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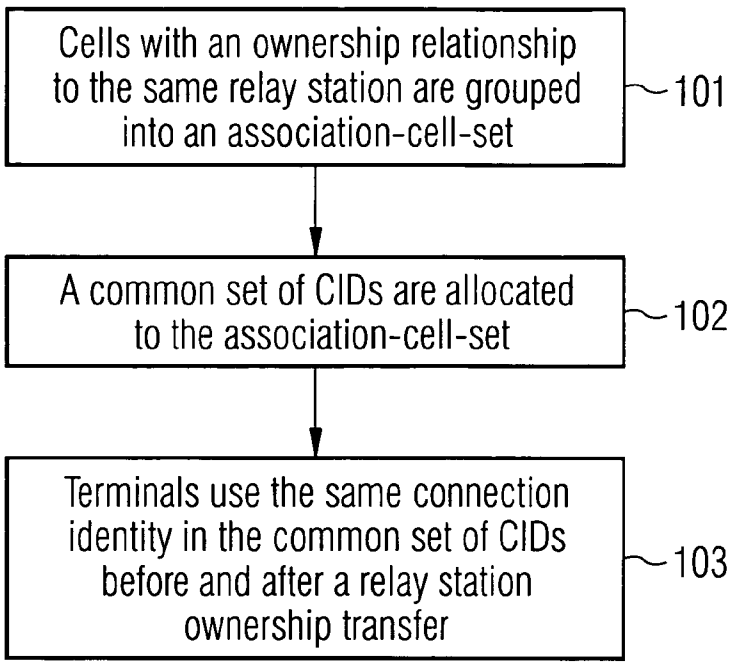
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(54) **Title:** CONNECTION IDENTITY ALLOCATION METHOD



(57) **Abstract:** This invention describes a type of connection identity allocation method, for use in Wimax, whereby the network allocates cells connected by an ownership relationship to the same relay station to association-cell-sets, and allocates a connection identity group to the aforementioned relay station, so that terminals may communicate with a cell within the association-cell-set using connection identities in the connection identity group, through the following steps: The network informs the target cell which has an ownership relationship with the relay station to reserve the aforementioned connection identity group, where the aforementioned target cell belongs to the aforementioned cell set; the transfer of relay station ownership occurs, and the original cell releases the connection identity with the terminal; the terminal then uses the reserved connection identity in the connection identity group to communicate with the aforementioned target cell. The use of this invention can avoid signal interchanges during the connection identity reallocation negotiation procedure, simplifies the relay station ownership transfer signal procedure, thus reducing time delays, improving service quality, and reducing line drop rates.

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Connection Identity Allocation Method

Technology scope

This invention involves the wireless communication field, and specifically a type of connection identity allocation method.

Background technology

In recent years, along with the rapid development of communications technology, the World Interoperability for Microwave Access (Wimax) based on the Institute of Electrical and Electronics Engineers (IEEE)'s Standard 802.16 has become a popular technology with extremely high competitive ability. Wimax is a Wireless Metropolitan Area Network (WMAN) technology, a type of new spatial connection standard proposed for the microwave and millimeter wave band. Wimax provides advantages such as a high frequency spectrum usage rate, wide coverage areas, and a high data transmission rate. More importantly, Wimax combines the superior bandwidth of traditional cable-based broadband connections with the flexibility and mobility of wireless connections, and can also provide all types of service to satisfy high Quality of Service (QOS) requirements.

The terminals (Subscriber Stations or Mobile Stations) access the cells of Wimax's Base Station via wireless means, and can achieve free mobility by moving through different cells. The difference with previous technologies is that in Wimax, the connections between cells and terminals depend on the creation of different connection identities (CIDs). Cells must therefore allocate connection identities as part of the process whereby a terminal connects and disconnects from a network.

One of the connection identity allocations under existing technology is as follows: The terminal completes the initial arrangements, and sends a connection request to the network;

upon receiving this, the network sends either a Basic CID or a Primary CID to the terminal, allowing the terminal to complete the connection and gain control. When the terminal registers on the network, the network must also assign a Secondary CID. These identity allocation processes accomplish such negotiation tasks as access control prior to data transmission and resource allocation. Depending on the results of the prior negotiation between the network and the terminal, a Transport CID is allocated to the terminal to control the connection for data transmission between the terminal and the network, which allows data transmission between the terminal and the cells. This allocation process is performed through the interchange of a series of signals between the terminal and the network.

Standard 802.16j also proposes the arrangement of Relay Stations (RS) around the cells so that the terminal communicates with the cell through the relay station, thus allowing improved cell coverage and enhanced capacity.

Currently existing technology also provides for a relay station belonging to one cell to be transferred to another cell, and the network must as part of this process interchange a series of signals with the relay station to complete this ownership transfer. During this process, as the ownership of the relay station is transferred, the terminal disconnects its communication with the cell which was connected to the relay station prior to the ownership transfer, and establishes communication with the target cell which now holds ownership of the relay station. If this connection identity allocation is performed according to the above method, when a relay station's ownership is transferred, the network must perform the negotiation to reallocate Basic CID, Primary CID, Secondary CID and other connection identities to the terminal, until the terminal finally receives a Transport CID to transmit data to the cell. This allocation process includes an interchange of a series of signals between the terminal and the network, an interchange of signals which is much larger than that used for

the cell relay station transfer ownership transaction, and the process of which also takes a relatively long time. Data transmission is interrupted during this signal interchange process, and this can therefore cause extended time delays at the terminal; terminals receiving data can suffer problems with interruptions leading to drops in quality, and the communication link established between the terminal and the target cell can also potentially fail if any of the signals in the process are lost, causing the terminal line to cut out; this complex signal interchange process increases the rate of terminal line drops.

Content of invention

The aim of this invention is to provide a connection identity allocation method which helps to overcome the problems of the existing technology arising in the cell relay station ownership transfer process, as this requires the reallocation of connection identities and thus requires complex signal interchanges during the negotiation process, causing increases in excessive, extended time delays in data transactions between the cell and the terminal, drops in quality and an increase of line drop rates.

In order to solve the above technical issues, this invention provides a type of connection identity allocation method implemented as follows:

A type of connection identity allocation method whereby the network allocates cells connected by an ownership relationship to the same relay station to association-cell-sets, and allocates a connection identity group to the aforementioned relay station, so that terminals may communicate with a cell within the cell network using connection identities in the connection identity group, comprising the following steps:

A. The network informs the target cell which has an ownership relationship to the aforementioned relay station to reserve the aforementioned connection identity group, where the aforementioned target cell belongs to the aforementioned association-cell-set; the transfer of relay station ownership occurs, and the original cell releases the connection identity with the terminal;
B. The terminal uses the reserved connection identity in the connection identity group to communicate with the aforementioned target cell.

The aforementioned Step A is performed through the following steps:
The transfer of relay station ownership occurs, and the original cell releases the connection identity with the terminal; the network only instructs the aforementioned target cell to reserve the aforementioned connection identity group.
The use of the following process in Step A: the transfer of relay station ownership occurs, and the original cell releases the connection identity with the terminal; the network only instructs the aforementioned target cell to reserve the aforementioned connection identity group.
The aforementioned allocation of cells connected by an ownership relationship to the same relay station to an association-cell-set further includes:
The aforementioned association-cell-set includes or excludes connected cells.
The network allocates a connection identity group to the relay station through the following step:
The connection identity group is allocated to the relay station in accordance with that relay station’s load.
The aforementioned process wherein the network allocates a connection identity group to the relay station further includes:
The aforementioned association-cell-set includes or excludes connected cells.

The aforementioned process wherein the network allocates a connection identity group to the relay station further includes:
Connection identities in the aforementioned connection identity group can be altered.
The following process comprises a step to include or exclude connection identities in/from the aforementioned connection identity group:
Connection identities are included or excluded from the connection identity group in accordance with the load on the relay station.

It is clear from the technical plan provided by this invention that this invention allows the network to allocate cells connected by an ownership relationship to the same relay station to association-cell-sets, allocate a connection identity group to the aforementioned relay station and instructs target cells within the cell set which have an ownership relationship with the relay station to reserve the connection identity group when the transfer of the ownership relationship occurs, so that terminals use the same connection identity within the connection identity group to communicate with the target cell, thus avoiding the signal interchange created during the connection identity reallocation negotiation procedure, simplifying the signaling procedure for terminal transmission during the relay station ownership transfer, and thus reducing time delays, improving service quality, and reducing line drop rates.

Diagram Legend
Diagram 1 Flow chart for the connection identity allocation method of this invention;
Diagram 2 Schematic diagram for the allocation of cells of this invention;
Diagram 3 Flow chart for connection identity allocation method 1 in the ownership transfer process of this invention;

Diagram 4 Flow chart for connection identity allocation method 2 in the ownership transfer process of this invention;
Diagram 5 An optimal implementation example of a connection identity allocation method of this invention.

Practical implementation method

The aim of this invention is to provide a type of connection identity allocation method. When implemented in practice, it establishes an association-cell-set with cells which are connected by ownership of the same relay station, and this cell network is allocated a public connection identity group. The network instructs all target cells to reserve the connection identities in the public connection identity group, such that a terminal will be able to use the same connection identity in the aforementioned connection identity group before and after any transfer of relay station ownership.
Technical personnel familiar with this field will know that Standard 802.16j proposes relay station (RS) technology. The terminal communicates with the cell through a relay station, a method which can enhance cell coverage, increase capacity, reduce the terminal's required emission power, and reduce the influence of shadows. Moreover, this method can achieve the goal of balancing the load within one cell by altering the ownership relationship between the relay station and the cell.
The method in this invention of altering the ownership relationship between the relay station and the cell may be automatically adjusted by the relay station based on the load on surrounding cells.
In order to help personnel in this area of technology to gain an even better understanding of this invention, diagrams and practical implementations are given below to provide an even clearer explanation of this invention.

Step 101: All cells connected by ownership of the same relay station are grouped into an association-cell-set.

As mentioned earlier, existing technology also allows a method for a relay station to be transferred from the ownership of one cell to the ownership of another. Thus, the ownership relationship between the cell and the relay station changes. Here, a cell which has an ownership relationship with a relay station is defined as an association cell, such that all cells associated with that relay station can be grouped into an association-cell-set. When initially laid out, their selected respective geographic locations are often factors related to the association of cells with a relay station.
The network is responsible for establishing, maintaining and preserving the association-cell-set.
When a relay station is able to belong to a new cell, this cell is added to the aforementioned association-cell-set. As shown in Diagram 2, the dashed line indicates the ownership relationships which may occur between the relay station and the cells. Initially, the RS association-cell-set comprises BS1, and BS2, such that {BS1, BS2} are the RS association-cell-set. When BS1 and BS2 are simultaneously highly loaded because of changes in network load, RS initiates a request to function under the ownership of BS3 to the relay station, and then BS3 joins the relay station's corresponding association-cell-set, such that the association-cell-set becomes {BS1, BS2, BS3}. In the same way, when the relay station has no ownership relationship with a cell in an association-cell-set for an extended period of time, this cell may be removed from the association-cell-set.

Step 102: A common set of CIDs is allocated to the association-cell-set.
The network will assign an association-cell-set a set quantity of connection identities, and these connection identities are collectively the common set of CIDs. For example, if the five connection identities 0001, 0002, 0003, 0004 and 0005 are assigned to RS corresponding terminals, the five connection identities 0001 to 0005 comprise the common connection identity group. Each terminal connected to an associated cell through

this RS will use a connection identity from this common set of CIDs.

The network is responsible for establishing, maintaining and preserving the common set of CIDs.

When the network allocates the common set of CIDs, it can do so based on the normal static status of the relay station load within the association-cell-set, and can also reallocate IDs on the basis of the dynamic status of the load. Dynamic reallocation in practice works as follows - when the relay station load increases, the network will allocate further common IDs to the relay station; when the relay station load drops, the network will correspondingly reduce the common IDs allocated to the relay station.

Of course, the connection identities can also change without changing the size of the common set of CIDs. For example, in Diagram 2, the current association-cell-set is {BS1, BS2}, with RS belonging to BS1, and RS's corresponding common set of CIDs is {0001, 0002, 0003, 0004 and 0005}. When at any point the load on BS1 and BS2 increases, RS transmits a new ownership request to BS3, at which point BS3 is added to the association-cell-set, and the association-cell-set then comprises {BS1, BS2, BS3}. However, prior to the transfer of ownership of RS to BS3, BS3 was using 0001 to connect to a terminal; this connection identity 0001 in the common set of CIDs must be replaced, for example with 0011, such that once the RS belongs to BS3, the corresponding common set of CIDs now comprises {0011, 0002, 0003, 0004 and 0005}. In this way, the quantity of the common set of CIDs remains unchanged, while one of its connection identities is changed. This kind of connection identity change is allocated and maintained by the network.

Step 103: Terminals use the same connection identities in the common set of CIDs before and after the transfer of ownership between different cells in the association-cell-set.

As mentioned earlier, the connection between the terminal and the cell is created through the connection identity, namely,

when the terminal is communicating with the cell, it transmits and receives data using the connection identity.

The terminal initially uses a connection identity in the common set of CIDs to communicate with the original cell through the relay station. At a given point, due to an increase in its load, the original cell can transfer ownership of the relay station to a cell with a lighter load belonging to the same association-cell-set, so that the terminal can establish communications with the target cell which owns the relay station. Of course, there may be other reasons for a transfer of ownership of the relay station.

There are two ways to ensure that the terminal uses the same connection identity within the common set of CIDs before and after a transfer of ownership between different cells within an association-cell-set.

Let us first look at Method 1, the workflow of which is shown in Diagram 3:

Step 301: The network transmits a command to the target cell instructing the target cell to reserve a connection identity from the common set of CIDs for that relay station, and the target cell performs this command.

Step 302: The terminal terminates the connection with the original cell, i.e. releases the connection identity used to communicate with the original cell.

Steps 301 and 302 have no strict successive order, i.e. Step 302 can be performed first followed by Step 301, the key point being that the target cell must have confirmed the ownership transfer.

Step 303: The terminal uses the same reserved connection identity in the connection identity group to communicate with the aforementioned target cell.

The reserved connection identity is thus the same as the connection identity used by the terminal to communicate with the original cell prior to the transfer of ownership.

During this ownership transfer process, the terminal does not change its connection identity, such that when the relay station undergoes a transfer of ownership within the

association-cell-set, the terminal uses the same connection identity in the common set of CIDs before and after the transfer.

The connection identities for all terminals under the aforementioned relay station are all handled using the same method given in Steps 301~303 during the relay station ownership transfer process.

Method 2 is given below, and Diagram 4 shows the workflow for this method:

Step 401: The network transmits a command to associated cells instructing each cell in the association-cell-set to reserve a connection identity in the common set of CIDs, and each cell in the association-cell-set will perform this command.

This step differs from Step 301 in Method 1 in that in Method 1, only the target cell for an ownership transfer is instructed to reserve a connection identity in the common set of CIDs once the target cell is identified. Under Method 2, each cell in the association-cell-set is instructed to reserve a connection identity in the common set of CIDs, thus including the target cell for the subsequent ownership transfer as well as all other cells in the association-cell-set. As shown in Diagram 2, the association-cell-set comprises {BS1, BS2 and BS3}, and the terminal initially connects to BS1 through RS. When the ownership of that relay station is transferred to BS2, Method 1 only instructs target cell BS2 to reserve a connection identity in the common set of CIDs, while Method 2 instructs BS1, BS2 and BS3 in a confirmed association-cell-set all to reserve a connection identity in the common set of CIDs, regardless of which cell the terminal is connected to. Method 1 is more nimble, while the process in Method 2 is simpler.

Step 402: The terminal terminates the connection with the original cell, i.e. releases the connection identity used to communicate with the original cell.

Step 403: The terminal uses the same reserved connection identity in the connection identity group to communicate with the target cell.

Chart 5 shows an optimal implementation of this invention.

Relay station RS initially belongs to BS1 and may also belong to BS2. The network establishes an association-cell-set {BS1, BS2} corresponding to RS. 4 users connect to service cell BS1 through RS, and the network allocates a common set of CIDs {0001, 0002, 0003 and 0004}, each terminal using one connection identity. When the load on BS1 is relatively heavy and that on BS2 is relatively lighter, the RS ownership relationship is adjusted, such that this is transferred from BS1 to BS2. In this process, the network instructs BS2 to reserve the connection identities in the common set of CIDs, the terminals release the connection identities with the original cell, terminate their connections with the original cell, and the terminals then use the reserved same connection identities in the connection identity group to communicate through the relay station with the target cell. Taking terminal MS1 with connection identity 0001 as an example, MS1 initially communicates through RS with BS1; after RS is transferred to BS2, MS1 continues to use connection identity 0001 to communicate through RS with BS2. The connection identities of other terminals are processed using the same method as the connection identity of MS1.
Of course, in the above example, the network may also instruct each cell in the association-cell-set to reserve a connection identity in the common set of CIDs, including the target cell for the RS ownership transfer, such that when RS is transferred from BS1 back to BS2, the terminal uses the same reserved connection identity in the connection identity group to communicate with the target cell through the aforementioned RS.

In the implementation example above, it is clear that in this process, because the network allocates cells BS1 and BS2, which have an ownership relationship to relay station RS, to an association-cell-set, and also allocates a common set of CIDs to the relay station, such that when the relay station undergoes a transfer of ownership, the network informs the target cell to reserve this common set of CIDs, so that the terminal uses the same connection identity before and after the

relay station's transfer of ownership, and thus avoiding the process of reallocating Basic CIDs, Primary CIDs, Secondary CIDs and Transport CIDs etc. to terminals, reducing network (especially relay station) signal interchanges with terminals and simplifying signals in the relay station ownership transfer process, thus reducing time delays, improving service quality, and reducing line drop rates.

Although this invention has been described using implementation examples, normal technical personnel familiar with this field will know that this invention allows many variations and changes which are not excluded from the spirit of this invention, and it is hoped that the submitted claims request will include these variations and changes rather than strip them from the spirit of this invention.

CLAIMS

1. A type of connection identity allocation method characterized by the fact that the network allocates cells connected by an ownership relationship to the same relay station to association-cell-sets, and allocates a connection identity group to the aforementioned relay station, so that terminals may communicate with a cell within the cell set using a connection identity in the connection identity group, through the following steps:

A. The network instructs the target cell which has an ownership relationship with the relay station to reserve the aforementioned connection identity group, where the aforementioned target cell belongs to the aforementioned cell set; the transfer of relay station ownership occurs, and the original cell releases the connection identity with the terminal;

B. The terminal uses the reserved connection identity in the connection identity group to communicate with the aforementioned target cell.

2. The aforementioned method in Claim 1 is characterized by the use of the following process in Step A: the network instructs each cell within the cell set to reserve the aforementioned connection identity group; the transfer of relay station ownership occurs, and the original cell releases the connection identity with the terminal.

3. The aforementioned method in Claim 1 is characterized by the use of the following process in Step A: the transfer of relay station ownership occurs, and the original cell releases the connection identity with the terminal; the network only instructs the aforementioned target cell to reserve the aforementioned connection identity group.

4. The aforementioned method in Claim 1 is characterized by the fact that the aforementioned allocation of cells connected by an ownership relationship to the same relay station to an association-cell-set further includes:

The aforementioned association-cell-set includes or excludes connected cells.

5. The aforementioned method in Claim 1 is characterized by the following step, whereby the network allocates a connection identity group to the relay station:

The connection identity group is allocated to the relay station in accordance with that relay station's load.

6. The aforementioned method in Claim 1 is characterized by the fact that the process wherein the network allocates a connection identity group to the relay station further includes:

The aforementioned association-cell-set includes or excludes connected cells.

7. The aforementioned method in Claim 1 is characterized by the fact that the step wherein the network allocates a connection identity group to the relay station further includes:

Connection identities in the aforementioned connection identity group can be altered.

8. The aforementioned method in Claim 6 is characterized by the fact that the following step is included in the inclusion or exclusion of connection identities to/from the connection identity group:

Connection identities are included or excluded from the connection identity group in accordance with the load on the relay station.

FIG 1

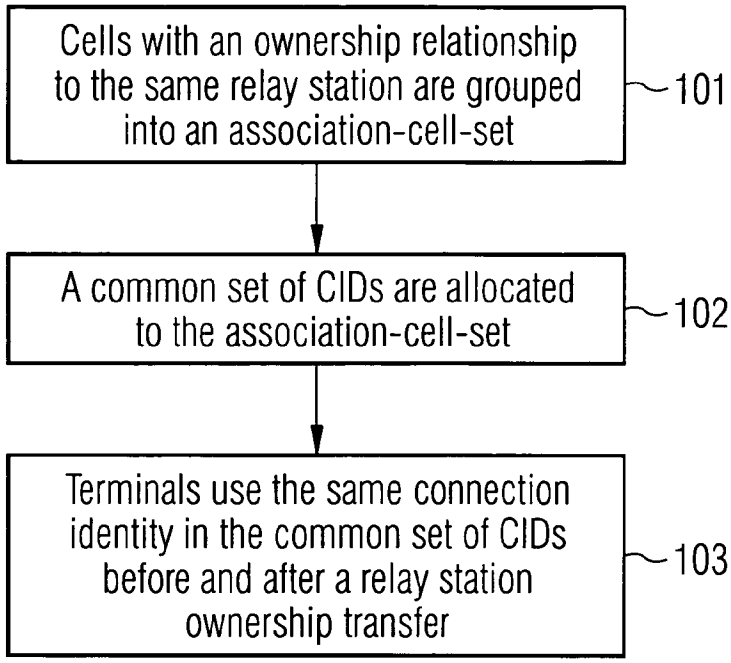

Cells with an ownership relationship to the same relay station are grouped into an association-cell-set
101
A common set of CIDs are allocated to the association-cell-set
102
Terminals use the same connection identity in the common set of CIDs before and after a relay station ownership transfer
103

FIG 2

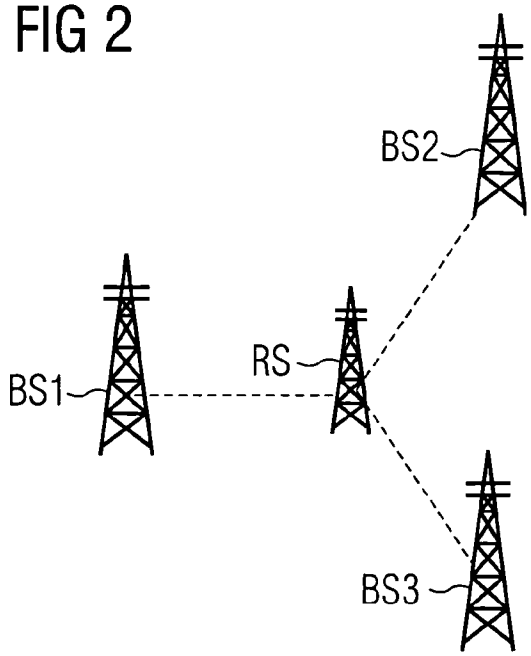

BS2
BS1
RS
BS3

FIG 3

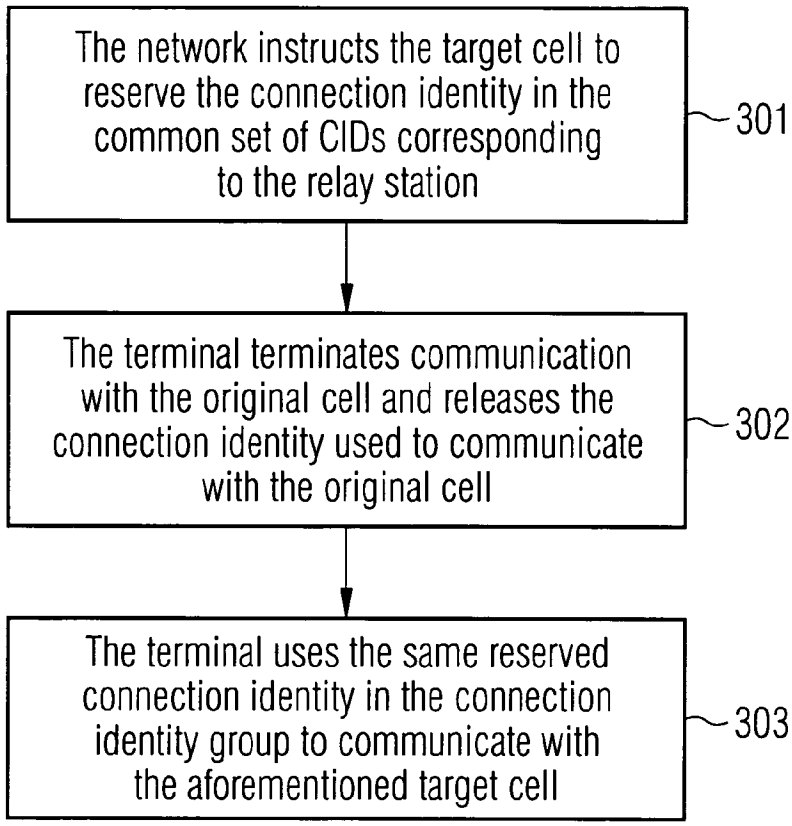

The network instructs the target cell to reserve the connection identity in the common set of CIDs corresponding to the relay station
301
The terminal terminates communication with the original cell and releases the connection identity used to communicate with the original cell
302
The terminal uses the same reserved connection identity in the connection identity group to communicate with the aforementioned target cell
303

FIG 4

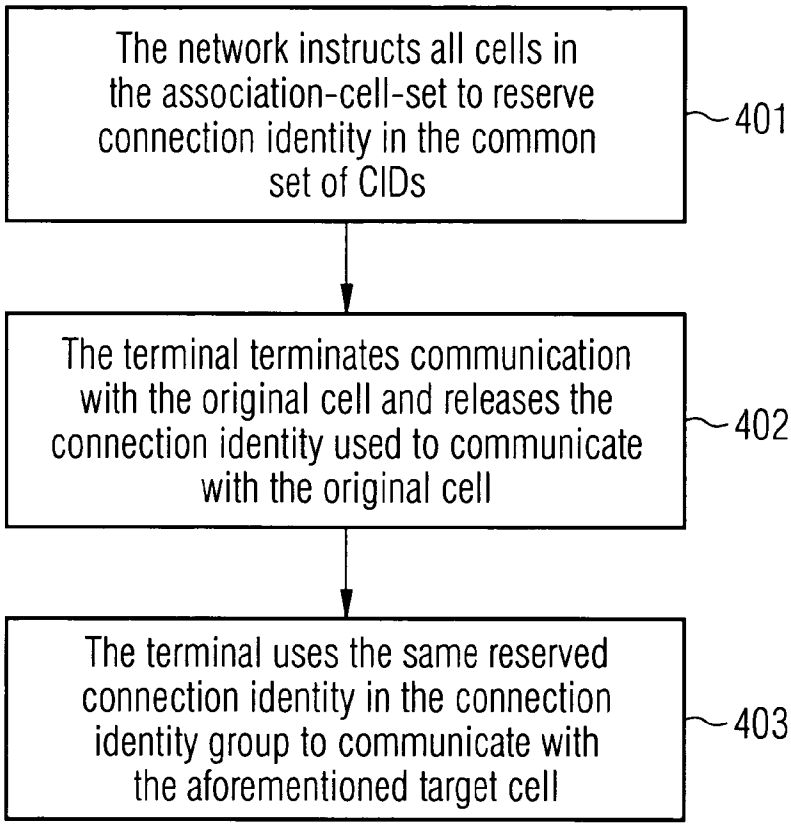
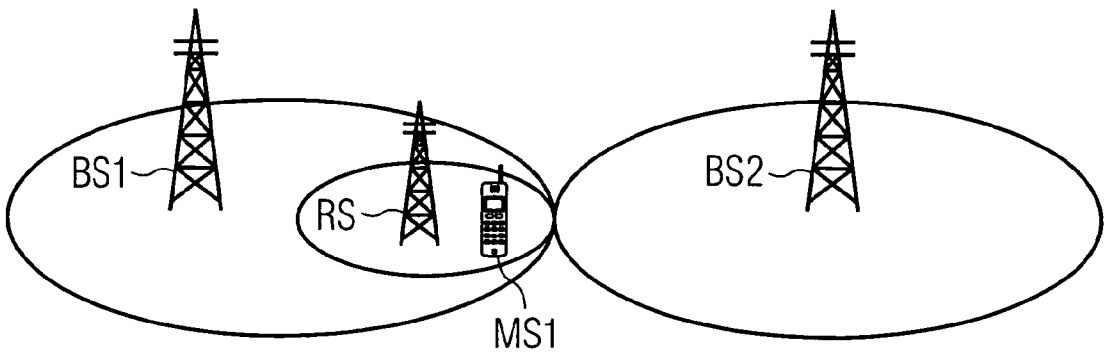

The network instructs all cells in the association-cell-set to reserve connection identity in the common set of CIDs
401
The terminal terminates communication with the original cell and releases the connection identity used to communicate with the original cell
402
The terminal uses the same reserved connection identity in the connection identity group to communicate with the aforementioned target cell
403

FIG 5


BS1
RS
MS1
BS2

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2007/060408

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04Q7/32

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)
H04L H04B H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2002/191560 A1 (CHEN JYH-CHENG [TW] ET AL) 19 December 2002 (2002-12-19) paragraphs [0011] - [0021]	1-7
Y	US 6 459 881 B1 (HODER MATHIAS [DE] ET AL) 1 October 2002 (2002-10-01) column 1, line 46 - column 2, line 16	1-7

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
19 December 2007	11/01/2008

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Hegeman, Hans

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2007/060408

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CHRISTIAN HOYMANN ET AL: "Multihop Communication in Relay Enhanced IEEE 802.16 Networks" PERSONAL, INDOOR AND MOBILE RADIO COMMUNICATIONS, 2006 IEEE 17TH INTERNATIONAL SYMPOSIUM ON, IEEE, PI, [Online] 11 September 2006 (2006-09-11), - 14 September 2006 (2006-09-14) pages 1-4, XP002462917 ISBN: 1-4244-0329-4 Retrieved from the Internet: URL:http://ieeexplore.ieee.org/iel5/40222 43/4022244/04022436.pdf?tp=&isnumber=&arnum ber=4022436> [retrieved on 2007-12-18] the whole document	1-7
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