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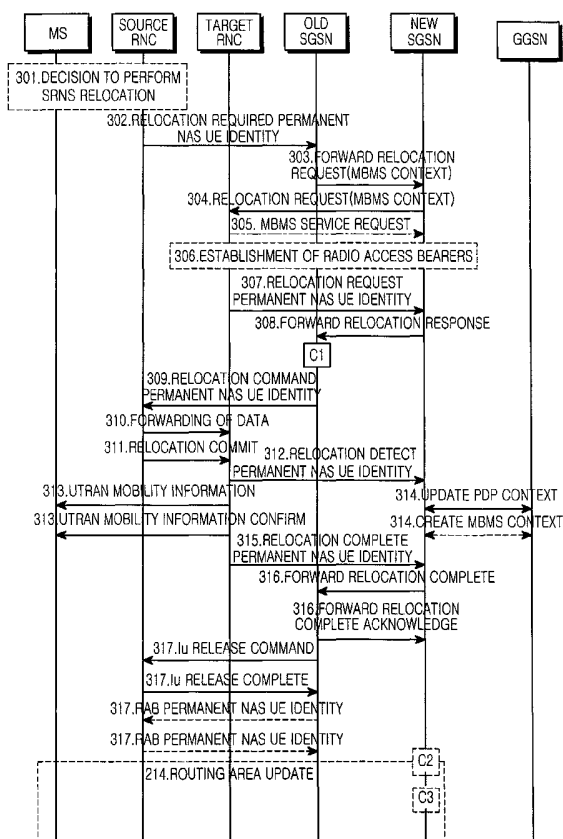
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(54) Title: METHOD FOR SUPPORTING MULTICAST BROADCAST/MULTICAST SERVICE TO EMPLOY SHARED IU SIGNALING CONNECTION



(57) Abstract: A method of supporting MBMS service to employ shared Iu signaling connection comprises: UE has non-MBMS service necessary for being transmitted while receiving MBMS service; The UE sends a non-access stratum message "Service Request" to SGSN; RNC checks whether the UE receives MBMS service or not, and the RNC forwards the non-access stratum message of the UE through the shared Iu connection to the SGSN; After receiving the "Service Request" message, in the case where the service request is accepted, the SGSN returns a "Service Acceptance" message to MS; The SGSN sends an "RAB Assignment Request" message for identifying the UE in UTRAN and CN to the RNC; The RNC allocates resources and sends an "RAB Assignment Response" message to existing message "RAB Assignment Response"; The SGSN receives the message from the RNC and knows the corresponding user plane bearer establishment for UE has been completed.



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METHOD FOR SUPPORTING MULTICAST BROADCAST/MULTICAST SERVICE TO EMPLOY SHARED IU SIGNALING CONNECTION

BACKGROUND OF THE INVENTION

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1. Field of invention

This invention relates to a method of how the procedures related with RANAP message and Iu interface supporting MBMS service to employ shared signaling connection on Iu interface in a mobile communication system.

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2. Description of prior art

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Multicast Broadcast/Multicast Service (hereinafter referred to as MBMS) is a new service under standardization by 3rd Generation Partnership Project (hereinafter referred to as 3GPP). The standard under development is TR23.846, and the latest version is 1.0.0. MBMS service is a unidirectional point-to-multipoint (p-t-m) service, and its most remarkable characteristic is that it can make use of radio resources and network resources efficiently.

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In order to explain this invention, Figure 1 describes MBMS architecture. MBMS architecture is based on Core Network of General Packet Radio Service (hereinafter referred to as GPRS), and has added new network units. The MBMS architecture as shown in Figure 1 is described below. Broadcast/Multicast Service Center (referred to as BM-SC) 101 is the service control center of MBMS system. The transmission network of MBMS service is composed of Gateway GPRS Supporting Node 102 (hereinafter referred to as GGSN) and Service GPRS Supporting Node 103 (hereinafter referred to as SGSN), providing routes for data transfer. Home Location Register 106 (hereinafter referred to as HLR) saves the data related with users and can provide services such as user's authentication. UMTS Terrestrial Radio Access Network 104 (hereinafter referred to as UTRAN) provides radio resources for MBMS service over the air-interface. Iu indicates the interface between Access Network and Core Network. User Equipment (hereinafter referred to as UE) 105 is a terminal device used to receive data. Radio resources used by MBMS service are not dedicated for one user, but are shared by all users using this service.

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The SRNS relocation procedure is described in 3GPP specification TR 23.846 v1.2.0. Figure 2 is the corresponding signaling flow. Each step of the

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flow is described in detail as follows.

201 A source RNC decides to execute SRNS relocation procedure.

202 The source RNC sends a "Relocation Required" message to an original SGSN.

5 203 The original SGSN forwards a "Relocation Request" message to a new SGSN.

10 204 The new SGSN sends the "Relocation Request" message to a target RNC and a radio access bearer (hereinafter referred to as RAB) is established between the target RNC and the new SGSN. After the resources needed by RAB including resources on the user plane are allocated successfully, the target RNC sends a "Relocation Request Acknowledge" message to the new SGSN.

205 The new SGSN forwards a "Relocation Response" message to the original SGSN.

15 206 The original SGSN sends a "Relocation Command" message to the source RNC.

207 The source RNC starts to copy data and sends them to the target RNC through network protocol layer (hereinafter referred to as IP layer).

20 208 The source RNC sends a "Relocation Commit" message to the target RNC, which is used to transmit SRNS Context to the target RNC and the role of SRNS converts from source RNC to target RNC.

209 When the target RNC receives the trigger message for executing relocation, it sends a "Relocation Detection" message to the new SGSN. Thereafter, the target RNC starts to play the role of Serving Radio Network Controller (hereinafter referred to as SRNC).

25 210 UE exchanges mobility-related information, such as new SRNC Identity, expression of location area and upstream user data, with the target RNC.

30 211 If the SRNS relocation is the one between different SGSNs, the new SGSN sends an "Update Packet Data Protocol (hereinafter referred to as PDP) Context Request" message to the corresponding GGSN after receiving the "Relocation Detection" message. GGSN updates PDP context and returns an "Update PDP Context Response" message. The new SGSN examines each MBMS service in MBMS Context of UE. If a certain service is joined by UE in SGSN for the first time, a GPRS Tunnel Protocol (hereinafter referred to as GTP) tunnel is established between SGSN and GGSN, and MBMS Context is created at
35 GGSN.

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212 The target SRNC initiates a Relocation Complete procedure after receiving an "UTRAN Mobility Information Confirm" message. The new SGSN sends a "Relocation Complete" message to notify the original SGSN of the completion of the SRNS relocation procedure.

5 213 Release an Iu connection between the source RNC and the source SGSN as well as user resources.

214 If a new Route Area Indication (hereinafter referred to as RAI) is different from an original one, UE initiates a route location update procedure.

10 C1, C2 and C3 execute Customized Applications for Mobile network Enhanced Logic (hereinafter referred to as CAMEL).

Existing RANAP message

In 3GPP specification TR 25.413 v5.0.0, the "RAB Assignment Request" message includes information on the following several aspects:

- 15 - RABs To Be Setup Or Modified List: information such as RAB Identity (ID) to be setup or modified, RAB parameters on user plane, etc.
- RABs To Be Released List: RAB ID to be released, release reason.

20 This message is connection-oriented. There is no identity of information element UE being included in the message. Similarly, messages of "RAB Assignment Response" and "Initial UE Information" also don't include identity of UE. SGSN and RNC may get UE information according to Iu connection identity.

The Relocation Request message includes information on the following several aspects:

- 25 - Relocation Type: this information element indicates whether the execution of SRNS relocation is related with UE.
- Cause: indicates the reason for initiating relocation.
- Source ID: indicates the source of SRNC relocation.
- 30 - Target ID: indicates the target ID of SRNC relocation, which might be either an ID of target RNC, or a global Cell ID of target cell (in the case of relocating from UMTS to GSM).
- Source RNC To Target RNC Transparent Container: includes parameters such as encryption information, cell load information and mapping relation between Radio Access Bearer (RAB) and transmission channel.

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- Old BSS To New BSS Information: information created by Source RNC and transferred to Target RNC, includes password index, RAB information, transmission channel information as the like.

5 The Relocation Command message includes information on the following several aspects:

- Target RNC To Source RNC Transparent Container: includes parameters such as encryption information, cell load information and mapping relation between Radio Access Bearer (RAB) and transport channel.
- Inter-System Information Transparent Container: includes temporary ID of
10 transmission network and radio resource control information.
- L3 information: messages of wireless network layer.
- RABs To Be Released List: information on Radio Access Bearer (hereinafter referred to as RAB) to be released.
- RABs Subject To Data Forwarding List: information on RAB subject to
15 forward data.

These messages are between Source RNC and Source SGSN during relocation procedure, and are connection-oriented. So there is no ID of UE being included in these messages, and SGSN and RNC can get the UE which is relocated according to Iu connection ID.

20 Similarly, other messages such as "Relocation Request Acknowledge", "Relocation Detection", "Relocation Complete", "Relocation Preparation Failure", "Relocation Failure", and "Relocation Cancel" in relocation procedure are all connection-oriented, therefore there is no ID of UE being included in information elements of these messages.

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Signaling connection establishment and release of existing Iu interface

When information of UE and CN needs to be exchanged between Radio Network Controller (hereinafter referred to as RNC) and CN and there is no Signaling Connection Control Part (hereinafter referred to as SCCP) for this UE
30 on Iu interface, start to establish a new SCCP connection. SCCP connection is established as follows:

I) RNC initiates an establishment of SCCP signaling connection

When RNC receives a non-access stratum message from UE for the first time, and if there is no Iu connection for this UE, RNC initiates the procedure of

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SCCP connection establishment. RNC sends a "SCCP Connection Request" message including one RANAP message in its data field to CN.

II) CN initiates an establishment of SCCP signaling connection

5 CN initiates an establishment of SCCP signaling connection when executing relocation. CN initiates an establishment of Iu connection by sending a "SCCP Connection Request" message to RNC, and the data field of the "SCCP Connection Request" includes a RANAP message (optional).

10 Above are only the cases where SCCP connection establishment have been decided at present. And the others will be introduced in the future.

15 When RNC decides to execute SRNS relocation procedure, it sends a "Relocation Required" message to a Source SGSN. However, since there is no ID of UE in the "Relocation Required" message, if the message is sent through the shared Iu connection of certain MBMS service that UE receives, SGSN will not know the "Relocation Required" message comes from which UE. Other RANAP messages, such as "Relocation Command", "RAB Assignment Request", "RAB Assignment Response", "Initial UE Information" and "Direct Transfer" will encounter the same problem of RNC or SGSN unable to identify when sending through a shared Iu connection.

20 Iu release procedure is used to release Iu signaling connection as well as UTRAN resources related with this signaling connection. During relocation procedure, if the moving UE is not the unique user of certain MBMS service, after SGSN sends a "Iu Release Command" to a Source RNC, it will release the shared connection as well as user plane resources for MBMS. This is unreasonable, and it should be that transmitting proper message will only release UTRAN resources related with the moving user.

30 In the conditions of existing SCCP connection establishment: when RNC receives a non-access stratum message from UE for the first time, if there is no Iu connection for this UE, RNC initiates the procedure of SCCP connection establishment. If UE has upstream non-MBMS data necessary for being transmitted while receiving MBMS service, it will send a Service Request message to RNC. According to above described conditions for SCCP connection establishment, RNC will initiate a procedure to setup dedicated Iu connection for the UE. This is true if a plurality of UEs receiving a same kind of MBMS service, 35 dedicated Iu connections will be setup for a plurality of UEs, which is contradict with the shared Iu connection mode.

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CN initiates an establishment of SCCP signaling connection when executing relocation. CN initiates an Iu signaling connection establishment procedure by sending a "SCCP Connection Request" message to RNC. If a shared Iu connection for certain MBMS service has been setup between a target RNC and a new SGSN when UE moves to the RNC, then it is unnecessary to setup a dedicated Iu connection for the UE. So it is necessary to modify the existing conditions of SCCP connection establishment.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a method that can support to use shared Iu signaling connection for MBMS service in a mobile communication system by modifying existing specifications (e.g. message, flow).

To accomplish above object, a method of supporting MBMS service to employ shared Iu signaling connection comprises:

- (a) UE has non-MBMS service necessary for being transmitted while receiving MBMS service;
- (b) The UE sends a non-access stratum message "Service Request" to SGSN;
- (c) RNC checks whether the UE receives MBMS service or not, when forwarding the non-access stratum message "Service Request" of the UE to SGSN, and if there is a shared Iu connection for the UE to receive certain MBMS service, don't initiate a SCCP Connection Establishment procedure, and the RNC forwards the non-access stratum message of the UE through the shared Iu connection to the SGSN;
- (d) After receiving the "Service Request" message, in the case where the service request is accepted, the SGSN returns a "Service Acceptance" message to MS;
- (e) The SGSN sends an "RAB Assignment Request" message to the RNC through the shared Iu connection for receiving certain MBMS service by the UE in order to request to establish RAB, and adding an information element, i.e. Permanent NAS UE Identity, to existing message "RAB Assignment Request" for identifying the UE in UTRAN and CN;
- (f) The RNC allocates resources and sends an "RAB Assignment Response" message through the shared Iu connection, and adding an information element, i.e. Permanent NAS UE Identity, to existing message "RAB Assignment Response" for identifying the UE in UTRAN and CN;

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(g) The SGSN receives the "RAB Assignment Response" message from the RNC and knows that the corresponding user plane bearer establishment for UE has been completed according to ID of the UE in this message.

5 This invention makes WCDMA system able to support shared Iu connection mode for MBMS service. It solves the problem of user mobility caused by shared connection being employed for MBMS service on Iu interface, and at the same time, solves the problem of how MBMS shared Iu signaling connection provides service for UE dedicated non-MBMS service in WCDMA system. Modifications for the specification made in the invention will not affect the existing functions of
10 the system. It keeps backward compatibility.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic diagram of MBMS system architecture;
15 Figure 2 shows the existing SRNS relocation procedure;
Figure 3 shows SRNS relocation procedure that supports shared Iu connection;
Figure 4 is the procedure of MBMS shared Iu signaling connection serving UE dedicated non-MBMS service.

20 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

(1) Modifications to existing messages

Relocation Required:

Based on existing specification, a new information element, i.e. Permanent
25 NAS UE Identity, is added to this message for identifying UE in UTRAN and CN. SGSN finds other signaling connections (e.g. shared Iu signaling connections that other UEs can use) that have been save by this information element. This parameter uses the type of International Mobile User Identity (hereinafter referred to as IMSI). This parameter is optional. For UEs that don't receive MBMS
30 service, this message is transferred through UE dedicated Iu; while for UEs that receive MBMS service, this message is transferred through shared Iu connection. This parameter is meaningful.

Relocation Command:

Based on the existing specification, an information element, i.e. Permanent
35 NAS UE Identity, is newly added to this message for identifying UE in UTRAN and CN. RNC finds other signaling connections (e.g. RRC signaling connection

or other shared Iu signaling connection that other UEs can use) that have been save by this information element. This parameter is the type of IMSI.

Other messages used for relocation on Iu Interface: an information element, i.e. Permanent NAS UE Identity shall be newly added to Relocation Request Acknowledge, Relocation Detection; Relocation Complete, Relocation Preparation Failure, Relocation Cancel, Relocation Cancel Confirmation.

Messages for establishing, modifying and releasing bearer on user plane: an information element, i.e. Permanent NAS UE Identity shall be added to RAB Assignment Request, RAB Assignment Response, RAB Release Request. RNC and SGSN can then distinguish which UE the operation of RAB establishing, modifying or releasing will be performed for.

Meanwhile, Initial UE Information and Direct Transfer message shall also be added with an information element, i.e. Permanent NAS UE Identity.

(2) Modification to the flow of SRNS relocation signaling

In this signaling flow, after the Source SGSN has executed the step of forwarding Relocation Confirmation to the new SGSN (the 12th step in Figure 2):

- If SGSN finds that a moving user is the last user leaving or quitting a certain MBMS service, it sends an "Iu Release Command" message to a Source RNC for requesting to release a certain shared Iu connection and UTRAN resources related with this connection. If the moving user is the last user of several MBMS services between SGSN and RNC, SGSN needs to send the "Iu Release Command" message to Source RNC repeatedly.
- If the moving user is not the last user receiving MBMS service and the user is receiving other non-MBMS service besides the MBMS service, SGSN needs to send an "RAB Assignment Request" message to RNC for releasing a non-MBMS RAB for this user.
- If the moving user is not the last user receiving MBMS service and the user isn't receiving other non-MBMS service than MBMS service, then this step is unnecessary.

RNC decides to perform different operations according to a message received:

- If RNC receives an "Iu Release Command" from SGSN, it releases an Iu connection and relevant resources and then returns an "Iu Release Complete" message to SGSN.

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- If RNC receives an "RAB Assignment Request" message, it releases RAB indicated in the message for the UE according to ID of UE, i.e. Permanent NAS UE Identity, in the message, and returns a "RAB Assignment Response" message to SGSN.

5 In this signaling flow, after a Target RNC receives a "Relocation Request" message from a new SGSN, according to MBMS context in the message, it sends a "MBMS Service Request" message to the new SGSN to request for a certain MBMS service, if the Target RNC hasn't yet joined in the service used by UE. If the Target RNC hasn't yet joined in several MBMS services used by UE, it is
10 necessary to send this message repeatedly for several times.

(3) SCCP Connection Establishment and Release

15 In order to support the means of employing shared Iu signaling connection for MBMS service in a mobile communication system, the trigger condition of existing SCCP connection establishment is modified as follows:

 In the case of SCCP connection establishment:

I) RNC initiates an establishment of SCCP signaling connection

20 When RNC receives a Non-Access Stratum (NAS) message transmitted from UE for the first time, if there is neither Iu connection for this UE nor shared Iu connection for UE to receive MBMS service, RNC initiates a SCCP Connection Establishment procedure. RNC sends a "SCCP Connection Request" message including one RANAP message in its data field to CN.

25 When RNC sends a "MBMS Service Request" message to SGSN, if there is no Iu connection used for this service on Iu interface, then RNC initiates a SCCP connection establishment procedure. One RANAP message is included in the data field of "SCCP Connection Establishment Request" (Please refer to "A Method of Signaling Bearer Connection for MBMS on Iu Interface").

30 II) CN initiates an establishment of SCCP signaling connection

 When CN performs relocation,

- if UE hasn't received MBMS service or there is no shared signaling connection for UE to receive MBMS service between RNC and SGSN, then CN initiates an establishment of SCCP signaling connection. CN
35 initiates the establishment of Iu connection by sending a "SCCP

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Connection Request” message to RNC, whose data field includes one RANAP message (optional).

5 If there exists a shared signaling connection for UE to receive MBMS service between RNC and SGSN, CN will not initiate the procedure of SCCP connection establishment.

In order to support the shared Iu signaling connection for MBMS service in the mobile communication system, SRNS relocation procedure is shown in Figure 3. Each step is described in detail as followings:

301 A Source RNC decides to perform SRNS relocation procedure;

10 302 The Source RNC constructs a “Relocation Required” message, if a Iu connection dedicated for UE exists (UE doesn’t receive MBMS service), then directly sends the message to SGSN. If the UE is receiving the MBMS service, then there is no dedicated Iu connection for the UE, and the message is sent to SGSN through the shared Iu connection for UE to receive a certain MBMS
15 service. Information elements of the Relocation Required message include Permanent NAS UE Identity. According to ID of the UE, SGSN can get known which UE has roamed.

303 An Original SGSN forwards a “Relocation Request” message including MBMS Context to a new SGSN.

20 304 The New SGSN sends a “Relocation Request” message to a Target RNC. If UE doesn’t receive MBMS service or there is no shared signaling connection for UE to receive MBMS service between RNC and SGSN, SGSN initiates a SCCP Signaling Connection Establishment procedure during sending the “Relocation Request” message. SGSN initiates an establishment of Iu connection
25 by sending a “SCCP Connection Request” message to RNC, whose data field includes one RANAP message (optional). In the case where UE doesn’t receive MBMS service, what is established is a dedicated Iu connection for the UE.

30 If shared signaling connection for UE to receive MBMS service between RNC and SGSN exists, then the new SGSN directly sends the “Relocation Request” to the Target RNC, and will not initiate SCCP connection establishment procedure.

305 If the target RNC hasn’t joined in a corresponding service, it sends a “MBMS Service Request” message to SGSN.

35 306 Radio access bearer including RABs of MBMS is established between the target RNC and the new SGSN.

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307 After the resources needed by RAB including resources on the user plane are allocated, the target RNC sends a "Relocation Request Acknowledge" message to the new SGSN. Information elements of the "Relocation Request Acknowledge" message include Permanent NAS UE Identity.

5 308 The new SGSN forwards the "Relocation Response" to the original SGSN.

309 The original SGSN sends a "Relocation Command" message including information element Permanent NAS UE Identity to the Source RNC.

10 310 The source RNC starts to copy data and sends them to the target RNC through network protocol layer (hereinafter referred to as IP layer).

311 The source RNC sends "Relocation Commit" to the target RNC. This procedure is used to transmit SRNS Context to the target RNC and the role of SRNS converts from the source RNC to the target RNC.

15 312 When the target RNC receives a trigger message for performing relocation, it sends a "Relocation Detect" message to the new SGSN, the "Relocation Detect" message includes information element, Permanent NAS UE Identity. After that, the target RNC starts to play the role of Serving Radio Network Controller (hereinafter referred to as SRNC).

20 313 UE exchanges mobility-related information, such as new SRNC Identity, expression of location area and upstream user data, with the target RNC.

314 If the SRNS relocation is the one between different SGSNs, the new SGSN sends an "Update Packet Data Protocol (hereinafter referred to as PDP) Context Request" message to the corresponding GGSN after receiving the "Relocation Detection" message. GGSN updates PDP context and returns an
25 "Update PDP Context Response" message. The new SGSN examines each MBMS service in MBMS Context of UE. If a certain service is joined by UE in SGSN for the first time, a GTP tunnel is established between SGSN and GGSN, and MBMS Context is created at GGSN.

315 The target SRNC initiates a Relocation Complete procedure after
30 receiving a "UTRAN Mobility Information Confirm" message. The "Relocation Complete" message includes information element, Permanent NAS UE Identity.

316 The new SGSN sends the "Relocation Complete" message to notify the original SGSN of the completion of SRNS relocation procedure, and the original SGSN returns a "Relocation Complete Acknowledge" message.

35 317 Release relevant resources between the Source RNC and the Source

SGSN.

If the UE is the last one that uses MBMS service in the source RNC, the shared connection and user plane resources corresponding to MBMS service shall be released. SGSN sends an "Iu Release Command" message to the Source RNC for requesting RNC to release a corresponding Iu connection and UTRAN resources related with this connection; the Source RNC releases corresponding resources and sends an "Iu Release Complete" message to SGSN. If the UE is the last user of the source RNC for several services, then above release procedure is performed for several times.

If the moving user is not the last user that receives MBMS service, SGSN sends an "RAB Assignment Request" message to RNC for releasing non-MBMS RAB of this user. The Source RNC releases corresponding resources and sends an "RAB Assignment Response" message to SGSN. These two messages both include information element Permanent NAS UE Identity. RNC and SGSN may get known which user's RAB should be released.

If the moving user is not the last user that receives MBMS service and the user doesn't receive other non-MBMS service than MBMS service, this step is unnecessary.

318 If the new Route Area Indication (hereinafter referred to as RAI) is different from the original, UE initiates a route location update procedure.

The procedure of MBMS shared Iu signaling connection serving UE dedicated non-MBMS service is shown in Figure 4. Each step is described as following:

401 MS receives MBMS service.

402 Since an RRC connection has been existed, MS has upstream data of non-MBMS service to be sent, and constructs a "Service Request" message.

403 MS sends the "Service Request" message to SGSN for requesting SGSN to reserve resources. The service type parameter of "Service Request" message shall be set as data. When RNC forwards Non-Access Stratum message "Service Request" of UE to SGSN, if Iu connection for the UE or the shared Iu connection for UE to receive MBMS service has existed, then RNC forwards the "Service Request" message through the existed connection.

405 In the case where the service request is accepted, SGSN returns a "Service Acceptance" message to MS. For the UE receiving MBMS service, this

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message is sent through the shared Iu signaling connection.

5 406 SGSN sends an "RAB Assignment Request" message to RNC through the shared Iu connection used for UE receiving a certain MBMS service for requesting the establishment of RAB. A new information element, i.e. Permanent NAS UE Identity, included in the message "RAB Assignment Request" is used to identify UE in UTRAN and CN. RNC finds other signaling connections (e.g. shared Iu signaling connections that other UEs can use) that have been save by this information element.

10 407 RNC sends an "Establishment of RB" message to MS for notifying MS of that new establishment of RAB ID request establishment of radio resources.

408 MS returns an "Establishment of RB Complete" to notify RNC of radio bearer establishment success.

15 409 RNC returns an "RAB Assignment Response" to SGSN through the shared Iu signaling connection, which indicates the completion of user plane bearer establishment. The message includes information element Permanent NAS UE Identity.

410 For each Re-established RAB by using modified QoS, SGSN initiates a "PDP Context Modification" procedure to notify MS and GGSN of corresponding to the new negotiated QoS of PDP Context.

20 411 MS sends upstream data packets.

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WHAT IS CLAIMED IS:

1. A method of supporting MBMS service to employ shared Iu signaling connection comprises:

5 (a) UE has non-MBMS service necessary for being transmitted while receiving MBMS service;

(b) the UE sends a non-access stratum message "Service Request" to SGSN;

10 (c) RNC checks whether the UE receives MBMS service or not, when forwarding the non-access stratum message "Service Request" of the UE to SGSN, and if there is a shared Iu connection for the UE to receive certain MBMS service, don't initiate a SCCP Connection Establishment procedure, and the RNC forwards the non-access stratum message of the UE through the shared Iu connection to the SGSN;

15 (d) after receiving the "Service Request" message, in the case where the service request is accepted, the SGSN returns a "Service Acceptance" message to MS;

20 (e) the SGSN sends an "RAB Assignment Request" message to the RNC through the shared Iu connection for receiving certain MBMS service by the UE in order to request to establish RAB, and adding an information element, i.e. Permanent NAS UE Identity, to existing message "RAB Assignment Request" for identifying the UE in UTRAN and CN;

25 (f) the RNC allocates resources and sends an "RAB Assignment Response" message through the shared Iu connection, and adding an information element, i.e. Permanent NAS UE Identity, to existing message "RAB Assignment Response" for identifying the UE in UTRAN and CN;

(g) the SGSN receives the "RAB Assignment Response" message from the RNC and knows that the corresponding user plane bearer establishment for UE has been completed according to ID of the UE in this message.

30 2. The method according to Claim 1, wherein further comprises that the modifications to the establishment procedure of the RNC initiating the SCCP signaling connection comprising:

the RNC initiates the establishment of SCCP signaling connection;

when the RNC receives a non-access stratum message from UE for the first time, if there is no Iu connection for this UE, the RNC initiates the procedure of SCCP connection establishment, and the RNC sends an "SCCP Connection Request" message including one RANAP message in its data field to CN.

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3. The method according to Claim 1, wherein a new information element, i.e. Permanent NAS UE Identity, is added to existing messages of "Initial UE Information" and "Direct Transfer" for identifying the UE in UTRAN and CN.

10 4. A method of supporting MBMS service to employ shared Iu signaling connection comprises:

(a) SRNC decides to perform relocation procedure;

(b) the SRNC constructs a "Relocation Required" message, and if there is no dedicated Iu signaling connection for the UE, then the "Relocation Required" message is sent to an original SGSN through the shared Iu signaling connection for UE receiving a certain MBMS service;

15

(c) the original SGSN forwards a "Relocation Request" to a new SGSN;

(d) the new SGSN sends the "Relocation Request" message to a Target RNC, and if UE doesn't receive MBMS service or there is no shared signaling connection for UE to receive MBMS service between RNC and SGSN, SGSN then initiates a SCCP Signaling Connection Establishment procedure; otherwise, the "Relocation Request" message is sent to the Target RNC through the shared Iu signaling connection for UE receiving the certain MBMS service;

20

(e) after the Target RNC allocates RAG for the service required by UE, a "Relocation Request Acknowledge" message is sent to the new SGSN through the shared Iu signaling connection for UE receiving the certain MBMS service;

25

(f) after the original SGSN receives the "Relocation Response" message from the new SGSN, a "Relocation Command" message is sent to an original RNC through the shared Iu signaling connection for UE receiving the certain MBMS service;

30

(g) after a Target RNC receives a "Relocation Commit" message from the original RNC, a "Relocation Detect" message is sent to the new SGSN through the shared Iu signaling connection for UE receiving the certain MBMS service;

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(h) after the Target RNC receives a "UE Mobility Information Confirm" message from UE, a "Relocation Complete" message is sent to the new SGSN through the shared Iu signaling connection for UE receiving the certain MBMS service;

5 (i) after the Source SGSN forwards Relocation Complete Acknowledge to the new SGSN:

◆ if the SGSN finds that the moving user is the last user leaving or quitting the certain MBMS service, SGSN sends an "Iu Release Command" message to the Source RNC for requesting to release a certain shared Iu connection as well as UTRAN resources related with this connection, and if the moving user is the last user for several MBMS services between SGSN and RNC, it is necessary for SGSN to send the "Iu Release Command" message to Source RNC repeatedly for several times;

15 ◆ if the moving user is not the last one receiving the MBMS service, this step is unnecessary;

◆ if the moving user is not the last one receiving the MBMS service and the user receives other non-MBMS service than the MBMS service, it is necessary for SGSN to send an "RAB Assignment Request" message to RNC for releasing a non-MBMS RAB of this user;

20 (j) if the Source RNC receives the "Iu Release Command" or the "RAB Assignment Request" message of the Source SGSN, relevant resources is released and an "Iu Release Complete" or "RAB Assignment Response" message is sent back respectively.

25 5. The method according to Claim 4, wherein a new information element, i.e. Permanent NAS UE Identity, is added to existing messages of "Relocation Required", "Relocation Command", "Relocation Request Acknowledge", "Relocation Detect" and "Relocation Complete" for identifying the UE in UTRAN and CN.

30 6. The method according to Claim 4, wherein further comprises that the modifications to the establishment procedure of CN initiating SCCP signaling connection comprising:

when CN performs relocation,

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- if UE doesn't receive MBMS service or there is no shared signaling connection for UE to receive MBMS service between RNC and SGSN, CN initiates the establishment of SCCP signaling connection, and CN initiates the establishment of Iu connection by sending an "SCCP Connection Request" message including one RANAP message in its data field to the RNC;
- if a shared signalling connection for UE to receive MBMS service between RNC and SGSN has existed, CN doesn't initiate the procedure of SCCP connection establishment.

7. The method according to Claim 4, wherein further comprises, in the SRNS relocation flow, after the Target RNC receives the "Relocation Request" message from the new SGSN, according to MBMS context in the message, if the Target RNC doesn't join in a certain MBMS context used by UE, it sends a "MBMS Service Request" message to the new SGSN for requesting the service, and if the Target RNC doesn't join in several MBMS services used by UE, it is necessary to send this message repeatedly for several times.

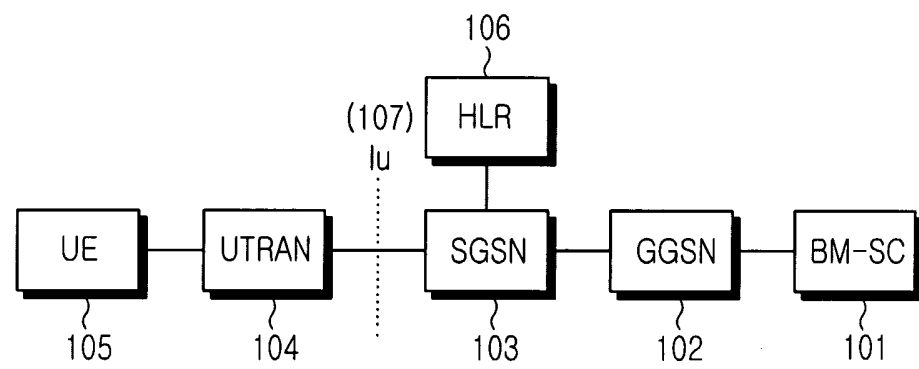


FIG.1

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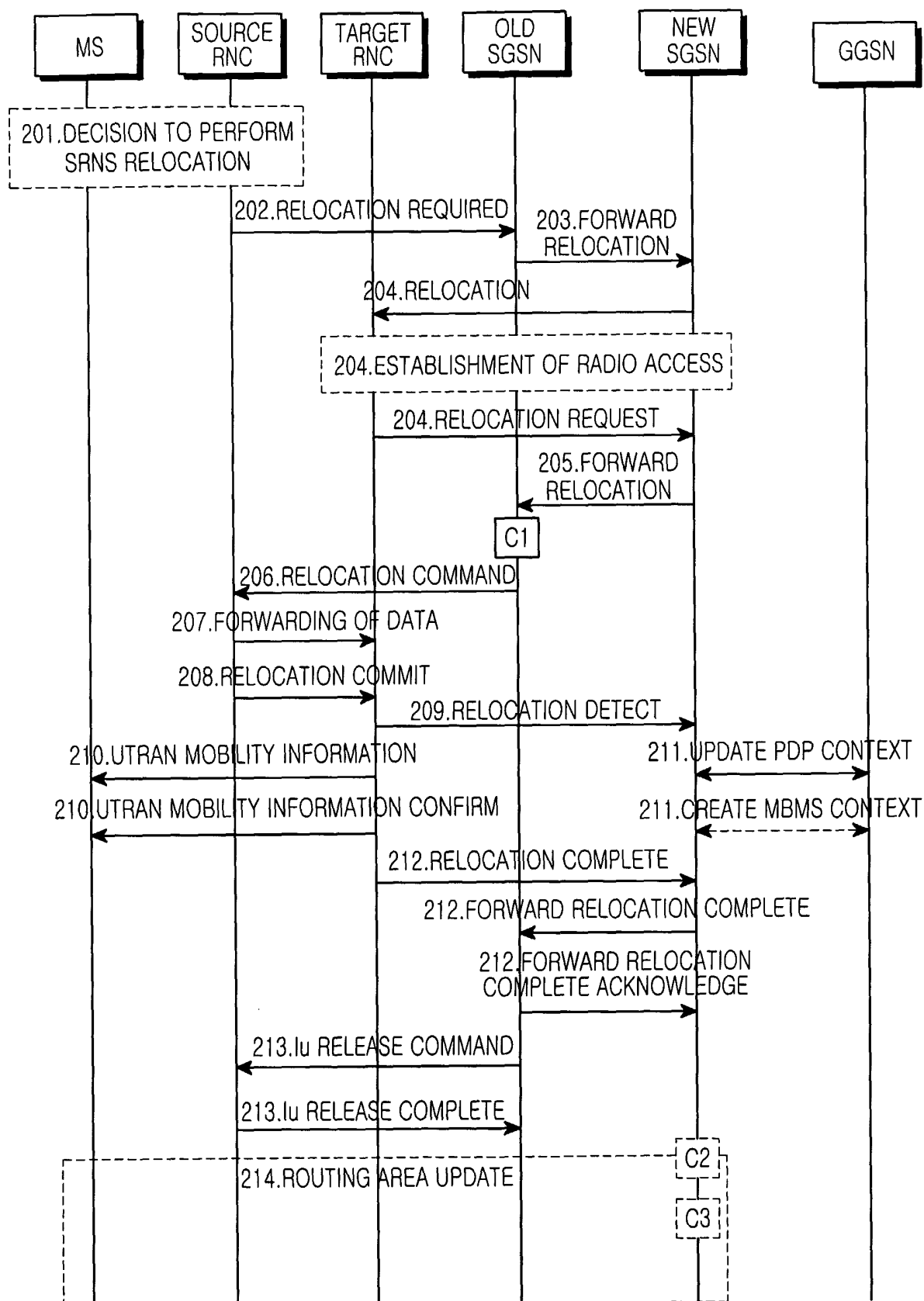


FIG.2

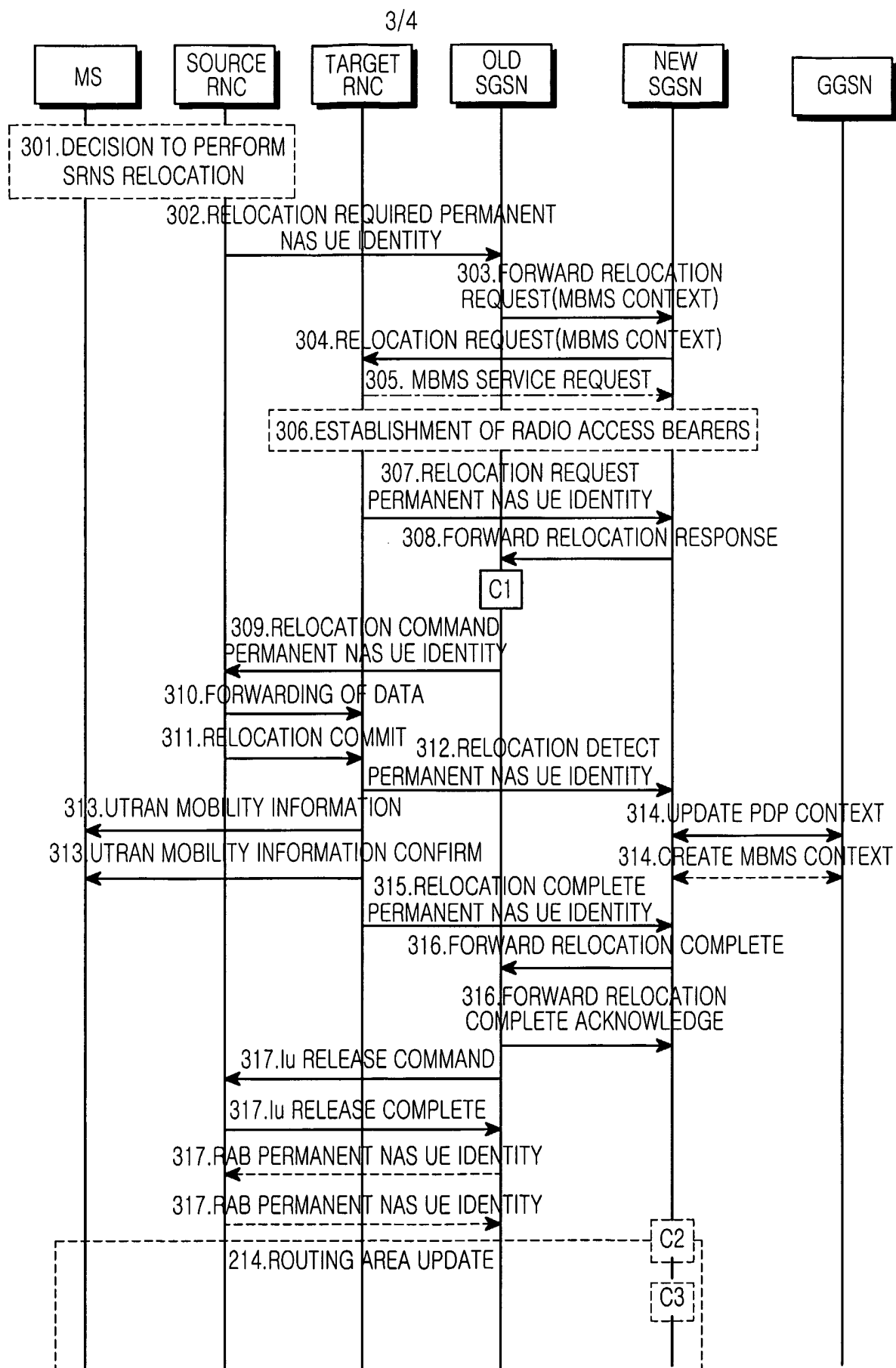


FIG.3

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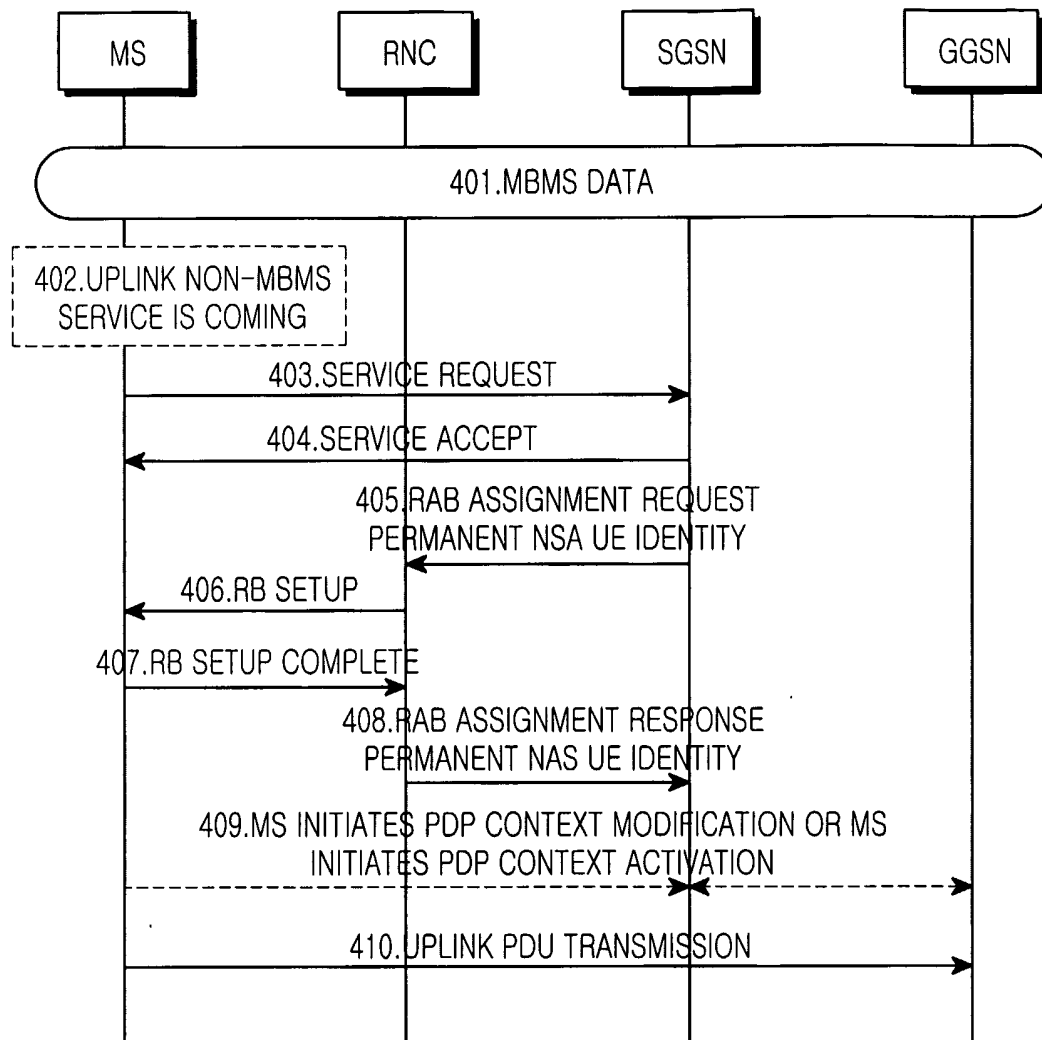


FIG.4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2003/002358

A. CLASSIFICATION OF SUBJECT MATTER**IPC7 H04L 12/56**

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and applications for inventions since 1975
Korean Utility models and applications for Utility models since 1975

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,335,927 B1 (MCI Communications Corporation) 1 January 2002 (01.01.2002) See the whole document	1 - 7
A	US 5,949,871 A (Hewlett-Packard Company) 7 September 1999 (07.09.1999) See the whole document	1 - 7
A	US 5,673,265 A (Integrated Network Corporation) 30 September 1997 (30.09.1997) See the whole document	1 - 7

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

☐ See patent family annex.

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

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