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(54) Title: SYSTEM AND METHOD OF RACH OPTIMIZATION

(57) Abstract: System and method of RACH optimization According to embodiments of the invention, a method for optimizing Random Access Channel (RACH) resources in a mobile wireless communication system is disclosed. The disclosed method may include, identifying one or more user equipment's (UEs) in proximity to a cell edge of a source eNB, identifying one or more target eNB in proximity to the cell edge of the source eNB, and sharing information about the identified UE that may move out of the Source eNB to one of the target eNBs.

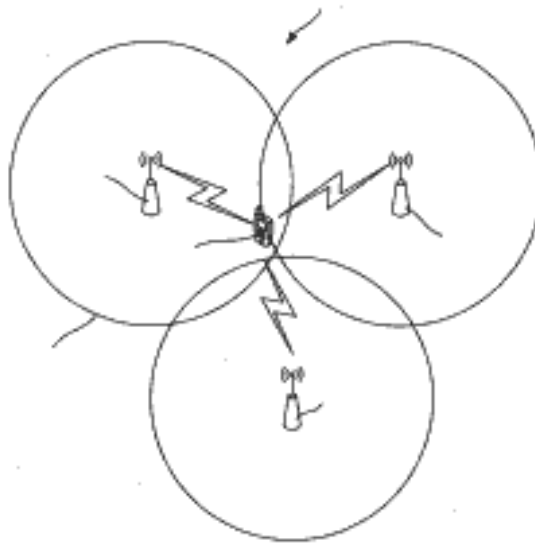


Figure 1



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FORM 2

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(39 OF 1970)

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The Patent Rules, 2003

Provisional Specification

(See Section 10 and Rule 13)

1. TITLE OF THE INVENTION

System and method of RACH optimization

2. APPLICANT(S)

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3. PREAMBLE TO THE DESCRIPTION

PROVISIONAL

The following specification describes the invention.

FIELD OF INVENTION

This invention relates generally to communication systems, and, more particularly, optimizing Random Access Channel (RACH) resources in a mobile wireless communication
5 systems.

BACKGROUND

Mobile wireless communication systems typically include a plurality of base stations or
10 access points that provide wireless connectivity to mobile units within a geographical area. The device that provides the wireless connectivity and the geographic area of coverage is conventionally referred to as a cell. The air interface between the base station or access point and the mobile unit supports one or more downlink (or forward link) channels from the base station to the mobile unit and one or more uplink (or reverse link) channels from the mobile
15 units to the base station. The uplink and/or downlink channels include traffic channels, signalling channels, broadcast channels, paging channels, pilot channels, and the like. The channels can be defined according to various protocols based on what kind of information is transmitted and how, such as the various multiple access schemes like time division multiple access (TDMA), frequency division multiple access (FDMA), code division multiple access
20 (CDMA), orthogonal frequency division multiple access (OFDMA), as well as combinations of these techniques. The geographical extent or cell edge of each cell may be determined by the transmission powers used by the base stations/access points as well as environmental conditions, physical obstructions, and the like.

An evolved universal terrestrial radio access network (E-UTRAN) includes a plurality of evolved Node-B's (eNBs) and communicates with a plurality of mobile stations, also referred as user equipment's (UEs) in an LTE system. The LTE system further have a random access channel (RACH) that is an uplink channel, and is used to transfer control information from a UE to the network. There may be two types of RACH procedures, one is Contention based RACH procedure and other is contention free RACH procedure. The contention based RACH procedure may be used when UE is attaching to eNB and contention free RACH procedure is used while latching to target eNB when UE is performing Handover. During Handover, Contention Free Rach Procedure is introduced to reduce the latency in completing the Handover Procedure. At times, when Contention free preambles are not available at target eNB because of less allocation to Contention Free Preambles or may be the allocated Contention Free Preambles bucket is not able to serve because of burst of Handovers occurred at target eNB. Moreover, since the RACH channel is a contention-based channel where several users might access the same resource, the RACH configuration has critical impacts to system performance. For example, the RACH collision probability is significantly affected by the RACH configuration, thereby making this a critical factor for call setup delays, data resuming delays from the uplink unsynchronized state, and handover delays. In addition, the RACH configuration also affects the call setup success rate and handover success rate.

In order to improve the system performance, RACH optimization functionality is introduced in the LTE system. The network may perform the RACH optimization for optimizing the RACH configuration, thereby increasing efficiency as well as improving the system performance. However, when the network wants to perform the RACH optimization, all it can do is to wait, the UE performs the random access procedure for RACH parameter

collection. This may unable the network to perform the RACH optimization timely, thereby affecting system performance. Knowing well in advance by target eNB information towards potential UEs towards Handover may help target eNB to arrange the buckets of preambles for Contention Free and Contention based RACH configurations. Also knowing well in advance
5 may help in preserving the Physical Resources well ahead.

Accordingly, there is a need for an improved system and method for optimizing Random Access Channel (RACH) resources in a mobile wireless communication systems.

10 SUMMARY OF THE INVENTION

According to embodiments of the invention, a method for optimizing Random Access Channel (RACH) resources in a mobile wireless communication system is disclosed. The disclosed method may include, identifying one or more user equipment's (UEs) in proximity
15 to a cell edge of a source eNB, identifying one or more target eNB in proximity to the cell edge of the source eNB, and sharing information about the identified UE that may move out of the Source eNB to one of the target eNBs.

According to yet another embodiment, a system for optimizing Random Access Channel
20 (RACH) resources in a mobile wireless communication system is disclosed. The disclosed system may include a source eNB, wherein the source eNB may be configured to identify one or more user equipment's (UEs) in proximity to a cell edge of the source eNB and transmit the information of identified UE to one or more target eNB, wherein the target eNB is configured to optimizes the Random Access Channel (RACH) resources based on the
25 information received from the source eNB.

BRIEF DESCRIPTION OF DRAWINGS

Other objects, features, and advantages of the invention will be apparent from the following description when read with reference to the accompanying drawings. In the drawings, 5 wherein like reference numerals denote corresponding parts throughout the several views:

Figure 1 illustrates an exemplary mobile wireless communication system capable of optimizing Random Access Channel (RACH) resources according to an embodiment of the invention;

10 Figure 2 illustrate an exemplary process flow for mobile wireless communication system according to an embodiment of the invention;

Figure 3 illustrate another exemplary process flow for mobile wireless communication system according to an embodiment of the invention;

15 Figure 4 illustrate yet another exemplary process flow for mobile wireless communication system according to an embodiment of the invention; and

Figure 5 illustrates a flow chart of an exemplary method for optimizing Random Access Channel (RACH) resources in a mobile wireless communication system according to an embodiment of the invention.

20 DETAILED DESCRIPTION OF DRAWINGS

In the drawings and specification there has been set forth preferred embodiments of the invention, and although specific terms are employed, these are used in a generic and descriptive sense only and not for purposes of limitation. Changes in the form and the 25 proportion of parts, as well as in the substitution of equivalents, are contemplated as

circumstances may suggest or render expedient without departing from the spirit or scope of the invention.

Figure 1 illustrates an exemplary mobile wireless communication system 100 capable of optimizing Random Access Channel (RACH) resources according to an embodiment of the invention. The system 100 may have a source eNB 102, one or more user equipment's (UEs) 104 and one or more target eNBs 106. According to embodiments of the disclosure, source eNB 102 may be configured to identify one or more UEs 104 that may be moving to another eNB (target eNB). According to an embodiment, the identification of the UE 104 may be based on identification of UE in proximity to a cell edge 108 of the source eNB. The identification may be using any known location identification technologies such as but not limited to GPS. According to yet another embodiment, the identification of the UE 104 may be based on probable UEs 104, which are getting better signal from neighbour eNBs 106a, 106b than the source eNB 102.

The source eNB 102 may share information of the identified UEs 104 that may move to another eNB with one or more target eNBs 106a, 106b. The information may be shared through a communication interface such as, but not limited to, X2, S1 or NSM. Further depending on the type of interface, the information may be transmitted directly to the target eNBs 106a, 106b or through a core network (not shown). According to further embodiments, the target eNBs 106a, 106b may optimize the Random Access Channel (RACH) resources based on the information received from the source eNB 102.

Figure 2, illustrate an exemplary process flow for mobile wireless communication system 100 according to an embodiment of the invention. As illustrated, the Source eNB 102 may

observe one or more UEs 104 that are at the Cell Edge 108 and they are potential UEs 104 to Handover to the Target eNBs 106. The Source eNB 102 collects this UE information and may share the details to the Target eNB 106. Considering the input received from the Source eNB 102, the Target eNB 106 optimises RACH Resources and may update the broadcasting information accordingly. During Handover Process, the Target eNB 106 will share the preamble details from updated RACH information.

Figure 3, illustrate another exemplary process flow for mobile wireless communication system 100 according to an embodiment of the invention. As illustrated, the Source eNB 102 may observe the UEs 104 that are at the Cell Edge 108 and they are potential UEs to Handover to the Target eNB/eNBs. The Source eNB 102 collects the UEs information and share the details to a MME/CN(Core Network). The Core Network may collect, analyse and may distribute the corresponding UE information to the corresponding target eNBs so that the target eNBs may optimize the RACH Resources to serve the Contention free Handovers.

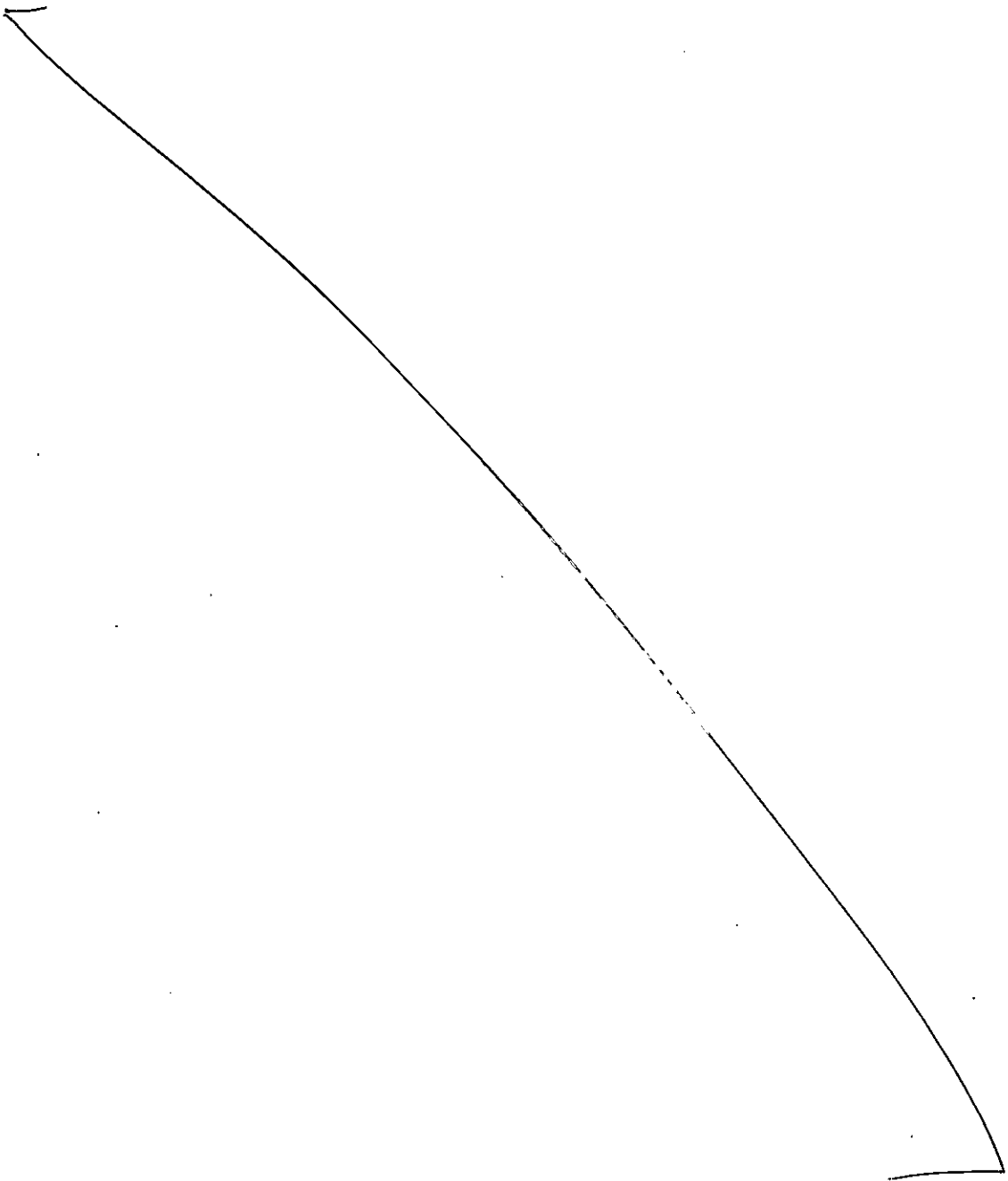
Figure 4, illustrate yet another exemplary process flow for mobile wireless communication system 100 according to an embodiment of the invention. As illustrated, the Source eNB 102 may observe the UEs 104 that are at the Cell Edge 108 and are potential UEs to Handover to Target eNB/eNBs 106. The Source eNB 102 collects these UEs information and may share the details to a Network Service Managers (NSM). The NSM may collect, analyse and may distribute the corresponding UE information to corresponding target eNBs so that the target eNBs may optimize the RACH Resources to serve the Contention free Handovers.

Figure 5 illustrates a flow chart of an exemplary method 200 for optimizing Random Access Channel (RACH) resources in a mobile wireless communication system 100 according to an

embodiment of the invention. The mobile wireless communication system 100 may have a source eNB 102, one or more user equipment's (UEs) 104 and one or more target eNBs 106. The disclosed method 200 at step 202 may include identifying one or more user equipment's (UEs) 104 in proximity to a cell edge 108 of the source eNB 102. The identification may be using any known location identification technologies such as but not limited to GPS. At step 5 204, the method 200 includes identifying one or more target eNB 106 in proximity to the cell edge 108 of the source eNB 102. At step 206, the method includes sharing information of the identified UEs 104 that may move to another eNB with one or more target eNBs 106a, 106b. According to an embodiment, the identification may be based on the movement of the UE 10 104 that may be moving away from the source eNB 102. The information may be shared through a communication interface such as, but not limited to, X2, S1 or NSM. Further depending on the type of interface, the information may be transmitted directly to the target eNBs 106a, 106b or through a core network (not shown). The method at step 208 may further include optimizing Random Access Channel (RACH) resources of the target eNBs 106a, 15 106b based on the information received from the source eNB 102.

Throughout the various contexts described in this disclosure, the embodiments of the invention further encompass computer apparatus, computing systems and machine-readable media configured to carry out the foregoing systems and methods. In addition to an 20 embodiment consisting of specifically designed integrated circuits or other electronics, the present invention may be conveniently implemented using a conventional general purpose or a specialized digital computer or microprocessor programmed according to the teachings of the present disclosure, as will be apparent to those skilled in the computer art.

Appropriate software coding can readily be prepared by skilled programmers based on the teachings of the present disclosure, as will be apparent to those skilled in the software art. The invention may also be implemented by the preparation of application specific integrated circuits or by interconnecting an appropriate network of conventional component circuits, as
5 will be readily apparent to those skilled in the art.



We Claim:

1. A wireless communication system 100 capable of optimizing Random Access Channel (RACH) resources, the system 100 comprising:

a source eNB 102, wherein the source eNB 102 is configured to:

5 identify one or more user equipment's (UEs) 104 in proximity to a cell edge 108 of the source eNB 102 and

transmit information about said UE 104 to one or more target eNB 106;

wherein the target eNB 104 is configured to optimizes the Random Access Channel (RACH) resources based on the information received from the source eNB
10 102.

2. The system as claimed in claim 1, wherein the source eNB 102 identify movement of the UE 104.
- 15 3. The system as claimed in claim 2, wherein the source eNB 102 transmit information about UE 104 to source eNB 106 that are moving away from the source eNB 102.
4. The system as claimed in claim 2, wherein the movement is identified using GPS.
- 20 5. The system as claimed in claim 2, wherein the source eNB 102 transmit information about UE 104 to target eNB 106 that are getting better signal from neighbour eNBs 106a, 106b than the source eNB 102.
6. The system as claimed in claim 1, wherein the information is shared through a X2, S1 or
25 NSM communication interface.

7. A method for optimizing Random Access Channel (RACH) resources in a mobile wireless communication systems, the method comprising:

5 identifying one or more user equipment's (UEs) in proximity to the cell edge of a source eNB;

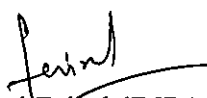
identifying one or more target eNB in proximity to the cell edge of the source eNB; and

10 sharing information of the identified UEs that may move to another eNB with one or more target eNBs.

8. The method as claimed in claim 1, wherein the Random Access Channel (RACH) resources are optimized at target eNB based additionally on information transmitted from the Source eNB.

15 9. The method as claimed in claim 3, wherein the step of sharing information includes transmitting information about the UE that are moving away from the source eNB.

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ABSTRACT

System and method of RACH optimization

According to embodiments of the invention, a method for optimizing Random Access Channel (RACH) resources in a mobile wireless communication system is disclosed. The disclosed method may include, identifying one or more user equipment's (UEs) in proximity to a cell edge of a source eNB, identifying one or more target eNB in proximity to the cell edge of the source eNB, and sharing information about the identified UE that may move out of the Source eNB to one of the target eNBs.

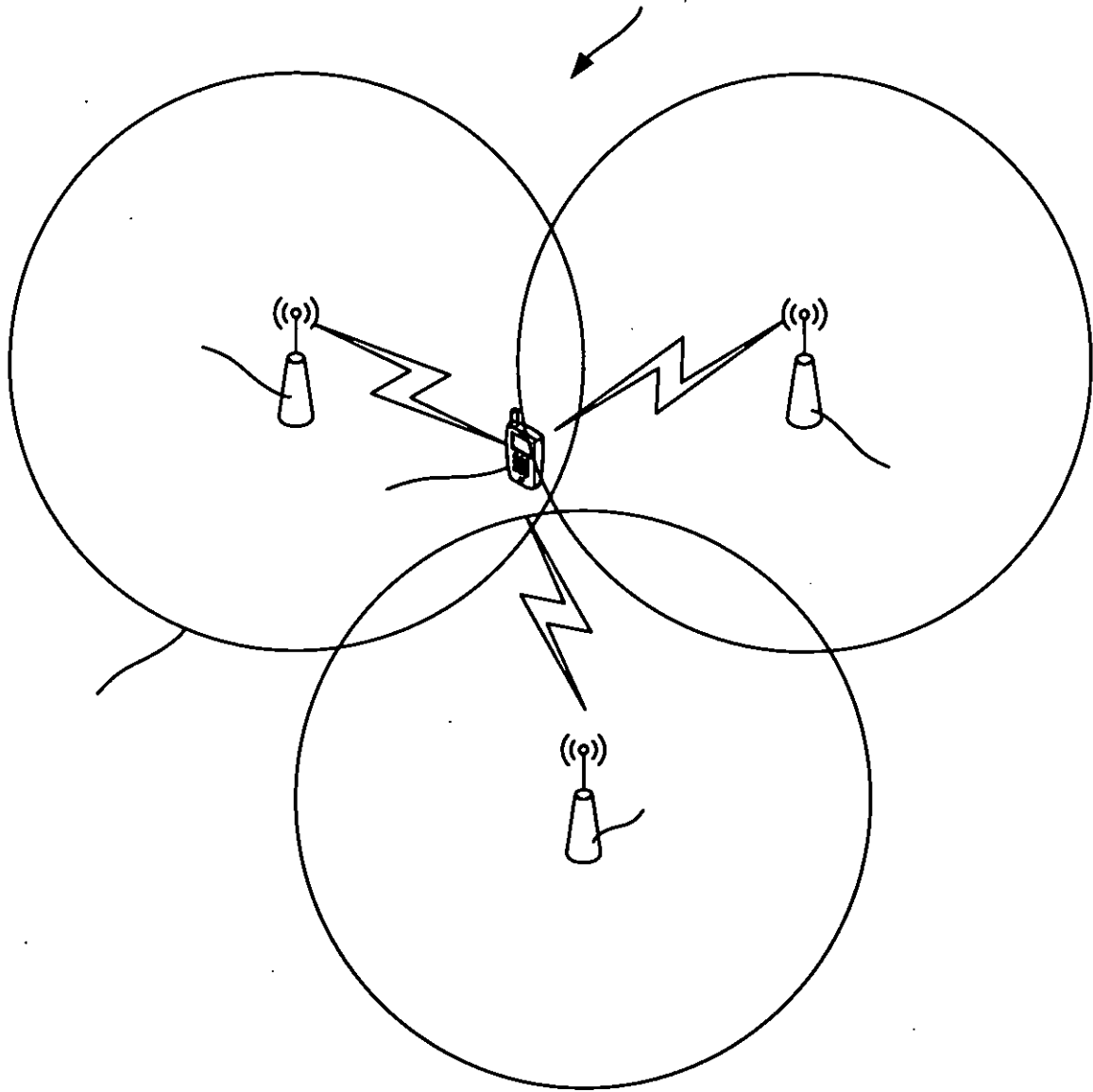


Figure 1

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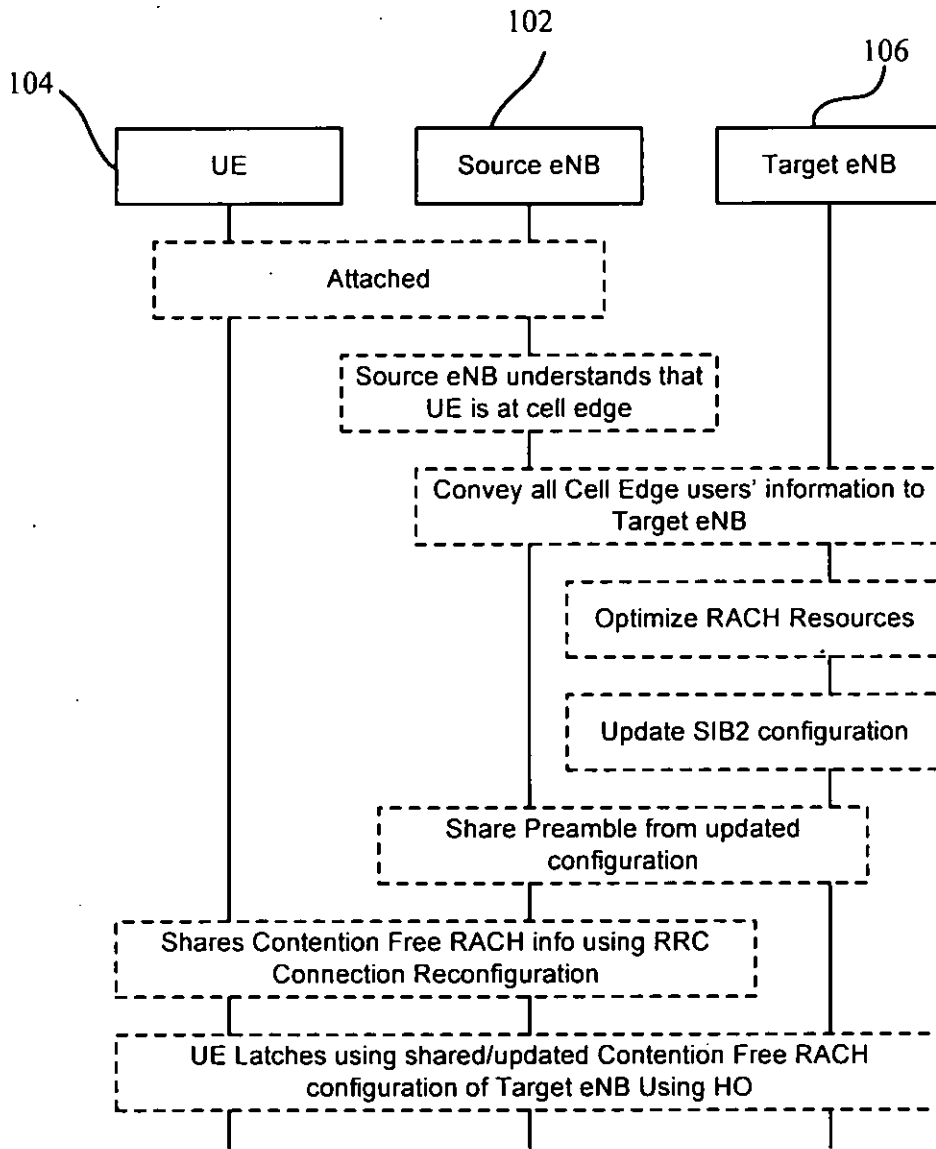


Figure 2

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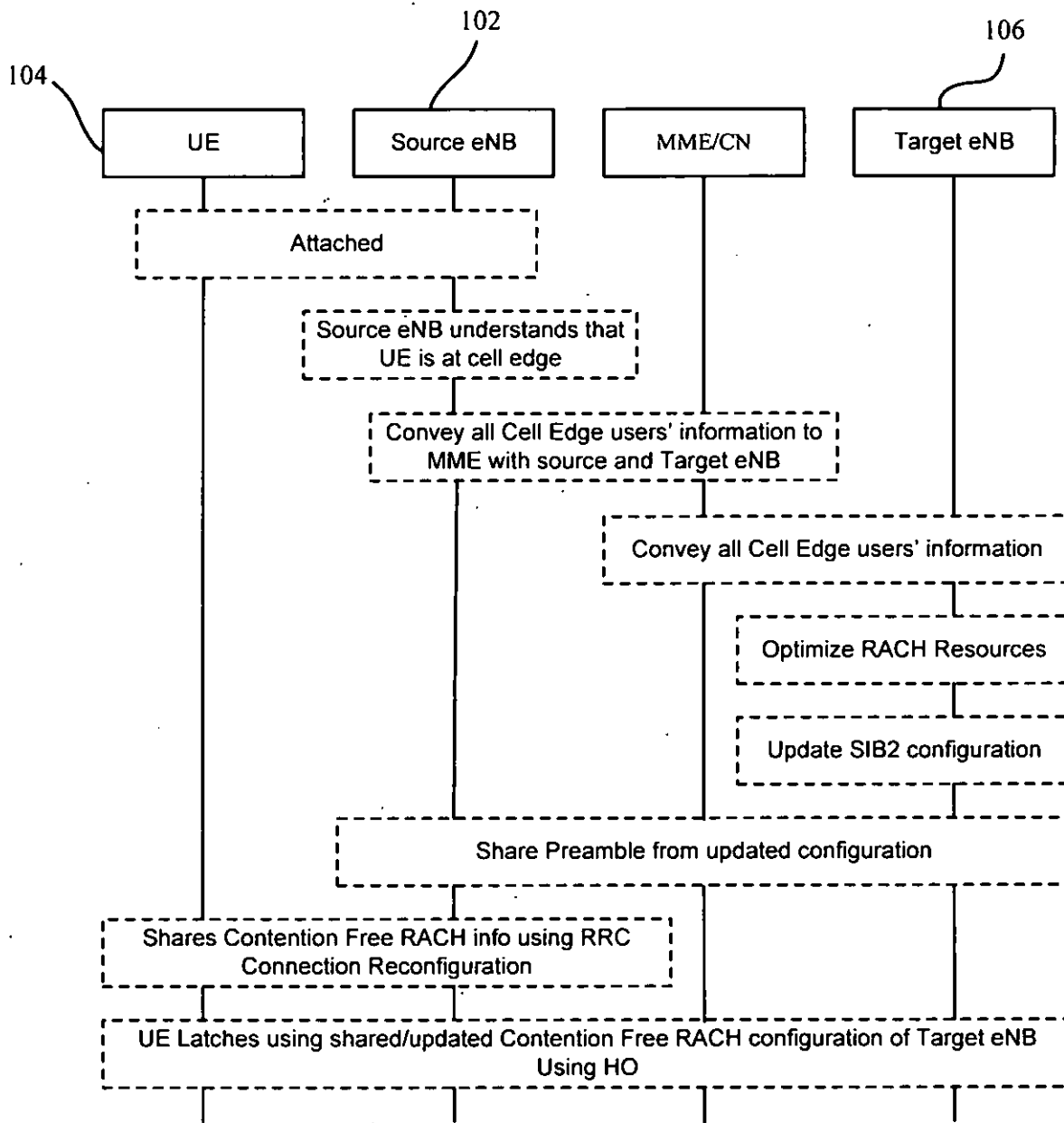


Figure 3

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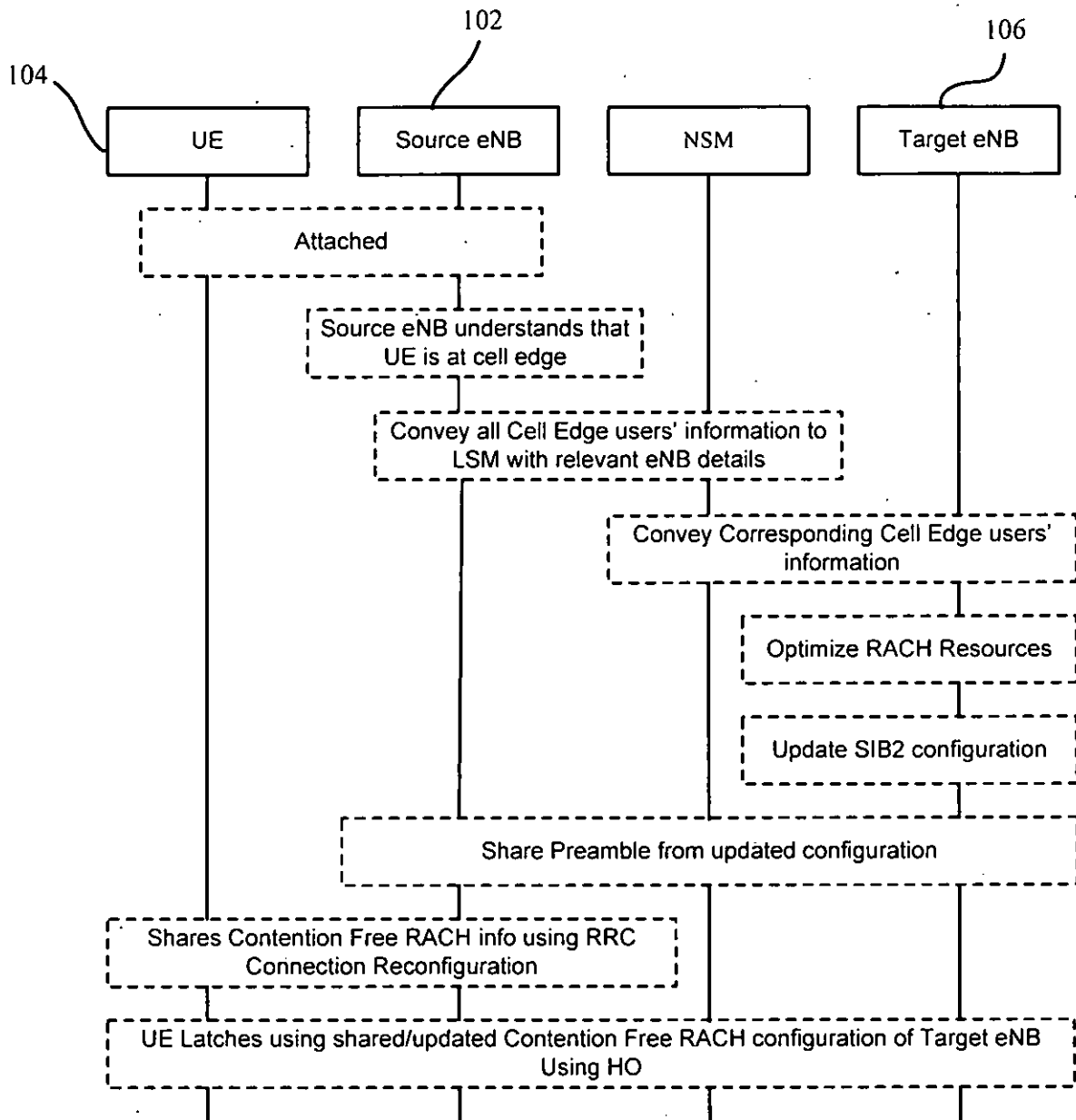


Figure 4

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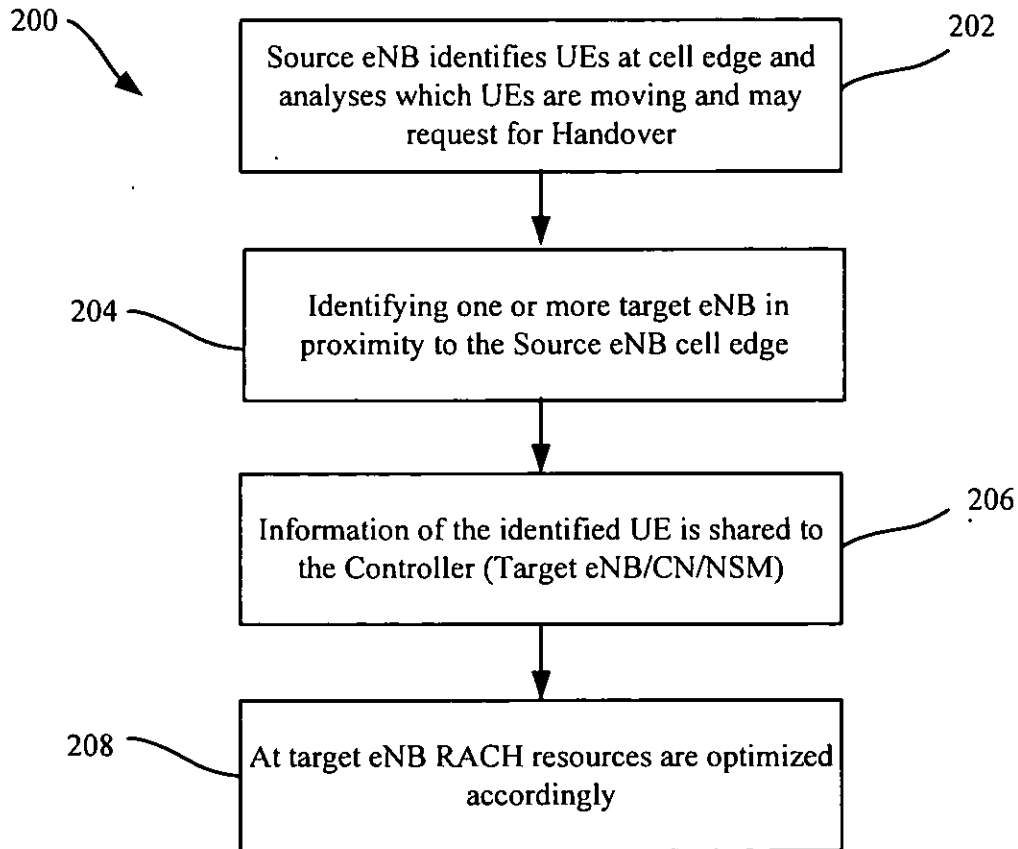


Figure 5

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