, or other injury, offense, violation, breach of duty or wrong relating to, any of the Patents, or any license, agreement, contract or other matter relating thereto.

Assignor hereby authorizes and requests the Commissioner of Patents and Trademarks of the United States of America and the appropriate officers of all other jurisdictions in which the Patents are or may be registered or in which applications included among the Patents are pending, to record the title of Assignee, its successors, legal representatives and assigns, as owner of all right, title and interest in and to the Patents, and to issue to Assignee, its successors, legal representatives and assigns, all letters patent and any legal equivalent thereof that may be granted in any country or countries foreign to the United States and recordations of patent rights resulting from any application included among the Patents, according to this instrument.

Except to the extent that federal law preempts state law with respect to the matters covered hereby, this Assignment shall be governed by and construed in accordance with the laws of the State of Delaware, without giving effect to any of the principles of conflicts of laws thereof that would result in the application of the laws of another jurisdiction to this Assignment.

This Assignment will inure to the benefit of Assignee, its successors, assigns, and other legal representatives and will be binding upon Assignor, its successors, assigns, and other legal representatives.

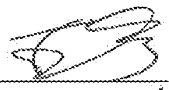
Assignor has the full power and authority, and has obtained all Third Party consents, approvals and/or other authorizations required to enter into this Assignment and to carry out its obligations hereunder.

If Assignee is unable for any reason to secure Assignor's or its affiliates or their respective successors' or assigns' signature to any document it is entitled to under this Assignment, Assignor and its affiliates hereby irrevocably designate and appoint Assignee, and Assignee's duly authorized officers, agents and representatives, as its agents and attorneys-in-fact, coupled with an interest, with full power of substitution to act for and on the behalf and instead of Assignor, to execute and file any such document or documents and to do all other lawfully permitted acts to further the purposes of this Assignment with the same legal force and effect as if executed by Assignor.

IN WITNESS WHEREOF, Assignor has caused this Assignment to be executed by its duly authorized officer, as of the date first written above.

ASSIGNOR:

Pantech Inc.

By: 

Name: KIM BYEONG JIN

Title: C.E.O

Schedule A

Country	Application #	Application Date	Issued #	Issued Date
US	13/518326	2010-12-10	8811268	2014-08-19
US	13/638507	2011-03-29	8995372	2015-03-31
US	14/356143	2012-10-24	9246841	2016-01-26
US	14/374604	2013-01-17	9554341	2017-01-24
US	14/782468	2014-03-26	9961648	2018-05-01
KR	2013-0037322	2013-04-05	2037388	2019-10-22
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/935,626	03/26/2018	Myung Cheul JUNG	P6672USC1	8564

58027 7590 04/08/2020

H.C. PARK & ASSOCIATES, PLC
1894 PRESTON WHITE DRIVE
RESTON, VA 20191

EXAMINER	
KIM, HARRY H	

ART UNIT	PAPER NUMBER
2411	

NOTIFICATION DATE	DELIVERY MODE
04/08/2020	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PATENT@PARK-LAW.COM

Office Action Summary	**Application No.** 15/935,626	**Applicant(s)** JUNG et al.	
	Examiner HARRY H KIM	**Art Unit** 2411	**AIA (FITF) Status** Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 03/13/2020.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Response to Arguments

Applicant's arguments filed on 08/29/2019 regarding priority date of previously identified prior art, Zhang et al. (US 2015/0215827) have been deemed persuasive. Therefore, the rejections in the previous Office Action mailed 05/29/2019 have been withdrawn hereby. However, up further search and consideration, newly identified prior art is found to have adequately taught the claimed features and thus applied in instant Office Action as detailed below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim(s) 1 rejected under 35 U.S.C. 103 as being unpatentable over Ohta et al. (US 2012/0182971, "Ohta") in view of Yi et al. (US 2010/0304733, "Yi").

Examiner's note: in what follows, references are drawn to Ohta unless otherwise mentioned.

Ohta discloses "Base Station, Mobile Station, Communication System, Transmission Method and Reordering Method" (Title) where "A mobile station, that includes a receiving means for receiving first PDCP PDU from a source base station and a receiving means for receiving second PDCP-PDU from a target base station" Abstract.

Ohta's invention comprises the following features:

Regarding claim 1, a method for user equipment receiving multi-flow data with respect to one evolved packet system (EPS) bearer through **a macro base station (macro eNB)** (Fig. 1; Source Base Station 11a) **and a small base station (small eNB)** (Fig. 1; Target Base Station 11b), the method comprising:

receiving packet data convergence protocol (PDCP) packet data units (PDUs) through the macro base station ([Claim 1] "a receiving means for receiving first PDCP PDU from a source base station") **and the small base station** ([Claim 1] "a receiving means for receiving second PDCP-PDU from a target base station");

obtaining PDCP service data units (SDUs) corresponding to the PDCP PDUs ([claim 1] "a storage means for storing PDCP SDU conforming to the first PDCP PDU and the PDCP SDU conforming to the second PDCP PDU").; and

receiving from the macro base station information related to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message (Note that Ohta does not specifically teach about a timer through a RRC message. This will be discussed in view of Yi.),

wherein **the PDCP SDUs are indicated by a predefined PDCP sequence number (SN)** ([Claim 1] "a reordering means for performing in order delivery of the

stored PDCP SDUs based on the sequence numbers.", and [0029] "In the PDCP layer, the transmitting side compresses the upper protocol header, as well as attaches a sequence number and performs transmission." Thus, it is clear that the sequence numbers are predetermined at the transmitter side.).

It is noted that while disclosing receiving PDCP PDUs from a dual connectivity, Ohta does not specifically teach about a timer through a RRC message. It, however, had been known in the art at the time of instant application as shown by Hong in a disclosure "Method for Activating or Deactivating Small Cell and Apparatus Therefor" (Title) as follows; **receiving from the macro base station information related to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message** ([Hong, 0183 and Fig. 7] "The generated activation-related indication information is transmitted to the UE 703 through a MAC signaling in step S730, and the UE 703 activates or deactivates a second BS-associated cell based on the received activation-related indication information in step S740.",and [Hong, 0184] "The UE 703 maintains a second BS-associated cell deactivation timer, for a configured second BS-associated cell. When the second BS-associated cell deactivation timer expires, the UE 703 may deactivate a second BS-associated cell that is associated with the expiration. The second BS-associated cell deactivation timer may be configured by an RRC. The first BS 701 may not quickly acknowledge information associated with an activated state of a second BS secondary cell due to a non-ideal backhaul delay, and thus, the deactivation timer may define and configure a field that is different from a secondary cell deactivation timer (sCellDeactivationTimer-r10) of the first BS 701.").

It, therefore, would have been obvious to one of ordinary skill in the art at the time of instant application to modify Ohta's features by using the features of Hong in order to provide an effective way for data traffic such that “the power consumption of the UE may be reduced, and a method and system for activating or deactivating a small cell appropriate for data traffic” [Hong, 0017].

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry H. Kim whose telephone number is 571-272-5009 and email address is harry.kim2@uspto.gov. The examiner can normally be reached on 7:30a~5:00p.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Andrew Lai can be reached at 571-272-9741. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/HARRY H KIM/
Examiner, Art Unit 2411

Notice of References Cited	Application/Control No. 15/935,626	Applicant(s)/Patent Under Reexamination JUNG et al.	
	Examiner HARRY H KIM	Art Unit 2411	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20150373559-A1	12-2015	HONG; Sung-pyo	H04W52/0206	370/329
*	B	US-20120182971-A1	07-2012	OHTA; Yoshiaki	H04L47/10	370/331
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/935,626	JUNG et al.
	Examiner	Art Unit
	HARRY H KIM	2411

CPC - Searched*		
Symbol	**Date**	**Examiner**
H04W76/27 or H04W76/15 or H04W48/20 or H04L47/34 or H04W76/00 or H04L5/00 or H04B7/2612 or H04W16/32 or H04W84/045	05/23/2019	hhk
same as above	11/07/2019	hhk
same as above	04/02/2020	hhk

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
EAST string searched and IDS, Inventors searched	05/23/2019	hhk
EAST string searched	11/07/2019	hhk
EAST string searched and Google searched with keywords of in-sequence timer RRC	04/02/2020	hhk

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/935,626	JUNG et al.
	Examiner	Art Unit
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✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS										
☐ Claims renumbered in the same order as presented by applicant					☐ CPA		☐ T.D.		☐ R.1.47	
CLAIM		DATE								
Final	Original	05/23/2019	11/07/2019	04/02/2020						
	1	✓	✓	✓						

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S5	32	(receiv$3 obtain$4) near5 ((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit))) near9 (((macro source primary) adj (BS (base adj station) enb enodeb))) near7 (((micro target small femto pico) adj (BS (base adj station) enb enodeb)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 15:54
S7	5	S5 same ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 15:57
S8	24	S5 and (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 15:59
S9	59	(receiv$3 obtain$4) near5 ((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit))) same ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:16
S11	225	(EPS (evoved adj packet adj system)) same ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:24
S12	57	S11 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:24
S13	2	S12 and ((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:28

S14	343	((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit))) same ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:54
S15	947	((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit))) and ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:54
S16	77	S15 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:55
S18	776	(determin$3 obtain$3 identif$5) near5 (SDU (service adj data adj unit)) near5 (PDU (packet adj data adj unit))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/23 08:08
S19	90	(determin$3 obtain$3 identif$5) near5 (SDU (service adj data adj unit)) near5 (accord$3 based correspond$3) near3 (PDU (packet adj data adj unit))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/23 08:10
S20	54	S19 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/23 08:11
S21	147	S18 and (H04W76/27 or H04W76/15 or H04W48/20 or H04L47/34 or H04W76/00 or H04L5/00 or H04B7/2612 or H04W16/32 or H04W84/045).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/23 08:11
S22	87	(receiv$3 acquir$3 obtain$3) near7 (PDCP packet near data near convergence near protocol) near3 (PDU packet near data near unit) near7 (master macro primary source) near7 (small target micro secondary pico femto)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 11:26
S23	35	S22 same (SDU service near data near unit)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/11/07 11:27

			DERWENT; IBM_TDB			
S24	7	S22 same (SDU service near data near unit) same (SN sequence near number) same (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 11:28
S26	20	S23 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 11:28
S27	260	(SDU service near data near unit) with (SN sequence near number) with (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 11:29
S28	163	S27 and ((master macro primary source) with (small target micro secondary pico femto))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 11:30
S29	80	S28 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 11:31
S30	4	(receiv$3 obtain$3 acquir$4) near9 (sequence near timer) near9 (SDU service near data near unit) near9 (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 11:57
S36	4	(sequence near timer) near9 (SDU service near data near unit) near9 (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 17:54
S37	10	(sequence near timer) near9 (SDU service near data near unit)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 17:56
S38	2	S37 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR;	OR	ON	2019/11/07 17:56

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S41	4	(sequence near timer) with (SDU service near data near unit data near unit DU) with (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 17:58
S42	256	(sequence near timer timer) with (SDU service near data near unit data near unit) with (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 18:05
S43	38	S42 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 18:06
S44	2067	(delay near3 backhaul (in near sequence in$1sequence in-sequence) near timer)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/02 19:06
S45	54	S44 with (SDU service near data near unit PDU packet near data near unit DU data near unit)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/02 19:08
S46	13	S45 same (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/02 19:09
S48	5	S45 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/02 19:09
S49	437	S44 with (SDU service near data near unit PDU packet near data near unit DU data near unit frame data)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/02 19:14
S50	16	S49 same (RRC radio near resource near	US-PGPUB;	OR	ON	2020/04/02

		control)	USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			19:15
S52	237	S49 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/02 19:16
S53	65	S49 same3 (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/02 19:16
S54	20	S53 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/02 19:17
S55	14	S54 and (H04W76/27 or H04W76/15 or H04W48/20 or H04L47/34 or H04W76/00 or H04L5/00 or H04B7/2612 or H04W16/32 or H04W84/045).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/02 21:13

EAST Search History (Interference)

<This search history is empty>

4/2/2020 9:18:10 PM
C:\Users\hkim6\Documents\EAST\Workspaces\15935626.wsp

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/935,626	Filing Date 03/26/2018	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	03/23/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 1	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0		x $460 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/STEFANIE A BRYCE/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:	Docket No.: P6672USC1
Myung Cheul JUNG, *et al.*	
Serial No.: 15/935,626	Group Art Unit: 2411
Confirmation No.: 8564	
Filed: March 26, 2018	Examiner: KIM, HARRY H.

For: **METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM**

Mail Stop: Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REPLY UNDER 37 C.F.R. § 1.111

Dear Commissioner:

In response to the Non-Final Office Action mailed November 14, 2019 ("Office Action"), Applicant respectfully requests reconsideration of the Application in view of the following Remarks.

A **Claim List** begins on page 2.

Remarks begin on page 3.

A Petition for a one (1)-month extension of time under 37 C.F.R. § 1.136(a) is filed to extend the period for response through March 14, 2020. No further extensions of time are required other than those in the accompanying Petition. If further extensions of time are necessary to prevent abandonment of this Application, then they are petitioned for under 37 C.F.R. § 1.136(a). No fees for net addition of claims are required at this time. Any fees required for further extensions of time or for the net addition of claims may be charged to Deposit Account No. 50-3698.

CLAIM LIST

This claim list replaces all prior claim lists in the Application.

1. (Original) A method for user equipment receiving multi-flow data with respect to one evolved packet system (EPS) bearer through a macro base station (macro eNB) and a small base station (small eNB) in a wireless communication system supporting dual connectivity, the method comprising:

receiving packet data convergence protocol (PDCP) packet data units (PDUs) through the macro base station and the small base station;

obtaining PDCP service data units (SDUs) corresponding to the PDCP PDUs; and

receiving from the macro base station information related to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message,

wherein the PDCP SDUs are indicated by a predefined PDCP sequence number (SN).

REMARKS

The claim has not been amended. Accordingly, independent claim 1 is currently pending in the Application.

In view of the following Remarks, Applicant respectfully requests reconsideration and timely withdrawal of the pending objections and rejections for the reasons discussed below.

Rejections Under 35 U.S.C. § 103

Claim 1 stands rejected under 35 U.S.C. § 103 as allegedly being unpatentable over U.S. Patent Application Publication No. 2012/0182971 applied for by Ohta, *et al.* ("Ohta") in view of U.S. Patent Application Publication No. 2010/0304733 applied for by Yi, *et al.* ("Yi"). Applicant respectfully traverse this rejection for at least the following reasons.

To establish an obviousness rejection under 35 U.S.C. § 103, four factual inquiries must be examined. The four factual inquiries include (a) determining the scope and contents of the prior art; (b) ascertaining the differences between the prior art and the claims in issue; (c) resolving the level of ordinary skill in the pertinent art; and (d) evaluating evidence of secondary consideration. *Graham v. John Deere*, 383 U.S. 1, 17-18 (1966).

In view of these four factors, the analysis supporting a rejection under 35 U.S.C. § 103 should be made explicit, and should "identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the [prior art] elements" in the manner claimed. *KSR Int'l. Co. v. Teleflex, Inc.*, 127 S. Ct. 1727, 82 USPQ2d 1385, 1396 (2007). The Federal Circuit requires that "rejections on obviousness cannot be sustained with mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006).

Finally, even if the prior art may be combined, there must be a reasonable expectation of success, and the reference or references, when combined, must disclose or suggest every claimed feature. *See in re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The Office Action fails to establish a *prima facie* case of obviousness of claim 1 at least because even if combined, Ohta and Yi fail to disclose or suggest every claimed feature.

The Office Action admits that Ohta fails to disclose "receiving from the macro base station information related to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message" as recited in claim 1, and relies upon Yi to allegedly cure this deficiency. *See* Office Action, pages 4-5. Applicant respectfully disagrees.

As disclosed in Applicant's specification, an ***in-sequence timer*** (*see, e.g.*, ¶¶ [0109]-[0111] and [0114]-[0119]) takes into account a transmission delay time of the backhaul between the macro base station and the small base station and is used to pass PDCP SDU's to the upper layer. This is ***different*** from a ***discard timer*** (*see, e.g.,* Applicant's ¶¶ [0103]-[0105]) which is used for retransmission purposes. The duration of the discard timer may be configured from the upper layer and when the PDCP SDU is received from the upper layer, the timer starts. When the discard has expired, the PDCP entity discards the corresponding PDCP SDU. Accordingly, a PDCP SDU of a specific SN may be missed due to expiration of the discard timer.

The disclosed timer of Yi relates, if anything, to a discard timer, not an in-sequence timer as presently claimed. As disclosed in Yi:

> the timer starting condition is triggered when at least one portion of the data unit is allocated with a radio link control (RLC) sequence number; and ***setting a timer for re-transmission of the data unit*** when the timer starting condition is triggered, wherein the data unit is either RLC PDU (Protocol Data Unit) or RLC SDU (Service Data Unit), a radio link control (RLC) layer ***receives a discard indication*** to discard the data unit from an upper layer, the RLC layer is operated in an Acknowledged Mode (AM), a data unit retransmission error is occurred if

> the retransmission of the data unit is ***not successfully received before an expiry of the timer***.

Yi, ¶ [0058] (emphasis added). As such, Applicant respectfully submits that Yi discloses a discard timer, not an in-sequence timer, as claimed. For at least this reason, Applicant respectfully submits that the asserted art fails to disclose or fairly suggest all elements of claim 1.

Accordingly, Applicant respectfully requests withdrawal of the 35 U.S.C. § 103 rejection of claim 1.

CONCLUSION

A full and complete response has been made to the pending Office Action, and all of the stated grounds for rejection have been overcome or rendered moot. Accordingly, all pending claims are allowable, and the Application is in condition for allowance.

The Examiner is invited to contact Applicant's undersigned representative at the number below if it would expedite prosecution. Prompt and favorable consideration of this Reply is respectfully requested.

Respectfully submitted,

/Christopher B. Kilner/

Christopher B. Kilner
Reg. No. 45,381

Date: March 13, 2020

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Electronic Patent Application Fee Transmittal	
Application Number:	15935626
Filing Date:	26-Mar-2018
Title of Invention:	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM
First Named Inventor/Applicant Name:	Myung Cheul JUNG
Filer:	Hae-Chan Park/Sheila Jallow
Attorney Docket Number:	P6672USC1
Filed as Large Entity	
Filing Fees for Utility under 35 USC 111(a)	

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	1251	1	200	200
Miscellaneous:				
		Total in USD ($)		**200**

Electronic Acknowledgement Receipt	
EFS ID:	38864416
Application Number:	15935626
International Application Number:	
Confirmation Number:	8564
Title of Invention:	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM
First Named Inventor/Applicant Name:	Myung Cheul JUNG
Customer Number:	58027
Filer:	Hae-Chan Park/Sheila Jallow
Filer Authorized By:	Hae-Chan Park
Attorney Docket Number:	P6672USC1
Receipt Date:	13-MAR-2020
Filing Date:	26-MAR-2018
Time Stamp:	16:58:56
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$200
RAM confirmation Number	E20203CH00478564
Deposit Account	
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Extension of Time	P6672USC1_EOT.pdf	1054793 f7172698a33f21fdc51580e81686019c475a a269	no	2
Warnings:					
Information:					
2		P6672USC1_RESPONSE.pdf	115700 8ef5a384d87e11b82eadb57e15f15c042a1 415fa	yes	6

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	2
	Applicant Arguments/Remarks Made in an Amendment	3	6

Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	31051 6f377163333f4982f06cb18b45911a76cb74 6984	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1201544		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

Docket Number (Optional): P6672USC1

Application Number: 15/935,626

Filed: 2018-03-26

For: METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

Art Unit: 2411

Examiner: KIM, HARRY H

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

		Fee	Small Entity Fee	Micro Entity Fee	
☑	One month (37 CFR 1.17(a)(1))	$200	$100	$50	$ 200
☐	Two months (37 CFR 1.17(a)(2))	$600	$300	$150	$
☐	Three months (37 CFR 1.17(a)(3))	$1,400	$700	$350	$
☐	Four months (37 CFR 1.17(a)(4))	$2,200	$1,100	$550	$
☐	Five months (37 CFR 1.17(a)(5))	$3,000	$1,500	$750	$

☐ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29.
Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-3698.

☑ Payment made via EFS-Web.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant.

☑ attorney or agent of record. Registration number 45,381.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/Christopher B. Kilner/ — Signature

2020-03-13 — Date

Christopher B. Kilner — Typed or printed name

703-288-5105 — Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☑ * Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/935,626	03/26/2018	Myung Cheul JUNG	P6672USC1	8564

58027 7590 11/14/2019

H.C. PARK & ASSOCIATES, PLC
1894 PRESTON WHITE DRIVE
RESTON, VA 20191

EXAMINER	
KIM, HARRY H	

ART UNIT	PAPER NUMBER
2411	

NOTIFICATION DATE	DELIVERY MODE
11/14/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PATENT@PARK-LAW.COM

Office Action Summary	**Application No.** 15/935,626	**Applicant(s)** JUNG et al.	
	Examiner HARRY H KIM	**Art Unit** 2411	**AIA (FITF) Status** Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 08/29/2019.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Terminal Disclaimer

The terminal disclaimer filed on 08/29/2019 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of the full statutory term of prior **(patent granted on application number 14890407 (US 20160113058 A1) or patent number 9,930,720)** has been reviewed and is accepted. The terminal disclaimer has been approved on 08/29/2019.

Response to Arguments

Applicant's arguments filed on 08/29/2019 regarding priority date of previously identified prior art, Zhang et al. (US 2015/0215827) have been deemed persuasive. Therefore, the rejections in the previous Office Action mailed 05/29/2019 have been withdrawn hereby. However, up further search and consideration, newly identified prior art is found to have adequately taught the claimed features and thus applied in instant Office Action as detailed below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim(s) 1 rejected under 35 U.S.C. 103 as being unpatentable over Ohta et al. (US 2012/0182971, "Ohta") in view of Yi et al. (US 2010/0304733, "Yi").

Examiner's note: in what follows, references are drawn to Ohta unless otherwise mentioned.

Ohta discloses "Base Station, Mobile Station, Communication System, Transmission Method and Reordering Method" (Title) where "A mobile station, that includes a receiving means for receiving first PDCP PDU from a source base station and a receiving means for receiving second PDCP-PDU from a target base station" Abstract.

Ohta's invention comprises the following features:

Regarding claim 1, a method for user equipment receiving multi-flow data with respect to one evolved packet system (EPS) bearer through **a macro base station (macro eNB)** (Fig. 1; Source Base Station 11a) **and a small base station (small eNB)** (Fig. 1; Target Base Station 11b), the method comprising:

receiving packet data convergence protocol (PDCP) packet data units (PDUs) through the macro base station ([Claim 1] "a receiving means for receiving first PDCP PDU from a source base station") **and the small base station** ([Claim 1] "a receiving means for receiving second PDCP-PDU from a target base station");

obtaining PDCP service data units (SDUs) corresponding to the PDCP PDUs ([claim 1] “a storage means for storing PDCP SDU conforming to the first PDCP PDU and the PDCP SDU conforming to the second PDCP PDU”).; and

receiving from the macro base station information related to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message (Note that Ohta does not specifically teach about a timer through a RRC message. This will be discussed in view of Yi.),

wherein **the PDCP SDUs are indicated by a predefined PDCP sequence number (SN)** ([Claim 1] “a reordering means for performing in order delivery of the stored PDCP SDUs based on the sequence numbers.”, and [0029] “In the PDCP layer, the transmitting side compresses the upper protocol header, as well as attaches a sequence number and performs transmission.” Thus, it is clear that the sequence numbers are predetermined at the transmitter side.).

It is noted that while disclosing receiving PDCP PDUs from a dual connectivity, Ohta does not specifically teach about a timer through a RRC message. It, however, had been known in the art at the time of instant application as shown by Yi in a disclosure "Method of Detecting and Handling and Endless RLC Restransmission" (Title) as follows; **receiving from the macro base station information related to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message** ([Yi, 0058] “setting a timer for re-transmission of the data unit when the timer starting condition is triggered, wherein the data unit is either RLC PDU (Protocol Data Unit) or RLC SDU (Service Data Unit), … a timer value assigned to the timer is received through a RRC message”).

It, therefore, would have been obvious to one of ordinary skill in the art at the time of instant application to modify Ohta's features by using the features of Yi in order to have more effective method such that “to prevent an endless PDU re-transmission by the AM RLC so as to prevent the RLC protocol from a deadlock situation” [Yi, 0020].

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry H. Kim whose telephone number is 571-272-5009 and email address is harry.kim2@uspto.gov. The examiner can normally be reached on 7:30a~5:00p.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Andrew Lai can be reached at 571-272-9741. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/HARRY H KIM/
Examiner, Art Unit 2411

/ANDREW LAI/
Supervisory Patent Examiner, Art Unit 2411

Notice of References Cited	Application/Control No. 15/935,626	Applicant(s)/Patent Under Reexamination JUNG et al.	
	Examiner HARRY H KIM	Art Unit 2411	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20120182971-A1	07-2012	OHTA; Yoshiaki	H04L47/10	370/331
*	B	US-20100304733-A1	12-2010	Yi; Seung-June	H04L1/1874	455/422.1
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/935,626	JUNG et al.
	Examiner	Art Unit
	HARRY H KIM	2411

CPC - Searched*		
Symbol	Date	Examiner
H04W76/27 or H04W76/15 or H04W48/20 or H04L47/34 or H04W76/00 or H04L5/00 or H04B7/2612 or H04W16/32 or H04W84/045	05/23/2019	hhk
same as above	11/07/2019	hhk

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
EAST string searched and IDS, Inventors searched	05/23/2019	hhk
EAST string searched	11/07/2019	hhk

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/935,626	JUNG et al.
	Examiner	**Art Unit**
	HARRY H KIM	2411

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS										
☐ Claims renumbered in the same order as presented by applicant				☐ CPA		☐ T.D.		☐ R.1.47		
CLAIM		**DATE**								
Final	Original	05/23/2019	11/07/2019							
	1	✓	✓							

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L9	4	(sequence near timer) near9 (SDU service near data near unit) near9 (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 17:54
L10	10	(sequence near timer) near9 (SDU service near data near unit)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 17:56
L11	2	L10 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 17:56
L14	4	(sequence near timer) with (SDU service near data near unit data near unit DU) with (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 17:58
L15	256	(sequence near timer timer) with (SDU service near data near unit data near unit) with (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 18:05
L16	38	L15 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 18:06
S2	3	"14890407"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 11:51
S3	3	"20110199998"	US-PGPUB;	OR	ON	2019/05/22

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			15:38
S4	3	"20090190554"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 15:38
S5	32	(receiv$3 obtain$4) near5 ((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit))) near9 (((macro source primary) adj (BS (base adj station) enb enodeb))) near7 (((micro target small femto pico) adj (BS (base adj station) enb enodeb)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 15:54
S7	5	S5 same ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 15:57
S8	24	S5 and (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 15:59
S9	59	(receiv$3 obtain$4) near5 ((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit))) same ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:16
S11	225	(EPS (evoved adj packet adj system)) same ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:24
S12	57	S11 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:24
S13	2	S12 and ((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/05/22 16:28

			DERWENT; IBM_TDB			
S14	343	((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit))) same ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:54
S15	947	((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit))) and ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:54
S16	77	S15 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:55
S17	2	"14495825"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/23 07:33
S18	776	(determin$3 obtain$3 identif$5) near5 (SDU (service adj data adj unit)) near5 (PDU (packet adj data adj unit))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/23 08:08
S19	90	(determin$3 obtain$3 identif$5) near5 (SDU (service adj data adj unit)) near5 (accord$3 based correspond$3) near3 (PDU (packet adj data adj unit))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/23 08:10
S20	54	S19 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/23 08:11
S21	147	S18 and (H04W76/27 or H04W76/15 or H04W48/20 or H04L47/34 or H04W76/00 or H04L5/00 or H04B7/2612 or H04W16/32 or H04W84/045).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/23 08:11
S22	87	(receiv$3 acquir$3 obtain$3) near7 (PDCP packet near data near convergence near protocol) near3 (PDU packet near data	US-PGPUB; USPAT; USOCR;	OR	ON	2019/11/07 11:26

		near unit) near7 (master macro primary source) near7 (small target micro secondary pico femto)	FPRS; EPO; JPO; DERWENT; IBM_TDB			
S23	35	S22 same (SDU service near data near unit)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 11:27
S24	7	S22 same (SDU service near data near unit) same (SN sequence near number) same (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 11:28
S26	20	S23 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 11:28
S27	260	(SDU service near data near unit) with (SN sequence near number) with (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 11:29
S28	163	S27 and ((master macro primary source) with (small target micro secondary pico femto))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 11:30
S29	80	S28 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 11:31
S30	4	(receiv$3 obtain$3 acquir$4) near9 (sequence near timer) near9 (SDU service near data near unit) near9 (RRC radio near resource near control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/07 11:57

EAST Search History (Interference)

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PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/935,626	Filing Date 03/26/2018	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	08/29/2019	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 1	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0		x $460 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/NICOLE L NICHOLSON/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:	Docket No.: P6672USC1
Myung Cheul JUNG *et al.*	
Serial No.: 15/935,626	Group Art Unit: 2411
Confirmation No.: 8564	
Filed: March 26, 2018	Examiner: KIM, HARRY H

For: **METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM**

Mail Stop: Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REPLY UNDER 37 C.F.R. § 1.111

Dear Commissioner:

In response to the Non-Final Office Action mailed May 29, 2019 ("Office Action"), Applicants respectfully request reconsideration of the Application in view of the following Remarks.

A **Claim List** begins on page 2.

Remarks begin on page 3.

No extensions of time are required at this time. If extensions of time are necessary to prevent abandonment of this Application, then they are petitioned for under 37 C.F.R. § 1.136(a). No fees for net addition of claims are required at this time. Any fees required for extensions of time or for the net addition of claims may be charged to Deposit Account No. 50-3698.

CLAIM LIST

This claim list replaces all prior claim lists in the Application.

1. (Original) A method for user equipment receiving multi-flow data with respect to one evolved packet system (EPS) bearer through a macro base station (macro eNB) and a small base station (small eNB) in a wireless communication system supporting dual connectivity, the method comprising:

receiving packet data convergence protocol (PDCP) packet data units (PDUs) through the macro base station and the small base station;

obtaining PDCP service data units (SDUs) corresponding to the PDCP PDUs; and

receiving from the macro base station information related to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message,

wherein the PDCP SDUs are indicated by a predefined PDCP sequence number (SN).

REMARKS

The claim has not been amended. Accordingly, independent claim 1 is currently pending in the Application.

In view of the following Remarks, Applicants respectfully request reconsideration and timely withdrawal of the pending objections and rejections for the reasons discussed below.

Rejection of Claims under Double Patenting

Claim 1 stands rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 1 of prior U.S. Patent No. 9,930,720, issued to Jung, *et al.* ("Jung").

Applicants have submitted a terminal disclaimer to overcome this rejection. Accordingly, Applicants respectfully request withdrawal of this double patenting rejection of claim 1.

Applicants note that "[t]he filing of a terminal disclaimer to obviate a rejection based on nonstatutory double patenting is not an admission of the propriety of the rejection [because] the filing of a terminal disclaimer simply serves the statutory function of removing the rejection of double patenting, and raises neither a presumption nor estoppel on the merits of the rejection" (MPEP § 804.02.II, citations omitted). Hence, the terminal disclaimer included with this reply simply serves the statutory function of removing the double patenting rejection without raising a presumption or estoppel on the merits of the rejection.

Rejections Under 35 U.S.C. § 103

Claim 1 stands rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent Application Publication No. 2015/0215827, applied for by Zhang, *et al.* ("Zhang") in

view of U.S. Patent Application Publication No. 2010/0046448, applied for by Peisa, *et al.* ("Peisa"). Applicants respectfully traverse this rejection for at least the following reasons.

The subject rejection explicitly relies upon U.S. Patent Application Publication No. 2015/0215827, applied for by Zhang, *et al.* ("Zhang"), which has an earliest-possible effective filing date of January 30, 2014 (filing date of Provisional application No. 61/933,847). In contrast, the present invention has an effective filing date of May 10, 2013, based upon this application being a U.S. National Phase application of PCT/KR2014/004189, filed on May 9, 2014, which claims priority from and the benefit of Korean Patent Application No. 10-2013-0053408, filed on May 10, 2013. Accordingly, Applicants respectfully submit that Zhang does not qualify as prior art. Moreover, the only remaining art of Peisa admittedly fails to disclose or suggest all elements of the claims.

Accordingly, Applicants respectfully request withdrawal of the 35 U.S.C. § 103(a) rejection of claim 1.

CONCLUSION

A full and complete response has been made to the pending Office Action, and all of the stated grounds for rejection have been overcome or rendered moot. Accordingly, all pending claims are allowable, and the Application is in condition for allowance.

The Examiner is invited to contact Applicants' undersigned representative at the number below if it would expedite prosecution. Prompt and favorable consideration of this Reply is respectfully requested.

Respectfully submitted,

/**Christopher B. Kilner**/

Christopher B. Kilner
Reg. No. 45,381

Date: August 29, 2019

CUSTOMER NUMBER: 58027
H.C. Park & Associates, PLC
1894 Preston White Drive
Reston, VA 20191
Tel: 703-288-5105
Fax: 703-288-5139
CBK/emp/sj

Electronic Acknowledgement Receipt	
EFS ID:	37019774
Application Number:	15935626
International Application Number:	
Confirmation Number:	8564
Title of Invention:	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM
First Named Inventor/Applicant Name:	Myung Cheul JUNG
Customer Number:	58027
Filer:	Hae-Chan Park/Sheila Jallow
Filer Authorized By:	Hae-Chan Park
Attorney Docket Number:	P6672USC1
Receipt Date:	29-AUG-2019
Filing Date:	26-MAR-2018
Time Stamp:	15:04:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		P6672US00_RESPONSE.pdf	34847 e8cca6a1ba13204534b018b98b55bb89e4a76c63	yes	5

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Response After Final Action	1	1
	Claims	2	2
	Applicant Arguments/Remarks Made in an Amendment	3	5
Warnings:			
Information:			
	Total Files Size (in bytes):	34847	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed	PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT**
Application Number	15935626
Filing Date	26-Mar-2018
First Named Inventor	Myung Cheul JUNG
Attorney Docket Number	P6672USC1
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action

☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

Owner	Percent Interest
Pantech, Inc.	100%

The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)

9930720

as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:
- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

◉ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

○ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.	
Applicant claims the following fee status: ○ Small Entity ○ Micro Entity ◉ Regular Undiscounted I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.	
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ◉ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application Registration Number 45381 ○ A sole inventor ○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application ○ A joint inventor; all of whom are signing this request	
Signature	/Christopher B. Kilner/
Name	Christopher B. Kilner

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

Application Number:	15935626
Filing Date:	26-Mar-2018
Title of Invention:	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM
First Named Inventor/Applicant Name:	Myung Cheul JUNG
Filer:	Hae-Chan Park/Sheila Jallow
Attorney Docket Number:	P6672USC1

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**160**

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 15935626

Filing Date: 26-Mar-2018

Applicant/Patent under Reexamination: JUNG

Electronic Terminal Disclaimer filed on August 29, 2019

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt	
EFS ID:	37014367
Application Number:	15935626
International Application Number:	
Confirmation Number:	8564
Title of Invention:	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM
First Named Inventor/Applicant Name:	Myung Cheul JUNG
Customer Number:	58027
Filer:	Hae-Chan Park/Sheila Jallow
Filer Authorized By:	Hae-Chan Park
Attorney Docket Number:	P6672USC1
Receipt Date:	29-AUG-2019
Filing Date:	26-MAR-2018
Time Stamp:	14:58:59
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$160
RAM confirmation Number	E20198SE58493952
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Terminal Disclaimer-Filed (Electronic)	eTerminal-Disclaimer.pdf	33691 a6856e5a437f01ca903d927af7cdd36920a1722a	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30698 65ec37a3b8368762b1fe0a52491872a19fec4ff1	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	64389		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/935,626	03/26/2018	Myung Cheul JUNG	P6672USC1	8564

58027 7590 05/29/2019

H.C. PARK & ASSOCIATES, PLC
1894 PRESTON WHITE DRIVE
RESTON, VA 20191

EXAMINER	
KIM, HARRY H	

ART UNIT	PAPER NUMBER
2411	

NOTIFICATION DATE	DELIVERY MODE
05/29/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PATENT@PARK-LAW.COM

Office Action Summary	**Application No.** 15/935,626	**Applicant(s)** JUNG et al.	
	Examiner HARRY H KIM	**Art Unit** 2411	**AIA (FITF) Status** Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 03/26/2018.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 03/26/2018 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date 03/26/2018.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Double Patenting

A rejection based on double patenting of the "same invention" type finds its support in the language of 35 U.S.C. 101 which states that "whoever invents or discovers any new and useful process... may obtain a patent therefor..." (Emphasis added). Thus, the term "same invention," in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957).

A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the claims that are directed to the same invention so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

Claim 1 is/are rejected under 35 U.S.C. 101 as claiming the same invention as that of claim 1 of prior U.S. Patent No. 9,930,720 (hereinafter Pat-720). This is a statutory double patenting rejection.

Regarding claim 1, as shown in the following table, claim 1 of Pat-720 recites all the claimed limitations of the claim 1.

Claims / App Language		Pat-720 Language	
1	A method for user equipment receiving multi-flow data with respect to one evolved packet system (EPS) bearer through a macro base station (macro eNB) and a small base station (small eNB) in a wireless communication system supporting dual connectivity, the method comprising: receiving packet data convergence protocol (PDCP) packet data units (PDUs) through the macro base station and the small base station; obtaining PDCP service data units (SDUs) corresponding to the PDCP PDUs; and receiving from the macro base station information related to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message,	1	A method for user equipment receiving multi-flow data with respect to one evolved packet system (EPS) bearer through a macro base station (macro eNB) and a small base station (small eNB) serving a single cell in a wireless communication system supporting dual connectivity, the method comprising: configuring a first radio bearer (RB) and a second RB; receiving packet data convergence protocol (PDCP) packet data units (PDUs) through the macro base station through the first RB and the small base station through the second RB; obtaining PDCP service data units (SDUs) corresponding to the PDCP PDUs; receiving from the macro base station information related to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message over the first RB; and confirming the respective PDCP sequence numbers (SNs) of the obtained PDCP SDUs and performing in-sequence delivery of the PDCP SDUs to an upper layer

	wherein the PDCP SDUs are indicated by a predefined PDCP sequence number (SN).		from a PDCP entity according to the PDCP SN, wherein the PDCP SDUs are indicated by a predefined PDCP sequence number (SN).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim(s) 1 rejected under 35 U.S.C. 103 as being unpatentable over Zhang et al. (US 2015/0215827, "Zhang") in view of Peisa et al. (US 2010/0046448, "Peisa").

Examiner's note: in what follows, references are drawn to Zhang unless otherwise mentioned.

Zhang discloses "Packet Data Convergence Protocol (PDCP) Enhancements in Dual-Connectivity Networks" (Title) where "apparatuses, methods, and storage media may be described for identifying, by a master evolved NodeB (MeNB), one or more packet data convergence protocol (PDCP) packets that were previously scheduled to be transmitted to a user equipment (UE) by a secondary eNB (SeNB)." Abstract.

Zhang's invention comprises the following features:

Regarding claim 1, a method for user equipment receiving multi-flow data with respect to one evolved packet system (EPS) bearer through **a macro base station (macro eNB)** (Fig. 2; MeNB 215) **and a small base station (small eNB)** (Fig. 2; SeNB 225) **in a wireless communication system supporting dual connectivity** ([0004 and Fig. 2] "A dual-connectivity network may be a network where a user equipment (UE) can connect with more than one cell site simultaneously. A cell site may be considered to be an evolved NodeB (eNB). When a UE connects to two (or more) eNBs, it may receive data from both eNBs at the same time."), the method comprising:

receiving packet data convergence protocol (PDCP) packet data units (PDUs) through the macro base station and the small base station ([Zhang, 0025 and Fig. 2] "the MeNB 215 and the SeNB 225 may be configured to transmit a PDCP data to the UE 205. The PDCP data may include PDCP packets 1, 2, 3, and 4. In some embodiments, the MeNB 215, and particularly the PDCP circuitry 220 of the MeNB 215, may be configured to transmit PDCP packets 1 and 3. The SeNB 225 may be configured to transmit PDCP packets 2 and 4. In some embodiments, the SeNB 225 may have received PDCP packets 2 and 4 from the MeNB 215.");

obtaining PDCP service data units (SDUs) corresponding to the PDCP PDUs (This will be discussed in view of Peisa).; and

receiving from the macro base station information related to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message ([0013] "the reordering process may be related to a timer indicated by the MeNB to the UE.", and [0034] "the PDCP-Config IE, or some other IE, may include an

indication of a timer that may be referred to as a "prohibit timer." In some embodiments, the prohibit timer may be signaled in an RRC signal"),

wherein **the PDCP SDUs are indicated by a predefined PDCP sequence number (SN)** ([0037] "PDCP reordering may refer to a process wherein the UE 205 receives the PDCP packets out of order, for example, PDCP packets 1, 3, 2, and 4, and then reorders the packets to the correct order, for example, PDCP packets 1, 2, 3, and 4.").

It is noted that while disclosing receiving PDCP PDUs from a dual connectivity, Zhang does not specifically teach about determining SDUs from PDUs. It, however, had been known in the art at the time of instant application as shown by Peisa in a disclosure "Single Bit Segmentation Indicator" (Title) as follows; **obtaining PDCP service data units (SDUs) corresponding to the PDCP PDUs** ([Peisa, 0032 and Fig. 5] "The RLC processor 22, 42 receives PDUs 52 comprising one or more SDUs 50 (block 152). For each SDU 50, the start of the SDU 50 is determined based on the sequence number of the PDU 52 containing the end of the last SDU 50 (block 154).").

It, therefore, would have been obvious to one of ordinary skill in the art at the time of instant application to modify Zhang's features by using the features of Peisa in order to have more effective method such that "a method for segmenting data units according to a first transmission format into data units according to a second transmission format." [Peisa, 0011].

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry H. Kim whose telephone number is 571-272-5009 and email address is harry.kim2@uspto.gov. The examiner can normally be reached on 7:30a~5:00p.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Andrew Lai can be reached at 571-272-9741. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/HARRY H KIM/
Examiner, Art Unit 2411

/RAJ JAIN/
Primary Examiner, Art Unit 2411

Notice of References Cited	Application/Control No. 15/935,626	Applicant(s)/Patent Under Reexamination JUNG et al.	
	Examiner HARRY H KIM	Art Unit 2411	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20150215827-A1	07-2015	Zhang; Yujian	H04W28/0247	370/331
*	B	US-20100046448-A1	02-2010	Peisa; Janne	H04W28/065	370/329
	C					
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	E					
	F					
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FOREIGN PATENT DOCUMENTS

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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/935,626	JUNG et al.
	Examiner	Art Unit
	HARRY H KIM	2411

CPC - Searched*		
Symbol	Date	Examiner
H04W76/27 or H04W76/15 or H04W48/20 or H04L47/34 or H04W76/00 or H04L5/00 or H04B7/2612 or H04W16/32 or H04W84/045	05/23/2019	hhk

CPC Combination Sets - Searched*		
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US Classification - Searched*			
Class	Subclass	Date	Examiner

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Search Notes		
Search Notes	Date	Examiner
EAST string searched and IDS, Inventors searched	05/23/2019	hhk

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/935,626	JUNG et al.
	Examiner	**Art Unit**
	HARRY H KIM	2411

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
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CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	05/23/2019								
	1	✓								

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L3	2	"14495825"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/23 07:33
L4	776	(determin$3 obtain$3 identif$5) near5 (SDU (service adj data adj unit)) near5 (PDU (packet adj data adj unit))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/23 08:08
L5	90	(determin$3 obtain$3 identif$5) near5 (SDU (service adj data adj unit)) near5 (accord$3 based correspond$3) near3 (PDU (packet adj data adj unit))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/23 08:10
L6	54	L5 and (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/23 08:11
L8	147	L4 and (H04W76/27 or H04W76/15 or H04W48/20 or H04L47/34 or H04W76/00 or H04L5/00 or H04B7/2612 or H04W16/32 or H04W84/045).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/23 08:11
S2	3	"14890407"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 11:51
S3	3	"20110199998"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 15:38
S4	3	"20090190554"	US-PGPUB;	OR	ON	2019/05/22

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			15:38
S5	32	(receiv$3 obtain$4) near5 ((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit))) near9 (((macro source primary) adj (BS (base adj station) enb enodeb))) near7 (((micro target small femto pico) adj (BS (base adj station) enb enodeb)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 15:54
S7	5	S5 same ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 15:57
S8	24	S5 and (@ad @prad @rlad)<"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 15:59
S9	59	(receiv$3 obtain$4) near5 ((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit))) same ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:16
S11	225	(EPS (evoved adj packet adj system)) same ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:24
S12	57	S11 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:24
S13	2	S12 and ((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:28
S14	343	((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit))) same ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2019/05/22 16:54

			DERWENT; IBM_TDB			
S15	947	((PDCP (packet near data near convergence near protocol)) near3 (PDU (packet near data near unit))) and ((dual double multiple) adj (connection connectivity))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:54
S16	77	S15 and (@ad @prad @rlad) <"20130510"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/05/22 16:55

EAST Search History (Interference)

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2018-03-26
	First Named Inventor	Myung Cheul JUNG
	Art Unit	
	Examiner Name	
	Attorney Docket Number	P6672USC1

U.S.PATENTS						
Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20120039226		2012-02-16	YANG et al.	
	2	20120294281		2012-11-22	PARK	Corresponding to KR 10-2012-0128078
	3	20100039996		2010-02-18	OHTA et al.	Corresponding to KR 10-2010-0005017
	4	20040151154		2004-08-05	WU	Corresponding to JP 2003-283592
	5	20090190554		2009-07-30	CHO	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.H.K./

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	Application Number	
	Filing Date	2018-03-26
	First Named Inventor	Myung Cheul JUNG
	Art Unit	
	Examiner Name	
	Attorney Docket Number	P6672USC1

	6	20090323663		2009-12-31	NAKATSUGAWA	
	7	20110188377		2011-08-04	KIM et al.	
	8	20110199998		2011-08-18	YI et al.	
	9	20110286387		2011-11-24	SANE et al.	
	10	20120069750		2012-03-22	XING et al.	

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	1	2013-062882	JP		2013-04-04	FUJITSU LTD.		☐
	2	10-2012-0128078	KR		2012-11-26	ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTIT	Corresponding to US 2012/0294281	☐
	3	2013-062884	JP		2013-04-04	FUJITSU LTD.		☐
	4	10-2010-0005017	KR		2010-01-13	FUJITSU LTD.	Corresponding to US 2010/0039996	☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2018-03-26
	First Named Inventor	Myung Cheul JUNG
	Art Unit	
	Examiner Name	
	Attorney Docket Number	P6672USC1

	5	2003-283592	JP		2003-10-03	ASUSTEK COMPUTER INC.	Corresponding to US 2004/0151154	☐

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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	International Search Report issued on August 14, 2014, in International Patent Application No. PCT/KR2014/004189	☐
	2	R2-070130, "Selective forwarding/retransmission during HO"; 3GPP TSG-RAN2 Meeting #56bis; Discussion and decision Agenda Item: 5.2.6, (R2-070130 hereinafter) was published 15th January - 19th January 2007.	☐
	3	Non-Final Office Action issued July 19, 2017 in U.S. Patent Application No. 14/890,407.	☐
	4	Notice of Allowance issued November 9, 2017 in U.S. Patent Application No. 14/890,407.	☐

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	Application Number	
	Filing Date	2018-03-26
	First Named Inventor	Myung Cheul JUNG
	Art Unit	
	Examiner Name	
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Signature	/Christopher B. Kilner/	Date (YYYY-MM-DD)	2018-03-26
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/935,626	03/26/2018	Myung Cheul JUNG	P6672USC1

CONFIRMATION NO. 8564

58027
H.C. PARK & ASSOCIATES, PLC
1894 PRESTON WHITE DRIVE
RESTON, VA 20191

PUBLICATION NOTICE



Title:METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

Publication No.US-2018-0213592-A1
Publication Date:07/26/2018

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Application Number

출 원 년 월 일 : 2013년 05월 10일
Filing Date 5월 10, 2013

출 원 인 : 주식회사 팬택
Applicant(s) PANTECH INC.

2018년 04월 24일

특 허 청
COMMISSIONER

제출 일자 : 2013-05-10

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【명칭】 에스앤아이피특허법인

【대리인번호】 9-2013-100001-8

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【발명의 영문명칭】 METHOD AND APPARATUS OF IN SEQUENCE DELIVERY CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

【발명자】

【성명】 정명철

【성명의 영문표기】 JUNG Myung Cheul

【주민등록번호】 740410-1XXXXXX

【우편번호】 121-792

【주소】 서울특별시 마포구 상암동 DMC, I-2, 팬택빌딩

【국적】 KR

【발명자】

【성명】 허강석

【성명의 영문표기】 HUH Kang Suk

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제출 일자 : 2013-05-10

【주민등록번호】 700815-1XXXXXX

【우편번호】 121-792

【주소】 서울특별시 마포구 상암동 DMC, I-2, 팬택빌딩

【국적】 KR

【발명자】

【성명】 안재현

【성명의 영문표기】 AHN Jae Hyun

【주민등록번호】 800831-1XXXXXX

【우편번호】 121-792

【주소】 서울특별시 마포구 상암동 DMC, I-2, 팬택빌딩

【국적】 KR

【발명자】

【성명】 권기범

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【취지】 위와 같이 특허청장에게 제출합니다.

대리인 에스앤아이피특허법인 (서명 또는 인)

【수수료】

【출원료】 0 면 38,000 원

【가산출원료】 51 면 0 원

【우선권주장료】 0 건 0 원

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제출 일자 : 2013-05-10

【심사청구료】	0 항	0 원
【합계】	38,000 원	

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【발명의 설명】

【발명의 명칭】

이중연결 시스템에서 멀티 플로우를 고려한 순차적 전달 방법 및 장치 {METHOD AND APPARATUS OF IN SEQUENCE DELIVERY CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM}

【기술분야】

<1> 본 발명은 무선 통신에 관한 것으로, 보다 상세하게는 이중 연결(dual connectivity)를 지원하는 무선 통신 시스템에서 멀티 플로우를 고려한 순차적 전달(in-sequence delivery) 방법 및 그 장치에 관한 것이다.

【배경기술】

<2> 셀 내부의 핫 스팟(hotspot)과 같은 특정 지역에서는 특별히 많은 통신 수요가 발생하고, 셀 경계(cell edge) 또는 커버리지 홀(coverage hole)과 같은 특정 지역에서는 전파의 수신 감도가 떨어질 수 있다. 무선 통신 기술이 발달함에 따라, 핫 스팟이나, 셀 경계, 커버리지 홀과 같은 지역에서 통신을 가능하게 하기 위한 목적으로 매크로 셀(Macro Cell)내에 스몰 셀(small cell)들, 예를 들어, 피코 셀(Pico Cell), 펨토 셀(Femto Cell), 마이크로 셀(Micro Cell), 원격 무선 헤드(remote radio head: RRH), 릴레이(relay), 중계기(repeater)등이 함께 설치된다. 이러한 네트워크를 이종 네트워크(Heterogeneous Network: HetNet)라 부른다. 이종 네트워크 환경에서는 상대적으로 매크로 셀은 커버리지(coverage)가 큰 셀(large

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cell)이고, 펨토 셀과 피코 셀과 같은 스몰 셀은 커버리지가 작은 셀이다. 매크로 셀에 비하여 펨토 셀과 피코 셀과 같은 스몰 셀은 저전력을 사용함으로 저전력네트웍(LPN: Low Power Network)라고도 한다. 이종 네트워크 환경에서 다수의 매크로 셀들 및 스몰 셀들 간에 커버리지 중첩이 발생한다.

<3> 단말은 적어도 하나의 서빙셀을 구성하는 기지국들 중 둘 이상의 기지국을 통하여 무선 통신을 수행할 수 있다. 이를 이중 연결(dual connectivity)이라 하고, 상기 이중 연결을 지원하는 무선 통신 시스템을 이중 연결 시스템이라 한다. 이때, 이중 연결을 구성하는 물리적으로 또는 논리적으로 구분된 복수의 기지국들 중 하나는 매크로 기지국(또는 앵커기지국)이고, 다른 하나는 스몰 기지국(또는 어시스팅 기지국)일 수 있다. 단말은 이중 연결이 가능한 '이중 연결 가능 단말' 과 이중 연결 지원이 불가능한 '이중 연결 불가능 단말' 일 수 있다.

<4> 매크로 기지국은 무선베어러(Radio Bearer:RB)를 통해 스몰 기지국으로 전송되는 데이터들에 대한 패킷 데이터 수렴 규약(PDCP: Packet Data Convergence Protocol)에 따라서 데이터 흐름 제어, 보안 및 해더압축(Header compression) 등을 관리한다.

<5> 일반적으로 무선 통신 시스템은 하나의 EPS 베어러 서비스를 위하여 하나의 RB를 통하여 서비스가 단말에 제공되는 싱글 플로우 구조이다. 그러나, 이중 연결을 지원하는 무선 통신 시스템의 경우 하나의 EPS 베어러를 하나의 RB가 아닌 매크로 셀과 스몰 셀에 각각 설정되는 두 개의 RB를 통하여 서비스를 단말에 제공할 수 있다. 즉, 멀티 플로우를 통하여 서비스가 단말로 제공될 수 있다.

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<6> RLC AM(Acknowlegdged mode)의 경우 하향링크에서 단말의 RLC 엔티티는 수신한 RLC PDU(Packet Data Unit)가 순차에 어긋나게 수신된 경우, 상기 RLC PDU를 재배열(reorder)한다. RLC AM의 경우 수신 측에서 수신누락된 RLC PDU를 송신 측에서 다시 재전송 (retransmission) 할 수 있다. 상기 RLC 엔티티는 상기 재배열된 RLC PDU를 기반으로 RLC SDU(Service Date Unit)를 재조립(reassemble)하고, 상위 계층(즉, PDCP 엔티티)으로 순차적으로 전달한다. RLC AM 의 경우 RLC PDU의 재배열(Reordering)과 재전송(Retransmission) 방식을 통하여 순차적인 전달이 가능하다. 다시 말해, PDCP 엔티티는 하위 계층의 재설정(re-establishment)를 제외한 경우, RLC SDU를 순차적으로 전달받아야 한다. 그러나 멀티 플로우가 구성되는 단말의 경우 스몰 기지국에 대한 RLC 엔티티와 매크로 기지국에 대한 RLC 엔티티가 구분되어 각각의 RLC SDU를 수신하고, PDCP SDU를 획득하여 상위 계층으로 전달할 수 있고, 이 경우 PDCP 엔티티에서는 PDCP SDU를 순차적으로 획득하지 못할 수 있다. 따라서, 멀티 플로우를 사용하는 단말의 경우 PDCP 엔티티에서 상위계층으로 PDCP SDU의 순차적인 전달을 위한 새로운 방안이 요구된다.

【발명의 내용】

【해결하려는 과제】

<7> 본 발명의 기술적 과제는 이중연결 시스템에서 멀티 플로우를 고려한 순차적 전달 방법 및 장치를 제공함에 있다.

<8> 본 발명의 다른 기술적 과제는 멀티 플로우 구조에서 단말 단에서의 PDCP 엔

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티티가 PDCP SDU를 상위계층으로 순차적으로 전달하는 방법 및 장치를 제공함에 있다.

<9> 본 발명의 또 다른 기술적 과제는 멀티 플로우 구조에서 단말에 순차적 전달 타이머를 구성함에 있다.

【과제의 해결 수단】

<10> 본 발명의 일 양태에 따르면, 이중 연결(dual connectivity)을 지원하는 무선 통신 시스템에서 단말(UE)이 매크로 기지국(Macro eNB) 및 스몰 기지국(Small eNB)을 통하여 하나의 EPS(Evolved Packet System) 베어러(bearder)에 대한 멀티 플로우(multi flow) 데이터를 수신하는 방법을 제공한다. 상기 방법은 상기 단말의 PDCP(Packet Data Convergence Protocol) 엔티티(entity)는 상기 매크로 기지국의 PDCP 엔티티로부터 상기 매크로 기지국 및 상기 스몰 기지국을 통하여 PDCP PDU들을 수신하는 단계, 상기 PDCP PDU(Packet Data Unit)들에 대응하는 PDCP SDU(Service Data Unit)들을 획득하는 단계, 및 상기 매크로 기지국으로부터 RRC(radio resource control) 메시지를 통하여 상기 PDCP SDU들에 대한 순차 타이머에 관한 정보를 수신하는 단계를 포함하되, 상기 PDCP SDU들은 미리 정의된 PDCP SN(Sequence Number)으로 지시됨을 특징으로 한다.

<11> 본 발명의 다른 일 양태에 따르면, 이중 연결(dual connectivity)을 지원하는 무선 통신 시스템에서 매크로 기지국에서 상기 매크로 기지국 및 스몰 기지국을 통하여 하나의 EPS 베어러에 대한 멀티 플로우 데이터를 단말로 전송하는 방법을

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제공한다. 상기 방법은 상기 매크로 기지국이 수신하는 패킷에 대하여 PDCP 엔티티에서 PDCP SDU의 PDCP SN에 따라 PDCP PDU들을 생성하는 단계, 상기 PDCP PDU들을 정해진 규칙에 따라 상기 매크로 기지국의 RLC(Radio Link Control) 엔티티 및 상기 스몰 기지국의 RLC 엔티티에 분배하여 상기 단말로 전송하는 단계, 및 상기 PDCP SDU들에 대한 순차 타이머에 관한 정보를 포함하는 RRC 메시지를 상기 단말로 전송하는 단계를 포함함을 특징으로 한다.

【발명의 효과】

<12> 본 발명에 따르면 이중 연결 시스템에서 멀티 플로우(multi flow)를 하향링크 전송을 수행함에 있어, 단말의 PDCP 엔티티에 비순차적으로 PDCP PDU가 수신되더라고도, PDCP SDU의 상위 계층으로 순차적 전달을 수행할 수 있고, 전송 효율을 향상할 수 있다.

【도면의 간단한 설명】

<13> 도 1은 본 발명이 적용되는 무선통신 시스템을 나타낸다.

도 2는 사용자 평면(user plane)에 대한 무선 프로토콜 구조(radio protocol architecture)를 나타낸 블록도이다.

도 3은 제어 평면(control plane)에 대한 무선 프로토콜 구조를 나타낸 블록도이다.

도 4는 본 발명이 적용되는 RLC 서브계층 모델의 일 예의 개요를 나타낸 도이다.

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도 5는 본 발명에 적용되는 단말의 이중 연결 상황의 일 예를 나타낸다.

도 6은 싱글 플로우가 구성된 경우의 EPS 베어러 구조 예를 나타낸다.

도 7은 이중 연결 상황에서, 싱글 플로우일때 매크로 기지국 및 스몰 기지국의 네트워크 구조의 예를 나타낸다.

도 8은 이중 연결 상황에서, 멀티 플로우가 구성된 경우의 EPS 베어러 구조 예를 나타낸다.

도 9는 멀티 플로우일때 매크로 기지국 및 스몰 기지국의 네트워크 구조의 예를 나타낸다.

도 10은 이중 연결을 고려할 때, 싱글 플로우인 경우 패킷 전달 과정을 나타낸다.

도 11은 이중 연결을 고려할 때, 멀티 플로우인 경우 패킷 전달 과정을 나타낸다.

도 12는 단말의 PDCP 엔티티에서 PDCP PDU 수신 타이밍의 예를 나타낸다.

도 13은 단말의 PDCP 엔티티에서 PDCP SN(Sequence Number)에 따른 순차적 상위 계층 전송의 예를 나타낸다.

도 14는 본 발명에 따른 멀티 플로우를 고려한 단말에 의해 수행되는 PDCP SDU 순차 전달 방법을 나타낸다.

도 15는 본 발명에 따른 매크로 기지국, 스몰 기지국 및 단말의 블록도이다.

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【발명을 실시하기 위한 구체적인 내용】

<14> 이하, 본 명세서에서는 본 발명과 관련된 내용을 본 발명의 내용과 함께 예시적인 도면과 실시 예를 통해 상세하게 설명한다. 각 도면의 구성 요소들에 참조 부호를 부가함에 있어서, 동일한 구성 요소들에 대해서는 비록 다른 도면상에 표시되더라도 가능한 한 동일한 부호를 가지도록 하고 있음에 유의해야 한다. 또한, 본 명세서의 실시 예를 설명함에 있어, 관련된 공지 구성 또는 기능에 대한 구체적인 설명이 본 명세서의 요지를 흐릴 수 있다고 판단되는 경우에는 그 상세한 설명은 생략한다.

<15> 또한 본 명세서는 무선 통신 네트워크를 대상으로 설명하며, 무선 통신 네트워크에서 이루어지는 작업은 해당 무선 통신 네트워크를 관할하는 시스템(예를 들어 기지국)에서 네트워크를 제어하고 데이터를 송신하는 과정에서 이루어지거나, 해당 무선 네트워크에 결합한 단말에서 작업이 이루어질 수 있다.

<16> 도 1은 본 발명이 적용되는 무선통신 시스템을 나타낸다. 이는 E-UMTS 시스템(Evolved- Universal Mobile Telecommunications System)의 네트워크 구조일 수 있다. E-UMTS 시스템은 LTE(Long Term Evolution) 또는 LTE-A(advanced)시스템 일 수 있다. 무선통신 시스템은 CDMA(Code Division Multiple Access), TDMA(Time Division Multiple Access), FDMA(Frequency Division Multiple Access), OFDMA(Orthogonal Frequency Division Multiple Access), SC-FDMA(Single Carrier-FDMA), OFDM-FDMA, OFDM-TDMA, OFDM-CDMA와 같은 다양한 다중 접속 기법을 사용할

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수 있다.

<17> 도 1을 참조하면, E-UTRAN은 단말(10; User Equipment, UE)에게 제어 평면(control plane:CP)과 사용자 평면(user plane:UP)을 제공하는 기지국(20; evolved NodeB :eNB)을 포함한다.

<18> 단말(10)은 고정되거나 이동성을 가질 수 있으며, MS(Mobile station), AMS(Advanced MS), UT(User Terminal), SS(Subscriber Station), 무선기기(Wireless Device) 등 다른 용어로 불릴 수 있다.

<19> 기지국(20)은 일반적으로 단말(10)과 통신하는 지점(station)을 말하며, BS(Base Station, BS), BTS(Base Transceiver System), 액세스 포인트(Access Point), 펨토 기지국(femto-eNB), 피코 기지국(pico-eNB), 홈기지국(Home eNB), 릴레이(relay) 등 다른 용어로 불릴 수 있다. 기지국(20)들은 X2 인터페이스를 통하여 서로 연결될 수 있다. 기지국(20)은 S1 인터페이스를 통해 EPC(Evolved Packet Core, 30), 보다 상세하게는 S1-MME를 통해 MME(Mobility Management Entity)와 S1-U를 통해 S-GW(Serving Gateway)와 연결된다. S1 인터페이스는 MME와 신호를 교환함으로써 단말(10)의 이동을 지원하기 위한 OAM(Operation and Management) 정보를 주고받는다.

<20> EPC(30)는 MME, S-GW 및 P-GW(Packet data network-Gateway)를 포함한다. MME는 단말(10)의 접속 정보나 단말(10)의 능력에 관한 정보를 가지고 있으며, 이러한 정보는 단말(10)의 이동성 관리에 주로 사용된다. S-GW는 E-UTRAN을 종단점으로 갖는 게이트웨이이며, P-GW는 PDN(Packet Data Network)을 종단점으로 갖는 게

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이트웨이이다.

<21> E-UTRAN과 EPC(30)를 통합하여 EPS(Evoled Packet System)라 불릴 수 있으며, 단말(10)이 기지국(20)에 접속하는 무선링크로부터 서비스 엔티티로 연결해주는 PDN까지의 트래픽 흐름은 모두 IP(Internet Protocol) 기반으로 동작한다.

<22> 단말과 기지국간의 무선 인터페이스를 Uu 인터페이스라 한다. 단말과 네트워크 사이의 무선 인터페이스 프로토콜(Radio Interface Protocol)의 계층들은 통신 시스템에서 널리 알려진 개방형 시스템간 상호접속(Open System Interconnection; OSI) 기준 모델의 하위 3개 계층을 바탕으로 제1계층(L1), 제2계층(L2), 제3계층(L3)로 구분될 수 있다. 이 중에서 제1계층에 속하는 물리계층은 물리채널(Physical Channel)을 이용한 정보전송서비스(Information Transfer Service)를 제공하며, 제3계층에 위치하는 RRC(Radio Resource Control) 계층은 RRC 메시지를 교환하여 단말과 네트워크 간에 무선자원을 제어한다.

<23> 도 2는 사용자 평면(user plane)에 대한 무선 프로토콜 구조(radio protocol architecture)를 나타낸 블록도이고, 도 3은 제어 평면(control plane)에 대한 무선 프로토콜 구조를 나타낸 블록도이다. 사용자 평면은 사용자 데이터 전송을 위한 프로토콜 스택(protocol stack)이고, 제어 평면은 제어신호 전송을 위한 프로토콜 스택이다.

<24> 도 2 및 도 3을 참조하면, 물리계층(PHY(physical) layer)은 물리채널(physical channel)을 이용하여 상위 계층에게 정보 전송 서비스(information transfer service)를 제공한다. 물리계층은 상위 계층인 매체접근제어(Medium

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Access Control: MAC) 계층과는 전송채널(transport channel)을 통해 연결된다. MAC 계층과 물리계층 사이에서 전송채널을 통해 데이터가 전달된다. 무선 인터페이스를 통해 데이터가 어떻게 전송되는가에 따라 전송채널이 분류된다.

<25> 또한, 서로 다른 물리계층 사이(즉, 송신기와 수신기의 물리계층 사이)에서 물리채널을 통해 데이터가 전달된다. 상기 물리채널은 OFDM(Orthogonal Frequency Division Multiplexing) 방식으로 변조될 수 있으며, 시간과 주파수를 무선자원으로 활용한다.

<26> 일 예로, 물리채널 중 PDCCH(physical downlink control channel)는 단말에게 PCH(paging channel)와 DL-SCH(downlink shared channel)의 자원 할당 및 DL-SCH와 관련된 HARQ(hybrid automatic repeat request) 정보를 알려주며, PDCCH는 단말에게 상향링크 전송의 자원 할당을 알려주는 상향링크 스케줄링 그랜트를 나를 수 있다. 또한, PCFICH(physical control format indicator channel)는 단말에게 PDCCH들에 사용되는 OFDM 심벌의 수를 알려주고, 매 서브프레임마다 전송된다. 또한, PHICH(physical Hybrid ARQ Indicator Channel)는 상향링크 전송의 응답으로 HARQ ACK/NAK 신호를 나른다. 또한, PUCCH(Physical uplink control channel)은 하향링크 전송에 대한 HARQ ACK/NAK, 스케줄링 요청 및 CQI와 같은 상향링크 제어 정보를 나른다. 또한, PUSCH(Physical uplink shared channel)은 UL-SCH(uplink shared channel)을 나른다.

<27> MAC 계층은 논리채널과 전송채널간의 맵핑 및 논리채널에 속하는 MAC SDU(service data unit)의 전송채널 상으로 물리채널로 제공되는 전송블록

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(transport block)으로의 다중화 또는 역다중화를 수행할 수 있다. MAC 계층은 논리채널을 통해 RLC(Radio Link Control) 계층에 서비스를 제공한다. 논리채널은 제어 영역 정보의 전달을 위한 제어채널과 사용자 영역 정보의 전달을 위한 트래픽 채널로 나눌 수 있다.

<28> RLC 계층의 기능은 RLC SDU의 연결(concatenation), 분할(segmentation) 및 재결합(reassembly)를 포함한다. 무선 베어러(Radio Bearer:RB)가 요구하는 다양한 QoS(Quality of Service)를 보장하기 위해, RLC 계층은 투명모드(Transparent Mode, TM), 비확인 모드(Unacknowledged Mode, UM) 및 확인모드(Acknowledged Mode, AM)의 세 가지의 동작모드를 제공한다.

<29> RLC SDU들은 다양한 사이즈로 지원되며, 일 예로 바이트(byte) 단위로 지원될 수 있다. RLC PDU(protocol data unit)들은 하위계층(예, MAC 계층)으로부터 전송 기회(transmission opportunity)가 통보(notify)될 때에만 규정되며, 상기 전송기회가 통보될 때 RLC PDU들은 하위계층으로 전달된다. 상기 전송기회는 전송될 총 RLC PDU들의 크기와 함께 통보될 수 있다. 이하 도 4에서 RLC 계층에 대해서 자세히 설명한다.

<30> 사용자 평면에서의 PDCP(Packet Data Convergence Protocol) 계층의 기능은 사용자 데이터의 전달, 헤더 압축(header compression) 및 암호화(ciphering)를 포함한다. 사용자 평면에서의 PDCP 계층의 기능은 제어 평면 데이터의 전달 및 암호화/무결점 보호(integrity protection)를 포함한다.

<31> RRC 계층은 RB들의 구성(configuration), 재구성(re-configuration) 및 해제

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(release)와 관련되어 논리채널, 전송채널 및 물리채널들의 제어를 담당한다. RB는 단말과 네트워크간의 데이터 전달을 위해 제1 계층(PHY 계층) 및 제2 계층(MAC 계층, RLC 계층, PDCP 계층)에 의해 제공되는 논리적 경로를 의미한다. RB가 구성된다는 것은 특정 서비스를 제공하기 위해 무선 프로토콜 계층 및 채널의 특성을 규정하고, 각각의 구체적인 파라미터 및 동작 방법을 설정하는 과정을 의미한다. RB는 다시 SRB(Signaling RB), DRB(Data RB)로 구분될 수 있다. SRB는 제어 평면에서 RRC 메시지 및 NAS(Non-Access Stratum) 메시지를 전송하는 통로로 사용되며, DRB는 사용자 평면에서 사용자 데이터를 전송하는 통로로 사용된다.

<32> NAS 계층은 RRC 계층 상위에 위치하며 연결관리(Session Management)와 이동성 관리(Mobility Management) 등의 기능을 수행한다.

<33> 단말의 RRC 계층과 E-UTRAN의 RRC 계층 사이에 RRC 연결(RRC Connection)이 있을 경우 단말은 RRC 연결 상태(RRC connected state)에 있고, 그렇지 못할 경우 RRC 휴지 상태(RRC idle state)에 있다.

<34> 네트워크에서 단말로 데이터를 전송하는 하향링크 전송채널로는 시스템정보를 전송하는 BCH(Broadcast Channel)과 그 이외에 사용자 트래픽이나 제어메시지를 전송하는 하향링크 SCH(Shared Channel)이 있다. 하향링크 멀티캐스트 또는 브로드캐스트 서비스의 트래픽 또는 제어메시지의 경우 하향링크 SCH를 통해 전송될 수도 있고, 또는 별도의 하향링크 MCH(Multicast Channel)을 통해 전송될 수도 있다. 한편, 단말에서 네트워크로 데이터를 전송하는 상향링크 전송채널로는 초기 제어메시지를 전송하는 RACH(Random Access Channel)와 그 이외에 사용자 트래픽이나 제어

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메시지를 전송하는 상향링크 SCH(Shared Channel)가 있다.

<35> 전송채널 상위에 있으며, 전송채널에 매핑되는 논리채널(Logical Channel)로는 BCCH(Broadcast Control Channel), PCCH(Paging Control Channel), CCCH(Common Control Channel), MCCH(Multicast Control Channel), MTCH(Multicast Traffic Channel) 등이 있다.

<36> 물리채널(Physical Channel)은 시간 영역에서 여러 개의 심벌과 주파수 영역에서 여러 개의 부반송파(Sub-carrier)로 구성된다. 하나의 서브프레임(Sub-frame)은 시간 영역에서 복수의 OFDM 심볼(Symbol)들로 구성된다. 하나의 서브프레임은 복수의 자원블록(Resource Block)들로 구성되며, 하나의 자원블록은 복수의 심볼들과 복수의 부반송파(sub-carrier)들로 구성된다. 또한 각 서브프레임은 PDCCH(Physical Downlink Control Channel)를 위해 해당 서브프레임의 특정 심볼들(가령, 첫 번째 심볼)의 특정 부반송파들을 이용할 수 있다. 데이터가 전송되는 단위시간인 TTI(Transmission Time Interval)는 1개의 서브프레임에 해당하는 1ms이다.

<37> 도 4는 본 발명의 실시예가 적용되는 RLC 서브계층 모델의 일 예의 개요를 나타낸 도이다.

<38> 도 4를 참조하면, 임의의 RLC 엔티티(entity)는 데이터 전송 방식에 따라 서로 다른 RLC 엔티티로 분류된다. 일 예로, TM RLC 엔티티(400), UM RLC 엔티티(420), AM RLC 엔티티(440)가 있다.

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<39> UM RLC 엔티티(400)는 RLC PDU들을 논리채널들(예, DL/UL DTCH, MCCH 또는 MTCH)을 통해 수신 또는 전달되도록 구성될 수 있다. 또한, UM RLC 엔티티는 UMD PDU(Unacknowledged Mode Data PDU)를 전달하거나 수신할 수 있다.

<40> UM RLC 엔티티는 송신 UM RLC 엔티티 또는 수신 UM RLC 엔티티로 구성된다.

<41> 송신 UM RLC 엔티티는 상위 계층으로부터 RLC SDU들을 수신하고 RLC PDU들을 하위 계층을 통해 피어 수신 UM RLC 엔티티로 전송한다. 송신 UM RLC 엔티티가 RLC SDU들로부터 UMD PDU들을 구성할 때, 하위계층에 의해 특정 전송 기회가 통보되면 RLC SDU들을 분할(segment)하거나 연접(concatenate)하여 하위계층에 의해 지시된 RLC PDU들의 총 크기 이내가 되도록 UMD PDU들을 구성하고, UMD PDU내에 관련 RLC 헤더들이 포함되도록 구성한다.

<42> 수신 UM RLC 엔티티는 상위 계층으로 RLC SDU들을 전달하고 하위 계층을 통해 피어(peer) 수신 UM RLC 엔티티로부터 RLC PDU들을 수신한다. 수신 UM RLC 엔티티가 UMD PDU들을 수신했을 때, 수신 UM RLC 엔티티는 UMD PDU들이 중복으로 수신되었는지 여부를 감지하여 중복된 UMD PDU들은 폐기하고, UMD PDU들이 순차에서 벗어나(out of sequence) 수신된 경우 UMD PDU들의 순서를 재배열(reorder)하고, 하위계층에서의 UMD PDU들의 손실을 감지하여 과도한 재배열 지연들을 방지하고(avoid), 재배열된 UMD PDU들로부터 RLC SDU들을 재조립(reassemble)하고, 상기 재조립된 RLC SDU들을 RLC SN(sequence number)의 오름차순(ascending order)으로 상위계층으로 전달하고, 하위계층에서의 특정 RLC SDU에 속한 UMD PDU 손실로 인해 RLC SDU로 재조립이 불가능한 UMD PDU들은 폐기할 수 있다. RLC 재설정(re-

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establishment)시, 수신 UM RLC 엔티티는 가능하다면 순차에서 벗어나 수신된 UMD PDU들로부터 RLC SDU들을 재조립하여 상위계층으로 전달하고, RLC SDU들로 재조립할 할 수 없었던 남아있는 UMD PDU들은 모두 폐기하고, 관련 상태 변수들을 초기화하고 관련 타이머들을 중지한다.

<43> 한편, AM RLC 엔티티(440)는 RLC PDU들을 논리채널(예, DL/UL DCCH or DL/UL DTCH)들을 통해 수신 또는 전달되도록 구성될 수 있다. AM RLC 엔티티는 AMD PDU 또는 ADM PDU 세그먼트(segnement)를 전달하거나 수신하고, RLC 제어 PDU(예, STATUS PDU)를 전달하거나 수신한다.

<44> 만약, STATUS PDU가 트리거되어 있으며 차단타이머(t-StatusProhibit)가 진행중(running)이지 않거나 만료되었을 때, 상기 STATUS PDU는 다음 전송 기회에 전송된다. 따라서 단말은 STATUS PDU의 크기를 예측하고, RLC 계층에서 전송을 위해 사용 가능한 데이터로써 상기 STATUS PDU를 고려한다.

<45> AM RLC 엔티티는 송신부(transmitting side)와 수신부(receiving side)로 구성된다.

<46> AM RLC 엔티티의 송신부는 상위 계층으로부터 RLC SDU들을 수신하고 RLC PDU들을 하위 계층을 통해 피어 AM RLC 엔티티로 전송한다. AM RLC 엔티티의 송신부는 RLC SDU들로부터 AMD PDU들을 구성할 때, 하위계층에 의해 특정 전송 기회가 통보될 때 하위계층에 의해 지시된 RLC PDU(들)의 총 크기 내로 맞추기 위해 RLC SDU들을 분할(segment)하거나 연접(concatenate)하여 AMD PDU들을 구성한다. AM RLC 엔티티의 송신부는 RLC data PDU들의 재전송(ARQ)을 지원한다. 만일 재전송될 상기

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RLC data PDU가 하위계층에 의해 특정 전송 기회가 통보될 때 하위계층에 의해 지시된 RLC PDU(들)의 총 크기 내로 맞지 않는다면 AM RLC 엔티티는 RLC data PDU를 AMD PDU segment들로 재분할(re-segment)한다.

<47> 이때, 재분할의 개수(the number of re-segmentation)는 제한되지 않는다. AM RLC 엔티티의 송신부가 상위계층으로부터 수신된 RLC SDU들로부터 AMD PDU들을 만들거나 또는 재전송될 RLC data PDU들로부터 AMD PDU 세그먼트들을 만들 때, RLC data PDU안에 관련 RLC 헤더들이 포함된다.

<48> AM RLC 엔티티의 수신부는 상위 계층으로 RLC SDU들을 전달하고 RLC PDU들을 하위 계층을 통해 피어 AM RLC 엔티티로부터 수신한다.

<49> AM RLC 엔티티의 수신부는 RLC 데이터 PDU들을 수신했을 때, RLC 데이터 PDU들이 중복으로 수신되었는지 여부를 감지하고, 중복된 RLC 데이터 PDU들은 폐기하고, RLC 데이터 PDU들이 시퀀스에서 벗어나(out of sequence) 수신된 경우 RLC 데이터 PDU들의 순서를 재배열(reorder)하고, 하위계층에서 발생한 RLC 데이터 PDU들의 손실을 감지하고 피어 AM RLC 엔티티에 재전송을 요구하고, 재배열된 RLC 데이터 PDU들로부터 RLC SDU들을 재조립(reassemble)하고, 상기 재조립된 RLC SDU들을 재조립된 순차대로(in sequence) 상위계층으로 전달한다.

<50> RLC 재설정시, AM RLC 엔티티의 수신부는 가능하다면 시퀀스에서 벗어나 수신된 RLC 데이터 PDU들로부터 RLC SDU들을 재조립하여 상위계층으로 전달하고, RLC SDU들로 재조립할 할 수 없는 남아있는 RLC 데이터 PDU들을 모두 폐기하고, 관련 상태 변수들을 초기화하고 관련 타이머들을 중지한다.

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<51> 도 5는 본 발명의 실시예에 적용되는 단말의 이중 연결 상황의 일 예를 나타낸다.

<52> 도 5를 참조하면, 매크로 기지국(또는 앵커(anchor) 기지국, 500) 내 매크로 셀의 서비스 지역에 위치하는 단말(550)이 스몰 기지국(또는 어시스팅(assisting) 기지국, 510) 내 스몰 셀의 서비스 지역과 중첩(over-laid)된 지역으로 진입한 경우이다.

<53> 매크로 기지국 내 매크로 셀을 통한 기존 무선 연결 및 데이터 서비스 연결을 유지한 채로 스몰 기지국 내 스몰 셀을 통한 추가적인 데이터 서비스를 지원하기 위하여, 네트워크는 단말에 대하여 이중 연결을 구성한다.

<54> 이에 따라, 매크로 셀에 도착한 사용자 데이터는 스몰 기지국내 스몰 셀을 통해 단말에게 전달될 수 있다. 구체적으로, F2 주파수 대역이 매크로 기지국에 할당되고, F1 주파수 대역이 스몰 기지국에 할당된다. 단말은 매크로 기지국으로부터 F2 주파수 대역을 통해 서비스를 수신하는 동시에, 스몰 기지국으로부터 F1 주파수 대역을 통해 서비스를 수신할 수 있는 상황이다.

<55> 도 6은 싱글 플로우가 구성된 경우의 EPS 베어러 구조 예를 나타낸다.

<56> 도 6을 참조하면, RB는 사용자의 서비스를 지원하기 위해 Uu 인터페이스에서 제공되는 베어러(bearer)이다. 상기 무선통신 시스템에서는 각 인터페이스마다 각각의 베어러를 정의하여, 인터페이스들간의 독립성을 보장하고 있다.

<57> 상기 무선통신 시스템이 제공하는 베어러를 총칭하여 EPS(Evolved Packet

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System) 베어러라고 한다. EPS 베어러는 단말과 P-GW 간에 생성되는 전송로(transmission path)이다. P-GW는 인터넷으로부터 IP 플로우를 수신 또는 인터넷으로 IP 플로우를 전송할 수 있다. EPS 베어러는 단말당 하나 이상 구성될 수 있으며, 각 EPS 베어러는 E-RAB(E-UTRAN Radio Access Bearer) 및 S5/S8 베어러로 나누어질 수 있고, 상기 E-RAB는 RB(Radio Bearer), S1 베어러로 나누어질 수 있다. 즉, 하나의 EPS 베어러는 각각 하나의 RB, S1 베어러, S5/S8 베어러에 대응된다. 어떤 서비스(또는 어플리케이션)을 이용하는가에 따라 IP 플로우는 다른 QoS(Quality of Service) 특성을 가질 수 있고, 각 EPS 베어러별로 서로 다른 QoS 특성을 가지는 IP 플로우가 맵핑되어 전송될 수 있다. EPS 베어러 식별자(EPS bearer identity)를 기반으로 EPS 베어러가 구분될 수 있다. 상기 EPS 베어러 식별자는 UE 또는 MME에 의하여 할당(allocate)된다.

<58> P-GW(Packet Gateway)는 본 발명에 따른 무선통신 네크워크(예를 들어 LTE 네트워크)와 다른 네트워크 사이를 연결하는 네트워크 노드이다. EPS 베어러는 단말과 P-GW사이에 정의된다. EPS 베어러는 각 노드(node) 사이에 더욱 세분화되어, 단말과 기지국 사이는 RB, 기지국과 S-GW 사이는 S1 베어러, 그리고 EPC 내부의 S-GW와 P-GW 사이는 S5/S8 베어러로 정의된다. 각각의 베어러는 QoS를 통해 정의된다. QoS는 데이터율(data rate), 에러율(error rate), 지연(delay) 등을 통해 정의된다.

<59> 따라서, 상기 무선통신 시스템이 전체적으로 제공해야 하는 QoS가 EPS 베어러로 정의되고 나면, 각 인터페이스마다 각각의 QoS가 정해진다. 각 인터페이스는

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자신이 제공해야 하는 QoS에 맞춰 베어러를 설정하는 것이다. 각 인터페이스의 베어러는 전체 EPS 베어러의 QoS를 인터페이스별로 나누어 제공하므로, EPS 베어러와 RB, S1 베어러 등은 모두 기본적으로 일대일의 관계에 있다.

<60> 즉, LTE 무선 통신 시스템은 기본적으로 싱글 플로우 구조로서, 하나의 EPS 베어러를 위하여 하나의 RB가 구성된다. 다시 말해, 하나의 EPS 베어러는 하나의 RB를 통하여 S1 베어러와 맵핑된다. 싱글 플로우의 경우 하나의 EPS 베어러가 하나의 RB를 통하여 서비스된다. 이 경우 기지국에는 해당 EPS 베어러를 위하여 하나의 RB(예를 들어, PDCP 엔티티, RLC 엔티티, MAC 엔티티, PHY 계층)가 설정되고, 단말에서도 하나의 RB가 설정된다.

<61> 도 7은 이중 연결 상황에서, 싱글 플로우일때 매크로 기지국 및 스몰 기지국의 네트워크 구조의 예를 나타낸다. 도 7은 두 EPS 베어러를 통하여 단말에 서비스가 제공되고 있는 경우이다.

<62> 도 7을 참조하면, 매크로 기지국은 2개의 PDCP 엔티티, RLC 엔티티, MAC 엔티티, 그리고 PHY 계층을 포함하지만, 스몰 기지국은 RLC 엔티티, MAC 엔티티 그리고 PHY 계층을 포함한다. EPS 베어러 #1(700)은 매크로 기지국에 구성된 RB(PDCP/RLC/MAC/PHY)를 통하여 단말에 서비스를 제공한다. 반면에 EPS 베어러 #2(750)는 매크로 기지국에 구성된 PDCP 엔티티와 스몰 기지국에 구성된 RB(RLC/MAC/PHY)를 통하여 단말에 서비스를 제공한다. 따라서, 싱글 플로우에서 하나의 EPS 베어러 별로 하나의 RB를 통하여 서비스가 제공된다.

<63> 도 8은 이중 연결 상황에서, 멀티 플로우가 구성된 경우의 EPS 베어러 구조

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예를 나타낸다.

<64> 도 8을 참조하면, 멀티 플로우가 구성된 경우 하나의 EPS 베어러에 대하여 하나의 RB가 아닌 매크로 기지국 및 스몰 기지국에 각각 구성된 2개의 RB를 통하여 서비스가 제공된다. 단말은 하나의 EPS 베어러에 대하여 매크로 기지국에 구성된 RB와 스몰 기지국에 구성된 RB를 통하여 동시에 서비스를 제공받을 수 있다. 이는 하나의 EPS 베어러가 두 개의 RB를 통하여 서비스를 제공하는 형태이다. 상기와 같이 하나의 EPS 베어러가 두 개 이상의 RB를 통하여 단말에 서비스를 제공하는 경우를 멀티 플로우가 구성되었다고 볼 수 있다.

<65> 도 9는 멀티 플로우일때 매크로 기지국 및 스몰 기지국의 네트워크 구조의 예를 나타낸다.

<66> 도 9를 참조하면, 매크로 기지국은 PDCP 엔티티, RLC 엔티티, MAC 엔티티, 그리고 PHY 계층을 포함하지만, 스몰 기지국은 RLC 엔티티, MAC 엔티티 그리고 PHY 계층을 포함한다. 도 9에서는 도 7과 달리 하나의 EPS 베어러(900)에 대하여 매크로 기지국 및 스몰 기지국에 RB가 각각 구성되어 단말에 서비스를 제공한다. 즉, 하나의 EPS 베어러에 대하여 매크로 기지국 및 스몰 기지국이 멀티플로우를 통하여 단말에 서비스를 제공한다.

<67> 한편, 이중 연결을 고려할 때, 싱글 플로우인 경우와 멀티 플로우인 경우 패킷 전달 과정은 다음과 같이 나타낼 수 있다.

<68> 도 10은 이중 연결을 고려할 때, 싱글 플로우인 경우 패킷 전달 과정을 나타

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낸다.

<69> 도 10을 참조하면, 매크로 기지국(1030)은 P-GW 및 S-GW를 통하여 2개의 EPS 베어러 각각에 대한 패킷들을 수신한다. 여기서 패킷들이 전송되는 플로우는 각 EPS 베어러에 맵핑된다. EPS 베어러 #1을 통하여 전송되는 패킷들을 패킷1이라 하고, EPS 베어러 #2를 통하여 전송되는 패킷들을 패킷2라고 가정한다.

<70> 매크로 기지국(1030)의 PDCP(1035-1)은 패킷1을 S-GW로부터 수신하고, PDCP(1035-2)는 패킷2를 S-GW로부터 수신한다. PDCP(1035-1)은 패킷1을 기반으로 PDCP PDU1을 생성하고, 상기 PDCP PDU1은 매크로 기지국(1030)의 RLC(1040)으로 전달되고, MAC(1045), PHY(1050)를 통하여 각 엔티티 및 계층에 맞는 형식으로 변형되어 단말(1000)로 전송된다.

<71> 매크로 기지국(1030)의 PDCP(1035-2)는 패킷2를 기반으로 PDCP PDU2를 생성하고, 상기 PDCP PDU2는 스몰 기지국(1060)의 RLC(1070)로 전달하고, MAC(1075), PHY(1080)을 통하여 각 엔티티 및 계층에 맞는 형식으로 변형되어 단말(1000)로 전송된다.

<72> 단말(1000)에는 EPS 베어러 #1 및 EPS 베어러 #2 각각에 대하여 무선 프로토콜 엔티티가 존재한다. 다시 말해 단말(1000)에는 EPS 베어러 #1에 대하여 PDCP/RLC/MAC/PHY 엔티티(또는 계층)가 존재하고, EPS 베어러 #2에 대하여 PDCP/RLC/MAC/PHY 엔티티(또는 계층)이 존재한다. 구체적으로 EPS 베어러 #1에 대하여 PHY(1005-1), MAC(1010-1), RLC(1015-1), 및 PDCP(1020-1)이 존재하여 EPS 베어러 #1에 대한 서비스 데이터 및 패킷 등을 처리한다. EPS 베어러 #2에 대하여

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PHY(1005-2), MAC(1010-2), RLC(1015-2), 및 PDCP(1020-2)가 존재하며, EPS 베어러 #2에 대한 서비스 데이터 및 패킷 등을 처리한다.

<73> 한편, 매크로 기지국(1030)과 스몰 기지국(1060)은 X2 인터페이스를 통하여 연결될 수 있다. 즉, 매크로 기지국(1030)는 PDCP(1035-2)의 PDCP PDU2를 X2 인터페이스를 통하여 스몰 기지국(1060)의 RLC(1040)로 전달한다. 여기서 X2 인터페이스는 X3 인터페이스 혹은 기타 매크로 기지국과 스몰 기지국 간의 인터페이스를 지칭하는 다른 표현이 사용될 수 있다. 이 경우 상기 매크로 기지국(1030)과 스몰 기지국(1060) 간의 X2 인터페이스가 비-이상적인 백홀(non-ideal backhaul)로 구성된 경우 약 20~60ms 정도의 전송 지연이 발생할 수 있다. 다만, 이 경우에도 단말(1000)에는 EPS 베어러 #1에 대한 RLC(1015-1), PDCP(1020-1)와 EPS 베어러 #2에 대한 RLC(1015-2), PDCP(1020-2)가 따로 구성되므로, AM의 RLC 엔티티에서 PDCP 엔티티로 RLC SDU의 순차적인 전달을 수행하는 경우에도 문제가 발생하지 않는다.

<74> 도 11은 이중 연결을 고려할 때, 멀티 플로우인 경우 패킷 전달 과정을 나타낸다.

<75> 도 11을 참조하면, 매크로 기지국(1130)은 P-GW 및 S-GW를 통하여 하나의 EPS 베어러에 대한 패킷들을 수신한다. 상기 하나의 EPS 베어러에 대하여 매크로 기지국(1130) 및 스몰 기지국(1160)은 각각 RB를 구성한다. 구체적으로 매크로 기지국(1130)은 PDCP(1135), RLC(1140), MAC(1145), PHY(1150)을 구성하고, 스몰 기지국(1140)은 RLC(1170), MAC(1175), PHY(1180)을 구성한다.

<76> 매크로 기지국(1130)의 PDCP(1135)는 패킷을 S-GW로부터 수신한다.

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PDCP(1135)은 패킷을 기반으로 PDCP PDUs를 생성하고, 미리 정의된 규칙 또는 임의의 방법을 따라 상기 PDCP PDUs를 매크로 기지국(1130)의 RLC(1140) 및 스몰 기지국(1160)의 RLC(1170)로 적절히 배분하여 전달한다. 예를 들면, PDCP PDU 들 중에 홀수 번의 SN 를 가지는 PDCP PDU는 매크로 기지국(1130)의 RLC(1140)로 전송하고, 짝수 번의 SN를 가지는 PDCP PDU는 스몰 기지국(1160)의 RLC(1170)로 전송할 수 있다.

<77> RLC(1140)은 RLC PDU1(s)를 생성하고, 상기 RLC PDU1(s)는 MAC(1145), PHY(1150)를 통하여 각 엔티티 및 계층에 맞는 형식으로 변형되어 단말(1100)로 전송된다. 또한, RLC(1170)은 RLC PDU2(s)를 생성하고, 상기 RLC PDU2(s)는 MAC(1175), PHY(1180)을 통하여 각 엔티티 및 계층에 맞는 형식으로 변형되어 단말(1100)로 전송된다.

<78> 단말(1100)에는 EPS 베어러에 대하여 두개의 무선 프로토콜 엔티티가 존재한다. 다시 말해 단말(1100)에는 매크로 기지국(1130)에 대응하는 RB로서 PDCP/RLC/MAC/PHY 엔티티(또는 계층)가 존재하고, 스몰 기지국(1160)에 대응하는 RB로서 RLC/MAC/PHY 엔티티(또는 계층)이 존재한다. 구체적으로 EPS 베어러에 대하여 매크로 기지국(1130)에 대응하는 PHY(1105-1), MAC(1110-1), RLC(1115-1), 및 PDCP(1120)이 존재하고, 스몰 기지국(1160)에 대응하는 PHY(1005-2), MAC(1010-2), RLC(1015-2)가 존재한다. PDCP(1120)는 매크로 기지국(1130) 및 스몰 기지국(1160)에 동시에 대응되는 PDCP 엔티티이다. 즉, 이 경우는 단말(1100) 단에 2개의 RLC 엔티티(1115-1, 1115-2)가 존재하나, 상기 두 개의 RLC 엔티티(1115-1, 1115-2)는

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하나의 PDCP 엔티티(1120)에 대응한다.

<79> 상술한 바와 같이 매크로 기지국(1130)과 스몰 기지국(1160)은 X2 인터페이스를 통하여 연결될 수 있다. 즉, 매크로 기지국(1130)는 PDCP(1135-2)의 PDCP PDUs 중 일부를 X2 인터페이스를 통하여 스몰 지기국(1160)의 RLC(1140)로 전달한다. 여기서 X2 인터페이스는 X3 인터페이스 혹은 기타 매크로 기지국과 스몰 기지국 간의 인터페이스를 지칭하는 다른 표현이 사용될 수 있다. 이 경우 상기 매크로 기지국(1130)과 스몰 기지국(1160) 간의 X2 인터페이스가 비-이상적인 백홀로 구성된 경우 약 20~60ms 정도의 전송 지연이 발생할 수 있다. 단말(1100)의 PDCP 엔티티(1120)는 두개의 RLC 엔티티(1115-1, 1115-2)로부터 RLC SDU(즉, PDCP PDU)들을 각각 수신하고, PDCP SDU를 생성하여 상위 계층으로 전달해야 하는데, 상기 전송 지연으로 인하여 PDCP 엔티티(1120)에서 수신하는 RLC SDU(즉 ,PDCP PDU)들은 RLC 엔티티(1115-1)로부터 수신되는 것과, RLC 엔티티(1115-2)로부터 수신되는 것에 시간차가 발생하고, PDCP 엔티티(1120)는 PDCP SDU의 상위 계층으로의 순차적 전송을 수행함에 있어 문제가 발생할 수 있다.

<80> 도 11에서 볼 수 있는 바와 같이 이중 연결 환경에서 멀티 플로우를 위하여 매크로 기지국(1130)에 하나의 PDCP(1135)가 존재하고, 단말(1100)에 하나의 PDCP 엔티티(1120)가 존재한다. 그리고, 매크로 기지국(1130) 및 스몰 기지국(1130)에 RLC 엔티티(1140, 1170)가 각각 존재하고, 단말(1100)에도 이에 대응하여 2개의 RLC 엔티티(1115-1, 1115-2)가 존재한다. 즉, 단말(1110)의 RLC 엔티티(1115-1, 1115-2) 단에서는 상위 계층으로 순차적인(in-sequence) 전달이 보장될 수 있다.

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하지만 단말(1110)의 PDCP 엔티티(1120) 단에서는 하나의 RLC 엔티티가 아닌 두개의 RLC 엔티티(1115-1, 1115-2)로부터 RLC SDU(즉, PDCP PDU)가 전달된다. RLC 엔티티(1115-1, 1115-2) 단에서의 순차적인 전달이 PDCP 엔티티 단에서의 PDCP PDU의 순차적인 수신을 보장하지 못한다. 또한, 매크로 기지국(1130)의 PDCP 에티티(1135)로부터 스몰 기지국(1160)의 RLC 엔티티(1170)로의 PDCP PDU(s)의 전송은 20~60ms의 전송 지연을 수반할 수 있으며, 매크로 기지국(1130)의 RLC 엔티티(1140)를 향한 PDCP PDU(s)의 전송과 스몰 기지국(1130)의 RLC 엔티티(1170)을 향한 PDCP PDU(s)의 전송 사이에는 시간지연이 발생할 수 있다. 결국 매크로 기지국(1130)의 PDCP 엔티티(1135)에서 전송한 PDCP PDU(s)를 단말(1100) 단의 PDCP 엔티티(1120)에서 수신함에 있어도 매크로 기지국의 RLC 이하 단을 통한 전송과 스몰 기지국의 RLC 이하 단을 통한 전송에 있어 수신시간에 차이가 발생하고, 단말(1100) 단의 PDCP 엔티티(1120)는 PDCP PDU(s)를 순차적으로 수신하기 어렵게 된다.

<81> 도 12는 단말의 PDCP 엔티티에서 PDCP PDU 수신 타이밍의 예를 나타낸다. 도 12는 매크로 기지국을 통하여 전송된 PDCP PDU와 스몰 기지국을 통하여 전송된 PDCP PDU가 단말의 PDCP 엔티티에 도착하는 시간을 예시적으로 나타낸다. 매크로 기지국은 하나의 EPS 베어러에 대한 서비스에 대하여 매크로 기지국을 통하여 전송할 PDCP PDU와 스몰 기지국을 통하여 전송할 PDCP PDU를 결정할 수 있다. 도 12에서는 PDCP SN(Sequence Number) 중 홀수 번은 매크로 기지국을 통하여 전송하고, 짝수 번은 스몰 기지국을 통하여 전송한 경우를 예시적으로 나타낸다.

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<82> 도 12를 참조하면, 매크로 기지국을 통하여 전송된 PDCP PDU의 단말에서의 수신 시점과 스몰 기지국을 통하여 전송된 PDCP PDU의 단말에서의 수신 시점은 시간 지연 차이가 있다. 스몰 기지국을 통하여 전송되는 PDCP PDU에 약 20~60ms의 전송 지연이 발생할 수 있다. 이러한 경우 단말의 PDCP 엔티티가 두 개의 RLC 엔티티로부터 전달받는 RLC (AMD) SDU의 시간 차이로 인하여 비순차적으로 PDCP PDU를 수신하게 되고, PDCP 엔티티가 이를 바로 상위계층(예를 들어 어플리케이션 계층)으로 전송하게 될 경우, 순차적인 전송이 수행되지 않는 문제점이 있다.

<83> 즉, 멀티 플로우 구조에서 매크로 기지국의 하나의 PDCP 엔티티에서 전송된 PDCP PDU가 매크로 기지국의 RLC 엔티티 및 스몰 기지국의 RLC 엔티티를 통하여 전송되기에 단말의 PDCP 엔티티에서 PDCP PDU를 수신함에 있어, 시간 지연이 발생하고, 따라서 PDCP 엔티티에서 상위계층으로 PDCP SDU의 순차적인 전송을 수행하는데 있어 문제가 발생하게 된다.

<84> 단말의 PDCP 엔티티는 수신한 PDCP PDU를 판독(deciphering) 및 헤더 압축해제(header decompression)하고, PDCP SDU를 상위 계층으로 전송한다. 이 때, 만약 현재의 PDCP SDU의 SN(sequence number)보다 작은 SN의 PDCP SDU가 존재하면 작은 SN부터 큰 SN 순으로 PDCP SDU를 상위 계층으로 전송한다.

<85> 한편, PDCP 엔티티의 전송부(transmission side)는 제거 타이머(discard timer)를 운용할 수 있다. 상기 제거 타이머의 지속시간(duration)은 상위 계층으로부터 구성될 수 있으며, 상위계층으로부터 PDCP SDU를 수신하면 타이머가 시작된다. 상기 제거 타이머가 만료되면 PDCP 엔티티는 해당하는 PDCP SDU를 제거한다.

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따라서, 기존의 경우에도 제거 타이머의 만료로 인하여 특정 SN의 PDCP SDU가 빠질 수 있었다.

<86> 즉, 이중 연결 상황에서 멀티 플로우를 지원하는 경우, PDCP 엔티티에 PDCP PDU가 순차적으로 수신되지 않는 경우, 다음과 같은 두 가지 경우 중 어느 하나로 파악할 수 있다. 하지만, 아래의 두 경우 중 어느 경우인지는 구분되지 않을 수 있다.

<87> 첫째, 제거 타이머 만료된 경우일 수 있다. 기지국에서는 하향링크 전송 시에 기지국의 PDCP 엔티티에서 처리하는 PDCP SDU마다 제거 타이머(discard timer)를 구동한다. 상기 제거 타이머의 구동에 의하여 PDCP로 유입되는 패킷의 양이 일정 기준보다 많을 경우 등의 경우, 제거 타이머 지속시간 내에 처리되지 않은 패킷은 제거하고, 상위 계층에서 수행되는 재전송 요구 등을 기반하여 해당 패킷에 대한 처리가 새로이 수행될 수 있다.

<88> 둘째, PDCP PDU 전송경로 수신지연의 경우일 수 있다. 매크로 기지국의 PDCP 엔티티에서는 멀티 플로우로 인하여 매크로 기지국 및 스몰 기지국을 통하여 PDCP PDU를 분리하여 전송할 수 있다. 이 경우 서로 다른 경로로 인하여 발생하는 지연으로 인하여 단말의 PDCP 엔티티에서 PDCP PDU 수신시 시간차가 발생할 수 있다.

<89> 이와 같은 상황에서 상기 멀티 플로우 전송경로 수신지연의 경우와 PDCP 제거 타이머 만료의 경우와 구분하여, 단말의 PDCP 엔티티에서 PDCP SDU를 순차적으로 상위계층으로 전송할 수 있는 방안이 요구된다.

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<90> 멀티 플로우를 고려하는 상위계층으로의 PDCP SDU 순차적 전송 방법은 다음과 같다.

<91> PDCP 엔티티에서 수신된 PDCP PDU에 대응하는 PDCP SDU의 PDCP SN(sequence number)를 확인하고, 만약 PDCP SDU의 PDCP SN가 순차적이 아니라면(즉, 상기 PDCP SDU의 PDCP SN 앞의 SN이 누락되었다면), 상기 PDCP SDU에 대한 순차 타이머(in-sequence timer)를 구동한다. 이 때 상기 순차 타이머의 지속시간은 멀티 플로우의 경우 PDCP PDU 전송경로 수신지연을 고려하여 정해질 수 있다. 혹은 시스템 전체의 상황을 고려하여 정해질 수 있다.

<92> 만약, PDCP SDU에 대한 순차 타이머가 만료되는 경우 상위 계층으로 상기 PDCP SDU를 전송한다. 이는 상기 순차 타이머가 만료되기까지 누락된 PDCP SN에 대한 PDCP SDU에 대응하는 PDCP PDU가 단말의 PDCP 엔티티에 수신되지 않는 경우, 해당 PDCP SDU는 매크로 기지국의 PDCP 엔티티 송신부에서 제거 타이머의 경과에 의하여 제거된 것으로 볼 수 있기 때문이다.

<93> 만약, PDCP SDU에 대한 순차 타이머가 동작중에(running) 상기 PDCP SDU의 PDCP SN보다 앞서는(즉, 누락되었던) PDCP SN에 대한 PDCP SDU에 대응하는 PDCP PDU가 단말의 PDCP 엔티티에 수신되어, PDCP SDU의 순차적 전송이 가능한 경우, 상기 순차 타이머는 만료되고, 해당 PDCP SDU는 순차적으로 상위 계층으로 전송된다.

<94> TCP(Transmission Control Protocol) 등은 순차적으로 패킷이 수신되는 것을 기반하여 설계되어 있는 프로토콜이다. 구현에 따라서 TCP에 패킷이 수신되지 않는

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경우 TCP 단에서 전송할 수 있는 윈도우(window)가 줄어들 수 있고, 이는 전송효율을 을 감소시킬 수 있다. 따라서, 일정 무선 프로토콜 단에서 상위 계층으로 패킷 등을 전송함에 있어 지연시간이 추가되더라도 상기와 같이 순차적인 전송을 보장함이 네트워크 전반적인 성능에 있어서는 더 유리할 수 있다.

<95> 도 13은 단말의 PDCP 엔티티에서 PDCP SN(Sequence Number)에 따른 순차적 상위 계층 전송의 예를 나타낸다. 도 13은 PDCP SN 홀수번은 매크로 기지국을 통하여 단말로 수신되고, PDCP SN 짝수번은 스몰 기지국을 통하여 단말로 수신되는 경우이다.

<96> 도 13을 참조하면, PDCP SDU #1은 이전 또는 누락된 PDCP SN이 없기 때문에 상위 계층으로 전송될 수 있다. 하지만, PDCP SDU #3의 경우 단말의 PDCP 엔티티에 상기 PDCP SDU #3에 대응하는 PDCP PDU가 수신되는 시점에는 PDCP PDU #2에 대응하는 PDDP PDU가 수신되지 못하였다. 따라서 이 경우 PDCP PDU #3에 대한 순차 타이머가 구동된다. PDCP SDU #5, PDCP SDU #7의 경우도 마찬가지로 순차 타이머가 각각 구동된다.

<97> PDCP SDU #3에 대한 순차 타이머가 만료되기 전에 단말의 PDCP 엔티티에 PDCP SDU #2가 존재(즉, PDCP SDU #2에 대응하는 PDCP PDU가 수신)하는 경우, 단말은 PDCP SDU #1 이후에 PDCP SDU #2 및 PDCP SDU #3이 순차적으로 존재함을 확인하고, 상기 PDCP SDU #2 및 PDCP SDU #3을 상위계층으로 순차적으로 전달한다. 이 때 PDCP SDU #3에 대한 순차 타이머는 만료 또는 종료된다. 하지만, 이 경우에도 아직 PDCP SDU #4가 도착하지 않았고, PDCP SDU #5에 대한 순차 타이머, PDCP SDU #7에

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대한 순차 타이머는 여전히 동작한다.

<98> 이후, PDCP SDU#5에 대한 순차 타이머가 만료 되기 전에 단말의 PDCP 엔티티에 PDCP SDU #4가 존재하는 경우, 단말은 PDCP SDU #4 및 PDCP SDU #5를 상위 계층으로 전송하고, PDCP SDU#5에 대한 순차 타이머는 만료 또는 종료된다.

<99> 또한, PDCP SDU#7에 대한 순차 타이머가 만료 되기 전에 단말의 PDCP 엔티티에 PDCP SDU #6가 존재하는 경우, 단말은 PDCP SDU #6 및 PDCP SDU #7을 상위 계층으로 전송하고, PDCP SDU#7에 대한 순차 타이머는 만료 또는 종료된다.

<100> 상기에서 순차 타이머 지속시간은 매크로 기지국에서 PDCP 엔티티를 구성할 때 설정될 수 있다. 상기 순차 타이머 지속시간은 매크로 기지국과 스몰 기지국 간 백홀의 전송 지연시간을 고려하여 설정될 수 있다.

<101> 상기 순차 타이머는 RRC 메시지를 통하여 매크로 기지국에서 단말로 전송될 수 있다. 구체적으로 예를 들어 상기 순차 타이머는 RRC 정보 요소인 PDCP-구성(config)에 다음과 같은 구문으로 포함될 수 있다.

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<102> 【표 1】

```
-- ASN1START
PDCP-Config ::=             SEQUENCE {
    discardTimer                ENUMERATED {
                                    ms50, ms100, ms150, ms300, ms500,
                                    ms750, ms1500, infinity
    }                                               OPTIONAL,    -- Cond Setup
    inseqTimer                  ENUMERATED {
                                    ms20, ms30, ms40, ms50, ms60,
    }                                               OPTIONAL,    -- Cond Setup
    rlc-AM                      SEQUENCE {
        statusReportRequired        BOOLEAN
    }                                               OPTIONAL,    -- Cond Rlc-AM
    rlc-UM                      SEQUENCE {
        pdcp-SN-Size                ENUMERATED {len7bits, len12bits}
    }                                               OPTIONAL,    -- Cond Rlc-UM
    headerCompression           CHOICE {
        notUsed                     NULL,
        rohc                        SEQUENCE {
            maxCID                      INTEGER (1..16383)          DEFAULT 15,
            profiles                    SEQUENCE {
                profile0x0001               BOOLEAN,
                profile0x0002               BOOLEAN,
                profile0x0003               BOOLEAN,
                profile0x0004               BOOLEAN,
                profile0x0006               BOOLEAN,
                profile0x0101               BOOLEAN,
                profile0x0102               BOOLEAN,
                profile0x0103               BOOLEAN,
                profile0x0104               BOOLEAN
            },
            ...
        }
    },
    ...,
    [[ rn-IntegrityProtection-r10   ENUMERATED {enabled}    OPTIONAL    -- Cond RN
    ]],
    [[ pdcp-SN-Size-v11x0           ENUMERATED {len15bits}  OPTIONAL   -- Cond Rlc-AM2
    ]]
}
-- ASN1STOP
```


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<103> 표 1을 참조하면, PDCP-구성(config) 정보 요소는 inseqTimer 필드를 포함한다. 상기 inseqtimer 필드는 순차 타이머 값을 지시한다. 상기 inseqtimer 필드는 PDCP 엔티티에 수신되는 PDCP PDU에 대응하는 PDCP SDU가 PDCP SN의 순차적으로 형성되지 않는 경우, 구동된다. 즉, PDCP SDU의 PDCP SN #n보다 작은 PDCP SN #n-1의 PDCP SDU가 누락된 경우, 해당 PDCP SN #n의 PDCP SDU에 대하여 순차 타이머가 구동될 수 있다.

<104> 도 14는 본 발명의 실시예에 따른 멀티 플로우를 고려한 단말에 의해 수행되는 PDCP SDU 순차 전달 방법을 나타낸다.

<105> 도 14를 참조하면, 단말은 획득한 PDCP SDU들이 PDCP SN의 순차적으로 존재하는지 확인한다(S1400).

<106> 단말은 PDCP SN #n의 PDCP SDU가 존재하나 PDCP SN #n-1의 PDCP SDU가 누락된 경우, 상기 PDCP SN #n의 PDCP SDU에 대한 순차 타이머를 구동한다(S1410).

<107> 단말은 PDCP SN #n의 PDCP SDU에 대한 순차 타이머가 만료되기 전 PDCP SN #n-1의 PDCP SDU를 획득하게 된 경우, 상기 PDCP SN #n-1의 PDCP SDU와 상기 PDCP SN #n의 PDCP SDU의 상위 계층으로 순차적 전달을 수행한다(S1420).

<108> 만약, S1410에서 PDCP SN #n의 PDCP SDU에 대한 순차 타이머가 만료되는 경우, 단말은 PDCP SN #n의 PDCP SDU를 상위 계층으로 전달한다(S1430). 이 경우는, 이중 연결에 의한 PDCP PDU 전송경로 수신지연에 의한 경우가 아닌, PDCP 제거 타이머에 의하여 상기 PDCP SN #n01의 PDCP SDU가 제거된 것으로 볼 수 있기 때문이

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다.

<109> 도 15는 본 발명의 실시예에 따른 매크로 기지국, 스몰 기지국 및 단말의 블록도이다.

<110> 도 15를 참조하면, 본 발명의 실시예에 따른 단말(1500)은 매크로 기지국(1530) 및 스몰 기지국(1560)과 이중 연결(daul connectivity)를 구성할 수 있다. 또한, 본 발명에 따른 단말(1500), 매크로 기지국(1530) 및 스몰 기지국(1560)은 상술한 멀티 플로우를 지원한다.

<111> 매크로 기지국(1530)은 매크로 전송부(1535), 매크로 수신부(1540) 및 매크로 프로세서(1550)를 포함한다.

<112> 매크로 수신부(1540)은 S-GW로부터 하나의 EPS 베어러에 대한 패킷을 수신한다. 매크로 프로세서(1550)는 매크로 기지국(1530)의 PDCP 엔티티를 제어하여 PDCP PDU들을 생성한다. 매크로 프로세서(1550)는 상기 PDCP PDU들을 정해진 기준에 따라 분배하여 일부를 매크로 기지국(1540)의 RLC 엔티티로 전달(또는 전송)하고 매크로 전송부(1535)를 통하여 단말로 전송한다. 매크로 프로세서(1550)는 나머지 일부를 매크로 전송부(1535)를 통하여 스몰 기지국(1560)의 RLC 엔티티로 전송(또는 전달)한다. 이 경우 PDCP PDU들에 대응하는 PDCP SDU들은 SN으로 구분 및 지시될 수 있다.

<113> 또한, 매크로 프로세서(1550)는 PDCP SDU에 대한 순차 타이머에 대한 정보를 생성하고 매크로 전송부(1535)를 통하여 단말로 전송한다. 상기 순차 타이머에 대

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한 정보는 PDCP SDU마다 정의될 수 있다. 매크로 전송부(1535)는 상기 순차 타이머에 대한 정보를 RRC 메시지(예를 들어, RRC 연결 재구성 메시지)에 포함하여 단말(1500)로 전송할 수 있다.

<114> 스몰 기지국(1560)은 스몰 전송부(1565), 스몰 수신부(1570) 및 스몰 프로세서(1580)을 포함한다.

<115> 스몰 수신부(1570)은 매크로 기지국(1530)으로부터 PDCP PDU를 수신한다.

<116> 스몰 프로세서(1580)는 스몰 기지국(1530)의 RLC 엔티티, MAC 엔티티, 및 PHY 계층을 제어하여 상기 PDCP PDU를 처리하고, 스몰 전송부(1565)를 통하여 단말로 전송한다.

<117> 단말(1500)은 단말 수신부(1505), 단말 전송부(1510) 및 단말 프로세서(1520)을 포함한다. 단말 프로세서(1520)는 상술한 바와 같은 본 발명의 특징이 구현되도록 필요한 기능과 제어를 수행한다.

<118> 단말 수신부(1505)는 매크로 기지국(1530)으로부터 순차 타이머에 대한 정보를 수신한다. 상기 순차 타이머에 대한 정보는 PDCP SDU마다 정의될 수 있으며, 상기 순차 타이머에 대한 정보는 RRC 메시지(예를 들어, RRC 연결 재구성 메시지)에 포함되어 단말 수신부(1505)가 수신할 수 있다. 이 경우 단말 전송부(1510)는 매크로 기지국(1530)으로 RRC 연결 재구성 완료 메시지를 전송할 수도 있다.

<119> 또한, 단말 수신부(1505)는 매크로 기지국(1530) 및 스몰 기지국(1560)으로부터 각각 PDCP PDU에 대한 데이터를 수신한다.

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<120> 단말 프로세서(1505)는 상기 데이터를 해석하고, 단말(1500)의 PHY 계층(s), MAC 엔티티(s), RLC 엔티티(s), 및 PDCP 엔티티를 제어하여 PDCP SDU를 획득한다.

<121> 단말 프로세서(1505)는 PDCP 엔티티에서 획득한 PDCP SDU의 PDCP SN을 확인하고, 누락된 PDCP SN #n-1의 PDCP SDU가 있는지 확인한다. 누락된 PDCP SN #n-1의 PDCP SDU가 있는 경우 단말 프로세서(1505)는 상기 누락된 PDCP SN #n-1의 다음 PDCP SN #n의 PDCP SDU에 대하여 상기 순차 타이머를 구동한다.

<122> 만약 단말 프로세서(1505)가 상기 순차 타이머가 만료되기 전에 상기 누락된 PDCP SN #n-1의 PDCP SDU를 획득하는 경우 상기 PDCP SN #n-1의 PDCP SDU 및 상기 PDCP SN #n의 PDCP SDU의 상위계층으로의 순차적 전달을 수행한다.

<123> 만약 단말 프로세서(1505)는 상기 순차 타이머가 만료된 경우, 상기 누락된 PDCP SN #n-1의 SDU가 획득되기까지 기다리지 않고, 상기 PDCP SN #n의 PDCP SDU를 상위계층으로 전달한다.

<124> 이상의 설명은 본 발명의 기술 사상을 예시적으로 설명한 것에 불과한 것으로서, 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자라면 본 발명의 본질적인 특성에서 벗어나지 않는 범위에서 다양한 수정 및 변형이 가능할 것이다. 따라서, 본 발명에 개시된 실시 예들은 본 발명의 기술 사상을 한정하기 위한 것이 아니라 설명하기 위한 것이고, 이러한 실시 예에 의하여 본 발명의 기술 사상의 범위가 한정되는 것은 아니다. 본 발명의 보호 범위는 아래의 청구범위에 의하여 해석되어야 하며, 그와 동등한 범위 내에 있는 모든 기술 사상은 본 발명의 권리범위

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에 포함되는 것으로 해석되어야 할 것이다.

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【특허청구범위】

【청구항 1】

이중 연결(dual connectivity)을 지원하는 무선 통신 시스템에서 단말(UE)이 매크로 기지국(Macro eNB) 및 스몰 기지국(Small eNB)을 통하여 하나의 EPS(Evolved Packet System) 베어러(bearder)에 대한 멀티 플로우(multi flow) 데이터를 수신하는 방법으로,

상기 단말의 PDCP(Packet Data Convergence Protocol) 엔티티(entity)는 상기 매크로 기지국의 PDCP 엔티티로부터 상기 매크로 기지국 및 상기 스몰 기지국을 통하여 PDCP PDU들을 수신하는 단계;

상기 PDCP PDU(Packet Data Unit)들에 대응하는 PDCP SDU(Service Data Unit)들을 획득하는 단계; 및

상기 매크로 기지국으로부터 RRC(radio resource control) 메시지를 통하여 상기 PDCP SDU들에 대한 순차 타이머에 관한 정보를 수신하는 단계를 포함하되,

상기 PDCP SDU들은 미리 정의된 PDCP SN(Sequence Number)으로 지시됨을 특징으로 하는, 수신 방법.

【청구항 2】

제 1항에 있어서,

상기 획득한 PDCP SDU들의 각 PDCP SN을 확인하고, 상기 PDCP SDU에 대하여 상기 PDCP SN에 따라 PDCP 엔티티에서 상위 계층으로 순차적 전달(in-sequence

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delivery)를 수행하는 단계를 더 포함함을 특징으로 하는, 수신 방법.

【청구항 3】

제 2항에 있어서,

PDCP SN #n의 PDCP SDU를 획득하였음에도 불구하고, 누락된 PDCP SN #n-1의 PDCP SDU가 있는지 확인하는 단계;

상기 누락된 PDCP SN#n-1의 PDCP SDU가 있는 경우, 상기 PDCP SN#n의 PDCP SDU에 대하여 상기 순차 타이머를 구동하는 단계를 포함함을 특징으로 하는, 수신 방법.

【청구항 4】

제 3항에 있어서,

만약 상기 PDCP SN#n의 PDCP SDU에 대한 순차 타이머가 만료되는 경우, 상기 PDCP SN #n-1의 PDCP SDU가 없음에도 불구하고, 예외적으로 상기 PDCP SN#n의 PDCP SDU를 PDCP 엔티티의 상위 계층으로 전달함을 특징으로 하는, 수신 방법.

【청구항 5】

제 3항에 있어서,

만약 상기 PDCP SN#n의 PDCP SDU에 대한 순차 타이머가 만료되기 전에, 상기 PDCP SN#n-1의 PDCP SDU를 획득하는 경우, PDCP SN의 순차에 따라 상기 PDCP SN#n-1의 PDCP SDU 및 상기 PDCP SN#n의 PDCP SDU를 상위 계층으로 전달함을 특징으로 하는, 수신 방법.

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【청구항 6】

이중 연결(dual connectivity)을 지원하는 무선 통신 시스템에서 매크로 기지국에서 상기 매크로 기지국 및 스몰 기지국을 통하여 하나의 EPS 베어러에 대한 멀티 플로우 데이터를 단말로 전송하는 방법으로,

상기 매크로 기지국이 수신하는 패킷에 대하여 PDCP 엔티티에서 PDCP SDU의 PDCP SN에 따라 PDCP PDU들을 생성하는 단계;

상기 PDCP PDU들을 정해진 규칙에 따라 상기 매크로 기지국의 RLC(Radio Link Control) 엔티티 및 상기 스몰 기지국의 RLC 엔티티에 분배하여 상기 단말로 전송하는 단계; 및

상기 PDCP SDU들에 대한 순차 타이머에 관한 정보를 포함하는 RRC 메시지를 상기 단말로 전송하는 단계를 포함함을 특징으로 하는, 전송 방법.

【청구항 7】

제 6항에 있어서,

상기 순차 타이머에 관한 정보를 포함하는 상기 RRC 메시지는 RRC 연결 재구성(RRC connection reconfiguration) 메시지임을 특징으로 하는, 전송 방법.

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제출 일자 : 2013-05-10

【요약서】

【요약】

본 발명은 이중 연결(dual connectivity)을 지원하는 무선 통신 시스템에서 단말(UE)이 매크로 기지국(Macro eNB) 및 스몰 기지국(Small eNB)을 통하여 하나의 EPS(Evolved Packet System) 베어러(bearder)에 대한 멀티 플로우(multi flow) 데이터를 수신하는 방법을 제공한다. 상기 방법은 상기 단말의 PDCP(Packet Data Convergence Protocol) 엔티티(entity)는 상기 매크로 기지국의 PDCP 엔티티로부터 상기 매크로 기지국 및 상기 스몰 기지국을 통하여 PDCP PDU들을 수신하는 단계, 상기 PDCP PDU(Packet Data Unit)들에 대응하는 PDCP SDU(Service Data Unit)들을 획득하는 단계, 및 상기 매크로 기지국으로부터 RRC(radio resource control) 메시지를 통하여 상기 PDCP SDU들에 대한 순차 타이머에 관한 정보를 수신하는 단계를 포함하되, 상기 PDCP SDU들은 미리 정의된 PDCP SN(Sequence Number)으로 지시됨을 특징으로 한다.

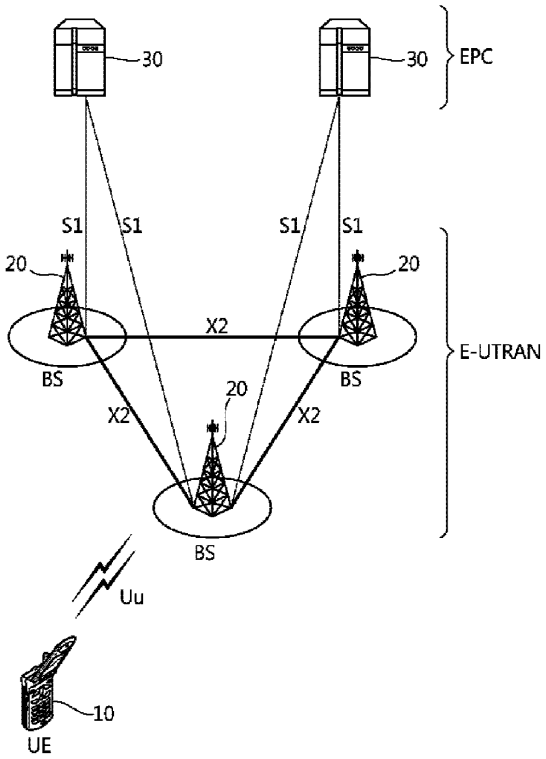
【대표도】

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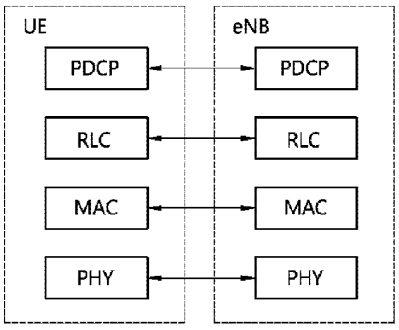
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【도면】

【도 1】

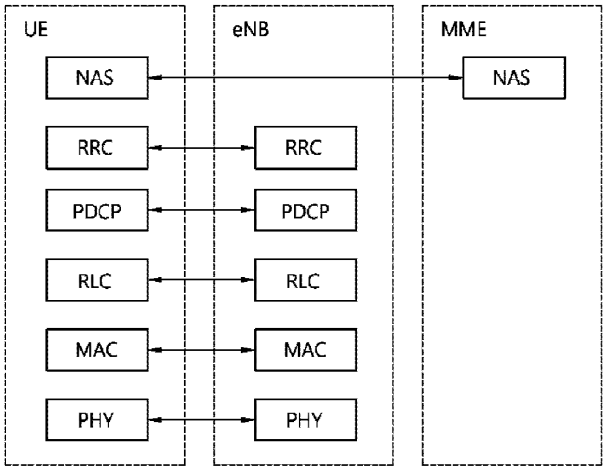


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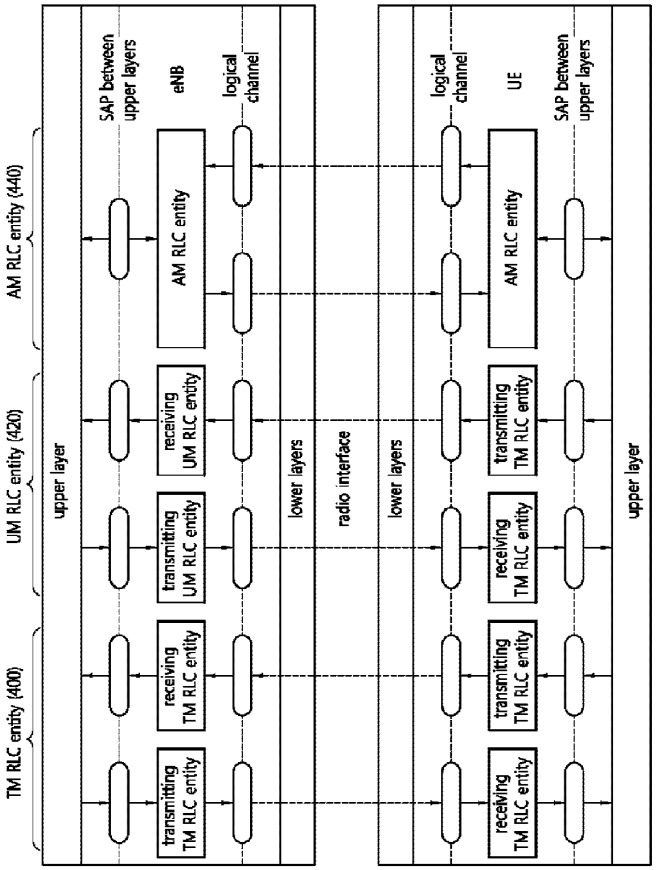


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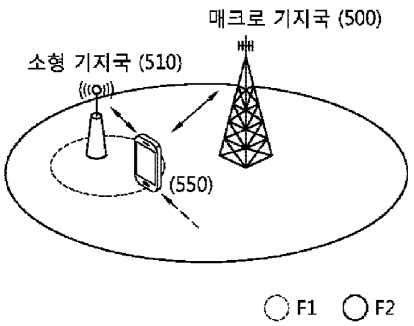
【도 3】



【도 4】

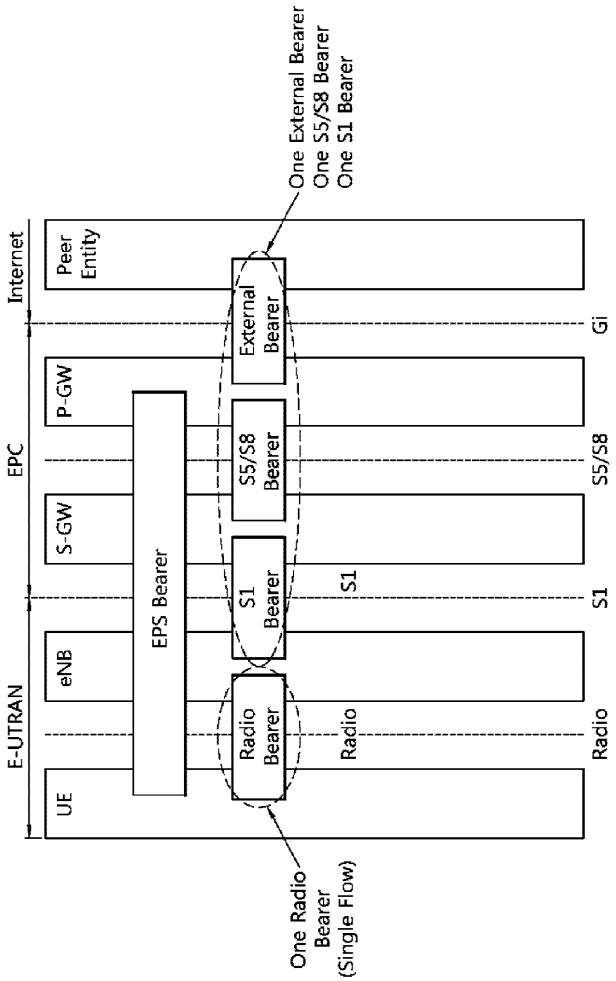

TM RLC entity (400)
UM RLC entity (420)
AM RLC entity (440)
upper layer
transmitting TM RLC entity
receiving TM RLC entity
transmitting UM RLC entity
receiving UM RLC entity
AM RLC entity
SAP between upper layers
eNB
logical channel
lower layers
radio interface
lower layers
logical channel
UE
receiving TM RLC entity
transmitting TM RLC entity
receiving TM RLC entity
transmitting TM RLC entity
AM RLC entity
SAP between upper layers
upper layer

【도 5】

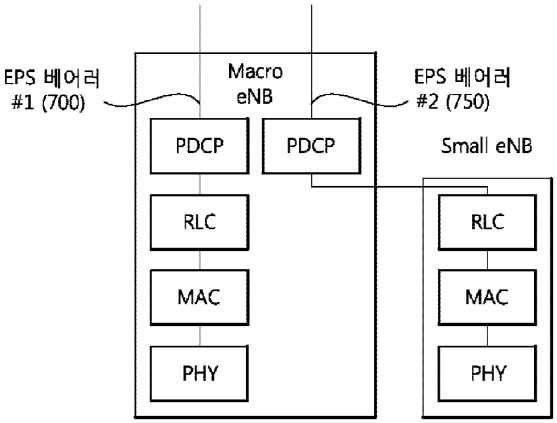


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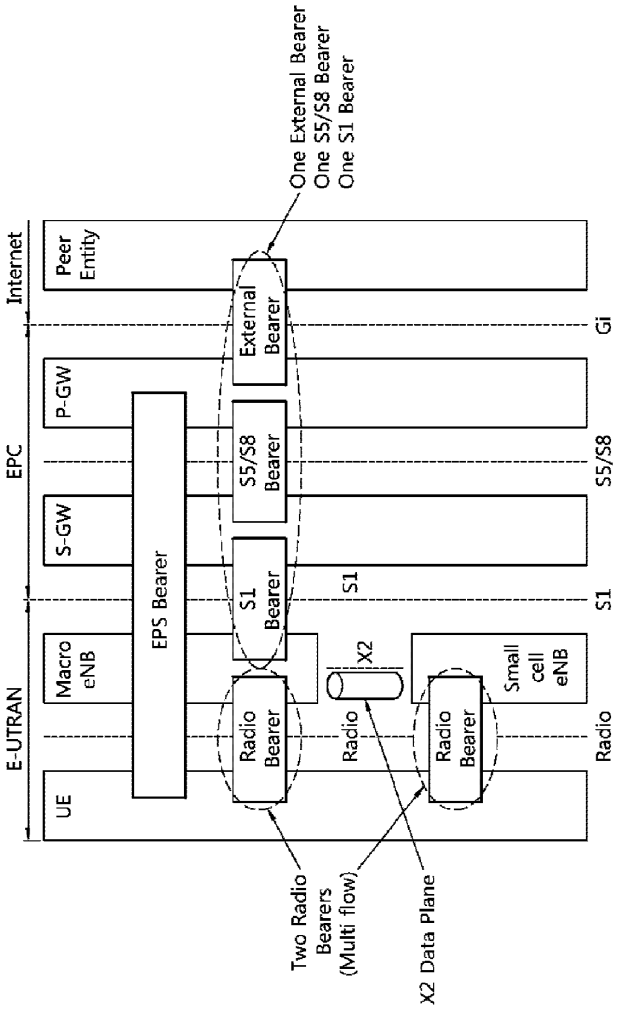
【도 6】


One External Bearer
One S5/S8 Bearer
One S1 Bearer
Internet
Peer Entity
External Bearer
Gi
P-GW
S5/S8 Bearer
S5/S8
EPC
S-GW
EPS Bearer
S1 Bearer
S1
S1
eNB
Radio Bearer
Radio
Radio
E-UTRAN
UE
One Radio Bearer (Single Flow)

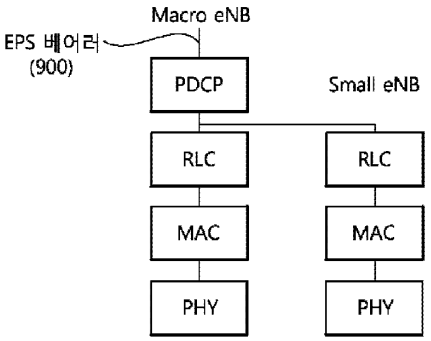
【도 7】


EPS 베어러
#1 (700)
Macro
eNB
EPS 베어러
#2 (750)
PDCP
PDCP
Small eNB
RLC
RLC
MAC
MAC
PHY
PHY

【도 8】

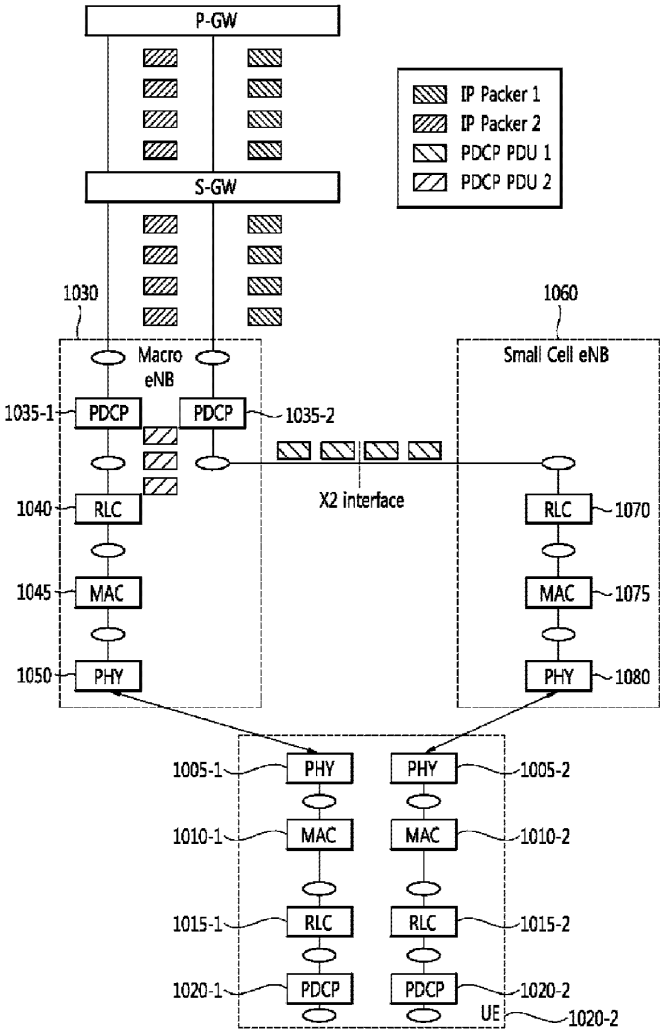

One External Bearer
One S5/S8 Bearer
One S1 Bearer
Internet
Peer Entity
Gi
EPC
P-GW
External Bearer
S5/S8 Bearer
S5/S8
S-GW
EPS Bearer
S1 Bearer
S1
S1
E-UTRAN
Macro eNB
X2
Small cell eNB
Radio Bearer
Radio
Radio Bearer
Radio
UE
Two Radio Bearers (Multi flow)
X2 Data Plane

【도 9】

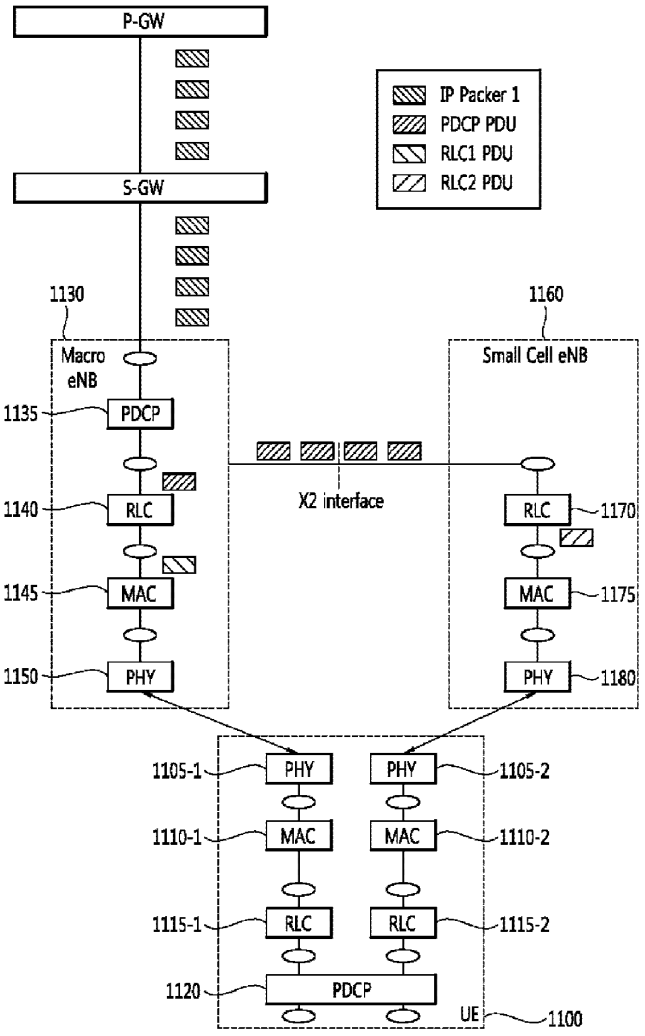


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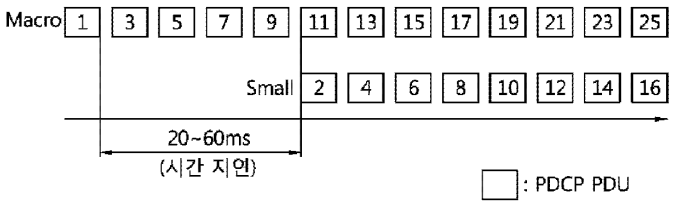
【도 10】


P-GW
S-GW
IP Packer 1
IP Packer 2
PDCP PDU 1
PDCP PDU 2
1030
1060
Macro eNB
Small Cell eNB
1035-1
PDCP
PDCP
1035-2
X2 interface
1040
RLC
RLC
1070
1045
MAC
MAC
1075
1050
PHY
PHY
1080
1005-1
PHY
PHY
1005-2
1010-1
MAC
MAC
1010-2
1015-1
RLC
RLC
1015-2
1020-1
PDCP
PDCP
1020-2
UE
1020-2

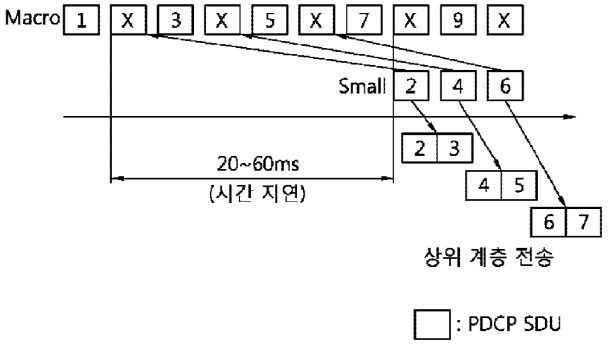
【도 11】


P-GW
S-GW
IP Packer 1
PDCP PDU
RLC1 PDU
RLC2 PDU
1130
Macro eNB
1135
PDCP
1140
RLC
1145
MAC
1150
PHY
X2 interface
1160
Small Cell eNB
RLC
1170
MAC
1175
PHY
1180
1105-1
PHY
PHY
1105-2
1110-1
MAC
MAC
1110-2
1115-1
RLC
RLC
1115-2
1120
PDCP
UE
1100

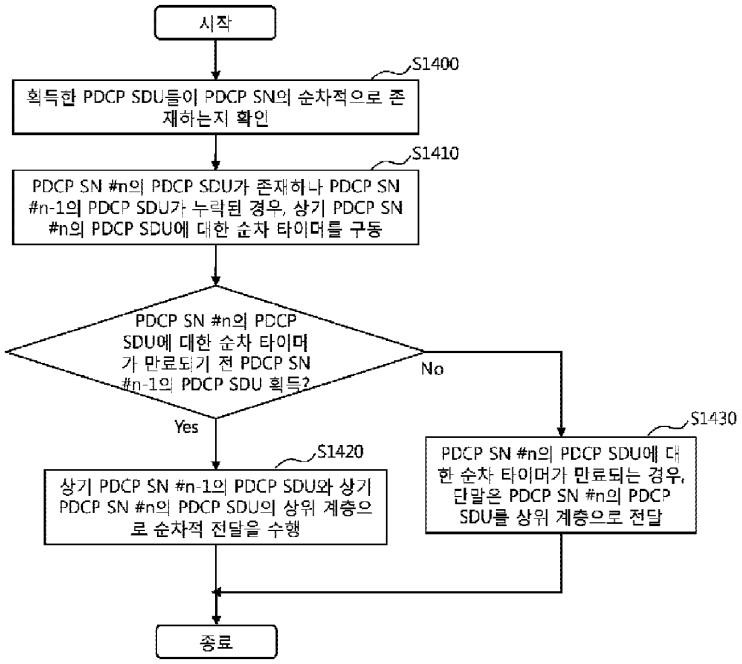
【도 12】


Macro
1
3
5
7
9
11
13
15
17
19
21
23
25
Small
2
4
6
8
10
12
14
16
20~60ms
(시간 지연)
: PDCP PDU

【도 13】

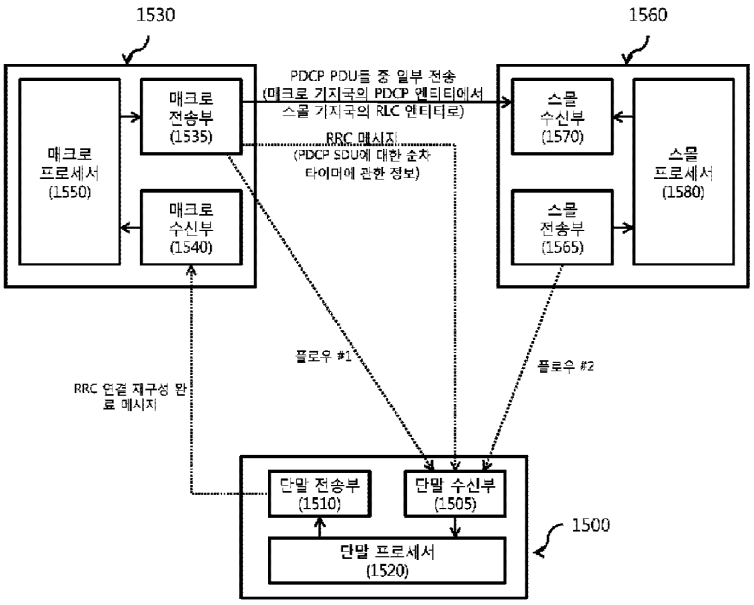

Macro
1
X
3
X
5
X
7
X
9
X
Small
2
4
6
2
3
4
5
6
7
20~60ms
(시간 지연)
상위 계층 전송
: PDCP SDU

【도 14】



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【도 15】



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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 15/935,626

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	1 minus 20 =	*			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*				x 460 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1720

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)	OR	RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
15/935,626	03/26/2018		1720	P6672USC1	1	1

CONFIRMATION NO. 8564

58027
H.C. PARK & ASSOCIATES, PLC
1894 PRESTON WHITE DRIVE
RESTON, VA 20191

FILING RECEIPT



Date Mailed: 04/20/2018

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Myung Cheul JUNG, Seoul, KOREA, REPUBLIC OF;
Kang Suk HUH, Seoul, KOREA, REPUBLIC OF;
Jae Hyun AHN, Seoul, KOREA, REPUBLIC OF;
Ki Bum KWON, Seoul, KOREA, REPUBLIC OF;

Applicant(s)

PANTECH INC., Seoul, KOREA, REPUBLIC OF;

Power of Attorney: The patent practitioners associated with Customer Number 58027

Domestic Priority data as claimed by applicant

This application is a CON of 14/890,407 11/10/2015 PAT 9930720
which is a 371 of PCT/KR2014/004189 05/09/2014

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2013-0053408 05/10/2013

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

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If Required, Foreign Filing License Granted: 04/19/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/935,626**

Projected Publication Date: 07/26/2018

Non-Publication Request: No

Early Publication Request: No

Title

METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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PTO/SB/08a (02-18)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2018-03-26
	First Named Inventor	Myung Cheul JUNG
	Art Unit	
	Examiner Name	
	Attorney Docket Number	P6672USC1

U.S.PATENTS						
Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS						
Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20120039226		2012-02-16	YANG et al.	
	2	20120294281		2012-11-22	PARK	Corresponding to KR 10-2012-0128078
	3	20100039996		2010-02-18	OHTA et al.	Corresponding to KR 10-2010-0005017
	4	20040151154		2004-08-05	WU	Corresponding to JP 2003-283592
	5	20090190554		2009-07-30	CHO	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2018-03-26
	First Named Inventor	Myung Cheul JUNG
	Art Unit	
	Examiner Name	
	Attorney Docket Number	P6672USC1

	6	20090323663		2009-12-31	NAKATSUGAWA	
	7	20110188377		2011-08-04	KIM et al.	
	8	20110199998		2011-08-18	YI et al.	
	9	20110286387		2011-11-24	SANE et al.	
	10	20120069750		2012-03-22	XING et al.	

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FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2013-062882	JP		2013-04-04	FUJITSU LTD.		☐
	2	10-2012-0128078	KR		2012-11-26	ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTIT	Corresponding to US 2012/0294281	☐
	3	2013-062884	JP		2013-04-04	FUJITSU LTD.		☐
	4	10-2010-0005017	KR		2010-01-13	FUJITSU LTD.	Corresponding to US 2010/0039996	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2018-03-26
	First Named Inventor	Myung Cheul JUNG
	Art Unit	
	Examiner Name	
	Attorney Docket Number	P6672USC1

	5	2003-283592	JP		2003-10-03	ASUSTEK COMPUTER INC.	Corresponding to US 2004/0151154	☐

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	International Search Report issued on August 14, 2014, in International Patent Application No. PCT/KR2014/004189	☐
	2	R2-070130, "Selective forwarding/retransmission during HO"; 3GPP TSG-RAN2 Meeting #56bis; Discussion and decision Agenda Item: 5.2.6, (R2-070130 hereinafter) was published 15th January - 19th January 2007.	☐
	3	Non-Final Office Action issued July 19, 2017 in U.S. Patent Application No. 14/890,407.	☐
	4	Notice of Allowance issued November 9, 2017 in U.S. Patent Application No. 14/890,407.	☐

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2018-03-26
	First Named Inventor	Myung Cheul JUNG
	Art Unit	
	Examiner Name	
	Attorney Docket Number	P6672USC1

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Christopher B. Kilner/	Date (YYYY-MM-DD)	2018-03-26
Name/Print	Christopher B. Kilner	Registration Number	45,381

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM
First Named Inventor/Applicant Name:	Myung Cheul JUNG
Filer:	Hae-Chan Park/Beatriz Sanchez
Attorney Docket Number:	P6672USC1

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1720**

Electronic Acknowledgement Receipt	
EFS ID:	32157250
Application Number:	15935626
International Application Number:	
Confirmation Number:	8564
Title of Invention:	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM
First Named Inventor/Applicant Name:	Myung Cheul JUNG
Customer Number:	58027
Filer:	Hae-Chan Park/Beatriz Sanchez
Filer Authorized By:	Hae-Chan Park
Attorney Docket Number:	P6672USC1
Receipt Date:	26-MAR-2018
Filing Date:	
Time Stamp:	15:26:09
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1720
RAM confirmation Number	032718INTEFSW15275000
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	P6672USC1_ADS.pdf	115660 fca58d3d8eb8a9d2787b5017831a61575da5fee0	no	9
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
2		P6672USC1_Specification.pdf	118226 4cbcb2001d6d1a4fc0a2c44b943c3043bcbddde1	yes	41

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Abstract	41	41
Claims	40	40
Specification	1	39

Warnings:					
Information:					
3	Drawings-only black and white line drawings	P6672USC1_Drawings.pdf	1870570 8c649da8c59fe24babcea2a379d476075086a1b2	no	15
Warnings:					
Information:					
4	Power of Attorney	P6672USC1_POA_Statement.pdf	836923 e47a3d109b8d1d1078377a0aa3efc2e333553d2d	no	5
Warnings:					
Information:					

5	Oath or Declaration filed	P6672USC1_Declaration.pdf	2101690 48e1d346ed056818143c935289eb141e2d1cfe04	no	3
Warnings:					
Information:					
6	Information Disclosure Statement (IDS) Form (SB08)	P6672USC1_IDS.pdf	68425 18234da9c8a11edc3bbaa6e9ba997443f73f3a94	no	5
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
7	Non Patent Literature	NPL_1.pdf	2442153 07663e4f2730a3e57b70bfb8c4d38dbdb3525008	no	19
Warnings:					
Information:					
8	Non Patent Literature	NPL_2.pdf	1807032 fefd189d8d35a95db1247dbb4b16a0e2babd5bfa	no	17
Warnings:					
Information:					
9	Fee Worksheet (SB06)	fee-info.pdf	34984 8f76abe9e647e39812284346a8a4a5b50d73d5c9	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	9395663	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/AIA/14 (02-18)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P6672USC1
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Myung Cheul		JUNG	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence	KR

Mailing Address of Inventor:

Address 1	(Pantech R&D Center Bldg., Sangam-dong)		
Address 2	179 Seongam-ro, Mapo-gu		
City	Seoul	**State/Province**	
Postal Code	121-904	**Country**	KR

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Kang Suk		HUH	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence	KR

Mailing Address of Inventor:

Address 1	(Pantech R&D Center Bldg., Sangam-dong)		
Address 2	179 Seongam-ro, Mapo-gu		
City	Seoul	**State/Province**	
Postal Code	121-904	**Country**	KR

Inventor 3 Remove

Legal Name

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P6672USC1
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

Prefix	Given Name	Middle Name	Family Name	Suffix
	Jae Hyun		AHN	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence [i]	KR

Mailing Address of Inventor:

Address 1	(Pantech R&D Center Bldg., Sangam-dong)
Address 2	179 Seongam-ro, Mapo-gu

City	Seoul	State/Province	
Postal Code	121-904	**Country** [i]	KR

Inventor 4 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Ki Bum		KWON	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country of Residence [i]	KR

Mailing Address of Inventor:

Address 1	(Pantech R&D Center Bldg., Sangam-dong)
Address 2	179 Seongam-ro, Mapo-gu

City	Seoul	State/Province	
Postal Code	121-904	**Country** [i]	KR

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	58027		
Email Address		Add Email	Remove Email

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P6672USC1
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

Application Information:

Title of the Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM		
Attorney Docket Number	P6672USC1	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	15	**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	58027		

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P6672USC1
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	14890407	2015-11-10
Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14890407	a 371 of international	PCT/KR2014/004189	2014-05-09

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

			Remove
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2013-0053408	KR	2013-05-10	

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P6672USC1
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

PTO/AIA/14 (02-18)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P6672USC1
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

(◉) Assignee	( ) Legal Representative under 35 U.S.C. 117	( ) Joint Inventor
( ) Person to whom the inventor is obligated to assign.	( ) Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:	

If the Applicant is an Organization check here. ☒

Organization Name	PANTECH INC.

Mailing Address Information For Applicant:

Address 1	179 Seongam-ro Mapo-gu		
Address 2			
City	Seoul	**State/Province**	
Country KR		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button.

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P6672USC1
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Christopher B. Kilner/			Date (YYYY-MM-DD)	2018-03-26
First Name	Christopher	Last Name	Kilner	Registration Number	45,381

Additional Signature may be generated within this form by selecting the Add button.

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P6672USC1
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM	

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ABSTRACT OF THE DISCLOSURE

The present invention provides a method for user equipment receiving multi-flow data with respect to one evolved packet system (EPS) bearer through a macro base station (macro eNB) and a small base station (small eNB) in a wireless communication system supporting dual connectivity. The method comprises the steps of: a packet data convergence protocol (PDCP) entity of the user equipment receiving PDCP packet data units (PDU) through the macro base station and the small base station from a PDCP entity of the macro base station; obtaining PDCP service data units (SDU) corresponding to PDCP PDUs; and receiving from the macro base station information related to a sequence timer for the PDCP SDUs through a radio resource control (RRC) message, wherein the PDCP SDUs are indicated by a predefined PDCP sequence number (SN).

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What is claimed is:

1. A method for user equipment receiving multi-flow data with respect to one evolved packet system (EPS) bearer through a macro base station (macro eNB) and a small base station (small eNB) in a wireless communication system supporting dual connectivity, the method comprising:

receiving packet data convergence protocol (PDCP) packet data units (PDUs) through the macro base station and the small base station;

obtaining PDCP service data units (SDUs) corresponding to the PDCP PDUs; and

receiving from the macro base station information related to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message,

wherein the PDCP SDUs are indicated by a predefined PDCP sequence number (SN).

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METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a Continuation of U.S. Patent Application No. 14/890,407, filed on November 10, 2015, which is a National Stage of International Application No. PCT/KR2014/004189, filed on May 9, 2014, and claims priority from and the benefit of Korean Patent Application No. 10-2013-0053408, filed on May 10, 2013, each of which is hereby incorporated by reference for all purposes as if fully set forth herein.

BACKGROUND

[0002] FIELD

[0003] The present invention relates to wireless communication, and more particularly, to a method and an apparatus of in-sequence delivery considering a multi-flow in a wireless communication system supporting dual connectivity.

[0004] DISCUSSION OF THE BACKGROUND

[0005] Particularly many communication demands are generated in a specific area such as a hotspot in a cell and receiving sensitivity of radio waves may deteriorate in a specific area such as a cell edge or a coverage hole. With the development of wireless communication technology, small cells, for example, a pico cell, a femto cell, a micro cell, a remote radio head

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(RRH), a relay, a repeater, and the like are together installed in a macro cell for the purpose of enabling communication in areas such as the hot spot, the cell edge, and the coverage hole. Such a network is called a heterogeneous network (HetNet). In a heterogeneous network environment, relatively, the macro cell is a cell having large coverage and the small cells such as the femto cell and the pico cell are cells having small coverage. Since the small cells such as the femto cell and the pico cell use lower power than the macro cell, the network is also referred to as a low power network (LPN). In the heterogeneous network environment, coverages of multiple macro cells and small cells overlap with each other.

[0006] User Equipment (UE) can perform wireless communication through two or more base stations among base stations constituting at least one serving cell. This is referred to as dual connectivity and a wireless communication system supporting the dual connectivity is referred to as a dual connectivity system. In this case, one of a plurality of base stations physically or logically divided, which constitute the dual connectivity may be a macro base station (alternatively, an anchorage station) and the other one may be a small base station (alternatively, an assisting base station). The UE may be 'dually connectable UE' in which dual connectivity is possible and 'dually inconnectable UE' in which dual connection supporting is impossible.

[0007] The macro base station manages data flow control, security, and header compression according to a packet data convergence protocol (PDCP) for data transmitted to the

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small base station through a radio bearer (RB).

[0008] In general, the wireless communication system is a single flow structure in which a service is provided to the UE through one RB for one EPS bearer service. However, in the case of the wireless communication system supporting the dual connectivity, the service of one EPS bearer can be provided to the UE through not one RB but two RBs established in the macro cell and the small cell, respectively. That is, the service can be provided to the UE through multi-flows.

[0009] In the case of an acknowledged mode (RLC AM), an RLC entity of the UE reorders RLC packet data units (PDUs) when received RLC PDUs are received out of the order in a downlink. In the case of the RLC AM, a transmitting side can retransmit an RLC PDU of which receiving is missed at a receiving side again. The RLC entity reassembles an RLC service data unit (SDU) based on the reordered RLC PDU and sequentially the reassembled RLC SDU to an upper layer (that is, PDCP entity). In the case of the RLC AM, the RLC PDUs can be sequentially delivered through reordering and retransmission methods of the RLC PDUs. In other words, the PDCP entity needs to be sequentially delivered with the RLC SDUs except for reestablishment of the lower layer. However, in the case of the UE in which the multi-flows are constituted, the RLC entity for the small base station and the RLC entity for the macro base station are distinguished to receive the respective RLC SDUs and acquire the PDCP SDU and deliver the acquired PDCP SDU to the upper layer and in this case, the PDCP entity cannot

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sequentially acquire the PDCP SDUs. Accordingly, in the case of the UE using the multi-flows, a new method for sequential delivery of the PDCP SDUs to the upper layer in the PDCP entity is required.

SUMMARY

[0010] The present invention provides a method and an apparatus of in-sequence delivery considering multi-flows in a dual connectivity system.

[0011] The present invention also provides a method and an apparatus in which a PDCP entity at a UE end delivers PDCP SDUs to an upper layer in sequence in a multi-flow structure.

[0012] The present invention also provides configuring a sequential delivery timer in UE in a multi-flow structure.

[0013] In one aspect, a method for user equipment receiving multi-flow data with respect to one evolved packet system (EPS) bearer through a macro base station (macro Evolved NodeB (eNB)) and a small base station (small eNB) in a wireless communication system supporting dual connectivity is provided. The method includes: receiving packet data convergence protocol (PDCP) packet data units (PDUs) through the macro base station and the small base station; obtaining PDCP service data units (SDUs) corresponding to the PDCP PDUs; and receiving from the macro base station information related to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message, wherein the PDCP SDUs are indicated by a

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predefined PDCP sequence number (SN).

[0014] In another aspect, a method for transmitting multi-flow data for one EPS bearer to UE from a macro base station through the macro base station and a small base station in a wireless communication system supporting dual connectivity is provided. The method includes: generating PDCP PDUs in a PDCP entity with respect to packets received by the macro base station according to a PDCP SN of a PDCP SDU; distributing the PDCP PDUs to radio link control (RLC) entities of the macro base station and RLC entities of the small base station according to a predetermined rule and transmitting the distributed PDCP PDUs to the UE; and transmitting to the UE an RRC message including information related to an in-sequence timer for the PDCP SDUs.

[0015] In yet another aspect, UE for receiving multi-flow data with respect to one evolved packet system (EPS) bearer through a macro base station (macro eNB) and a small base station (small eNB) in a wireless communication system supporting dual connectivity is provided. The UE includes: a receiving unit receiving packet data convergence protocol (PDCP) packet data units (PDUs) through the macro base station and the small base station and receiving from the macro base station information related to an in-sequence timer for the PDCP SDUs through a radio resource control (RRC) message; and a processor obtaining PDCP service data units (SDUs) corresponding to the PDCP PDUs, wherein the PDCP SDUs are indicated by a predefined PDCP sequence number (SN).

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[0016] According to the present invention, in performing downlink transmission through multi flows in a dual connectivity system, even though a PDCP entity of UE non-sequentially receives PDCP PDUs, PDCP SDUs can be delivered to an upper layer in sequence and transmission efficiency can be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 illustrates a wireless communication system according to the present invention.

[0018] FIG. 2 is a block diagram illustrating a radio protocol architecture for a user plane.

[0019] FIG. 3 is a block diagram illustrating a radio protocol architecture for a control plane.

[0020] FIG. 4 is a diagram illustrating an overview of one example of an RLC sublayer model according to the present invention.

[0021] FIG. 5 illustrates one example of a dual connectivity situation of UE applied to the present invention.

[0022] FIG. 6 illustrates an example of an EPS bearer structure when multi-flows are configured in the dual connectivity situation.

[0023] FIG. 7 illustrates an example of a network structure of the macro base station and

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the small base station in the case of a single flow in a dual connectivity situation.

[0024] FIG. 8 illustrates an example of an EPS bearer structure when multi-flows are configured in the dual connectivity situation.

[0025] FIG. 9 illustrates an example of a network structure of the macro base station and the small base station in the case of multi-flows.

[0026] FIG. 10 illustrates a packet delivery process in the case of the single flow when the dual connectivity is considered.

[0027] FIG. 11 illustrates a packet delivery process in the case of the multi-flows when the dual connectivity is considered.

[0028] FIG. 12 illustrates an example of a PDCP PDU receiving timing in a PDCP entity of UE.

[0029] FIG. 13 illustrates an example of sequential upper layer transmission depending on the PDCP sequence number (SN) in the PDCP entity of the UE.

[0030] FIG. 14 illustrates a method for sequentially delivering the PDCP SDU, which is performed by the UE considering the multi-flows according to an embodiment of the present invention.

[0031] FIG. 15 is a block diagram of a macro base station, a small base station, and UE according to an embodiment of the present invention.

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DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[0032] Hereinafter, in the specification, contents associated with the present invention will be described in detail through illustrated drawings and embodiments together with contents of the present invention. In the figures, even though the parts are illustrated in different drawings, it should be understood that like reference numbers refer to the same or equivalent parts of the present invention throughout the several figures of the drawing. In describing the embodiments of the present invention, when it is determined that the detailed description of the known art related to the present invention may obscure the gist of the present invention, the detailed description thereof will be omitted.

[0033] Further, a wireless communication network is described as target in the specification, and a work performed in the wireless communication network may be performed while a system (for example, a base station) that controls the corresponding wireless communication network controls the network and transmits data, or the work may be performed by UE coupled with the corresponding wireless network.

[0034] FIG. 1 illustrates a wireless communication system according to the present invention. This may be a network architecture of an evolved-universal mobile telecommunications system (E-UMTS). The E-UMTS may be called a long term evolution (LTE) or LTE-A (advanced) system. The wireless communication system may use various multiple access techniques, such as code division multiple access (CDMA), time division

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multiple access (TDMA), frequency division multiple access (FDMA), orthogonal frequency division multiple access (OFDMA), single carrier-FDMA (SC- FDMA), OFDM-FDMA, OFDM-TDMA, and OFDM-CDMA.

[0035] Referring to FIG. 1, the E-UTRAN includes an evolved NodeB (eNB) 20 that provides a control plane (CP) and a user plane (UP) to user equipment (UE) 10.

[0036] The UE 10 may be fixed or movable and may be called other terms such as a mobile station (MS), an advanced MS (AMS), a user terminal (UT), a subscriber station (SS), a wireless device, and the like.

[0037] The eNB 20 generally indicates a station that communicates with the UE 10, and may be called other terms such as a base station (BS), a base transceiver system (BTS), an access point, a femto-eNB, a pico_eNB, a home eNB, a relay, and the like. The eNBs 20 may be connected to each other through an X2 interface. The eNB 20 is connected with an evolved packet core (EPC) 30 through an S1 interface, more particularly, a mobility management entity (MME) through an S1-MME and a serving gateway (S-GW) through an S1-U. The S1 interface transmits and receives operation and management (OAM) information for supporting movement of the UE 10 by exchanging a signal with the MME.

[0038] The EPC 30 includes the MME, the S-GW, and a packet data network gateway (P-GW). The MME has access information of the UE 10 or information on capability of the UE 10, and the information is primarily used for mobility management of the UE 10. The S-GW is

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a gateway having the E-UTRAN as an end point and the P-GW is a gateway having the PDN as the end point.

[0039] The E-UTRAN and the EPC 30 are integrated to be called an evolved packet system (EPS) and a traffic flow from a wireless link through which the UE 10 is connected to the eNB 20 to the PDN connected to a service entity operates based an Internet protocol (IP).

[0040] A radio interface between the UE and the eNB is referred to as a Uu interface. Layers of a radio interface protocol between the UE and the eNB 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) reference model which is widely known in a communication system. Among the layers, a physical layer which belongs to the first layer provides an information transfer service using a physical channel and a radio resource control (RRC) layer positioned at the third layer controls a radio resource between the UE and the network by exchanging an RRC message.

[0041] FIG. 2 is a block diagram illustrating a radio protocol architecture for a user plane and FIG. 3 is a block diagram illustrating a radio protocol architecture for a control plane. The user plane is a protocol stack for transmitting user data and the control plane is a protocol stack for transmitting a control signal.

[0042] Referring to FIGS. 2 and 3, a physical (PHY) layer provides information transfer service to an upper layer by using a physical channel. The PHY layer is connected with a

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medium access control (MAC) layer which is an upper layer through a transport channel. Data is transferred between the MAC layer and the PHY layer through the transport channel. The transport channel is classified depending on how the data is transferred through the radio interface.

[0043] Further, data is transferred between different PHY layers (that is, between the PHY layers of the transmitter and the receiver) through the physical channel. The physical channel may be modulated by an orthogonal frequency division multiplexing (OFDM) scheme and uses a time and a frequency as the radio resource.

[0044] As an example, a physical downlink control channel (PDCCH) among the physical channels notifies resource allocation of a paging channel (PCH) and a downlink shared channel (DL-SCH) and hybrid automatic repeat request (HARQ) information associated with the DL-SCH to the UE and the PDCCH may transport an uplink scheduling grant notifying the resource allocation of the uplink transmission to the UE. Further, a physical control format indicator channel (PCFICH) notifies the number of OFDM symbols used in the PDCCHs to the UE and is transmitted every sub-frame. Further, a physical hybrid ARQ indicator channel (PHICH) transports an HARQ ACK/NAK signal as a response of the uplink transmission. Further, a physical uplink control channel (PUCCH) transports uplink control information such as HARQ ACK/NAK, a scheduling request, a CQI for the downlink transmission. Further, a physical uplink shared channel (PUSCH) transports an uplink shared channel (UL-SCH).

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[0045] The MAC layer may perform mapping between a logic channel and the transport channel and multiplexing or demultiplexing to a transport block provided to the physical channel onto the transport channel of an MAC service data unit (SDU) that belongs to the logic channel. The MAC layer provides a service to a radio link control (RLC) layer through the logic channel. The logic channel may be divided into a control channel for transferring control area information and a traffic channel for transferring user area information.

[0046] A function of the RLC layer includes concatenation, segmentation, and reassembly of an RLC SDU. In order to assure various quality of services (QoS) requested by a radio bearer (RB), the RLC layer provides three operating modes of a transparent mode (TM), an unacknowledged mode (UM), and an acknowledged mode (AM).

[0047] The RLC SDUs may be supported with various sizes and as an example, may be supported by a byte unit. RLC protocol data units (PDUs) are defined only when transmission opportunity is notified from the lower layer (for example, the MAC layer) and when the transmission opportunity is notified, the RLC PDUs are transferred to the lower layer. The transmission opportunity may be notified together with the sizes of the total RLC PDUs to be transmitted. Hereinafter, the RLC layer will be described in detail with reference to FIG. 4.

[0048] A function of a packet data convergence protocol (PDCP) layer on the user plane includes transferring of user data, header compression, and ciphering. A function of the PDCP layer on the user plane includes transferring of control plane data and ciphering/integrity

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protection.

[0049] The RRC layer serves to control the logic channel, the transport channel, and the physical channels in association with configuration, re-configuration, and release of the RBs. The RB means a logic route provided by the first layer (PHY layer) and the second layers (the MAC layer, the RLC layer, and the PDCP layer) in order to transfer data between the UE and the network. Configuring the RB defines features of the radio protocol layer and the channel in order to provide a specific service and means a process of setting respective detailed parameters and operating methods. The RB may be divided into two types of a signaling RB (SRB) and a data RB (DRB) again. The SRB is used as a passage for transmitting the RRC message on the control plane and a non-access stratum (NAS) message and the DRB is used as a passage for transmitting the user data on the user plane.

[0050] An NAS layer is positioned above the RRC layer and performs functions such as session management and mobility management.

[0051] When an RRC connection is established between the RRC layer of the UE and the RRC layer of the E-UTRAN, the UE is in an RRC connected state and if not, the UE is in an RRC idle state.

[0052] A downlink transport channel for transmitting data from the network to the UE includes a broadcast channel (BCH) for transmitting system information and besides, a downlink shared channel (SCH) for transmitting user traffic or a control message. Traffic or a control

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message of a downlink multicast or broadcast service may be transported through the downlink SCH or transported through a separate downlink multicast channel (MCH). Meanwhile, an uplink transport channel for transporting data from the UE to the network includes a random access channel (RACH) for transporting an initial control message and besides, an uplink shared channel (SCH) for transporting the user traffic or the control message.

[0053] The logical channel that is positioned on the transport channel and mapped to the transport channel includes a broadcast control channel (BCCH), a paging control channel (PCCH), a common control channel (CCCH), a multicast control channel (MCCH), a multicast traffic channel (MTCH), and the like.

[0054] The physical channel is constituted by a plurality of symbols in a time domain and a plurality of sub-carriers in a frequency domain. One sub-frame is constituted by a plurality of OFDM symbols in a time domain. One sub-frame is constituted by a plurality of resource blocks and one resource block is constituted by the plurality of symbols and the plurality of sub-carriers. Further, each sub-frame may use specific sub-carriers of specific symbols (e.g., first symbols) of a corresponding sub-frame for the PDCCH. A transmission time interval (TTI) which is a unit time when the data is transmitted is 1 ms corresponding to one sub-frame.

[0055] FIG. 4 is a diagram illustrating an outline of an example of an RLC sublayer model according to the embodiment of the present invention.

[0056] Referring to FIG. 4, any RLC entity is divided into different RLC entities

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according to a data transmission scheme. As an example, the RLC entity includes a TM RLC entity 400, a UM RLC entity 420, and an AM RLC entity 440.

[0057] The UM RLC entity 420 may be constituted to receive or transfer RLC PDUs through logical channels (for example, DL/UL DTCH, MCCH or MTCH). Further, the UM RLC entity 420 may transfer or receive a unacknowledged mode data (UMD) PDU.

[0058] The UM RLC entity is constituted by a transmission UM RLC entity or a reception UM RLC entity.

[0059] The transmission UM RLC entity receives the RLC SDUs from the upper layer and transmits the RLC PDUs to a peer reception UM RLC entity through the lower layer. When the transmission UM RLC entity configures the UMD PDUs from the RLC SDUs, if the specific transmission opportunity is notified by the lower layer, the RLC SDUs are segmented or concatenated to constitute the UMD PDUs so as to become within a total size of the RLC PDUs indicated by the lower layer and is constituted so that related RLC headers are included in the UMD PDU.

[0060] The reception UM RLC entity transfers the RLC SDUs to the upper layer and receives the RLC PDUs from the peer reception UM RLC entity through the lower layer. When the reception UM RLC entity receives the UMD PDUs, the reception UM RLC entity detects whether the UMD PDUs are duplicately received to discard the duplicated UMD PDUs, reorder a sequence of the UMD PDUs when the UMD PDUs are received out of the sequence, avoid

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excessive reorder delays by detecting loss of the UMD PDUs in the lower layer, reassemble the RLC SDUs from the reordered UMD PDUs, transfer the reassembled RLC SDUs to the upper layer in an ascending order of an RLC sequence number (SN), and discard the UMD PDUs which can not be reassembled to the RLC SDU due to the UMD PDU loss which belongs to the specific RLC SDU in the lower layer. During the RLC re-establishment, the reception UM RLC entity reassembles the RLC SDUs from the UMD PDUs received out of the sequence to transfer the reassembled RLC SDUs to the upper layer and all of the remaining UMD PDUs which may not be reassembled to the RLC SDUs are discarded, initialize related status parameters and stop related timers.

[0061] Meanwhile, the AM RLC entity 440 may be constituted to receive or transfer the RLC PDUs through logical channels (for example, DL/UL DCCH or DL/UL DTCH). The AM RLC entity transfers or receives an AMD PDU or ADM PDU segnement and transfers or receives an RLC control PDU (for example, a STATUS PDU).

[0062] If the STATUS PDU is triggered and a block timer (t-StatusProhibit) is not running or completed, the STATUS PDU is transmitted at the next transmission opportunity. Accordingly, the UE predicts the size of the STATUS PDU and considers the STATUS PDU as data available for transmission in the RLC layer.

[0063] The AM RLC entity is constituted by a transmitting side and a receiving side.

[0064] The transmitting side of the AM RLC entity receives the RLC SDUs from the

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upper layer and transmits the RLC PDUs to a peer AM RLC entity through the lower layer. When the transmitting side of the AM RLC entity constitutes the AMD PDUs from the RLC SDUs, the RLC SDUs are segmented or concatenated in order to be suitable within the total size of the RLC PDU(s) indicated by the lower layer when the specific transmission opportunity is notified by the lower layer to constitute the AMD PDUs. The transmitting side of the AM RLC entity supports retransmission (ARQ) of the RLC data PDUs. When the RLC data PDU to be retransmitted is not suitable within the total size of the RLC PDU(s) indicated by the lower layer when the specific transmission opportunity is notified by the lower layer, the AM RLC entity re-segments the RLC data PDU to the AMD PDU segments.

[0065] In this case, the number of re-segmentation is not limited. When the transmitting side of the AM RLC entity creates the AMD PDUs from the RLC SDUs received from the upper layer or AMD PDU segments from the RLC data PDUs to be retransmitted, related RLC headers are included in the RLC data PDU.

[0066] The receiving side of the AM RLC entity receives the RLC SDUs from the upper layer and receives the RLC PDUs to the peer AM RLC entity through the lower layer.

[0067] When receiving the RLC data PDUs, the receiving side of the AM RLC entity detects whether the RLC data PDUs are duplicatively received, discards the duplicated RLC data PDUs, reorders the sequence of the RLC data PDUs when the RLC data PDUs are received out of the sequence, detects the loss of the RLC data PDUs generated in the lower layer and requests

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the retransmission to the AM RLC entity, reassembles the RLC SDUs from the reordered RLC data PDUs, and transfers the reassembled RLC SDUs to the upper layer in the reassembled sequence.

[0068] During the RLC re-establishment, the receiving side of the AM RLC entity reassembles the RLC SDUs from the RLC data PDUs received out of the sequence if possible to transfer the reassembled RLC SDUs to the upper layer, discards all of the remaining RLC data PDUs which may not be reassembled with the RLC SDUs, and initializes the related status parameters and stops the related timers.

[0069] FIG. 5 illustrates one example of a dual connectivity situation of the UE applied to the embodiment of the present invention.

[0070] Referring To FIG. 5, UE 550 positioned in a service area of a macro cell in a macro eNB 500 (alternatively, an anchor base station) enters an area over-laid with the service acre of a small cell in a small eNB 510 (alternatively, an assisting base station).

[0071] In order to support an additional data service through the small cell in the small eNB while maintaining existing wireless connection and data service connection through the macro cell in the macro eNB, the network constitutes dual connection with respect to the UE.

[0072] As a result, the user data arriving to the macro cell may be transferred to the UE through the small cell in the small eNB. In detail, an F2 frequency band is allocated to the macro eNB and an F1 frequency band is allocated to the small eNB. The UE may receive the

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service from the macro eNB through the F2 frequency band and simultaneously receive the service from the small eNB through the F1 frequency band.

[0073] FIG. 6 illustrates an example of an EPS bearer structure in the case where the single flow is constituted.

[0074] Referring to FIG. 6, the RB is a bearer provided from the Uu interface in order to support the service of the user. In the wireless communication system, each bearer is defined for each interface to ensure independency between the interfaces.

[0075] The bearer provided by the wireless communication system is collectively called an evolved packet system (EPS) bearer. The EPS bearer is a transmission path generated between the UE and the P-GW. The P-GW may receive an IP flow from the Internet or transmit the IP flow to the Internet. One or more EPS bearers may be constituted per UE, each EPS bearer may be divided into an E-UTRAN radio access bearer (E-RAB) and an S5/S8 bearer, and the E-RAB may be divided into a radio bearer (RB) and an S1 bearer. That is, one EPS bearer corresponds to one RB, one S1 bearer, and one S5/S8 bearer, respectively. The IP flow may have a different quality of service (QoS) characteristic according to which service (alternatively, application) is used, and the IP flow having the different QoS characteristic may be mapped and transmitted for each EPS bearer. The EPS bearers may be divided based on an EPS bearer identity. The EPS bearer identity is allocated by the UE or the MME.

[0076] The Packet Gateway (P-GW) is a network node connecting the wireless

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communication network (for example, an LTE network) and another network according to the present invention. The EPS bearer is defined between the UE and the P-GW. The EPS bearer is further subdivided between the respective nodes, and the RB, the S1 bearer, and the S5/S8 bearer are defined between the UE and the base station, between the base station and the S-GW, and between the S-GW in the EPS and the P-GW, respectively. Each bearer is defined through the QoS. The QoS is defined through a data rate, an error rate, a delay, and the like.

[0077] Accordingly, if the QoS which needs to be entirely provided by the wireless communication system is defined as the EPS bearer, each QoS is defined for each interface. Each interface is to set the bearer according to the QoS which needs to be provided by the interface. Since The bearer of each interface is provided by dividing the QoS of the entire EPS bearer for each interface, the EPS bearer, the RB, and the SI bearer basically have one-to-one relationship.

[0078] That is, the LTE wireless communication system basically has a single flow structure and one RB is constituted for one EPS bearer. In other words, one EPS bearer is mapped with the S1 bearer through one RB. In the case of the single flow, one EPS bearer is serviced through one RB. In this case, one RB (for example, a PDCP entity, an RLC entity, a MAC entity, and a PHY layer) is set in the base station for the corresponding EPS bearer and one RB is set even in the UE.

[0079] FIG. 7 illustrates an example of a network structure of the macro base station and

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the small base station in the case of a single flow in a dual connectivity situation. FIG. 7 illustrates a case in which a service is provided to UE through two EPS bearers.

[0080] Referring to FIG. 7, the macro base station includes two PDCP entities, an RLC entity, an MAC entity, and a PHY layer, but the small base station the RLC entity, the MAC entity, and the PHY layer. EPS bearer #1 700 provides the service to the UE through RB (PDCP/RLC/MAC/PHY) configured in the macro base station. On the contrary, EPS bearer #2 750 provides the service to the UE through the PDCP entity configured in the macro base station and the RB (PDCP/RLC/MAC/PHY) configured in the small base station. Therefore, the service is provided through one RB for each EPS bearer in the single flow.

[0081] FIG. 8 illustrates an example of an EPS bearer structure when multi-flows are configured in the dual connectivity situation.

[0082] Referring to FIG. 8, when the multi-flows are configured, the service is provided through not one RB but two RBs configured in the macro base station and the small base station, respectively with respect to one EPS bearer. The UE may simultaneously receive the service through the RB configured in the macro base station and the RB configured in the small base station with respect to one EPS bearer. This is a type in which one EPS bearer provides the service through two RBs. As described above, in the case where one EPS bearer provides the service to the UE through two or more RBs, it regarded that the multi-flows are configured.

[0083] FIG. 9 illustrates an example of a network structure of the macro base station and

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the small base station in the case of multi-flows.

[0084] Referring to FIG. 9, the macro base station includes the PDCP entity, the RLC entity, the MAC entity, the PHY layer, but the small base station includes the RLC entity, the MAC entity, and the PHY layer. In FIG. 9, unlike FIG. 7, the RBs are configured in the macro base station and the small base station, respectively with respect to one EPS bearer 900 to provide the service the UE. That is, the macro base station and the small base station provide the service to the UE through the multi-flows with respect to one EPS bearer.

[0085] Meanwhile, when the dual connectivity is considered, packet delivery processes in the case of the single flow and in the case of the multi-flows may be described below.

[0086] FIG. 10 illustrates a packet delivery process in the case of the single flow when the dual connectivity is considered.

[0087] Referring to FIG. 10, a macro base station 1030 receives packets for two EPS bearers, respectively through P-GW and S-GW. Herein, flows in which the packets are transmitted are mapped to each EPS bearer. It is assumed that packets transmitted through EPS bearer #1 are packet 1 and packets transmitted through EPS bearer #2 are packet 2.

[0088] A PDCP 1035-1 of the macro base station 1030 receives packet 1 from the S-GW and a PDCP 1035-2 receives packet 2 from the S-GW. The PDCP 1035-1 generates PDCP PDU1 based on packet 1 and the PDCP PDU1 is delivered to an RLC 1040 of the macro base station 1030 and transformed to a format suitable for each entity and layer to be transmitted to

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UE 1000 through an MAC 1045 and a PHY 1050.

[0089] The PDCP 1035-2 of the macro base station 1030 generates PDCP PDU2 based on packet 2 and the PDCP PDU 2 is delivered to an RLC 1070 of a small base station 1060 and transformed to a format suitable for each entity and layer to be transmitted to the UE through an MAC 1075 and a PHY 1080.

[0090] Radio protocol entities are present in the UE 1000 with respect to EPS bearer #1 and EPS bearer #2, respectively. In other words, the PDCP/RLC/MAC/PHY entity (alternatively, layer) is present in the UE 1000 with respect to EPS bearer #1 and the PDCP/RLC/MAC/PHY entity (alternatively, layer) is present with respect to EPS bearer #2. In detail, a PHY 1005-1, an MAC 1010-1, an RLC 1015-1, and a PDCP 1020-1 are present with respect to EPS bearer #1 and service data and packets for EPS bearer #1 are processed. A PHY 1005-2, an MAC 1010-2, an RLC 1015-2, and a PDCP 1020-2 are present with respect to EPS bearer #2 and service data and packets for EPS bearer #2 are processed.

[0091] Meanwhile, the macro base station 1030 and the small base station 1060 may be connected through an X2 interface. That is, the macro base station 1030 delivers PDCP PDU2 of the PDCP 1035-2 to the RLC 1040 of the small base station 1060 through the X2 interface. Herein, the X2 interface may be used as an X3 interface or another expression designating an interface between other macro base station and other small base station. In this case, when the X2 interface between the macro base station 1030 and the small base station 1060 is constituted

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by a non-ideal backhaul, the transmission delay of approximately 20 to 60 ms may occur. However, even in this case, since the RLC 1015-1 and the PDCP 1020-1 for EPS bearer #1 and the RLC 1015-2 and the PDCP 1020-2 for EPS bearer #2 are separately configured in the UE 1000, a problem does not occur even when the RLC SDUs are sequentially delivered from the RLC entity to the PDCP entity of the AM.

[0092] FIG. 11 illustrates a packet delivery process in the case of the multi-flows when the dual connectivity is considered.

[0093] Referring to FIG. 11, a macro base station 1130 receives packets for one EPS bearer through a P-GW and an S-GW. The macro base station 1130 and a small base station 1160 configure RBs, respectively with respect to one EPS bearer. In detail, the macro base station 1130 constitutes a PDCP 1135, an RLC 1140, an MAC 1145, and a PHY 1150 and the small base station 1160 constitutes an RLC 1170, an MAC 1175, and a PHY 1180.

[0094] The PDCP 1135 of the macro base station 1130 receives the packet from the S-GW. The PDCP 1135 generates PDCP PDUs based on the packet and appropriately distributes and delivers the PDCP PDUs to the RLC 1140 of the macro base station 1130 and the RLC 1170 of the small base station 1160 according to a predefined rule or a predetermined method. For example, PDCP PDUs having odd SNs among the PDCP PDUs may be transmitted to the RLC 1140 of the base station 1130 and PDCP PDUs having even SNs may be transmitted to the RLC 1170 of the small base station 1160.

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[0095] The RLC 1140 generates RLC PDU1(s) and the RLC PDU1(s) is transformed to a format suitable for each entity or layer to be transmitted to the UE 1100 through the MAC 1145 and the PHY 1150. Further, the RLC 1170 generates RLC PDU2(s) and the RLC PDU2(s) is transformed to a format suitable for each entity or layer to be transmitted to the UE 1100 through the MAC 1175 and the PHY 1180.

[0096] Two radio protocol entities are present with respect to the EPS bearer. In other words, the PDCP/RLC/MAC/PHY entity (alternatively, layer) is present in the UE 1100 as the RB corresponding to the macro base station 1130 and the PDCP/RLC/MAC/PHY entity (alternatively, layer) is present as the RB corresponding to the small base station 1160. In detail, the PHY 1105-1, the MAC 1110-1, the RLC 1115-1, and a PDCP 1120 corresponding to the macro base station 1130 are present and the PHY 1005-2, the MAC 1010-2, and the RLC 1015-2 corresponding to the small base station 1160 are present with respect to the EPS bearer. The PDCP 1120 is a PDCP entity simultaneously corresponding to the macro base station 1130 and the small base station 1160. That is, in this case, two RLC entities 1115-1 and 1115-2 are present at the UE 1100 end, but two RLC entities 1115-1 and 1115-2 correspond to one PDCP entity 1120.

[0097] As described above, the macro base station 1130 and the small base station 1160 may be connected through the X2 interface. That is, the macro base station 1130 delivers some of PDCP PDU2 of the PDCP 1135-2 to the RLC 1140 of the small base station 1160 through the

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X2 interface. Herein, the X2 interface may be used as an X3 interface or another expression (for example, Xn) designating an interface between other macro base station and other small base station. In this case, when the X2 interface between the macro base station 1130 and the small base station 1160 is constituted by the non-ideal backhaul, the transmission delay of approximately 20 to 60 ms may occur. The PDCP entity 1120 of the UE 1100 receives RLC SDUs (that is, PDCP PDUs) from two RLC entities 1115-1 and 1115-2, respectively and generates PDCP SDUs and delivers the generated PDCP SDUs to the upper layer and a difference in time between receiving RLC SDUs (that is, PDCP PDUs) received from the PDCP entity 1120 from the RLC entity 1115-1 and receiving RLC SDUs (that is, PDCP PDUs) from the RLC entity 1115-2 occurs and a problem may occur when the PDCP entity 1120 sequentially transmits the PDCP SDUs to the upper layer.

[0098] As illustrated in FIG. 11, one PDCP 1135 present in the macro base station 1130 and one PDCP entity 1120 is present in the UE 1100 for the multi-flows in the dual connectivity environment. In addition, the RLC entities 1140 and 1170 are present in the macro base station 1130 and the small base station 1130, respectively and two RLC entities 1115-1 and 1115-2 are present even in the UE 1100 to correspond to the RLC entities 1140 and 1170. That is, in-sequence delivery to the upper layer may be guaranteed at the RLC entities 1115-1 and 1115-2 ends of the UE 1100. However, the RLC SDUs (that is, PDCP PDUs) are delivered from not one RLC entity but two RLC entities 1115-1 and 1115-2 at the PDCP entity 1120 end of the UE

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1100. In-sequence delivery at the RLC entities 1115-1 and 1115-2 may not guarantee in-sequence receiving of the PDCP PDUs at the PDCP entity end. Further, the transmission delay of 20 to 60 ms may be accompanied in transmission of the PDCP PDU(s) from the PDCP entity 1135 of the macro base station 1130 to the RLC entity 1170 of the small base station 1160 and a time delay may occur between transmission of the PDCP PDU(s) toward the RLC entity 1140 of the macro base station 1130 and transmission of the PDCP PDU(s) toward the RLC entity 1170 of the macro base station 1160. Consequently, even when the PDCP entity 1120 of the UE 1100 receives the PDCP PDU(s) transmitted by the PDCP entity 1135 of the macro base station 1130, a difference in receiving time between transmission through a lower end of the RLC of the macro base station and transmission through a lower end of the RLC of the small base station occurs and it is difficult to for the PDCP entity 1120 of the UE 1100 to sequentially receive the PDCP PDU(s).

[0099] FIG. 12 illustrates an example of a PDCP PDU receiving timing in a PDCP entity of UE. FIG. 12 exemplarily illustrates a time when a PDCP PDU transmitted through a macro base station and a PDCP PDU transmitted through a small base station reach a PDCP entity of UE. The macro base station may determine the PDCP PDU to be transmitted through the macro base station and the PDCP PDU to be transmitted through the small base station with respect to the service for one EPS bearer. FIG. 12 exemplarily illustrates a case in which odd numbers among PDCP sequence numbers (SNs) are transmitted through the macro base station and even

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numbers are transmitted through the small base station.

[0100] Referring to FIG. 12, there is a difference in time delay between a receiving time of the PDCP PDCU transmitted through the macro base station in the UE and a receiving time of the PDCP PDCU transmitted through the small base station in the UE. A transmission delay of approximately 20 to 60 ms may occur in the PDCP PDU transmitted through the small base station. In this case, when the PDCP entity of the UE non-sequentially receives the PDCP PDUs due to a difference in time between RLC (AMD) SDUs delivered from two RLC entities and the PDCP entity immediately delivers the received PDCP PDUs to the upper layer (for example, an application layer), sequential transmission is not performed.

[0101] That is, since the PDCP PDU transmitted from one PDCP entity of the macro base station is transmitted through the RLC entity of the macro base station and the RLC entity of the small base station in the multi-flow structure, the time delay occurs in receiving the PDCP PDU in the PDCP entity of the UE. Accordingly, there is a problem in sequentially transmitting the PDCP SDUs from the PDCP entity to the upper layer.

[0102] The PDCP entity of the UE deciphers and header compresses the received PDCP PDCU and transmits the PDCP SDU to the upper layer. In this case, when there is a PDCP SDU having the sequence number which is smaller than the sequence number (SN) of the current PDCP SDU, the PDCP SDUs are transmitted to the upper layer in the order from the smaller SN to the larger SN.

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[0103] Meanwhile, a transmission side of the PDCP entity may operate a discard timer. Duration of the discard timer may be configured from the upper layer and when the PDCP SDU is received from the upper layer, the timer starts. When the discard has expired, the PDCP entity discards the corresponding PDCP SDU. Accordingly, even in the existing case, a PDCP SDU of a specific SN may be missed due to expiration of the discard timer.

[0104] That is, when the multi-flows are supported in the dual connectivity situation, in the case where the PDCP PDUs are not sequentially received, the case may be determined as any one of two cases described below. However, which case of two cases described below the case is may not be distinguished.

[0105] The first case may be a case in which the discard timer has expired. In the base station, the discard timer is driven every PDCP SDU processed by the PDCP entity of the base station while uplink transmission. In the case where the quantity of packets input into the PDCP by driving the discard timer is larger than a predetermined reference, packets which are not processed within the duration of the discard timer may be discarded and the corresponding packets may be newly processed based on a retransmission request performed in the upper layer.

[0106] The second case may be a case of a receiving delay of a transmission path of the PDCP PDU. The PDCP entity of the macro base station may separate and transmit the PDCP through the macro base station and the small base station due to the multi-flows. In this case, a time difference may occur at the time of receiving the PDCP PDU in the PDCP entity of the UE

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due to a delay caused due to different paths.

[0107] In such a situation, in each of the case of the multi-flow transmission path receiving delay and the case where the PDCP discard timer has expired, a method that may sequentially transmit the PDCP SDUs to the upper layer in the PDCP entity of the UE is required.

[0108] A sequential transmission method of the PDCP SDUs to the upper layer considering the multi-flows will be described below.

[0109] The PDCP sequence number (SN) of the PDCP SDU corresponding to the PDP PDU received in the PDCP entity is confirmed and if the PDCP SN of the PDCP SDU is not sequential (that is, when the SN prior to the PDCP SN of the PDCP SDU is missed), an in-sequence timer for the PDCP SDU is driven. In this case, the duration of the in-sequence timer may be determined by considering the receiving delay of the transmission path of the PDCP PDU in the case of the multi-flows. Alternatively, the duration of the in-sequence timer may be determined by considering an overall situation of the system.

[0110] When the in-sequence timer for the PDCP SDU has expired, the PDCP SDU is transmitted to the upper layer. The reason is that when the PDCP PDU corresponding to the PDCP SDU for the PDCP SN which is missed is not received by the PDCP entity of the UE until the in-sequence timer has expired, the corresponding PDCP SDU is removed by the elapse of the discard timer at the transmission side of the PDCP entity of the macro base station.

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[0111] While the in-sequence timer for the PDCP SDU is running, when the PDCP PDU corresponding to the PDCP SDU for the PDCP SN prior to (that is, missed from) the PDCP SN of the PDCP SDU is received, and as a result, the PDCP SDUs may be sequentially transmitted, the in-sequence timer has expired and the corresponding PDCP SDUs are sequentially transmitted to the upper layer.

[0112] A transmission control protocol (TCP) is a protocol designed based on sequential reception of the packets. When the packet is not received in the TCP according to implementation, a window which may be transmitted at the TCP end may be reduced, which may cause reduce the transmission efficiency. Accordingly, when the packet is transmitted to the upper layer at a predetermined radio protocol end, even though the delay time is added, guaranteeing the sequential transmission may be more advantageous in terms of the overall capability of the network.

[0113] FIG. 13 illustrates an example of sequential upper layer transmission depending on the PDCP sequence number (SN) in the PDCP entity of the UE. FIG. 13 illustrates a case in which PDCH SDUs having odd PDCP SNs are received by the UE through the macro base station and PDCP SDUs having even PDCP SNs are received by the UE through the small base station.

[0114] Referring to FIG. 13, since there is no previous or missed PDCP SN, PDCP SDU #1 may be transmitted to the upper layer. However, in the case of PDCP SDU #3, at the time

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when a PDCP PDU corresponding to the PDCP SDU #3 is received by the PDCP entity of the UE, a PDCP PDU corresponding to PDCP PDU #2 may not be received. Accordingly, in this case, an in-sequence timer for PDCP PDU #3 is driven. Similarly in the cases of PDCP SDU #5 and PDCP SDU #7, the in-sequence timer for each of PDCP SDU #5 and PDCP SDU #7 is driven.

[0115] When PDCP SDU #2 is present in the PDCP entity of the UE (that is, the PDCP PDU corresponding to PDCP SDU #2) before the in-sequence timer for PDCP SDU #3 has expired, the UE confirms that PDCP SDU #2 and PDCP SDU #3 are sequentially present after PDCP SDU #1 and sequentially delivers PDCP SDU #2 and PDCP SDU #3 to the upper layer. In this case, the in-sequence timer for PDCP SDU #3 expires or ends. However, even in this case, PDCP SDU #4 has not yet reached and an in-sequence timer for PDCP SDU #5 and an in-sequence timer for PDCP SDU #7 still operate.

[0116] Thereafter, when PDCP SDU #4 is present in the PDCP entity of the UE before the in-sequence timer for PDCP SDU#5 has expired, the UE transmits PDCP SDU #4 and PDCP SDU #5 to the upper layer and the in-sequence timer for PDCP SDU#5 expires or ends.

[0117] Further, when PDCP SDU #6 is present in the PDCP entity of the UE before an in-sequence timer for PDCP SDU#7 has expired, the UE transmits PDCP SDU #6 and PDCP SDU #7 to the upper layer and the in-sequence timer for PDCP SDU#7 expires or ends.

[0118] In the above description, the in-sequence timer duration may be established when

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the PDCP entity is configured in the macro base station. The in-sequence timer duration may be established by considering a transmission delay time of the backhaul between the macro base station and the small base station.

[0119] The in-sequence timer may be transmitted from the macro base station to the UE through the RRC message. In detail, for example, the in-sequence timer may be included in a PDCP configuration which is an RRC information element as the following syntax.

[0120] [Table 1]

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```
-- ASN1START

PDCP-Config ::=                 SEQUENCE {
    discardTimer                    ENUMERATED {
                                        ms50, ms100, ms150, ms300, ms500,
                                        ms750, ms1500, infinity
    }                                                   OPTIONAL,     -- Cond Setup
    inseqTimer                      ENUMERATED {
                                        ms20, ms30, ms40, ms50, ms60,
    }                                                   OPTIONAL,     -- Cond Setup
    rlc-AM                          SEQUENCE {
        statusReportRequired            BOOLEAN
    }                                                   OPTIONAL,     -- Cond Rlc-AM
    rlc-UM                          SEQUENCE {
        pdcp-SN-Size                    ENUMERATED {len7bits, len12bits}
    }                                                   OPTIONAL,     -- Cond Rlc-UM
    headerCompression               CHOICE {
        notUsed                         NULL,
        rohc                            SEQUENCE {
            maxCID                          INTEGER (1..16383)          DEFAULT 15,
            profiles                        SEQUENCE {
                profile0x0001                   BOOLEAN,
                profile0x0002                   BOOLEAN,
                profile0x0003                   BOOLEAN,
                profile0x0004                   BOOLEAN,
                profile0x0006                   BOOLEAN,
                profile0x0101                   BOOLEAN,
                profile0x0102                   BOOLEAN,
                profile0x0103                   BOOLEAN,
                profile0x0104                   BOOLEAN
            },
            ...
        }
    },
    ....
    [[ rn-IntegrityProtection-r10   ENUMERATED {enabled}    OPTIONAL    -- Cond RN
    ]],
    [[ pdcp-SN-Size-v11x0           ENUMERATED {len15bits}  OPTIONAL    -- Cond Rlc-AM2
    ]]
}

-- ASN1STOP
```

[0121] Referring to Table 1, the PDCP configuration information element includes an inseqTimer field. The inseqTimer field indicates an in-sequence timer value. The inseqTimer field is driven when the PDCP SDU corresponding to the PDCP PDU received by the PDCP entity is not sequentially formed in the order of the PDCP SN. That is, when a PDCP SDU of

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PDCP SN #n-1 smaller than PDCP SN #n of the PDCP SDU is missed, the in-sequence timer may be driven with respect to the PDCP SDU of the corresponding PDCP SN #n.

[0122] FIG. 14 illustrates a method for sequentially delivering the PDCP SDU, which is performed by the UE considering the multi-flows according to an embodiment of the present invention.

[0123] Referring to FIG. 14, the UE confirms whether acquired PDCP SDUs are sequentially present in the order of the PDCP SN (S1400).

[0124] When the PDCP SDU of PDCP SN #n is present, but the PDCP SDU of PDCP SN #n-1 is missed, the in-sequence timer for the PDCP SDU of the PDCP SN #n is driven (S1410).

[0125] When the UE acquires the PDCP SDU of PDCP SN #n-1 before the in-sequence timer for the PDCP SDU of PDCP SN #n has expired, the UE sequentially delivers the PDCP SDU of PDCP SN #n-1 and the PDCP SDU of PDCP SN #n (S1420).

[0126] When the in-sequence timer the PDCP SDU of PDCP SN #n has expired in S1410, the UE delivers the PDCP SDU of PDCP SN #n to the upper layer (S1430). The reason is that this case is not the case by the receiving delay of the transmission path of the PDCP PDU by the dual connectivity but a case in which the PDCP SDU of PDCP SN #n-1 is discarded by the PDCP discard timer.

[0127] FIG. 15 is a block diagram of a macro base station, a small base station, and UE

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according to an embodiment of the present invention.

[0128] Referring to FIG. 15, UE 1500 according to the embodiment of the present invention may configure dual connectivity with a macro eNB 1530 and a small eNB 1560. Further, the UE 1500, the macro eNB 1530, and the small eNB 1560 according to the present invention support the aforementioned multi flow.

[0129] The macro eNB 1530 includes a macro transmitting unit 1535, a macro receiving unit 1540, and a macro processor 1550.

[0130] The macro receiving unit 1540 receives a packet for one EPS bearer from the S-GW. The macro processor 1550 controls the PDCP entity of the macro eNB 1530 to generate PDCP PDUs. The macro processor 1550 distributes the PDCP PDUs according to a predetermined reference to transfer (alternatively, transmit) some of the PDCP PDUs to the RLC entity of the macro receiving unit 1540 and transmit some of the PDCP PDUs to the UE through the macro transmitting unit 1535. The macro processor 1550 transfers (alternatively, transmits) others to the RLC entity of the small eNB 1560 through the macro transmitting unit 1535. In this case, the PDCP SDUs corresponding to the PDCP PDUs may be divided and indicated to the SN.

[0131] Further, the macro processor 1550 generates information on an in-sequence timer for the PDCP SDU and transmits the information to the UE through the macro transmitting unit 1535. The information on the in-sequence timer may be defined every PDCP SDU. The macro

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transmitting unit 1535 may transmit the information on the in-sequence timer including the RRC message (for example, a RRC connection reconfiguration message) to the UE 1500.

[0132] The small eNB 1560 includes a small transmitting unit 1565, a small receiving unit 1570, and a small processor 1580.

[0133] The small receiving unit 1570 receives the PDCP PDU from the small eNB 1560.

[0134] The small processor 1580 processes the PDCP PDU by controlling the RLC entity, the MAC entity, and the PHY layer of the small eNB 1560 and transmits the processed PDCP PDU to the UE through the small transmitting unit 1565.

[0135] The UE 1500 includes a UE receiving unit 1505, a UE transmitting unit 1510, and a UE processor 1520. The UE processor 1520 performs a function and a control required to implement the aforementioned features of the present invention.

[0136] The UE receiving unit 1505 receives the information on the in-sequence timer from the macro eNB 1530. The information on the in-sequence timer may be defined every PDCP SDU and the information on the in-sequence timer is included in the RRC message (for example, the RRC connection reconfiguration message) to be received by the UE receiving unit 1505. In this case, the UE transmitting unit 1510 may transmit an RRC connection reconfiguration complete message to the macro eNB 1530.

[0137] Further, the UE receiving unit 1505 receives data for the respective PDCP PDUs from the macro eNB 1530 and the small eNB 1560.

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[0138] The UE processor 1505 analyzes the data and controls the PHY layer(s), the MAC entity(s), the RLC entity(s), and the PDCP entity to acquire the PDCP SDU.

[0139] The UE processor 1505 verifies the PDCP SN of the PDCP SDU acquired from the PDCP entity and verifies whether there is a PDCP SDU of omitted PDCP SN #n-1. When there is the PDCP SDU of the omitted PDCP SN #n-1, the UE processor 1505 operates the in-sequence timer with respect to a PDCP SDU of the next PDCP SN #n of the omitted PDCP SN #n-1.

[0140] When the UE processor 1505 acquires the PDCP SDU of the omitted PDCP SN #n-1 before the in-sequence timer is completed, the UE processor 1505 performs in-sequence delivery of the PDCP SDU of the PDCP SN #n-1 and the PDCP SDU of the PDCP SN #n to the upper layer.

[0141] When the in-sequence timer is completed, the UE processor 1505 transfers the PDCP SDU of the PDCP SN #n to the upper layer without waiting until the SDU of the omitted PDCP SN #n-1 is acquired.

[0142] The above description is illustrative purpose only and various modifications and transformations become apparent to those skilled in the art within a scope of an essential characteristic of the present invention. Accordingly, the various embodiments disclosed herein are not intended to limit the technical spirit but describe with the true scope and spirit being indicated by the following claims. The scope of the present invention may be interpreted by the

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appended claims and the technical spirit in the equivalent range are intended to be embraced by the invention.

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FIG. 1

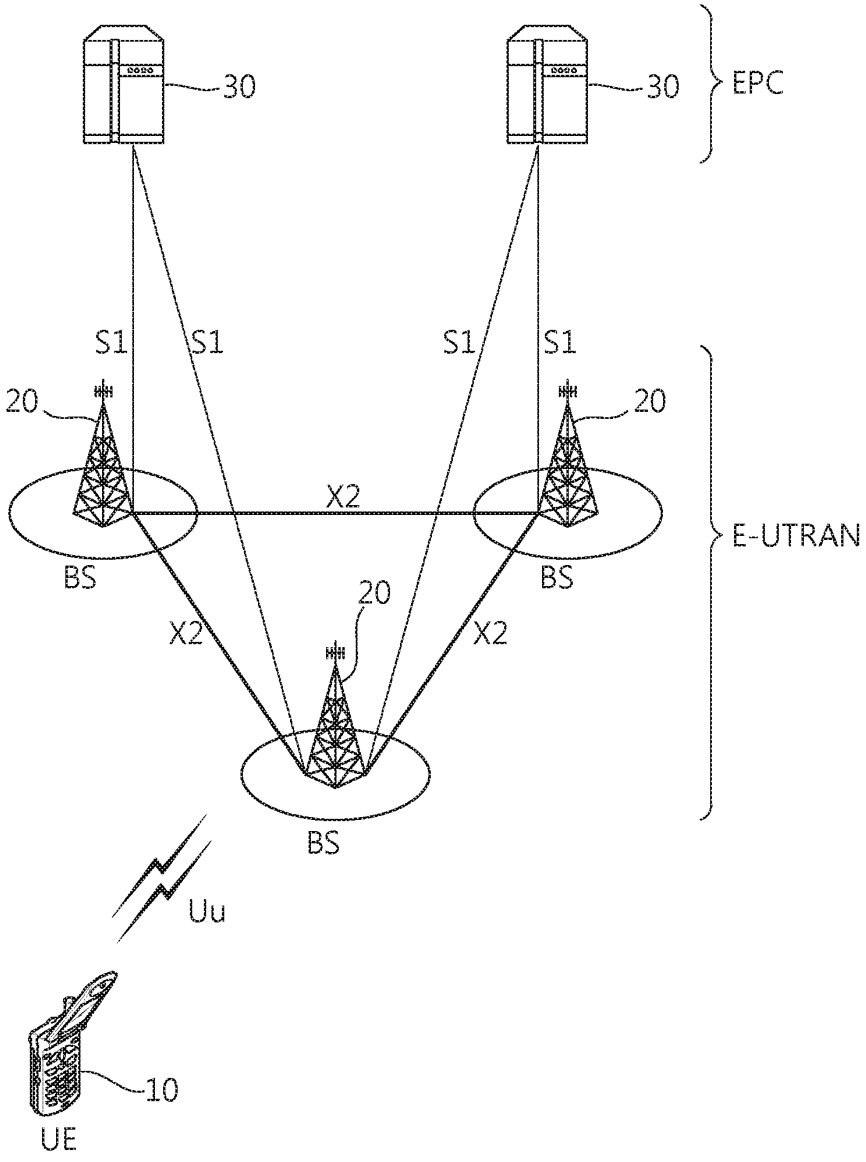


FIG. 2

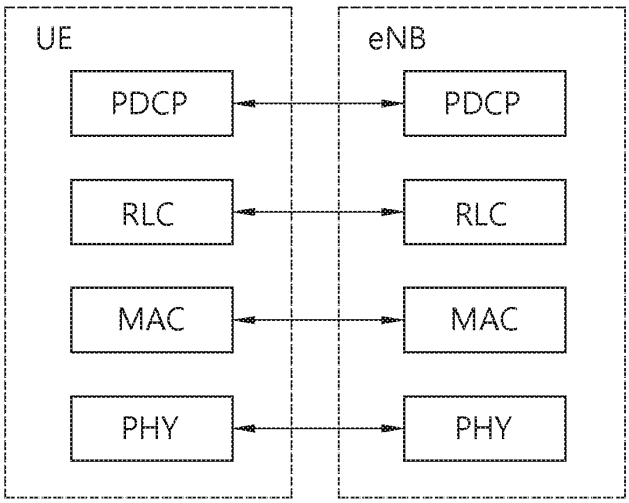


FIG. 3

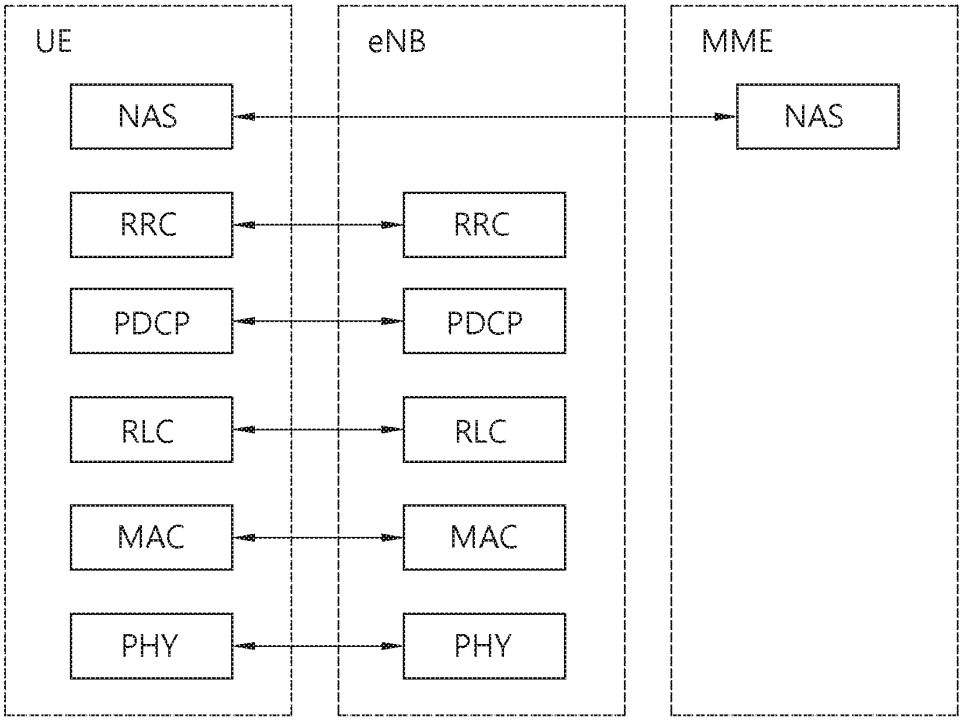


FIG. 4

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Page 314

FIG. 5

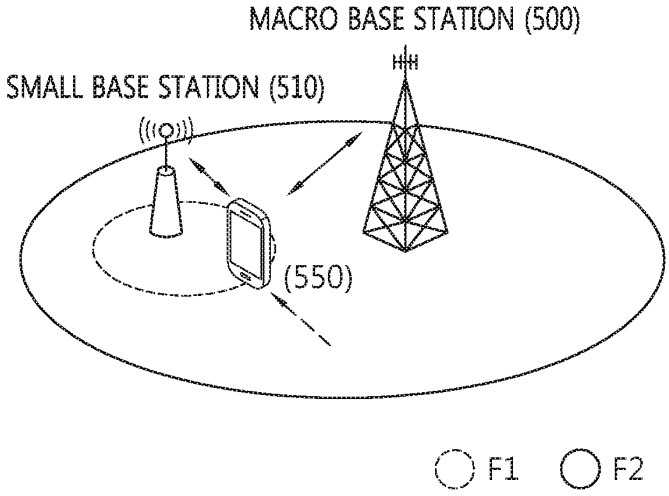


FIG. 6

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Page 316

FIG. 7

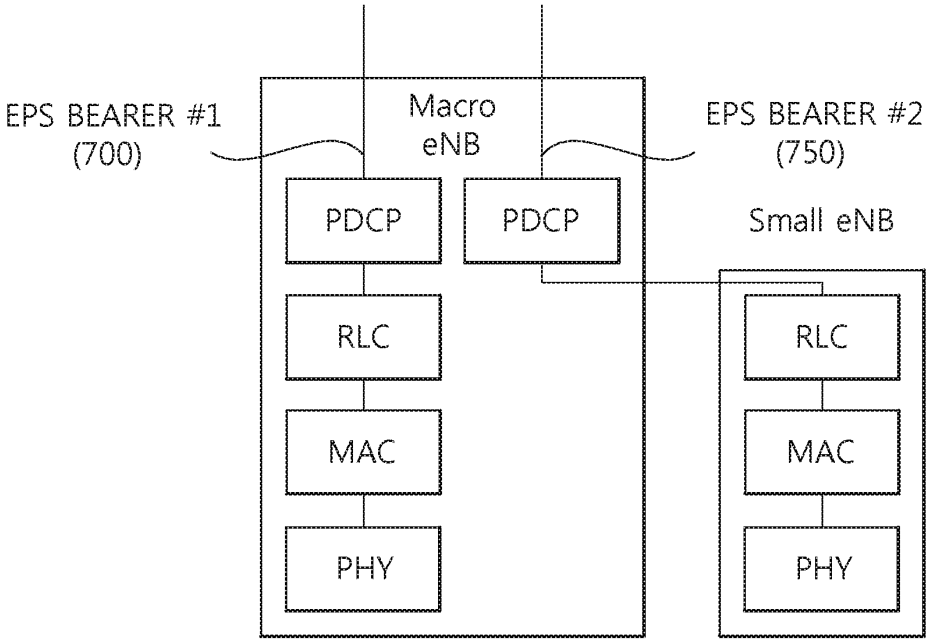

EPS BEARER #1
(700)
Macro
eNB
EPS BEARER #2
(750)
PDCP
PDCP
Small eNB
RLC
RLC
MAC
MAC
PHY
PHY

FIG. 8

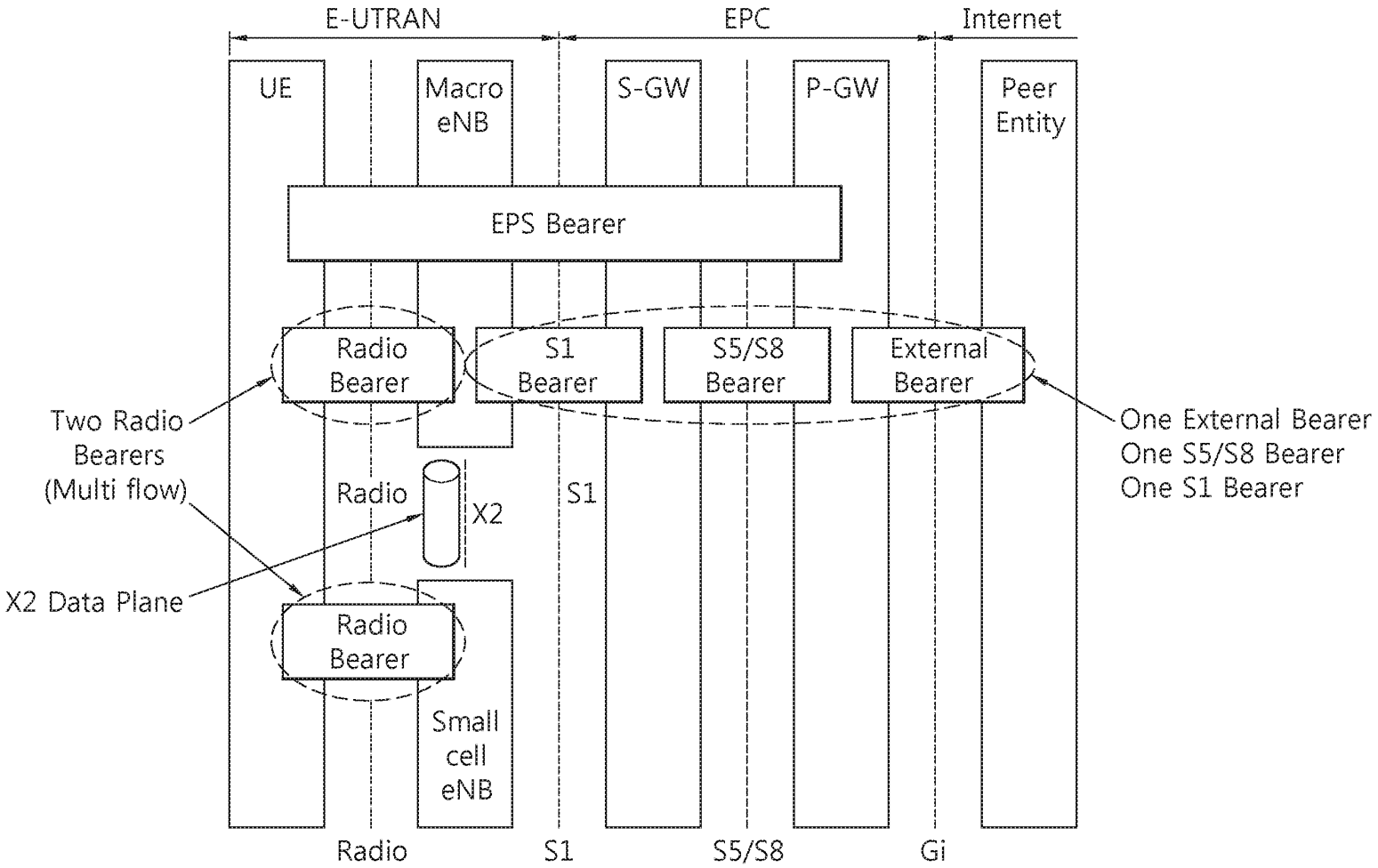

E-UTRAN
EPC
Internet
UE
Macro eNB
S-GW
P-GW
Peer Entity
EPS Bearer
Radio Bearer
S1 Bearer
S5/S8 Bearer
External Bearer
Two Radio Bearers (Multi flow)
One External Bearer
One S5/S8 Bearer
One S1 Bearer
Radio
X2
S1
X2 Data Plane
Radio Bearer
Small cell eNB
Radio
S1
S5/S8
Gi

FIG. 9

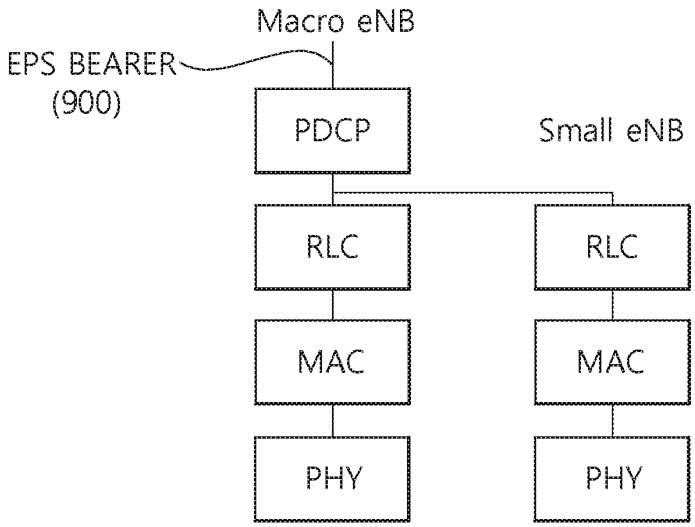

Macro eNB
EPS BEARER
(900)
PDCP
Small eNB
RLC
RLC
MAC
MAC
PHY
PHY

FIG. 10

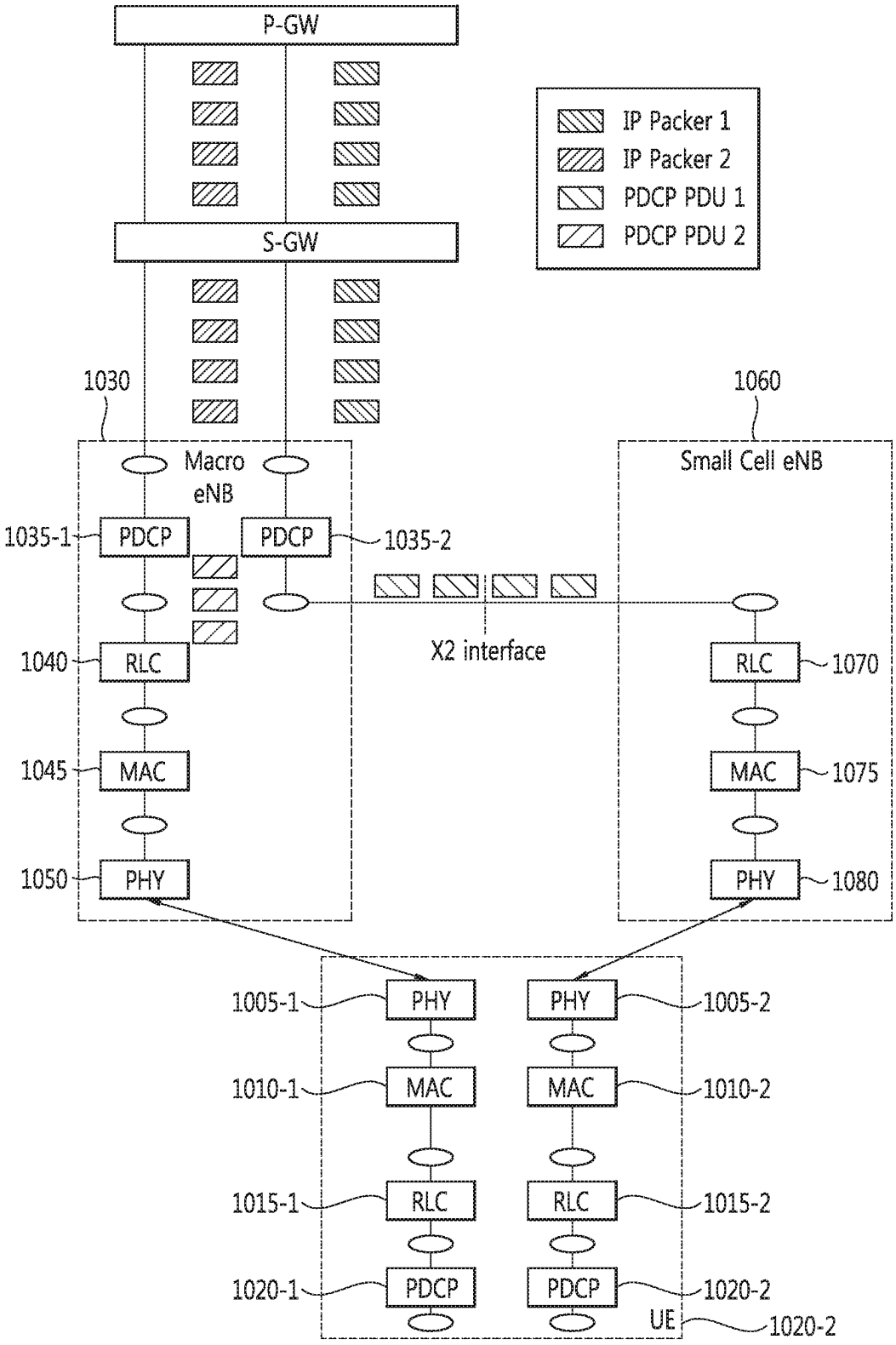

P-GW
S-GW
IP Packer 1
IP Packer 2
PDCP PDU 1
PDCP PDU 2
1030
1060
Macro eNB
Small Cell eNB
1035-1
PDCP
PDCP
1035-2
X2 interface
1040
RLC
RLC
1070
1045
MAC
MAC
1075
1050
PHY
PHY
1080
1005-1
PHY
PHY
1005-2
1010-1
MAC
MAC
1010-2
1015-1
RLC
RLC
1015-2
1020-1
PDCP
PDCP
1020-2
UE
1020-2

FIG. 11

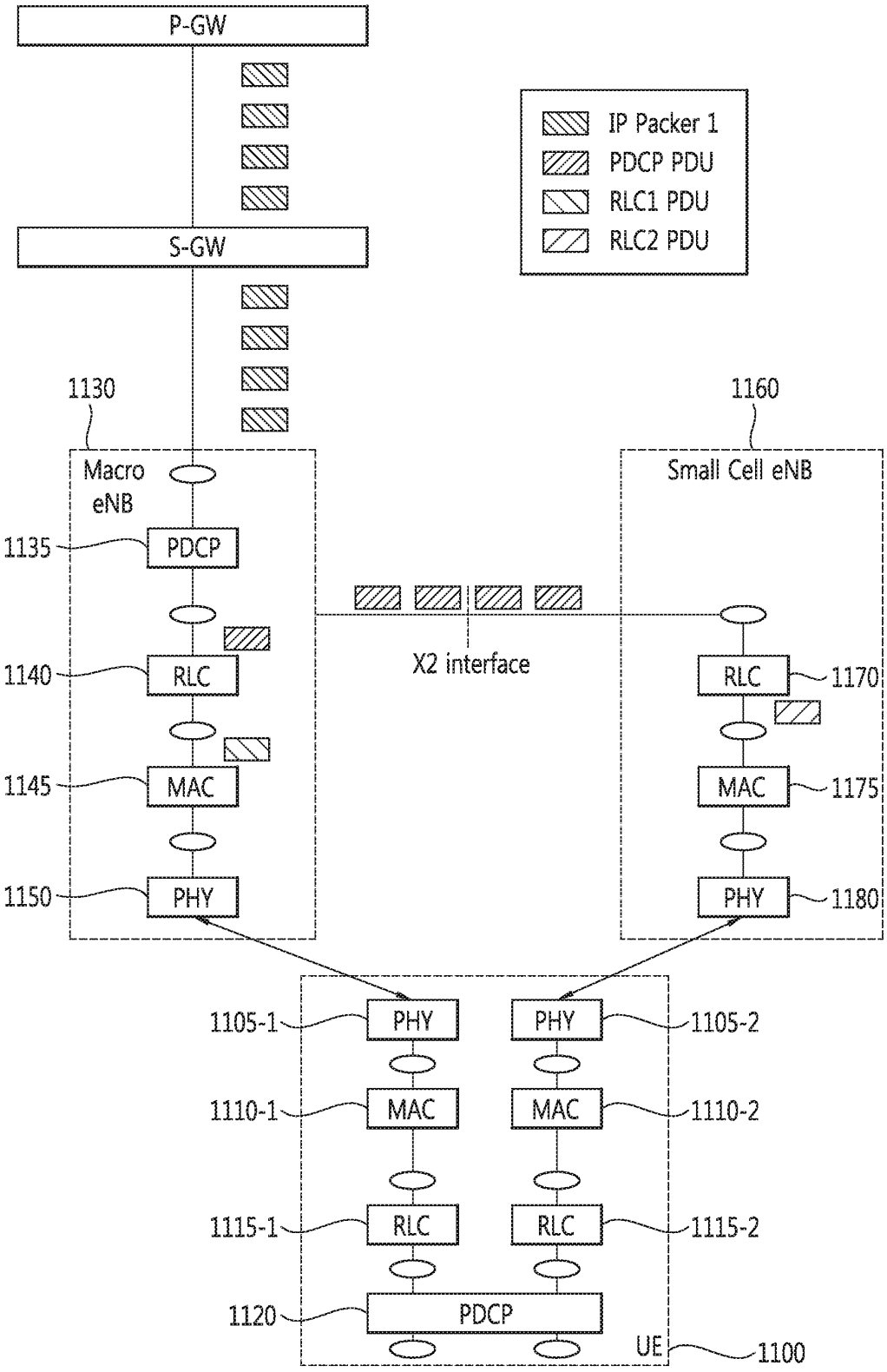

P-GW
S-GW
IP Packer 1
PDCP PDU
RLC1 PDU
RLC2 PDU
1130
Macro eNB
1135
PDCP
1140
RLC
1145
MAC
1150
PHY
X2 interface
1160
Small Cell eNB
RLC
1170
MAC
1175
PHY
1180
1105-1
PHY
PHY
1105-2
1110-1
MAC
MAC
1110-2
1115-1
RLC
RLC
1115-2
1120
PDCP
UE
1100

FIG. 12

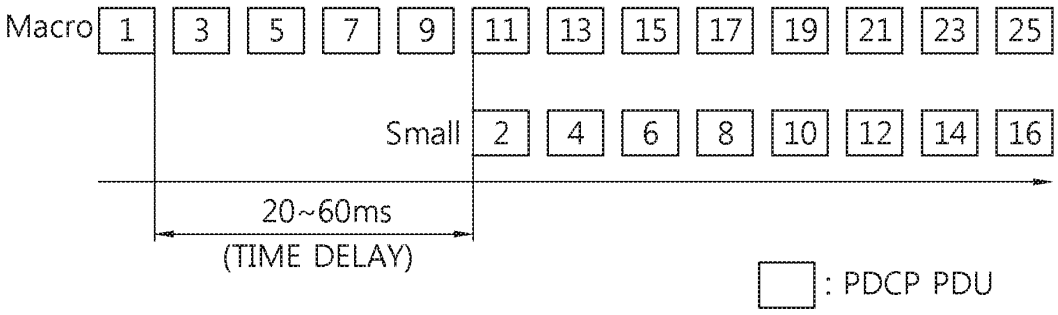

Macro
1
3
5
7
9
11
13
15
17
19
21
23
25
Small
2
4
6
8
10
12
14
16
20~60ms
(TIME DELAY)
: PDCP PDU

FIG. 13

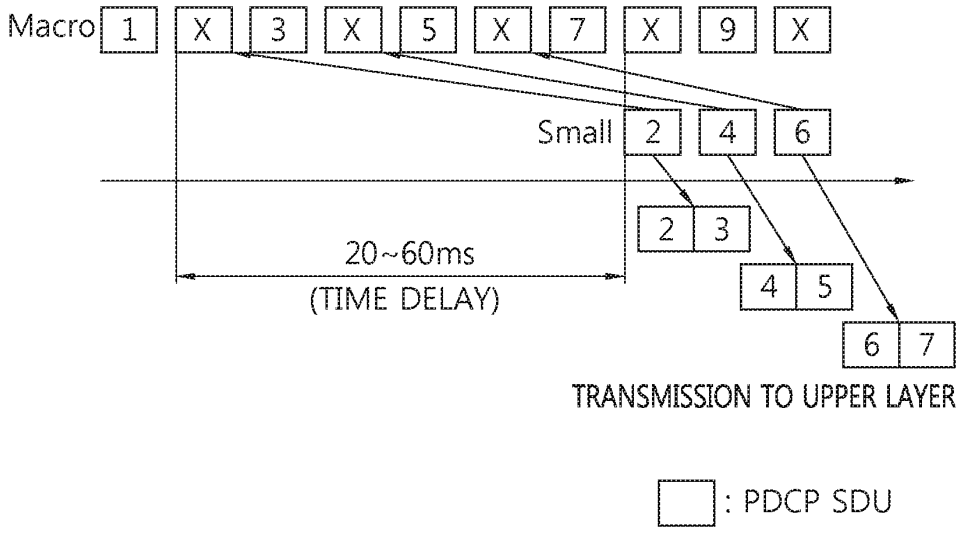

Macro
1
X
3
X
5
X
7
X
9
X
Small
2
4
6
2
3
20~60ms
(TIME DELAY)
4
5
6
7
TRANSMISSION TO UPPER LAYER
: PDCP SDU

FIG. 14

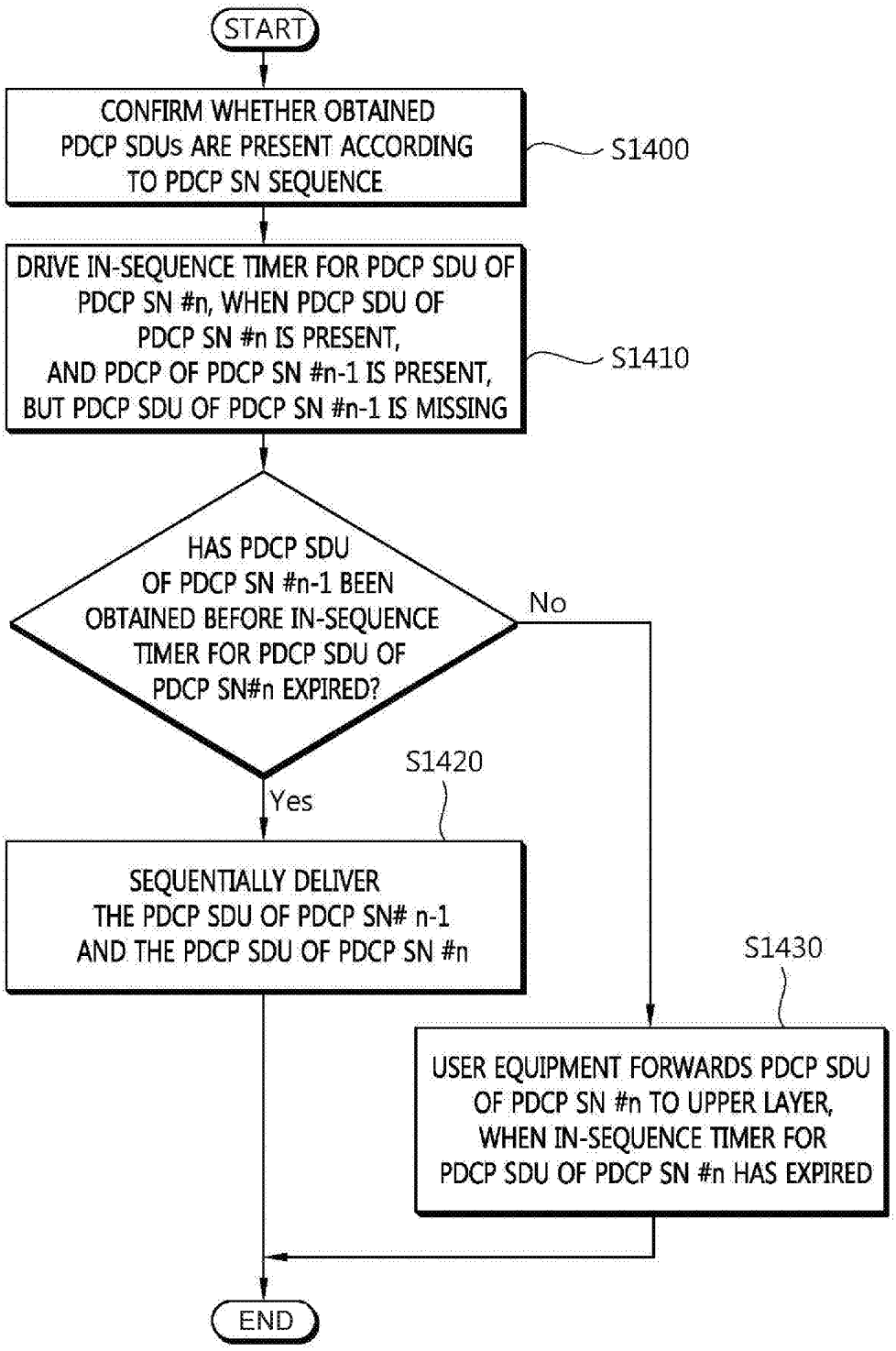
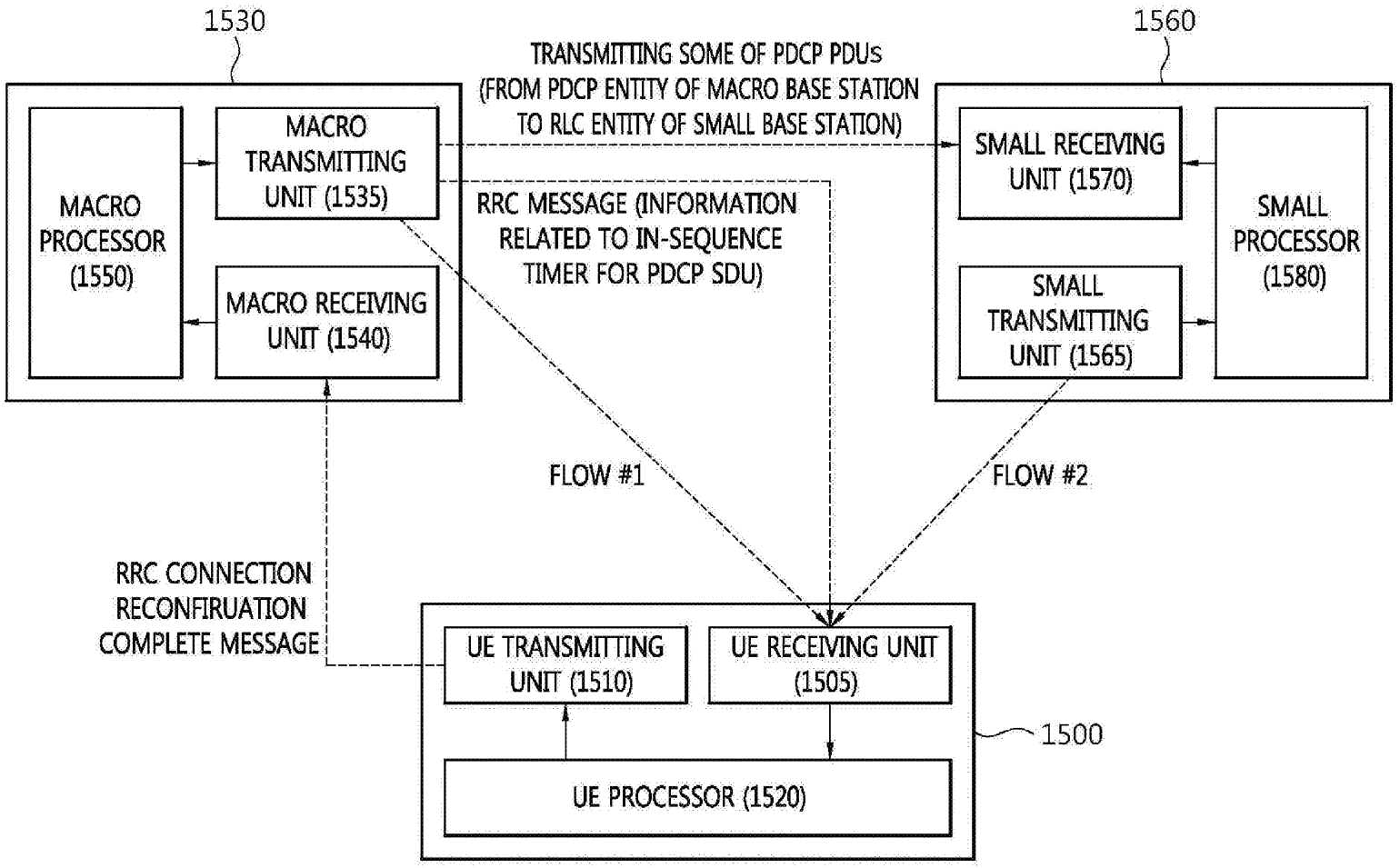

START
CONFIRM WHETHER OBTAINED PDCP SDUs ARE PRESENT ACCORDING TO PDCP SN SEQUENCE
S1400
DRIVE IN-SEQUENCE TIMER FOR PDCP SDU OF PDCP SN #n, WHEN PDCP SDU OF PDCP SN #n IS PRESENT, AND PDCP OF PDCP SN #n-1 IS PRESENT, BUT PDCP SDU OF PDCP SN #n-1 IS MISSING
S1410
HAS PDCP SDU OF PDCP SN #n-1 BEEN OBTAINED BEFORE IN-SEQUENCE TIMER FOR PDCP SDU OF PDCP SN#n EXPIRED?
No
Yes
S1420
SEQUENTIALLY DELIVER THE PDCP SDU OF PDCP SN# n-1 AND THE PDCP SDU OF PDCP SN #n
S1430
USER EQUIPMENT FORWARDS PDCP SDU OF PDCP SN #n TO UPPER LAYER, WHEN IN-SEQUENCE TIMER FOR PDCP SDU OF PDCP SN #n HAS EXPIRED
END

FIG. 15



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PTO/AIA/80 (07-12)
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

☒ Practitioners associated with Customer Number: 58027

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

☒ The address associated with Customer Number: 58027

OR

☐	Firm or Individual Name		
	Address		
	City	State	Zip
	Country		
	Telephone	Email	

Assignee Name and Address: Pantech Inc.
179 Seongam-ro, Mapo-gu, Seoul, Republic of Korea

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature	[signature]	Date	November 19, 2015
Name	Jong-Seok Lee	Telephone	82-2-2030-0491
Title	IP Legal Team Leader		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PTO/AIA/96 (08-12)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Pantech Inc.

Application No./Patent No.: _____ Filed/Issue Date: 2018-03-26

Titled: METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM

Pantech Inc., a Corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Myung Cheul JUNG, et al. To: PANTECH CO., LTD.

   The document was recorded in the United States Patent and Trademark Office at

   Reel 037006, Frame 0013, or for which a copy thereof is attached.

2. From: PANTECH CO., LTD. To: PANTECH INC.

   The document was recorded in the United States Patent and Trademark Office at

   Reel 044786, Frame 0742, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Christopher B. Kilner/	2018-03-26
Signature	Date
Christopher B. Kilner	45,381
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

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1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

HC Park & Associates, PLC
COUNSELORS at LAW

ASSIGNMENT SERVING AS DECLARATION PER 37 C.F.R. § 1.63(e)

As a below named inventor and Assignor, I declare that:

This assignment and declaration are directed to:

☒ The attached application entitled **METHOD AND APPARATUS FOR SEQUENTIAL FORWARDING CONSIDERING MULTI-FLOW IN DUAL CONNECTIVITY SYSTEM** having attorney docket number _____ ("Application"), which is the national stage entry of PCT/KR2014/004189, filed on May 9, 2014, and which claims priority from:
Korean Patent Application No. 10-2013-0053408, filed May 10, 2013.
☐ As amended on _____ (if applicable);

The above-identified Application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the Application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. § 1001 by fine or imprisonment of not more than five (5) years, or both.

Whereas, Assignor has invented certain new and useful processes, machines, articles of manufacture, compositions of matter, and/or improvements thereof ("Invention") disclosed in the Application,

Whereas, Assignor desires to convey all rights, titles, and interests in and to the same to:

PANTECH INC.
(Pantech R&D Center Bldg., Sangam-dong)
179 Seongam-ro, Mapo-gu
121-904 Seoul
Republic of Korea

PANTECH INC. herein further referred to as ("Assignee").

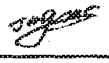
Now, for valuable consideration by Assignee to Assignor, the receipt of which is hereby acknowledged, and for other good and valuable consideration, Assignee and Assignor hereby agree as follows:

Assignor hereby conveys, assigns, sells and transfers to Assignee all rights, title and interests in and to the Invention disclosed in said application and in and to any Letters Patent of the United States (US), any continuation, division, renewal, or substitute thereof, and hereby grant to Assignee the right to apply in its own name for patents or Inventor's certificates and related rights heretofore or hereafter filed for the Invention in any and all countries, including (without limitation) all rights to claim priority based thereon, all patents granted thereon and all reissues, extensions and renewals thereof.

Assignor hereby covenants that no assignment, sale, agreement or encumbrance has been or will be made or entered into which would conflict with this Assignment.

Assignor further covenants that Assignee will, upon Assignee's request, be provided promptly with all pertinent facts and documents relating to the Invention, Patent, Application and any patents granted thereon, as may be known and accessible to Assignor, and Assignor will testify as to the same in any interference, litigation or proceeding related thereto and will promptly execute and deliver to Assignee or Assignee's legal representative any and all papers, instruments or affidavits required to apply for, protect, obtain, maintain, issue, defend and enforce the Application, Patent, Invention, whether in the US or any and all foreign countries and any patents granted thereon and/or for obtaining any reissue or reissues of any patent which may be granted for the invention and perform such further acts which may be necessary or desirable to carry out the intent of this agreement as the Assignee thereof shall hereafter require and prepare at assignee's expense.

IN WITNESS WHEREOF, Inventor and Assignor has hereunto set hand and seal.

First Inventor's and Assignor's Name:	JUNG, Myung Cheul
Address:	(Pantech R&D Center Bldg., Sangam-dong) 179 Seongam-ro, Mapo-gu 121-904 Seoul Republic of Korea
First Inventor's and Assignor's Signature:	
Date:	November 10, 2015
Second Inventor's and Assignor's Name:	HUH, Kang Suk
Address:	(Pantech R&D Center Bldg., Sangam-dong) 179 Seongam-ro, Mapo-gu 121-904 Seoul Republic of Korea
Second Inventor's and Assignor's Signature:	KANG SUK HUH
Date:	November 10, 2015

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