



(51) International Patent Classification:  
*H04W 36/04* (2009.01) *H04W 12/08* (2009.01)

(21) International Application Number:  
PCT/EP2009/060615

(22) International Filing Date:  
17 August 2009 (17.08.2009)

(25) Filing Language: English

(26) Publication Language: English

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AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

(54) Title: CORE NETWORK ENTITY, SERVING BASE STATION, TARGET BASE STATION, AND METHODS CONFIGURED FOR PERFORMING ACCESS CONTROL DURING HANDOVER IN A COMMUNICATIONS NETWORK

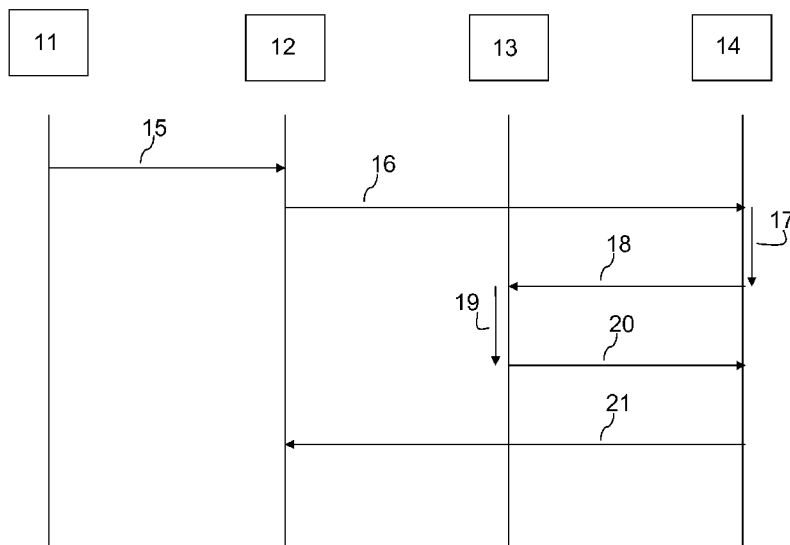


Fig. 1

(57) Abstract: The present invention relates to access control during handover in a communications network. The present invention concerns a method, said method configured for performing access control in a communications network during handover of a mobile terminal from a serving base station to a target base station, said target base station spanning a closed subscriber group cell, said method comprising a first access control step performed by said core network entity and a second access control step performed by said target base station. If said first closed subscriber group identifier is equal to a second closed subscriber group identifier supported by said target base station, a request for said handover is accepted by the target base station, and otherwise the request for said handover is rejected. The present invention further refers to a core network entity, a serving base station, a target base station, and corresponding methods, computer program products, and data carriers used for said access control.

## DESCRIPTION

Core network entity, serving base station, target base station, and methods configured for performing access control  
5 during handover in a communications network

## FIELD OF THE INVENTION

The present invention relates to access control during hand-  
10 over in a communications network. Particularly, the present invention refers to a core network entity configured for performing said access control, a serving base station supporting performing said access control, a target base station configured for performing said access control, and corre-  
15 sponding methods, a computer program product, and a data carrier used for said access control.

## BACKGROUND OF THE INVENTION

20 As mentioned above, the present invention addresses access control during handover in a communications network.

In communications networks, a solution needs to be found to the problem of active mode mobility towards Closed Subscriber  
25 Group (CSG) cells. In the following, for sake of clarity, the present invention and its background will be described with regard to the 3rd Generation Partnership Project (3GPP) standard, Release 9, as example for a communications network. However, it has to be noted that the present invention can be  
30 applied accordingly also with regard to further kinds of communications networks, established by use of further standards.

The concept of Closed Subscriber Groups allows restricting  
35 cell access to a defined group of subscribers, i.e. mobile terminals, or User Equipments (UEs). A cell supporting CSGs is called a CSG cell, and each CSG cell has an associated CSG Identifier (CSG ID), identifying the cell's CSG. CSG cells

can be spanned by different kinds of base stations, amongst them 3rd Generation (3G) Home NodeBs (HNBs), Long Term Evolution (LTE) Home eNodeBs (HeNBs), or macro NBs / macro eNBs. In the 3G and LTE case, HNBs / HeNBs can be served by an HNB Gateway / HeNB Gateway (HNB GW / HeNB GW). An HNB GW / HeNB GW is a node arranged between HNBs / HeNBs and the Core Network (CN), masking the CN from any information concerning the HNBs / HeNBs connected to the HNB GW / HeNB GW. In essence, the CN does not know of the existence of HNBs / HeNBs if they are connected to a HNB GW / HeNB GW. This is to avoid scalability issues at the CN due to very large numbers of HNBs / HeNBs deployed. For the following, it has to be noted that the HNB GW / HeNB GW is mandatory in the 3G case and optional in the LTE case.

As described above, a CSG cell only accepts mobile terminals that have been subscribed for the cell's CSG. A mobile terminal moving towards a CSG cell, requiring a handover from the current serving cell to the CSG cell, therefore needs to undergo access control. It has been agreed in 3GPP that the respective access control procedure needs to be carried out in the CN, namely in the Mobility Management Entity (MME) in case of LTE, or in the Serving GPRS Support Node (SGSN). Access control here means that the CN takes steps to make sure that a mobile terminal requesting handover to a CSG cell is actually subscribed to that CSG cell and therefore allowed to enter that CSG cell.

In the current mobility procedures (both for 3G and LTE), the message sent from the serving cell to the CN, which requires for a handover (i.e. RELOCATION REQUIRED MESSAGE for 3G and HO REQUIRED MESSAGE for LTE), identifies the target cell by cell identification parameters. For example, in the LTE case the target cell is identified within the Target ID Information Element with a Cell Global ID (CGI) and with a Tracking Area Identifier (TAI). This implies that the CN is assumed to be aware of the mapping between CSG ID and Cell Identity parameters in order to verify if the CSG ID associated to the

target cell can be accessed by the mobile terminal requesting said handover.

However, the latter assumption is incorrect if the HNBs /  
5 HeNBs are served by a HNB GW / HeNB GW. As described above, the purpose of deploying a HNB GW / HeNB GW is that of hiding to the CN any detail about the HNBs / HeNBs served by the HNB GW / HeNB GW. Hence, the CN does not know the mapping between CGI, TAI, or Location Area Code (LAC) and CSG ID of the HNB /  
10 HeNB cells connected to a HNB GW / HeNB GW.

Furthermore, it could happen that the CSG ID of the target CSG cell provided by the mobile terminal in its measurement report has been forged, e.g. due to the mobile terminal being  
15 rogue. Namely, the mobile terminal could report a CSG ID for which it has access despite the target CSG cell is not accessible for the mobile terminal. The result of an access control carried out by CN would therefore be positive, while the handover would fail as the mobile terminal is not a member of  
20 the target cell's CSG. This would lead to degraded quality of service or even call loss.

Thus, there is a need for improved access control during handover in a communications network avoiding above discussed  
25 problems and disadvantages.

#### SUMMARY OF THE INVENTION

Object of the present invention is improving access control  
30 during handover in a communications network.

This object is achieved by a method comprising features according to claim 1, a computer program product comprising features according to claim 15, a data carrier comprising  
35 features according to claim 16, a serving base station comprising features according to claim 7, a method comprising features according to claim 8, a target base station comprising features according to claim 9, a method comprising fea-

tures according to claim 10, a core network entity comprising features according to claim 11, and a method comprising features according to claim 12.

5 Further embodiments of the present invention are provided with the corresponding dependent claims.

The object of the present invention is achieved by a method, said method configured for performing access control in a  
10 communications network during handover of a mobile terminal from a serving base station to a target base station, said target base station spanning a closed subscriber group cell, said method comprising

- signalling, from said serving base station to a core net-  
15 work entity of said communications network, a first closed subscriber group identifier,
- performing a first access control step by said core network entity, wherein said first access control step comprises checking if said mobile terminal is associated to said first  
20 closed subscriber group identifier, and wherein said first access control step further comprises forwarding said first closed subscriber group identifier to said target base station from said core network entity if said mobile terminal is associated to said first closed subscriber group identifier;
- 25 - performing a second access control step by said target base station, wherein said second access control step comprises accepting a request for said handover of said mobile terminal by said target base station if said first closed subscriber group identifier is equal to a second closed subscriber group  
30 identifier supported by said target base station.

Thus, the CN is able to perform access control for mobile terminals that are attempting to access a target cell which is a CSG cell spanned by the target base station, and which  
35 is served, e.g., by a Home NodeB or Home eNodeB connected to a Home NodeB Gateway or a Home eNodeB Gateway despite the fact that the Home NodeB Gateway or Home eNodeB Gateway hides any detail about the connected Home NodeBs or Home eNodeBs.

Further, the object of the present invention is achieved by a computer program product comprising a code, the code being configured to implement and/or perform said method.

5

Moreover, the object of the present invention is achieved by a data carrier comprising said computer program product.

According to a further embodiment of the present invention,  
10 the computer program product is configured to perform said method when the computer program product is executed by a processing unit like a processor, for example.

According to an embodiment of the present invention, said  
15 second access control step further comprises rejecting a request for said handover of said mobile terminal by said core network entity, if said first closed subscriber group identifier is not equal to a second closed subscriber group identifier supported by said target base station.

20

Thus, the invention allows to reject a request for handover in case the signalled CSG ID is not supported by the target base station, e.g. due to erroneous or fake transmission of the CSG ID.

25

According to a further embodiment of the present invention, said signalling further comprises sending of a handover request message from said serving base station to said core network entity of said communications network, said handover  
30 request message comprising said first closed subscriber group identifier.

Thus, the invention allows signalling the CSG ID from the serving base station to the CN using the RELOCATION REQUIRED  
35 message in case of 3G or the HO message in case of LTE.

According to a further embodiment of the present invention, in said signalling said first closed subscriber group identi-

fier is signalled in a TARGET ID information element and in a Source to Target Transparent Container information element, said TARGET ID information element and said Source to Target Transparent Container information element being comprised in  
5 said handover request message.

By including the CSG ID in the Source to Target Transparent Container IE which is forwarded to the target base station, one can resolve the case where a mobile terminal provides a  
10 fake or erroneous target CSG ID, as in both the case of 3G and LTE the Source to Target Transparent Container IE is an IE sent from the serving base station to the target base station, transparently to the CN. This means that the CN does not access this IE nor it modifies it, which ensures that the  
15 target base station is able to perform access control based on the CSG ID reported by the mobile terminal.

According to a further embodiment of the present invention, in said first access control step said first closed subscriber group identifier is obtained from said TARGET ID information element by said core network entity.  
20

According to a further embodiment of the present invention, in said second access control step said first closed subscriber group identifier is obtained from said Source to Target Transparent Container information element by said target base station.  
25

The object of the present invention is achieved also by a serving base station in a communications network, said serving base station configured for signalling a closed subscriber group identifier to a core network entity of said communications network.  
30

Further, the object of the present invention is achieved by a method performed by a serving base station in a communications network, said method comprising signalling a closed  
35

subscriber group identifier to a core network entity of said communications network.

The object of the present invention is achieved also by a  
5 target base station, said target base station spanning a  
closed subscriber group, and said target base station configured to perform access control in a communications network during handover of a mobile terminal from a serving base station to said target base station, and said target base station further configured for:

10 - receiving, from a core network entity, a first closed subscriber group identifier;  
- performing an access control step, wherein said access control step comprises accepting a request for said handover of  
15 said mobile terminal by said target base station if said first closed subscriber group identifier is equal to a second closed subscriber group identifier supported by said target base.

20 Further, the object of the present invention is achieved by a method performed by a target base station, said target base station spanning a closed subscriber group, said method configured for performing access control in a communications network during handover of a mobile terminal from a serving  
25 base station to said target base station, said method comprising

- receiving, from a core network entity, a first closed subscriber group identifier;  
- performing an access control step, wherein said access control  
30 step comprises accepting a request for said handover of said mobile terminal if said closed subscriber group identifier is equal to a second closed subscriber group identifier supported by said target base station.

35 The object of the present invention is achieved also by a core network entity, said core network entity configured for performing access control in a communications network during handover of a mobile terminal from a serving base station to

a target base station, said target base station spanning a closed subscriber group cell, said core network entity further configured for:

- receiving, from said serving base station, a closed subscriber group identifier, and

- performing an access control step, wherein said access control step comprises checking if said mobile terminal is associated to said closed subscriber group identifier, and

wherein said access control step further comprises forwarding said closed subscriber group identifier to said target base station if said mobile terminal is associated to said first closed subscriber group identifier.

Further, the object of the present invention is achieved by a method performed by a core network entity, said method configured for performing access control in a communications network during handover of a mobile terminal from a serving base station to a target base station, said target base station spanning a closed subscriber group cell, said method comprising:

- receiving, from said serving base station, a closed subscriber group identifier, and

- performing an access control step, wherein said access control step comprises checking if said mobile terminal is associated to said closed subscriber group identifier, and

wherein said access control step further comprises forwarding said closed subscriber group identifier to said target base station if said mobile terminal is associated to said first closed subscriber group identifier.

According to a further embodiment of the present invention, said core network entity is a Mobility Management Entity or a Serving GPRS Support Node.

Thus, the invention is applicable in a 3G or LTE communications system.

According to a further embodiment of the present invention, said target base station is a Home NodeB, or a Home eNodeB, or a macro NodeB, or a macro eNodeB.

5 The proposed methods, serving base station, target base station, and core network entity have several advantages. The invention allows the CN to perform access control for mobile terminals that are attempting to access a CSG cell served, e.g., by a Home NodeB or Home eNodeB connected to a Home  
10 NodeB Gateway or a Home eNodeB Gateway.

Furthermore, the invention enables the target base station to check if the CSG ID reported by the mobile terminal as part of the target base station measurement report is correct or  
15 fake/erroneous. In case of an incorrect CSG ID, the handover request is rejected, and an appropriate cause value is provided in the handover rejection message, allowing a controlled failure of the handover request instead of, e.g., a complete call loss.

20 Further, when implementing the present invention, earlier detection of handover failure to CSG cells is possible due to access control performed during the handover procedure instead of after the handover procedure.

25 The present invention further allows maintaining the perceived quality of service while the mobile terminal is moving, as well as performing cell changes during active services/calls by avoiding transitions to target CSG cells which  
30 are no longer accessible due to, e.g., network reconfigurations.

Furthermore, Home NodeBs / Home eNodeBs connected to a Home Node B Gateway / Home eNodeB Gateway benefit from this inven-  
35 tion, since the core network, i.e. the core network entity MME or SGSN, are not able to perform CSG cell access control properly in those cases, as Home NodeB / Home eNodeB specific

information is hidden by the Home NodeB Gateway /Home eNodeB Gateway, with the core network assuming any kind of RNC.

#### BRIEF DESCRIPTION OF THE DRAWINGS

5

The present invention will be more clearly understood from the following description of the preferred embodiments of the invention read in conjunction with the attached drawings, in which:

10

Fig. 1 shows an implementation of the present invention according to an embodiment of the present invention.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

15

In following the embodiments of the present invention are provided exemplary with regard to 3G and LTE communications networks. Here, it has to be noted that the present invention is not restricted to these kinds of communications networks only and that the present invention can be used accordingly also in further communications networks providing access control during handover of a mobile terminal.

20

Fig. 1 shows an implementation of the present invention according to an embodiment of the present invention.

25

According to the present embodiment, the CSG ID associated to the target base station, said target base station spanning a CSG cell, is included in the TARGET ID Information Element (IE) as specified for LTE in 3GPP specification document TS 36.413. The proposed modification of said TARGET ID IE can be seen in table 1:

30

| IE/Group Name    | Semantics description |
|------------------|-----------------------|
| Choice Target ID |                       |
| >Target eNB-ID   |                       |
| >> Global eNB ID |                       |
| >> Selected TAI  |                       |

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| >Target RNC-ID    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| >>LAI             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| >>RAC             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| >>RNC-ID          | If the Extended RNC-ID IE is included in the Target ID IE, the RNC-ID IE shall be ignored.                                                                                                                                                                                                                                                                                                                                                                                                                         |
| >>Extended RNC-ID | The Extended RNC-ID IE shall be used if the RNC identity has a value larger than 4095.                                                                                                                                                                                                                                                                                                                                                                                                                             |
| >>CSG-ID          | The CSG -ID shall be included if the target cell is a CSG cell                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| >CGI              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| >> PLMN identity  | <ul style="list-style-type: none"> <li>- digits 0 to 9, encoded 0000 to 1001,</li> <li>- 1111 used as filler digit,</li> <li>two digits per octet,</li> <li>- bits 4 to 1 of octet n encoding digit <math>2n-1</math></li> <li>- bits 8 to 5 of octet n encoding digit <math>2n</math></li> <li>-The PLMN identity consists of 3 digits from MCC followed by either</li> <li>-a filler digit plus 2 digits from MNC (in case of 2 digit MNC) or</li> <li>-3 digits from MNC (in case of a 3 digit MNC).</li> </ul> |
| >> LAC            | 0000 and FFFE not allowed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| >>CI              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| >>RAC             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| >>CSG-ID          | The CSG -ID shall be included if the target cell is a CSG cell                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

Table 1: Example of modified TARGET ID IE for LTE HO REQUIRED messages

By including the CSG ID in the TARGET ID IE, the SGSN (for  
5 3G) or MME (for LTE) responsible for carrying out the access control during handover is able to find all the information needed on the target cell within the same IE. Such information comprises identity parameters (such as CGI and TAI) and

CSG ID. This enables the SGSN/MME to perform access control for the mobile terminal attempting to access the target CSG cell spanned by the target base station.

5 In addition to including the CSG ID in the TARGET ID IE, according to the present embodiment the CSG ID of the target CSG cell is included in the Source to Target Transparent Container IE. In both the case of 3G and LTE the Source to Target Transparent Container IE is an IE sent from the serving  
10 base station to the target base station, transparently to the CN. This means that the CN does not access this IE nor does the CN modify the IE. The IE is generated by the serving base station and included in the HO / RELOCATION REQUIRED message from the serving base station to the CN. Once the  
15 message reaches the CN, the Source to Target Transparent Container IE is extracted and included in the subsequent HO / RELOCATION REQUEST message from the CN to the target cell.

The format of the Source to Target Transparent Container IE  
20 changes depending on whether the handover is an inter- or an intra-system handover. For example, in case of intra-LTE-system handover, the container shall be encoded according to the definition of the Source eNB to Target eNB Transparent Container IE. In case of handover from LTE to UTRAN, the in-  
25 formation in the Source to Target Transparent Container IE shall be encoded according to the Source RNC to Target RNC Transparent Container IE definition (defined in 3GPP specification documents TS 36.413 and TS 25.413).

30 It shall be recalled that the CSG ID of the target CSG cell available to the serving base station is derived from measurements reports provided by the mobile terminal. Hence, by including the CSG ID in the Source to Target Transparent Container IE, one can resolve the case where a mobile terminal  
35 provides a fake or erroneous target CSG ID.

Indeed, because of the target identification information included in the TARGET ID IE, the handover procedure is carried

out towards the target cell, spanned by the target base station. The CSG ID provided by the mobile terminal is included in the Source to Target Transparent Container IE. If the CSG ID reported by the mobile terminal does not correspond to the CSG ID of the target cell, this can be detected once the HO / RELOCATION REQUEST message (from CN to the target base station) reaches the target CSG cell. This message includes the Source to Target Transparent Container IE, and if the target base station realises that the CSG ID contained in the Source to Target Transparent Container IE is different from the one supported by the target base station, the handover procedure is rejected.

Fig. 1 shows an exemplary access control procedure carried out according to an embodiment of the present invention. The figure represents the case where the CSG ID included in the Source to Target Transparent Container IE is different from that supported by the target CSG cell. The communications system in this example can be a 3G or an LTE communications system. However, as said above, it has to be noted that the present invention is not restricted to these kinds of communications networks only and that the present invention can be used accordingly also in further communications networks providing access control during handover of a mobile terminal.

The communications system according to Fig. 1 comprises a mobile terminal 11, a serving base station 12, a target base station 13, and a core network entity 14. The target base station 13 spans a CSG cell, with a CSG ID associated to the CSG cell, the CSG ID identifying a CSG, and with the CSG comprising subscribers, i.e. mobile terminals, allowed to access the CSG cell spanned by the target base station 13.

The mobile terminal 11, requesting handover from the serving base station 12 to the target base station 13, performs a measurement report sending 15 to the serving base station 12. Said measurement report comprises a CSG ID and a CGI associated to the target base station 13.

The serving base station 12 performs a signalling 16 to the core network entity 14. For 3G, the core network entity 14 might be an SGSN. In the LTE case, the core network entity 14 might be an MME. The signalling 16 comprises sending of a handover request message, with the handover request message comprising, besides other data necessary for the handover, the CGI ID. The handover request message is a RELOCATION REQUIRED MESSAGE in case of 3G and HO REQUIRED MESSAGE in case LTE. This handover request message identifies the target base station 13 (or the respective target cell) by cell identification parameters comprised in the handover request message.

In more detail, the CSG ID is signalled in a TARGET ID information element and in a Source to Target Transparent Container information element, said TARGET ID information element and said Source to Target Transparent Container information element being comprised in said handover request message.

The core network entity 14, i.e. the MME or SGSN, performs a first access control step 17, 18. This first access control step comprises checking if the mobile terminal 11 requesting handover is associated to the CSG ID contained in the handover request message. In case the mobile terminal 11 is associated to the signalled CSG ID, i.e. if the mobile terminal 11 is subscribed to the corresponding CSG, the core network entity 14 forwards the handover request message to the target base station 13. According to this embodiment of the invention, the CSG ID used for the first access control step 17, 18 is obtained from the TARGET ID information element in the handover request message.

The target base station 13, after receiving the handover request message, performs a second access control step 19, 20. During this second access control step, the CSG ID comprised in the Source to Target Transparent Container is compared

with the current CSG ID associated to the target base station 13.

In the example access control procedure shown in Fig. 1, the  
5 CSG ID comprised in the Source To Target Transparent Container is not equal to the current CSG ID of the target base station 13. Therefore, the target base station 13 performs rejecting 19, 20 of a request for said handover by sending a  
10 HO / RELOCATION FAILURE message to the core network entity 14. The core network entity 14 finally performs a handover failure procedure 21 by sending a HO / RELOCATION PREPARATION FAILURE message to the serving base station 12, signalling within the HO / RELOCATION PREPARATION FAILURE  
15 message the reason for the failure of the requested handover, i.e. the wrong CSG ID comprised in the handover request message.

In a further embodiment of the invention, not shown in  
Fig. 1, the CSG ID comprised in the Source To Target Transparent  
20 Container is equal to the current CSG ID of the target base station 13. Therefore, the target base station 13 performs accepting a request for said handover. Consequently, the core network entity 14 initiates further handover procedures to accomplish the handover of the mobile terminal 11 to  
25 the target base station 13 (not shown in Fig. 1).

The present invention is explained by use of embodiments referring in particular to performing access control during  
handover in 3G and LTE communications networks. However, the  
30 present invention can be implemented accordingly also in further types of communications networks, in which access control during handover is performed.

While embodiments and applications of this invention have  
35 been shown and described above, it should be apparent to those skilled in the art, that many more modifications (than mentioned above) are possible without departing from the inventive concept described herein. The invention, therefore,

is not restricted except in the spirit of the appending claims. Therefore, it is intended that the foregoing detailed description should be regarded as illustrative rather than limiting.

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## LIST OF REFERENCES:

|    |        |                                       |
|----|--------|---------------------------------------|
|    | 11     | mobile terminal                       |
| 5  | 12     | serving base station                  |
|    | 13     | target base station                   |
|    | 14     | core network entity                   |
|    | 15     | measurement report sending            |
|    | 16     | signalling                            |
| 10 | 17, 18 | first access control step; receiving  |
|    | 19, 20 | second access control step; rejecting |
|    | 21     | handover failure procedure            |

## List of abbreviations

|    |         |                                       |
|----|---------|---------------------------------------|
|    | 3G      | 3rd Generation                        |
|    | 3GPP    | 3rd Generation Partnership Project    |
| 5  | CGI     | Cell Global ID                        |
|    | CN      | Core Network                          |
|    | CSG     | Closed Subscriber Group               |
|    | CSG ID  | Closed Subscriber Group Identity      |
|    | EPC     | Evolved Packet Core                   |
| 10 | eNB     | eNodeB                                |
|    | GPRS    | General Packet Radio Service          |
|    | HNB     | Home NodeB                            |
|    | HeNB    | Home eNodeB                           |
|    | HNB GW  | Home NodeB Gateway                    |
| 15 | HeNB GW | Home eNodeB Gateway                   |
|    | HO      | Handover                              |
|    | IE      | Information Element                   |
|    | LAC     | Location Area Identifier              |
|    | LTE     | Long Term Evolution                   |
| 20 | MME     | Mobility Management Entity            |
|    | PCI     | Primary Cell Identity                 |
|    | RNC     | Radio Network Controller              |
|    | SGSN    | Serving GPRS Support Node             |
|    | TAI     | Tracking Area Code                    |
| 25 | UE      | User Equipment                        |
|    | UTRAN   | UMTS Terrestrial Radio Access Network |

## CLAIMS

1. A method, said method configured for performing access control in a communications network during handover of a mobile terminal (11) from a serving base station (12) to a target base station (13), said target base station (13) spanning a closed subscriber group cell, said method comprising
- signalling (16), from said serving base station (12) to a core network entity (14) of said communications network, a first closed subscriber group identifier,
  - performing a first access control step (17, 18) by said core network entity (14), wherein said first access control step (17, 18) comprises checking if said mobile terminal (11) is associated to said first closed subscriber group identifier, and wherein said first access control step (17, 18) further comprises forwarding (17, 18) said first closed subscriber group identifier to said target base station (13) from said core network entity (14) if said mobile terminal (11) is associated to said first closed subscriber group identifier;
  - performing a second access control step (19, 20) by said target base station (13), wherein said second access control step (19, 20) comprises accepting a request for said handover of said mobile terminal (11) by said target base station (13) if said first closed subscriber group identifier is equal to a second closed subscriber group identifier supported by said target base station (13).
2. The method according to claim 1, said second access control step (19, 20) further comprising rejecting (19, 20) of said request for said handover of said mobile terminal (11) by said core network entity (14), if said first closed subscriber group identifier is not equal to a second closed subscriber group identifier supported by said target base station (13).
3. The method according to at least one of the preceding claims, wherein said signalling (16) further comprises send-

ing of a handover request message from said serving base station (12) to said core network entity (14) of said communications network, said handover request message comprising said first closed subscriber group identifier.

5

4. The method according to claim 3, wherein in said signalling (16) said first closed subscriber group identifier is signalled in a TARGET ID information element and in a Source to Target Transparent Container information element, said  
10 TARGET ID information element and said Source to Target Transparent Container information element being comprised in said handover request message.

5. The method according to claim 4, wherein in said first access control step (17, 18) said first closed subscriber group  
15 identifier is obtained from said TARGET ID information element by said core network entity (14).

6. The method according to claim 4 or 5, wherein in said second access control step (19, 20) said first closed subscriber  
20 group identifier is obtained from said Source to Target Transparent Container information element by said target base station (13).

7. A serving base station (12) in a communications network, said serving base station (12) configured for signalling (16)  
25 a closed subscriber group identifier to a core network entity (14) of said communications network.

8. A method performed by a serving base station (12) in a communications network, said method comprising signalling  
30 (16) a closed subscriber group identifier to a core network entity (14) of said communications network.

9. A target base station (13), said target base station (13) spanning a closed subscriber group cell, and said target base  
35 station (13) configured for perform access control in a communications network during handover of a mobile terminal (11)

from a serving base station (12) to said target base station (13), and said target base station (13) further configured for:

- receiving (17, 18), from a core network entity (14), a  
5 first closed subscriber group identifier;
- performing an access control step (19, 20), wherein said access control step (19, 20) comprises accepting a request for said handover of said mobile terminal (11) by said target base station (13) if said first closed subscriber group identifier is equal to a second closed subscriber group identifier supported by said target base station (13).

10. A method performed by a target base station (13), said target base station (13) spanning a closed subscriber group  
15 cell, said method configured for performing access control in a communications network during handover of a mobile terminal (11) from a serving base station (12) to said target base station (13), said method comprising
- receiving (17, 18), from a core network entity (14), a  
20 first closed subscriber group identifier;
  - performing an access control step (19, 20), wherein said access control step (19, 20) comprises accepting a request for said handover of said mobile terminal (11) if said closed subscriber group identifier is equal to a second closed subscriber group identifier supported by said target base station (13).

11. A core network entity (14), said core network entity (14) configured for performing access control in a communications  
30 network during handover of a mobile terminal (11) from a serving base station (12) to a target base station (13), said target base station (13) spanning a closed subscriber group cell, said core network entity (14) further configured for:
- receiving (16), from said serving base station (12), a  
35 closed subscriber group identifier, and
  - performing an access control step (17, 18), wherein said access control step (17, 18) comprises checking if said mobile terminal (11) is associated to said closed subscriber

group identifier, and wherein said access control step (17, 18) further comprises forwarding (17, 18) said closed subscriber group identifier to said target base station (13) if said mobile terminal (11) is associated to said first closed subscriber group identifier.

12. A method performed by a core network entity (14), said method configured for performing access control in a communications network during handover of a mobile terminal (11) from a serving base station (12) to a target base station (13), said target base station (13) spanning a closed subscriber group cell, said method comprising:

- receiving (16), from said serving base station (12), a closed subscriber group identifier, and

- performing an access control step (17, 18), wherein said access control step (17, 18) comprises checking if said mobile terminal (11) is associated to said closed subscriber group identifier, and wherein said access control step (17, 18) further comprises forwarding (17, 18) said closed subscriber group identifier to said target base station (13) if said mobile terminal (11) is associated to said first closed subscriber group identifier.

13. The core network entity (14) according to claim 11, wherein said core network entity (14) is a Mobility Management Entity or a Serving GPRS Support Node.

14. The target base station (13) according to claim 9, wherein said target base station (13) is a Home NodeB, or a Home eNodeB, or a macro NodeB, or a macro eNodeB.

15. A computer program product comprising a code, the code being configured to implement a method according to claim 1.

16. A data carrier comprising a computer program product according to claim 15.

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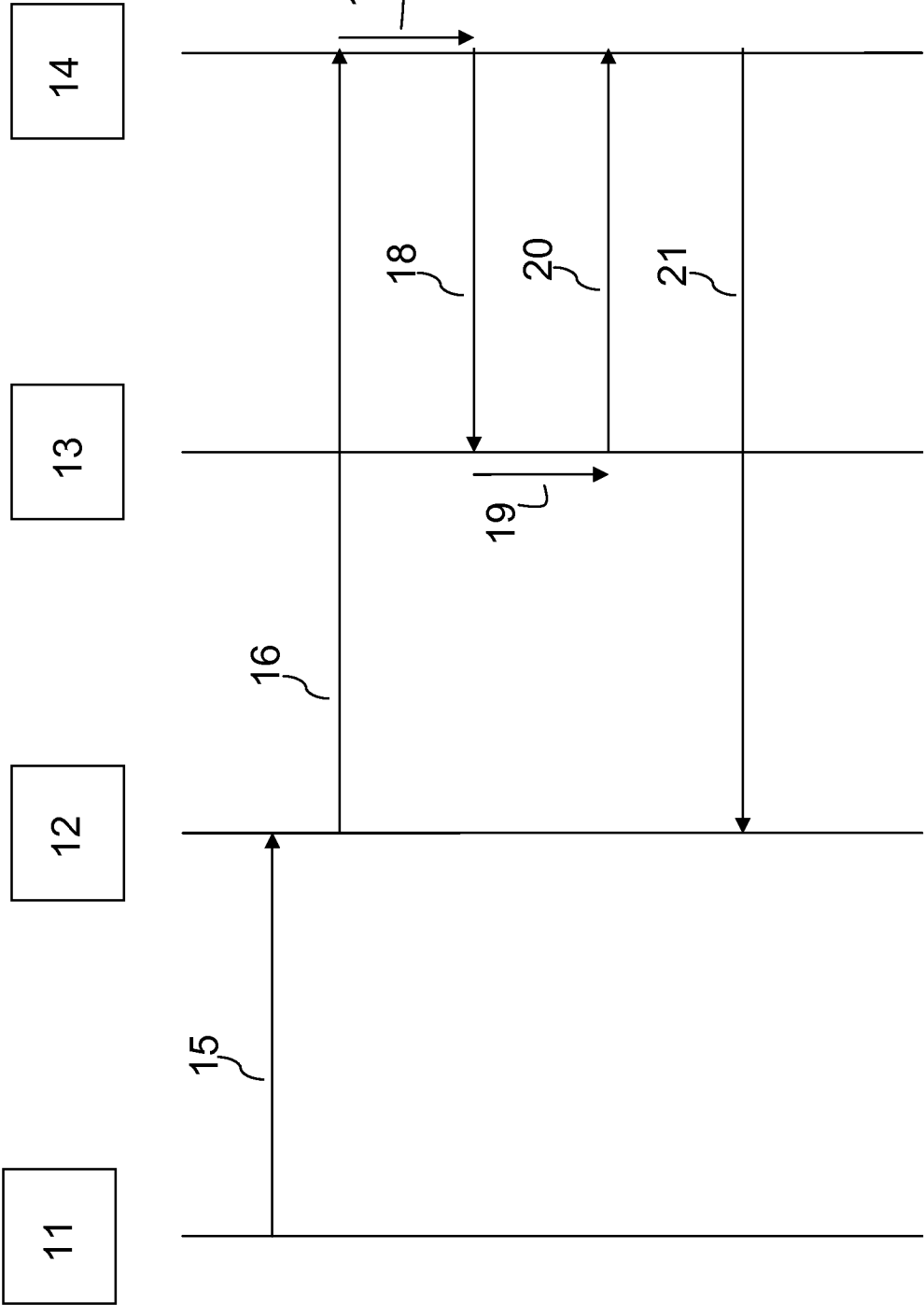


Fig. 1

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2009/060615

## A. CLASSIFICATION OF SUBJECT MATTER

INV. H04W36/04

ADD. H04W12/08

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)

H04W

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, COMPENDEX, INSPEC, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                                                                                                                | Relevant to claim No. |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | HUAWEI: "Discussion of Inbound Handove"<br>3GPP DRAFT; R3-090804 DISCUSSION OF<br>INBOUND HANDOVER_REVO, 3RD GENERATION<br>PARTNERSHIP PROJECT (3GPP), MOBILE<br>COMPETENCE CENTRE ; 650, ROUTE DES<br>LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX<br>; FRANCE, no. Seoul, Korea; 20090318,<br>18 March 2009 (2009-03-18), XP050341183<br>[retrieved on 2009-03-18] | 1,2,4-16              |
| Y         | paragraph 2.1, lines 1 and 3<br>paragraph 2.1.1, lines 1 and 11-18<br>page 2, line 11 - line 19<br>page 2, line 24 - line 29<br>page 3, line 1<br>page 3, line 6 - line 7<br>page 3, line 10 - line 11<br>-----<br>-/--                                                                                                                                           | 3                     |

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

☐ See patent family annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

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

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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

Date of the actual completion of the international search

5 May 2010

Date of mailing of the international search report

12/05/2010

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## INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2009/060615

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                                                                                                                                                                                            | Relevant to claim No. |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Y         | <p>NOKIA SIEMENS NETWORKS ET AL: "Impact on SIAP from HeNB GW concept"<br/> 3GPP DRAFT; R3-080156, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE,<br/> vol. RAN WG3, no. Sorrento, Italy;<br/> 20080205, 5 February 2008 (2008-02-05), XP050163379<br/> [retrieved on 2008-02-05]<br/> page 3, line 13 - line 17<br/> figure 1</p>                  | 3                     |
| A         | <p>-----</p> <p>NOKIA SIEMENS NETWORKS ET AL: "Location of CSG access control in active mode"<br/> 3GPP DRAFT; R3-090883, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, no. Seoul, Korea; 20090318, 18 March 2009 (2009-03-18), XP050341252<br/> [retrieved on 2009-03-18]<br/> the whole document</p>                                             | 1-16                  |
| A         | <p>-----</p> <p>HUAWEI: "Discussion on Access Control of Inbound Handover"<br/> 3GPP DRAFT; R3-091084 AC FOR INBOUND HO, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, no. San Francisco, USA; 20090429, 29 April 2009 (2009-04-29), XP050341459<br/> [retrieved on 2009-04-29]<br/> paragraph 2.1</p>                                             | 1-16                  |
| A         | <p>-----</p> <p>QUALCOMM EUROPE: "Access control for in-bound handover to a CSG cell"<br/> 3GPP DRAFT; R3-091025, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, no. San Francisco, USA; 20090429, 29 April 2009 (2009-04-29), XP050341410<br/> [retrieved on 2009-04-29]<br/> paragraph 2</p> <p>-----</p> <p style="text-align: center;">-/--</p> | 1-16                  |

## INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2009/060615

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Relevant to claim No. |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | <p>"Universal Mobile Telecommunications System (UMTS); UTRAN Iu interface Radio Access Network Application Part (RANAP) signalling (3GPP TS 25.413 version 8.3.0 Release 8)"</p> <p>TECHNICAL SPECIFICATION, EUROPEAN TELECOMMUNICATIONS STANDARDS INSTITUTE (ETSI), 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS ; FRANCE, no. V8.3.0, 1 July 2009 (2009-07-01), XP014044623 cited in the application</p> <p>paragraph 8.22</p> <p>page 65, line 1 - line 3</p> <p>paragraph 9.1.9</p> <p>paragraph 9.1.23</p> <p>paragraph 9.1.33</p> <p>paragraph 9.2.1.25</p> <p>paragraph 9.2.1.28</p> <p>paragraph 9.2.1.30a</p> <p>paragraph 9.2.1.79</p> <p>Annex B; page 397</p>            | 1-16                  |
| A         | <p>"LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) ; S1 Application Protocol (S1AP) (3GPP TS 36.413 version 8.6.1 Release 8)"</p> <p>TECHNICAL SPECIFICATION, EUROPEAN TELECOMMUNICATIONS STANDARDS INSTITUTE (ETSI), 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS ; FRANCE, no. V8.6.1, 1 July 2009 (2009-07-01), XP014044761 cited in the application</p> <p>paragraph 9.1.5.1</p> <p>paragraph 9.1.5.4</p> <p>paragraph 9.1.7.1</p> <p>paragraph 9.1.8.4</p> <p>paragraph 9.1.8.7</p> <p>paragraph 9.2.1.6</p> <p>paragraph 9.2.1.7</p> <p>paragraph 9.2.1.9</p> <p>paragraph 9.2.1.11</p> <p>paragraph 9.2.1.56</p> <p>paragraph 9.2.1.62</p> <p>Annex A; page 216</p> | 1-16                  |

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## INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2009/060615

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Relevant to claim No. |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| T         | <p>NOKIA SIEMENS NETWORKS: "Allowing Access Control for mobility to LTE CSG cells"<br/> 3GPP DRAFT; R3-091939 CSGID IN TARGETID, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, no. Shenzhen, China; 20090820, 20 August 2009 (2009-08-20), XP050353295 [retrieved on 2009-08-20]<br/> page 1, line 22 - line 35<br/> page 2, line 1 - line 10<br/> page 2, line 20 - line 25</p>                                                                                                                          | 1-16                  |
| T         | <p>NOKIA SIEMENS NETWORKS ET AL: "Access control for handover procedures to LTE CSG/hybrid cells"<br/> 3GPP DRAFT;<br/> R3-092645_ACCNTR_STAGE2_LTE_CR_FINAL, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, no. Miyazaki; 20091012, 12 October 2009 (2009-10-12), XP050392116 [retrieved on 2009-10-15]<br/> page 1<br/> page 2, line 3 - line 5<br/> page 3, line 13 - line 14<br/> page 4, line 4 - line 7<br/> page 6 - page 7<br/> figure 4.6.1-1<br/> figure 4.6.1-2<br/> lower figure at page 6</p> | 1-16                  |
| T         | <p>NOKIA SIEMENS NETWORKS ET AL: "Inclusion of CSG information for access control in 3G handover procedures and UE prioritization in 3G hybrid cells"<br/> 3GPP DRAFT;<br/> R3-093369_ACCNTR+HO+RESEL_STAGE3_3G_CR, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, no. Jeju; 20091109, 10 November 2009 (2009-11-10), XP050392781 [retrieved on 2009-11-19]<br/> page 1<br/> page 7, line 21 - line 26<br/> page 9, line 18 - line 20<br/> page 12, line 6 - line 8<br/> page 15, line 16 - line 17</p>    | 1-16                  |