

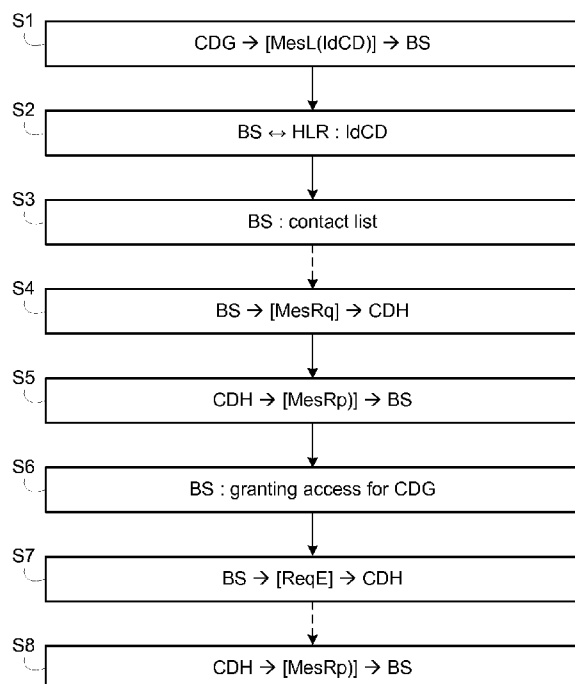


- (51) **International Patent Classification:**
H04L 29/06 (2006.01) **H04W 84/04** (2009.01)
H04W 12/08 (2009.01)
- (21) **International Application Number:**
PCT/EP2016/051703
- (22) **International Filing Date:**
27 January 2016 (27.01.2016)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
15305388.9 16 March 2015 (16.03.2015) EP
- (71) **Applicant:** ALCATEL LUCENT [FR/FR]; 148/152 route de la Reine, 92100 Boulogne-Billancourt (FR).
- (72) **Inventor:** C K, Madhusudana; #586, 14 B cross Bhuvaneshwari, nagar, hebbal-kempapur, Bangalore 560045 (IN).
- (74) **Agent:** MOUNEY, Jerome; Alcatel-Lucent International, 148/152, route de la Reine, 92100 Boulogne-Billancourt (FR).
- (81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, 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, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, 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, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, 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, RS, SE, SI, SK,

[Continued on next page]

(54) **Title:** COMMUNICATION DEVICE AUTHENTICATION IN SMALL CELL NETWORK

FIG. 2



(57) **Abstract:** For authenticating a first communication device (CDG) located in a coverage area of a base station (BS), the base station (BS): receives a localization message (MesL) from the first communication device (CDG), the localization message containing an identifier of the first communication device (CDG), interrogates a register (HLR) to retrieve a call number associated with the first communication device (CDG) by means of the identifier of the first communication device (CDG), sends a request message (MesRq) to a second communication device (CDH), the request message containing the call number and a request for access to the base station, receives a response message (MesRp) from the second communication device (CDH), if the response message (MesRp) contains a positive response to the request, grants the first communication device (CDG) access to the base station.

WO 2016/146287 A1



SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, **Published:**
GW, KM, ML, MR, NE, SN, TD, TG).

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

COMMUNICATION DEVICE AUTHENTICATION IN SMALL CELL NETWORK

FIELD OF THE INVENTION

5 The present invention pertains to the authentication of a user of a communication device located in a small cell network.

BACKGROUND

 Currently, there is no simple way for a user owning a small cell to
10 authenticate and authorize a guest user located in the small cell.

 An existing method is to add the guest user in to an access list by requesting operator, and no direct privilege is given to the user owning the small cell.

 There is a need for a user owning a small cell to be able to manage
15 an access list of users authorized to be connected to the small cell.

SUMMARY

 This summary is provided to introduce concepts related to the present inventive subject matter. This summary is not intended to identify
20 essential features of the claimed subject matter nor is it intended for use in determining or limiting the scope of the claimed subject matter.

 In accordance with one embodiment, a method is provided for for authenticating a first communication device located in a coverage area of a base station, comprising the following steps performed by the base station:

25 receiving a localization message from the first communication device, the localization message containing an identifier of the first communication device,

 interrogating a register to retrieve a call number associated with the first communication device by means of the identifier of the first
30 communication device,

sending a request message to a second communication device, the request message containing the call number and a request for access to the base station,

receiving a response message from the second communication
5 device,

if the response message contains a positive response to the request, granting the first communication device access to the base station.

Advantageously, the user owning the small cell can authorize other users even when said user is out of premises, can have the control of guest
10 user's usage time, can get the information of communication device that tries to enter the premises or coverage area, can preempt or extend the timer by sending a message to the operator

The guest user will not be aware of permissions and can use the small cell network seamlessly.

15 The owner of the base station will be able to know the call numbers and associated users which have tried to latch to the base station, so surveillance can also be achieved as security aspects.

In an embodiment, the identifier of the first communication device is
20 the international identity of the first communication device.

In an embodiment, the base station sends the request message to the second communication device, if the call number is present in a contact list.

In an embodiment, the base station does not grant the first
25 communication device access to the base station, if the response message is not received before the end of a countdown triggered after the sending of the request message.

In an embodiment, the response message further contains a timer value defining a duration of allowed access to the base station.

30 In an embodiment, the request message and the response message are short messages.

In an embodiment, the request message and the response message are HTTP messages.

The invention also pertains to a base station for authenticating a first
5 communication device located in a coverage area of the base station, comprising:

means for receiving a localization message from the first communication device, the localization message containing an identifier of the first communication device,

10 means for interrogating a register to retrieve a call number associated with the first communication device by means of the identifier of the first communication device,

means for sending a request message to a second communication device, the request message containing the call number and a request for
15 access to the base station,

means for receiving a response message from the second communication device,

means for granting the first communication device access to the base station, if the response message contains a positive response to the request.

20

The invention also pertains to a computer program capable of being implemented within a base station, said program comprising instructions which, when the program is executed within said base station, carry out steps according to the method according to the invention.

25

BRIEF DESCRIPTION OF THE FIGURES

Some embodiments of the present invention are now described, by way of example only, and with reference to the accompanying drawings. The same reference number represents the same element or the same type of
30 element on all drawings.

FIG. 1 is a schematic block diagram of a communication system according to one embodiment of the invention for an authentication of a communication device located in a small cell network.

FIG. 2 is a flow chart illustrating a method for an authentication of a communication device located in a small cell network according to one embodiment of the invention.

The same reference number represents the same element or the same type of element on all drawings.

10 DESCRIPTION OF EMBODIMENTS

The figures and the following description illustrate specific exemplary embodiments of the invention. It will thus be appreciated that those skilled in the art will be able to devise various arrangements that, although not explicitly described or shown herein, embody the principles of the invention and are included within the scope of the invention. Furthermore, any examples described herein are intended to aid in understanding the principles of the invention, and are to be construed as being without limitation to such specifically recited examples and conditions. As a result, the invention is not limited to the specific embodiments or examples described below, but by the claims and their equivalents.

Referring to FIG. 1, a communication system comprises a base station BS, a host communication device CDH and a guest communication device CDG which are able to be connected to the base station BS. The communication system comprises also a messaging server MS and a register HLR, which are able to communicate between them and with the base station BS via a telecommunication network TN.

For example, the base station is a pico base station or a femto base station located in residential buildings. The base station is linked to the core of the telecommunication network TN, typically via a modem and a wired line.

The base station includes baseband processing and radio module for a coverage area which access type is GSM (Global System for Mobile communications) coupled with a GPRS (General Packet Radio Service) network or UMTS (Universal Mobile Telecommunications System) or even
5 CDMA (Code Division Multiple Access) or even LTE (Long Term Evolution).

The base station comprises a user interface UI and a network interface NI.

The user interface UI gives access to a contact list and permits the host user to modify the contact list. The contact list contains call numbers.
10 The host communication device of the host user implements an application to login to this user interface with credentials, giving access to privileged tasks via a graphical interface.

The user interface UI implements a timer monitoring the network usage time of the guest user. In one example, timer waits for five minutes to
15 get a response from the host communication device; if no response is received from host communication device for five minutes then it will be treated as negative and no guest communication device will be added to the contact list.

The user interface UI manages also time extension requests
20 received from the host communication device.

The network interface NI is responsible for composing and sending short messages to the host communication device and for reading the short messages sent from the messaging server MS to do the required task inside the base station.

25 The network interface NI maintains the contact list in a database and communicates with the user interface.

A communication device CDH, CDG is capable of establishing a communication within a telecommunication network TN, for example with
30 another communication device, via a radio link with the base station. For instance, a communication device is a mobile telephone, a smartphone, or a

tablet, an electronic telecommunication device or object that is personal to the user.

The register HLR is accessible by the base station BS through the
5 telecommunication network TN. The register HLR is similar to a database containing an international identity IMSI (International Mobile Subscriber Identity) associated with a subscription profile for each user in the telecommunication network TN, especially for the users of the host communication device CDH and the guest communication device CDG.

10 The messaging server MS is able to parse messages sent from the host communication device CDH towards the base station.

With reference to FIG. 2, a method for an authentication of a communication device located in a small cell network according to one
15 embodiment of the invention comprises steps S1 to S8 executed within the communication system.

In step S1, the guest communication device CDG enters the coverage area of the base station and sends a localization message MesL to the base station BS. The localization message MesL contains an identifier
20 IdCD of the guest communication device CDG. For example, the identifier is the international identity IMSI (International Mobile Subscriber Identity) associated with the guest communication device.

In step S2, the base station BS interrogates the register HLR to retrieve a call number associated with the guest communication device CDG
25 by means of the identifier IdCD of the guest communication device CDG. To this end, the base station BS sends a request to the messaging server MS, the request containing the identifier of the guest communication device CDG, e.g. the international identity IMSI. The messaging server parses the request to extract the identifier of the guest communication device CDG and sends
30 another request to the register HLR, containing instructions interpretable by the HLR. The register HLR determines the call number associated with the

identifier IdCD. The register HLR sends a response to the base station, the response containing the call number.

In step S3, the base station BS determines if the call number is
5 present in the contact list.

If the call number is not present in the contact list, the base station BS does not take any further action, and the guest communication device will not access the small cell network.

If the call number is present in the contact list, the method goes to
10 step S4.

In step S4, the base station BS sends a request message MesRq to the host communication device CDH.

The request message MesRq contains the call number and a request
15 for access to the base station.

Additionally, the base station BS triggers a countdown running till a response to the sent request message MesRq is received. If no response is received before the end of the countdown, the base station drops the request considering the user of the host communication device CDH does not accept
20 the request and the guest communication device will not access the small cell network.

In one embodiment, the request message MesRq is a short message SMS.

In one embodiment, the request message MesRq is a HTTP request
25 sent towards the application implemented in the host communication device. If the base station does not receive an acknowledgement message, which means that the host communication device does not have internet access, the base station sends another request message MesRq under the form of a short message SMS.

30

In step S5, the user makes a decision for allowing the guest communication device associated with the call number an access to the base

station. The user can view a user name associated with the call number in the contact database of the host communication device.

The host communication device CDH sends a response message MesRp towards the base station BS. The response message contains a
5 positive response to the request or a negative response to the request. In case of positive response, the response message further contains a timer value defining a duration of allowed access to the base station.

In one embodiment, the request message MesRq is a short message SMS and the response message MesRp is also a short message. In this
10 case, the content of the message is entered by the user as typing usual SMS. For example, the content of the message is "yes duration 5 min". The base station receives the response message MesRp, forwards this latter to the messaging server that parses the response message MesRp to extract the user response and the duration and sends back a message to the base
15 station, the message containing instructions interpretable by the base station.

In one embodiment, the request message MesRq is a HTTP request and the response message MesRp is a HTTP message. In this case, the application in the host communication device CDH provides a user interface inviting user to select or enter values for the base station access request and
20 the duration.

In step S6, the base station BS associates the call number with an access indicator and grants the guest communication device CDG access to the base station network. The access is granted for a period corresponding to
25 the timer value.

In step S7, when the timer reaches the limit set by the timer value, the base station BS sends an extend request ReqE to the host communication device CDH. The extend request ReqE contains the call
30 number and a request for extension time for the access to the base station.

In step S8, the user makes a decision for allowing the guest communication device associated with the call number an extended duration for access to the base station. As in step S5, the host communication device CDH sends a response message MesRp towards the base station BS. The
5 response message contains a positive response to the request or a negative response to the request. In case of positive response, the response message further contains a timer value defining a duration of allowed access to the base station.

10

The invention described here relates to a method and a base station for an authentication of a user of a communication device located in a small cell network. According to one implementation of the invention, steps of the invention are determined by the instructions of a computer program
15 incorporated into a base station. The program comprises program instructions which, when said program is loaded and executed within the base station, carry out the steps of the method.

Consequently, the invention also applies to a computer program, particularly a computer program on or within an information medium, suitable
20 to implement the invention. This program may use any programming language, and be in the form of source code, object code, or intermediate code between source code and object code, such as in a partially compiled form, or in any other form desirable for implementing the method according to the invention.

25

CLAIMS

1. A method for authenticating a first communication device (CDG) located in a coverage area of a base station (BS), comprising the following
5 steps performed by the base station (BS):
 - receiving (S1) a localization message (MesL) from the first communication device (CDG), the localization message containing an identifier of the first communication device (CDG),
 - interrogating (S2) a register (HLR) to retrieve a call number
10 associated with the first communication device (CDG) by means of the identifier of the first communication device (CDG),
 - sending (S4) a request message (MesRq) to a second communication device (CDH), the request message containing the call number and a request for access to the base station,
 - 15 receiving (S5) a response message (MesRp) from the second communication device (CDH),
 - if the response message (MesRp) contains a positive response to the request, granting (S6) the first communication device (CDG) access to the base station (BS).
20
2. A method according to claim 1, wherein the identifier of the first communication device (CDG) is the international identity (IMSI) of the first communication device.
- 25 3. A method according to claim 1 or 2, wherein the base station sends the request message (MesRq) to the second communication device (CDH), if the call number is present in a contact list.
4. A method according to any of claims 1 to 3, wherein the base station
30 does not grant the first communication device (CDG) access to the base

station, if the response message (MesRp) is not received before the end of a countdown triggered after the sending of the request message (MesRq).

5. A method according to any of claims 1 to 4, wherein the response
5 message (MesRp) further contains a timer value defining a duration of allowed access to the base station.

6. A method according to any of claims 1 to 5, wherein the request
message (MesRq) and the response message (MesRp) are short messages.

10

7. A method according to any of claims 1 to 5, wherein the request
message (MesRq) and the response message (MesRp) are HTTP
messages.

15 8. A base station (BS) for authenticating a first communication device
(CDG) located in a coverage area of the base station (BS), comprising:

means (NI) for receiving a localization message (MesL) from the first
communication device (CDG), the localization message containing an
identifier of the first communication device (CDG),

20 means (NI) for interrogating a register (HLR) to retrieve a call number
associated with the first communication device (CDG) by means of the
identifier of the first communication device (CDG),

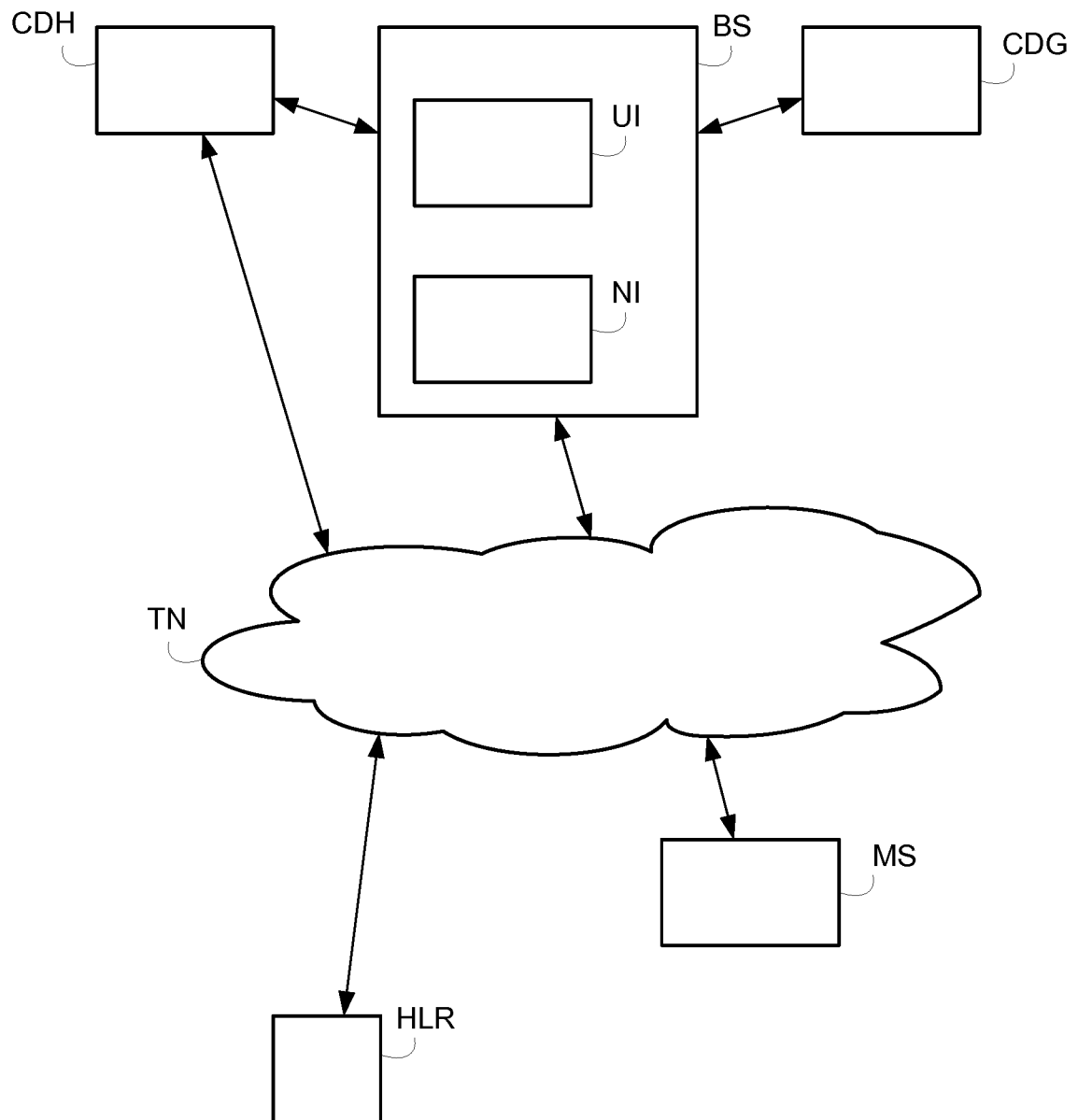
means (NI) for sending a request message to a second
communication device (CDH), the request message containing the call
25 number and a request for access to the base station,

means (NI) for receiving a response message from the second
communication device (CDH),

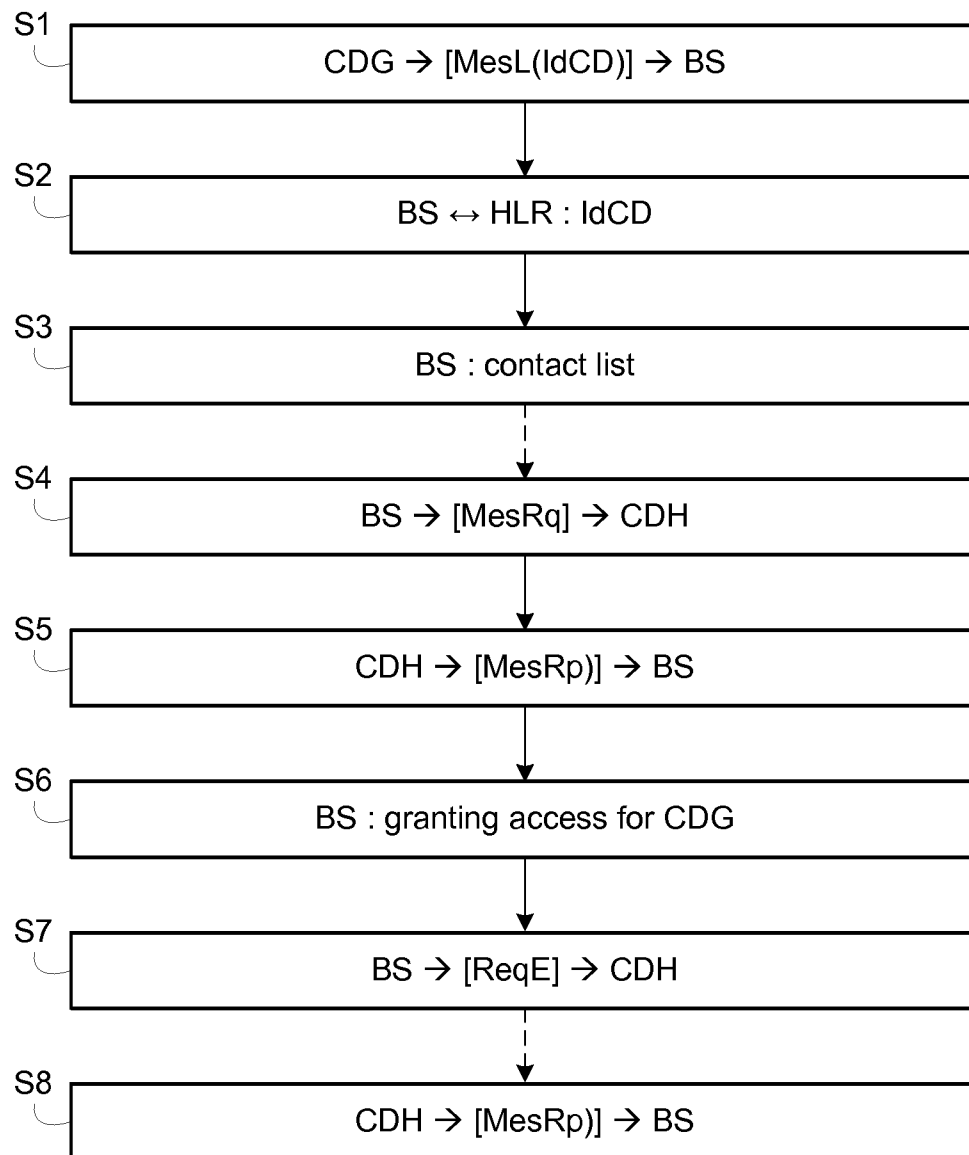
means (NI) for granting the first communication device (CDG) access
to the base station (BS), if the response message contains a positive
30 response to the request.

9. A computer program capable of being implemented within a base station (BS) for authenticating a first communication device (CDG) located in a coverage area of the base station, said program comprising instructions which, when the program is loaded and executed within said server (AS),
- 5 carry out the following steps:
- receiving (S1) a localization message (MesL) from the first communication device (CDG), the localization message containing an identifier of the first communication device (CDG),
 - interrogating (S2) a register (HLR) to retrieve a call number
 - 10 associated with the first communication device (CDG) by means of the identifier of the first communication device (CDG),
 - sending (S4) a request message (MesRq) to a second communication device (CDH), the request message containing the call number and a request for access to the base station,
 - 15 receiving (S5) a response message (MesRp) from the second communication device (CDH),
 - if the response message (MesRp) contains a positive response to the request, granting (S6) the first communication device (CDG) access to the base station (BS).

1/2
FIG. 1



2/2
FIG. 2



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/051703

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L29/06 H04W12/08 H04W84/04
ADD.

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 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 practicable, search terms used)

EPO-Internal, 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	US 2009/093232 A1 (GUPTA RAJARSHI [US] ET AL) 9 April 2009 (2009-04-09) figure 9 paragraph [0051] paragraph [0076] - paragraph [0100] paragraph [0102] - paragraph [0140] -----	1-9
A	US 2012/083270 A1 (ROBBINS WILLIAM [US] ET AL) 5 April 2012 (2012-04-05) figure 3 paragraph [0046] - paragraph [0047] paragraph [0067] paragraph [0075] -----	1-9



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 application or patent 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

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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"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

17 February 2016

Date of mailing of the international search report

03/03/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Lamelas Polo, Yvan

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2016/051703

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009093232	A1	09-04-2009	
		AU 2008311002 A1	16-04-2009
		AU 2008311003 A1	16-04-2009
		AU 2008311004 A1	16-04-2009
		BR PI0818609 A2	22-04-2015
		BR PI0818611 A2	22-04-2015
		BR PI0818612 A2	07-04-2015
		CA 2701906 A1	16-04-2009
		CA 2701924 A1	16-04-2009
		CA 2701961 A1	16-04-2009
		CA 2881157 A1	16-04-2009
		CN 101889419 A	17-11-2010
		CN 101889420 A	17-11-2010
		CN 101889464 A	17-11-2010
		EP 2198585 A2	23-06-2010
		EP 2198586 A1	23-06-2010
		EP 2198653 A2	23-06-2010
		EP 2273755 A1	12-01-2011
		EP 2273824 A2	12-01-2011
		HK 1150482 A1	28-03-2014
		IL 204864 A	30-11-2015
		IL 204871 A	24-09-2015
		JP 5248617 B2	31-07-2013
		JP 5290303 B2	18-09-2013
		JP 5623283 B2	12-11-2014
		JP 2010541514 A	24-12-2010
		JP 2010541515 A	24-12-2010
		JP 2011501917 A	13-01-2011
		JP 2013153485 A	08-08-2013
		JP 2014014122 A	23-01-2014
		KR 20100075627 A	02-07-2010
		KR 20100075628 A	02-07-2010
		KR 20100085095 A	28-07-2010
		KR 20120002611 A	06-01-2012
		KR 20120003957 A	11-01-2012
		KR 20120004534 A	12-01-2012
		KR 20130008627 A	22-01-2013
		KR 20130016405 A	14-02-2013
		MY 152239 A	15-09-2014
		SG 185280 A1	29-11-2012
		SG 185282 A1	29-11-2012
		TW 200932007 A	16-07-2009
		TW 200932008 A	16-07-2009
		TW 200935930 A	16-08-2009
		US 2009093232 A1	09-04-2009
		US 2009094351 A1	09-04-2009
		US 2009094680 A1	09-04-2009
		WO 2009048887 A1	16-04-2009
		WO 2009048888 A2	16-04-2009
		WO 2009048889 A2	16-04-2009
US 2012083270	A1	05-04-2012	NONE