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(54) Title: A METHOD FOR IDENTIFYING SLEEPING CELL AMONG A PLURALITY OF BASE STATIONS IN A COMMUNICATION NETWORK AND A BASE STATION THEREOF

(57) Abstract: According to embodiments of the invention, a method for identifying sleeping cell among a plurality of base stations in a communication network is disclosed. The communication network may have at least one Controller. The method includes periodically initiating a User Equipment (UE) handover request by a base station to one or more neighbouring base stations identifying one or more base station among the plurality of neighbouring base stations that failed to provide either a positive or a negative acknowledgement for accepting the handover request and categorizing such cells as candidate sleeping cell, and sending an alarm to the Controller indicating the candidate sleeping cell.

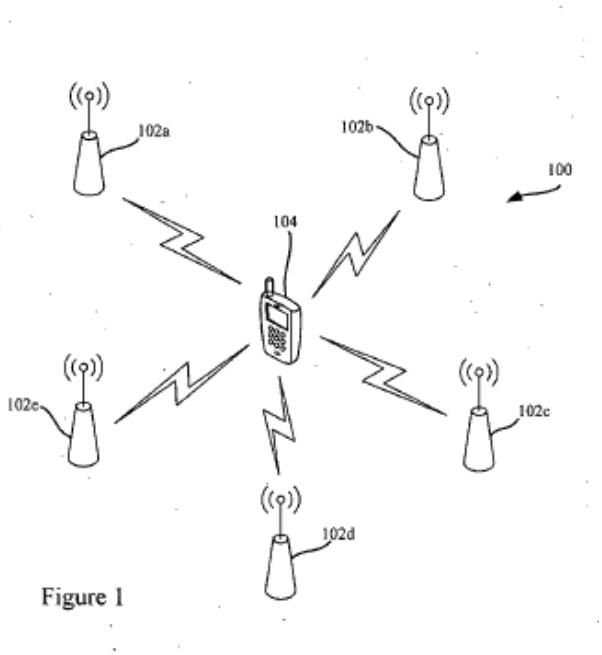

Figure 1

FORM 2

THE PATENTS ACT 1970
(39 OF 1970)
&
The Patent Rules, 2003

Provisional Specification

(See Section 10 and Rule 13)

1. TITLE OF THE INVENTION

A method for identifying sleeping cell among a plurality of base stations in a communication network and a base station thereof

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, to mobile wireless communication systems using base station.

BACKGROUND

Mobile wireless communication systems typically include a plurality of base stations or 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 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 (CDMA), orthogonal frequency division multiple access (OFDMA), as well as combinations of these techniques. The geographical extent 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.

Conventional hierarchical wireless communication systems include a central element such as a Radio Network Controller (RNC) or a Base Station Controller (BSC). The central controller

coordinates operation of the base stations and performs radio resource control functions such as call admission and resource allocation. In case of LTE controller function is realized by the eNodeB itself. A radio resource management function within the RNC or eNodeB coordinates/allocates the resources used by the base stations and/or the target mobile unit for communication over the air interface. For sake of clarity any of the station (RNC, BSC and eNodeB) performing radio resource management function are referred as Controller in the description.

In normal operation, base stations (or base station routers) serving each cell radiate a signal such as a pilot signal and mobile units in the corresponding cell may detect the presence of the base station by detecting the pilot signal. Mobile units may access the wireless communication system by establishing communication links with cells that have a sufficiently strong pilot signals. If the mobile unit and the cell establish the connection, the cell becomes the termination point for the wireless communication link and the mobile unit can register with the cell to begin transmitting and/or receiving traffic. Consequently, the number of attempted accesses, the number of terminations, the number of registrations, the number of Handovers admitted and the amount of traffic supported by a normally operating cell is roughly proportional to the number of mobile units that are located in each cell. However, cells do not always operate as expected.

One example of a cell that is not operating correctly is a "sleeping cell." A sleeping cell may be visible to mobile units in the cell because it is radiating the expected pilot signal but the sleeping cell may not be receiving the expected number of access requests, terminations, registrations, handovers and/or traffic. In another case, the sleeping cell may not even be radiating and so may be invisible to mobile units in the cell. Since mobile units cannot see the

sleeping cell, this cell may also be receiving a smaller than expected number of access requests, terminations, registrations, and/or traffic.

The sleeping cells may result from hardware, firmware, and/or software problems in the base station. Regardless of the source of the problem, conventional base stations and access points do not include any process for identifying sleeping cells in proximity. The network therefore interprets the sleeping cell as a coverage area hole, which can degrade coverage and/or capacity of the wireless communication system. User experience can also be degraded.

SUMMARY OF THE INVENTION

According to embodiments of the invention, a method for identifying sleeping cell among a plurality of base stations in a communication network is disclosed. The communication network may have at least one Controller. The method includes periodically initiating a User Equipment (UE) handover request by a base station to one or more neighbouring base stations identifying one or more base station among the plurality of neighbouring base stations that failed to provide either a positive or a negative acknowledgement for accepting the handover request and categorizing such cells as candidate sleeping cell, and sending an alarm to the Controller indicating the candidate sleeping cell.

According to another embodiment of the invention, a base station capable of identifying a sleeping cell among a plurality of base stations in a communication network is disclosed. The communication network may have at least one Controller. The base station is configured to periodically initiate a User Equipment (UE) handover request to one or more neighbouring base stations and identifying one or more base station among the plurality of neighbouring base

stations that failed to provide either a positive or a negative acknowledgement for accepting the handover request. The base station is further configured to categorize the neighbouring base stations that failed to provide either a positive or a negative acknowledgement as candidate sleeping cell, and initiating an alarm to the Controller indicating candidate sleeping cell.

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, wherein like reference numerals denote corresponding parts throughout the several views:

Figure 1 illustrates another exemplary arrangement for identifying sleeping cell among a plurality of base stations in a communication network according to an embodiment of the invention; and

Figure 2 illustrates an exemplary flow chart for identifying sleeping cell among a plurality of base stations in a communication network according to an embodiment of the invention.

DETAILED DESCRIPTION OF DRAWINGS

Figure 1 illustrates another exemplary communication network 100 having one or more base stations 102 for identifying sleeping cell among a plurality of base stations 102 according to an embodiment of the invention. As illustrated the communication network 100 may have plurality of base stations 102a, 102b, 102c, 102d, 102e, etc., one or more User Equipment (UE) 104 and at least one Controller (not shown) in case of 3rd generation or older. In case of LTE, eNodeB does not require a Radio Network controller as this function is within eNodeB. For

sake of clarity any of the station (RNC, BSC and eNodeB) performing radio resource management function are referred as Controller in the description. The UE 104 may be in wireless communication with at least one base station 102.

According to an embodiment of the invention, at least one of the base stations 102 in the communication network 100 may be capable of identifying a sleeping cell among the plurality of base stations 102 in the communication network 100. According to an embodiment the base stations 102 may have one or more processor 106. The base station may be configured to periodically initiate a UE handover request to all neighbouring base stations 102a, 102b, 102c, 102d, 102e. According to an embodiment, the handover request may be initiated by respective processor 106a, 106b, 106c, 106d, 106e. According to another embodiment, the handover request may be for any associated UE 104. According to yet another embodiment, the UE handover request may contain dummy data for handover of a dummy UE for testing.

The base station 102 may be further configured for identifying one or more base station 102 among the plurality of neighbouring base stations that failed to provide either a positive or a negative acknowledgement for accepting the handover request. The base station 102 is further configured to categorize the neighbouring base station that fails to provide either a positive or a negative acknowledgement as candidate sleeping cell, and initiating an alarm to the Controller indicating candidate sleeping cell.

Figure 2 is an exemplary flow chart illustrating a method 200 for identifying sleeping cell among a plurality of base stations 102 in a communication network 100 according to an embodiment of the invention. The communication network 100 may have at step 202, the

method 200 includes periodically initiating a User Equipment (UE) handover request by a base station 102 to all neighbouring base stations.

According to an embodiment, all the base stations 102 in a communication network may be configured to initiate the request at same time. According to another embodiment, the base stations 102 in a communication network 100 may be configured to initiate the request in a chronological order.

According to another embodiment, the UE handover request may be handover of an associated UE 104 with the base station 102. According to yet another embodiment, the UE handover request may contain dummy data for handover of a dummy UE for testing.

At step 204, the method 200 includes identifying one or more base station 102 among the plurality of neighbouring base stations that failed to provide either a positive or a negative acknowledgement for accepting the handover request. According to an embodiment, the base station 102 that fails to provide either a positive or a negative acknowledgement may be categorized as candidate sleeping cell. The communication system 100 may not have any sleeping cells, if the base station 102 receives either a positive or a negative acknowledgement from all the neighbouring base stations.

At step 206, the method 200 includes sending an alarm to a Controller (not shown) indicating the candidate sleeping cell, in case one or more the base station 102 fails to provide either a positive or a negative acknowledgement.

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 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.

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 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 will be readily apparent to those skilled in the art.

We claim:

1. A method for identifying sleeping cell among a plurality of base stations in a communication network having at least one Controller, the method comprising:

periodically initiating a User Equipment (UE) handover request by a base station to one or more neighboring base stations;

identifying one or more base station among the plurality of neighboring base stations that failed to provide either a positive or a negative acknowledgement for accepting the handover request; and

categorizing the cells as candidate sleeping cell who fail to provide either a positive or a negative acknowledgement.

2. The method as claimed in claim 1, further comprising sending an alarm to the Controller indicating the candidate sleeping cell.

3. The method as claimed in claim 1, wherein the UE handover request contain dummy data for handover of a dummy UE for testing.

4. A base station capable of identifying a sleeping cell among a plurality of base stations in a communication network having at least one Controller, the base station comprising:

one or more processor for periodically initiate a User Equipment (UE) handover request to one or more neighboring base stations and identifying one or more base station among the plurality of neighboring base stations that failed to provide either a positive or a negative acknowledgement for accepting the handover request;

one or more processor for categorize the neighboring base stations that failed to provide either a positive or a negative acknowledgement as candidate sleeping cell; and

one or more processor for initiating an alarm to the Controller indicating candidate sleeping cell.

5. The system as claimed in claim 4, wherein the controller perform radio resource management function.

6. The system as claimed in claim 4, wherein the UE handover request contain dummy data for handover of a dummy UE for testing.

Dated this 6th day of February 2015

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A Method For Identifying Sleeping Cell Among A Plurality Of Base Stations In A Communication Network And A Base Station Thereof

ABSTRACT

According to embodiments of the invention, a method for identifying sleeping cell among a plurality of base stations in a communication network is disclosed. The communication network may have at least one Controller. The method includes periodically initiating a User Equipment (UE) handover request by a base station to one or more neighbouring base stations identifying one or more base station among the plurality of neighbouring base stations that failed to provide either a positive or a negative acknowledgement for accepting the handover request and categorizing such cells as candidate sleeping cell, and sending an alarm to the Controller indicating the candidate sleeping cell.

L&T Technology Services Ltd.

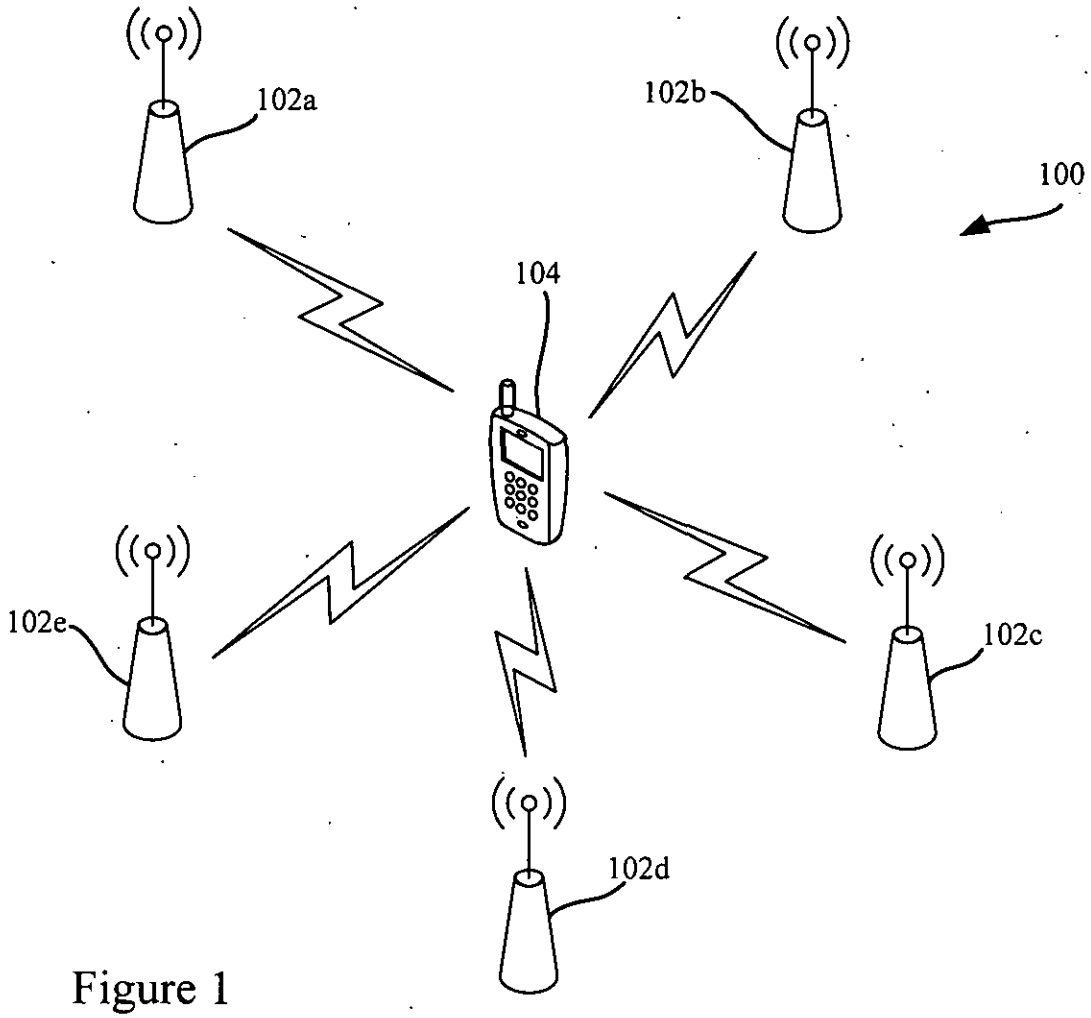

Figure 1

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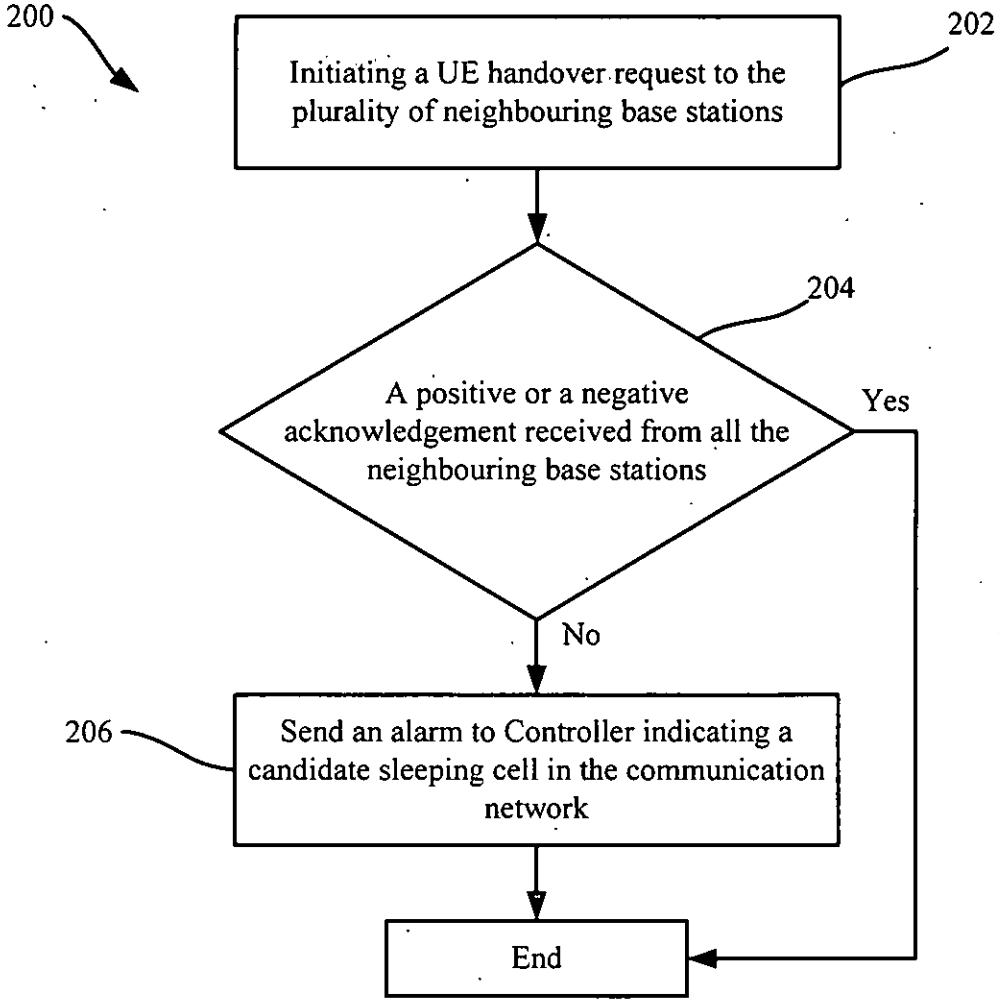

Figure 2

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