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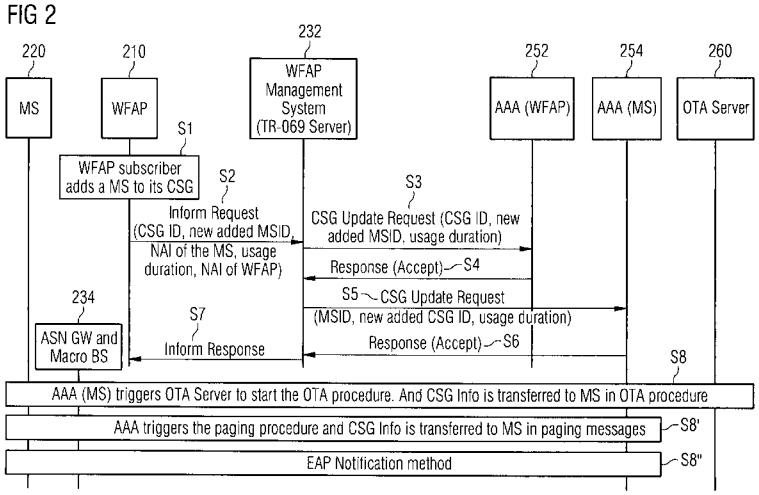
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(54) **Title**: METHOD, APPARATUS, COMPUTER MEDIUM AND PROGRAM FOR UPDATING CLOSED SUBSCRIBER GROUP FOR A FEMTO ACCESS POINT

FIG 2



(57) **Abstract**: It is described a method for performing an update of a closed subscriber group being assigned to a femto access point (210) of a telecommunication network, wherein the femto access point (210) is coupled to a femto access point management system (232). The method comprises (a) receiving by the femto access point management system (232) an update request for updating the closed subscriber group, (b) transmitting from the femto access point management system (232) an authorization request for updating the closed subscriber group to an authentication, authorization and accounting server (252, 254) or to a data base, (c) receiving by the femto access point management system (232) an authorization message for updating the closed subscriber group from the authentication, authorization and accounting server (252, 254) or from a data base, and (d) informing a mobile station (220) being connected to the femto access point (210) or to a macro base station (234) of the telecommunication network about a successful update of the closed subscriber group. It is further described a femto access point management system (232) for managing at least one femto access point (210).

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DESCRIPTION

METHOD, APPARATUS, COMPUTER MEDIUM AND PROGRAM FOR UPDATING CLOSED SUBSCRIBER GROUP FOR A FEMTO ACCESS POINT

Field of invention

The present invention generally relates to the field of telecommunication networks. In particular, the present invention relates to a method for performing an update of a closed subscriber group being assigned to a femto access point of a telecommunication network, wherein the femto access point is coupled to a femto access point management system. Further, the present invention relates to a femto access point management system for managing at least one femto access point of a telecommunication network. Furthermore, the present invention relates to a computer-readable medium with a computer program and to a program element, wherein both computer program and program element are adapted for controlling the above mentioned method for performing an update of a closed subscriber group being assigned to a femto access point.

Art Background

In the past the demand for handling wireless broadband data traffic (e.g. multimedia and/or video data traffic) over the internet has been increased. Therefore, also home users and office users have been become important target customers for wireless operators and solution providers in order to boost their Average Revenue per User (ARPU) or their operating margin. This trend seems to be unbowed.

Recently, a new Work Item on femto cells is being discussed in for Worldwide Interoperability for Microwave Access (WiMAX) networks in the so called WiMAX Forum. Specifically, WiMAX Femto Access Point (WFAP) targets to extend the reliable high data rate of a WiMAX access inside a home and/or inside an office environment. On the one hand a WFAP may provide

wireless broadband access to all Mobile Stations (MSs). In this respect there may be no difference compared to a so called macro BS (BS). On the other hand the WFAP may only provide service to a limited number of users. The latter means that the WFAP provides radio access only for a Closed Subscriber Group (CSG).

Information about a CSG such as for instance its members shall be administered or maintained by each WFAP of a telecommunication network. Thereby, for all allowed users (a) Mobile Station Identifiers (MSIDs), (b) Network Access Identifiers (NAIs) and/or (c) any other identities of devices or subscribers of the respective WiMAX telecommunication system are stored within a memory of the respective WFAP. At the same time, one system requirement for WiMAX Femto Systems requires that the MS or the WiMAX subscription shall maintain a list of WFAP identities for the WFAPs where the MS or the WiMAX subscription is a member of the WFAP's CSG. Because a WFAP is not expected to be configured with more than one CSG, a CSG Identifier (ID) can be used to denote this WFAP uniquely. Thereby, the CSG ID may have several forms such as for instance a string or the same form as a BS identifier (BSID). A corresponding list identifying CSGs a MS is assigned to, which list is maintained on the MS, can be called as CSG ID list.

Correspondingly, an Authentication, Authorization and Accounting (AAA) server or data base of a telecommunication network should store the related CSG information of the WFAP and the related CSG ID list of the MS, respectively. Because (a) a WFAP and the corresponding MS subscribers may belong to different Network Service Providers (NSPs) and a MS may have several subscriptions, two AAA server may be employed. One AAA server may manage WFAP related CSG information and may be called AAA (WFAP) server, the other AAA server may manage the MS related CSG information such as for instance a CSG ID list, MSID, etc. and may be called AAA (MS) server.

Further, for operating WFAPs in a general femto system architecture there is a WFAP management system. The WFAP Management System may be integrated into a Femto gateway (GW).

A proper CSG administering and maintaining concept is very important for a femto system because MSs can only access to the WFAPs with close type on its CSG ID list and enjoy the service provided by the respective WFAP. If a MS would always try to access the WFAPs with close type which are not on its CSG ID list, the MS would have to do lots of useless scanning attempts. Thus, the power consumption of the MS would be very large.

One of the system requirements of a WiMAX Femto System requires that a CSG which is maintained on a WFAP may be modified. In particular, there are two requirements (A) and (B), which must be feasible by a suitable CSG administering and maintaining concept. (A) The WFAP subscriber i.e. the owner of WFAP shall be able to add members to and/or remove members from the CSG of the WFAP for instance via a local interface after being authorized by the WiMAX femto system operator. For example, if a guest is visiting the WFAP subscriber, the WFAP subscriber may add the guest into his CSG and thus the guest can enjoy the services provided by the WFAP. (B) On the other hand, the WiMAX femto system operators shall also be able to add members to and/or remove members from the CSG of the WFAP.

Although the current WiMAX femto system requirement requires that it must be possible to modify the CSG of the WFAP, detailed solutions which fulfill the above mentioned requirements (A) and (B) are not known. In particular, it is not known how to modify the CSG of WFAP, which network elements will have to be involved in the modifications and how a CSG ID list can be modified in a MS.

There may be a need for providing a method and a management system for updating a CSG within a telecommunication network such as a WiMAX femto system.

Summary of the Invention

This need may be met by the subject matter according to the independent claims. Advantageous embodiments of the present invention are described by the dependent claims.

According to a first aspect of the invention there is provided a method for performing an update of a closed subscriber group being assigned to a femto access point of a telecommunication network, wherein the femto access point is coupled to a femto access point management system. The provided method comprises (a) receiving by the femto access point management system an update request for updating the closed subscriber group, (b) transmitting from the femto access point management system an authorization request for updating the closed subscriber group to an authentication, authorization and accounting server or to a date base ,(c) receiving by the femto access point management system an authorization message for updating the closed subscriber group from the authentication, authorization and accounting server or from a data base, and (d) informing a mobile station being connected to the femto access point or to a macro base station of the telecommunication network about a successful update of the closed subscriber group.

The described method is based on the idea that information about a change of the closed subscriber group (CSG) being assigned to the femto access point (FAP) can be distributed among all network elements, which may be affected by the CSG change. In addition to that, the described method provides a solution for checking the authorization for the closed CSG update. Thereby, the FAP Management System and the authenti-

cation, authorization and accounting (AAA) server may be associated with each other via a trusted relationship.

According to an embodiment of the invention the authentication, authorization and accounting server comprises (a) a first server component being used for authentication, authorization and accounting of femto access points and (b) a second server component being used for authentication, authorization and accounting of mobile stations (MSs). Thereby the first server component and the second server component may be different network elements respectively different server. The different network elements respectively different server may be operated by different Operators.

In case of a WiMAX system the first server component may be used for AAA of the WiMAX FAP (WFAP) and may be called an AAA (WFAP) server. Accordingly, the second server component may be used for AAA of the MSs and may be called an AAA (MS) server.

According to a further embodiment of the invention the update request is transmitted by the FAP to the FAP management system. In case of a WFAP once the subscriber respectively the owner of the WFAP adds or removes at least one member to or from the CSG of the WFAP, the WFAP will trigger a CSG update procedure to the FAP Management System, which in this case is a WFAP Management System.

In order to trigger the CSG update procedure an Inform Request message based on the known TR-069 protocol of the DSL Forum respectively the Broadband Forum may be used. The known bidirectional TR-069 protocol represents an application protocol for remote management of end-user devices. However, also Inform Request messages based on other protocols such as for instance the known Data Over Cable Service Interface Specification (DOCSIS) protocol can be used.

It is mentioned that the described update Inform Request message can be responded by the WFAP Management System by an appropriate Inform Response message based preferably on the same protocol as the Inform Request message.

In the described Inform Request message at least one of the following parameters may be included: (a) an identification (CSG ID) of the CSG of the respective WFAP, (b) an identification (MSID) of the added respectively the removed MS, (c) a usage duration for an added MSID, (d) security credentials to allow the WFAP Management System to authorize the WFAP request to update the CSG information and to allow the WFAP to authenticate and authorize any messages received from the WFAP Management System, (e) a Network Access Identifier (NAI) of the MS or of user of the MS, which is used to find the respective home AAA server of the MS respectively of the user of the MS and/or (f) a NAI of the WFAP, which is used to find the home AAA server of WFAP.

In this respect it is mentioned that the NAI is allocated to a WiMAX subscriber by its home operator and serves as primary ID for AAA purposes. Generally, the NAI has the format username@xyz.com. For example, a NAI of a MS can have the form "MAC address@xyz.com". Thereby, the realm portion can be used by an Access Service Network (ASN) to find the home AAA server of the MS.

According to a further embodiment of the invention the update request is transmitted by the AAA server or the data base to the FAP management system. This may mean that the described method can be also used for the case of an operator initiated CSG modification.

In case of a WiMAX system the AAA server respectively an AAA (WFAP) server may send the Update Request directly to the WFAP Management System. Thereby, the CSG Update Request may be based on the standardized protocols Remote Authentication Dial In User Service (RADIUS) or Diameter, which is an up-

grade respectively a successor of RADIUS. Preferably, a Change-of-Authorization (CoA) message carrying the CSG information within a RADIUS attribute may be used for this purpose. Further, the CSG Update Request may be specified specifically by an operator.

Alternatively, the AAA server respectively an AAA (WFAP) server may send the Update Request first to a femto gateway (GW) the FAP is connected to and then the femto GW transfers the Update Request to the WFAP Management System.

After having received the Update Request the WFAP Management System may push the new CSG to the WFAP by means of a message based on the above mentioned TR-069 protocol. Such a message may be called SetParameterValue Request message. After having obtained an "Accept" from the WFAP, the WFAP Management System may inform the AAA server respectively an AAA (MS) server about the CSG ID list update.

According to a further embodiment of the invention the authorization request is transmitted directly from the FAP management system to the AAA server or the data base.

In case of a WiMAX system a reference point respectively an appropriate interface between the WFAP Management System and the AAA server may be defined. This reference point respectively this interface may be based on appropriate protocols which may be defined by RADIUS, Diameter or a network operator. Preferably, for operator specified protocols, an Operation and Maintenance (OAM) based message may be reused for this purpose. In this respect it is noted that in case of a collocation of the WFAP Management System with a Femto GW, the respective reference point falls together with an interface, which may be an extension of the known standardized R3 interface.

It is mentioned that in case the AAA server comprises two server components, wherein a first server component is used

for AAA of the WFAP (i.e. the AAA (WFAP) server) and the second server component is used for AAA of the MSs (i.e. the AAA (MS) server), a direct connection may be established (a) on the one hand between the WFAP Management System and the AAA (WFAP) server and (b) on the other hand between the WFAP Management System and the AAA (MS) server.

The WFAP Management System may use the NAI of the WFAP and the NAI of the MS to contact the AAA server or the AAA (WFAP) server and the AAA (MS) server, respectively. Further, the AAA (WFAP) server may authenticate the CSG Update Request received by the WFAP Management System and the AAA server respectively the AAA (WFAP) server shall feedback to the WFAP Management System a CSG Update Response with an "Accept message" or a "Reject message" for adding/removing MSs from the CSG of the WFAP. Furthermore, the WFAP Management System may use a CSG Update Request message respectively a CSG Update Response message to inform the AAA server respectively the AAA (MS) server about the CSG ID list update of the MS.

According to a further embodiment of the invention the authorization request is transmitted indirectly from the FAP management system via a Femto GW to the AAA server or to the data base. Thereby, an appropriate reference point respectively interface between the WFAP Management System and the Femto GW may be defined. This reference point respectively interface may be based on an extension of the known standardized R4 interface. Of course this only holds if the FAP Management System and the Femto GW are not realized within one network element i.e. if the FAP Management System and the Femto GW are not co-located. Through this reference point respectively interface the FAP Management System may send the CSG Update Request to the Femto GW.

The Femto GW may reuse an extension of an existing R3 interface to contact the AAA server respectively the AAA (WFAP) server. The corresponding CSG-related information may be added to RADIUS or Diameter messages between the Femto GW and

the AAA server. For example, the Femto GW can send a CSG update as part of the known standardized Access-Request message for the RADIUS case. And then the AAA (WFAP) server may feedback result in the known standardized Access-Accept message.

The Femto GW may use the NAI of WFAP and NAI of MS to contact the AAA (WFAP) server and AAA (MS) server, respectively.

According to a further embodiment of the invention informing the mobile station comprises (a) sending an updated CSG information from the AAA server or from the data base via an over the air server to the MS, (b) piggybacking an updated CSG information on a paging message to the MS or (c) sending an updated CSG information as a part of a payload of an extensible authentication protocol notification message to the MS.

For sending the updated CSG information via an Over The Air (OTA) server the AAA server respectively the AAA (MS) server may trigger an appropriate OTA procedure on the OTA server. Thereby, the updated CSG information should be included into OTA messages and sent from the OTA server to the MS.

The alternatively described piggybacking of the updated CSG information may be accomplished with extended R4, extended R6 and/or air interface paging messages. Thereby, the air interface may be based on the known IEEE 802.16e standard and/or on the known IEEE 802.16m standard.

If the updated closed subscriber group information is sent as a part of a payload of an extensible authentication protocol (EAP) notification message the EAP notification message may be sent directly by the AAA server respectively the AAA (MS) server to the MS. As an alternative, the EAP notification message may be sent by an Access Service Network (ASN) GW to the MS. Thereby, the ASN GW may act as an authenticator for the MS. In this respect it is mentioned that the ASN GW may also represent the already above described Femto GW, which is

connected both to the FAP and to a connective service network (CSN) which accommodates the AAA server respectively the AAA (WFAP) and the AAA (MS) server.

According to a further embodiment of the invention the updated CSG information includes at least one of the following information elements: (a) an identification of the MS, (b) an identification of a CSG the MS is added to or removed from, (c) a usage duration for a CSG the MS is added to and/or (d) a complete updated list of CSG identifications the MS is assigned to.

According to a further embodiment of the invention the method further comprises informing the FAP about a successful update of the CSG. This may be accomplished by sending a corresponding feedback information from the FAP Management System to the FAP. Thereby, the FAP Management System may be a TR-069 server and the corresponding feedback information may be a TR-069 based feedback message.

According to a further embodiment of the invention (a) the FAP is a WiMAX FAP and (b) the FAP Management System is a WFAP Management System. Thereby, the WFAP Management System may be realized by means of a so called TR-69 server.

According to a further embodiment of the invention the WiMAX femto access point management system and a femto gateway the FAP is connected to are realized by one network element. This means that the WFAP Management System and the Femto GW are co-located and/or fall together. In other words the WFAP management system is integrated into the Femto GW. This may provide the advantage that the WFAP Management System and the Femto GW may share some information such as for instance the above described CSG information. As a consequence no messages have to be transferred between the WFAP Management System and the Femto GW.

The integration of the WFAP management system into the Femto GW may further provide the advantage that the Femto GW can use an extension of the existing R3 reference point respectively an extension of the existing R3 interface between the ASN GW (corresponding to the Femto GW) and a CSN for communicating with the AAA server respectively with the AAA (WFAP) server which is located within the CSN. Further, on the extension of the R3 interface the well known Radius respectively Diameter protocols can be used as usual.

According to a further aspect of the invention there is provided a femto access point management system for managing at least one femto access point of a telecommunication network and in particular for managing at least one WiMAX femto access point of a WiMAX telecommunication network. The provided femto access point management system comprises (a) a first receiving unit for receiving an update request for updating a closed subscriber group being assigned to the femto access point, (b) a transmitting unit for transmitting an authorization request for updating the closed subscriber group to an authentication, authorization and accounting server or to a data base, (c) a second receiving unit for receiving an authorization message for updating the closed subscriber group from the authentication, authorization and accounting server or from a data base, and (d) a unit for informing a mobile station being connected to the femto access point or to a macro base station of the telecommunication network about a successful update of the closed subscriber group.

The described management system is based on the idea that information about a change of the CSG being assigned to the FAP can be distributed among all network elements, which may be affected by the CSG change. In addition to that, the described management system provides a solution for checking the authorization for the CSG update. Thereby, the described FAP Management System and the AAA server may be associated with each other via a trusted relationship.

According to a further aspect of the invention there is provided a computer-readable medium on which there is stored a computer program for performing an update of a closed subscriber group being assigned to a femto access point of a telecommunication network, wherein the femto access point is coupled to a femto access point management system. The computer program, when being executed by a data processor, is adapted for controlling the above described method for performing an update of a closed subscriber group being assigned to a femto access point.

The computer-readable medium may be readable by a computer or a processor. The computer-readable medium may be, for example but not limited to, an electric, magnetic, optical, infrared or semiconductor system, device or transmission medium. The computer-readable medium may include at least one of the following media: a computer-distributable medium, a program storage medium, a record medium, a computer-readable memory, a random access memory, an erasable programmable read-only memory, a computer-readable software distribution package, a computer-readable signal, a computer-readable telecommunications signal, computer-readable printed matter, and a computer-readable compressed software package.

According to a further aspect of the invention there is provided a program element for performing an update of a closed subscriber group being assigned to a femto access point of a telecommunication network, wherein the femto access point is coupled to a femto access point management system. The program element, when being executed by a data processor, is adapted for controlling the above described method for performing an update of a closed subscriber group being assigned to a femto access point.

The computer program may be implemented as a computer readable instruction code in any suitable programming language, such as, for example, JAVA, C++, and may be stored on a computer-readable medium (removable disk, volatile or non-

volatile memory, embedded memory/processor, etc.). The instruction code is operable to program a computer or any other programmable device to carry out the intended functions. The computer program may be available from a network, such as the World Wide Web, from which it may be downloaded.

The invention may be realized by means of a computer program respectively software. However, the invention may also be realized by means of one or more specific electronic circuits respectively hardware. Furthermore, the invention may also be realized in a hybrid form, i.e. in a combination of software modules and hardware modules.

It has to be noted that embodiments of the invention have been described with reference to different subject matters. In particular, some embodiments have been described with reference to method type claims whereas other embodiments have been described with reference to apparatus type claims. However, a person skilled in the art will gather from the above and the following description that, unless other notified, in addition to any combination of features belonging to one type of subject matter also any combination between features relating to different subject matters, in particular between features of the method type claims and features of the apparatus type claims is considered as to be disclosed with this application.

The aspects defined above and further aspects of the present invention are apparent from the examples of embodiment to be described hereinafter and are explained with reference to the examples of embodiment. The invention will be described in more detail hereinafter with reference to examples of embodiment but to which the invention is not limited.

Brief Description of the Drawings

Figure 1a shows a femto system network architecture for a configuration of a Closed Subscriber Group within a Mobile Station, a WiMAX Femto Access Point and AAA servers.

Figure 1b shows a simplified femto system network architecture for a configuration of a Closed Subscriber Group within a Mobile Station, a WiMAX Femto Access Point and AAA servers.

Figure 2 shows a transactional flow diagram for performing a Closed Subscriber Group Update within selected network elements of a femto system network architecture.

Detailed Description

The illustration in the drawing is schematically. It is noted that in different figures, similar or identical elements are provided with the same reference signs or with reference signs, which are different from the corresponding reference signs only within the first digit.

Figure 1a shows a network architecture of a femto system 100a. The femto system 100a comprises a WiMAX Femto Access Point (WFAP) 110, which currently serves a Mobile Station (MS) 120. The WFAP 110 is connected to a WFAP Management System 132 and to a Femto Gateway (GW) 134 by respectively an extended R6 interface. The Femto GW 134 and the WFAP Management System 132 are connected to each other via an extended R4 interface. The Femto GW 134 is adapted for connecting the WFAP 110 to a Connective Service Network (CSN) 140.

As can be seen from Figure 1a, the MS 120 has an identification MSID equal to "1". Further, a list comprising different CSG ID's is stored in the MS 120. According to the embodiment described here the MS 120 is assigned at least to a first CSG having a CSG ID "x" and to a second CSG having a CSG ID "z".

As can be further seen from Figure 1a, the WFAP 110 serves the above mentioned CSG being identified with the CSG ID "x". Further, the WFAP 110 has stored ID's about different MS which are assigned to the CSG "x". According to the embodiment described here at least the MS 120 having the MSID "1" and a further not depicted MS having the MSID "2" are members of the CSG "x".

The CSN 140 comprises (a) a first AAA server 152 being used for authentication, authorization and accounting (AAA) of WFAPs and (b) a second AAA server 154 being used for AAA of MSs. According to the embodiment described here the first AAA server 152, which is abbreviated with "AAA (WFAP)", is assigned to a first operator such as for instance a first Network Service Provider (NSP) and the second AAA server 154, which is abbreviated with "AAA (MS)", is assigned to a second operator such as for instance a second NSP. The AAA (WFAP) server 152 stores all CSG profiles of the WFAP 110. The AAA (MS) server 154 stores all CSG identification profiles the MS 120 is assigned to. Further, also CSG identification profiles of other MSs, which are not depicted in Figure 1a, may be stored in the AAA (MS) server 154. Generally speaking, the AAA (WFAP) server 152 manages WFAP related CSG information, e.g. CSG ID and CSG, etc. The AAA (MS) server 154 manages the MS related CSG information such as CSG ID list, MSID, etc. More general, the AAA (WFAP) may be a data base.

The two AAA servers 152 and 154 are respectively connected the WFAP management system 132 and to the Femto GW 134 via an extension of the standardized R3 interface.

It has to be mentioned that the two AAA servers 152 and 154 could also be realized by one single AAA server.

A preferred CSG update procedure which can be carried out within the femto system architecture 100a will be described beneath in detail with reference to Figure 2.

Figure 1b shows a simplified femto system network architecture 100b for a configuration of a Closed Subscriber Group within a MS 120, a WFAP 110 and two AAA servers 152 and 154. As can be easily seen from the Figures 1a and 1b, the network architecture 100b differs from the network architecture 100b by the merge of the WFAP Management System 132 and the Femto GW 134 (see Figure 1a) into a single network element 130. Further, the WFAP 110 and the network element 130 are connected with each other via an extended R6 interface. Furthermore, extended R3 interfaces are used both for the connection of the network element 130 with the AAA (MS) server 154 and the connection of the network element 130 with the AAA (WFAP) server 152. Apart from these differences the femto system network architecture 100b is at least substantially the same as the femto system network architecture 100a.

Figure 2 shows a transactional flow diagram for performing a Closed Subscriber Group Update within selected network elements of a femto system network architecture. The femto system network architecture comprises a Mobile Station 220, a WiMAX Femto Access Point 210, a WiMAX Femto Access Point Management System 232, an AAA (WFAP) server 252, as AAA (MS) server 254, an Over The Air (OTA) server 260 and a Femto Gateway respectively an Access Service Network Gateway 234.

In a first step S1 the subscriber of the WFAP 210 wants to share his WiMAX femto service to his friend who is so far not belonged to the CSG of the WFAP 210. Therefore, the WFAP subscriber adds the MSID of his friend into his WFAP CSG through a local management interface. The WFAP subscriber may also define the usage duration for the new added MS 220.

In a second step S2 the WFAP 210 sends a TR-069 based message, Inform Request message, to the WFAP Management System 232. According to the embodiment described here the WFAP Management System is a TR-069 Server 232. The new added MSID,

the CSG ID of the WFAP 210, the usage duration, NAIs of the MS 220 and the WFAP 210 are included in this request.

After having received the Inform Request, the TR-069 Server 232 finds the home AAA (WFAP) server 252 based on the NAI of the WFAP 210. Then, in a third step S3 the TR-069 server 232 includes the information obtained from WFAP into CSG Update Request message and sends the CSG Update Request message to the AAA (WFAP) server 252.

In a fourth step S4 the AAA (WFAP) server 252 authorizes the CSG Update Request. If accept, the AAA (WFAP) server 252 feedbacks a Response message with "Accept" to the WFAP Management System 232.

After having received the "Accept" from the AAA (WFAP) server 252, the WFAP Management System 232 finds the home AAA (MS) server 254 of the MS 220 based on the NAI of MS 220. Then, in a fifth step S5 the WFAP Management System 232 sends a CSG Update Request message to the AAA (MS) server 254 in which the MSID, the usage duration and the added CSG ID are included. The AAA (MS) server 254 modifies the related MS's profile.

In a sixth step S6 the AAA (MS) server 254 feedbacks a Response "Accept" to the WFAP Management System 232.

In a seventh step S7 the WFAP Management System 232 transmits to the WFAP 210 a feedback TR-069 based message, Inform Response. Step 7 may be executed once step 4 has been finished.

In an eighth step S8 the AAA (MS) server 254 sends the CSG information (MSID, new added CSG ID of the WFAP 210, usage duration) to the OTA server 260. The OTA server 260 may obtain the IP address of the MS 220 from the AAA (MS) server 254 and then trigger an OTA procedure which has already been specified in the Network Working Group. The OTA server 260 pushes the CSG information to the MS 220 and to a network

element 234 representing the Femto Gateway respectively the Access Service Network Gateway and a Macro base station.

In an alternative eighth step S8' the AAA (MS) server 254 triggers a paging procedure and sends the CSG information through paging signaling. It is mentioned that this can only be used when the MS 220 is in an idle mode. The CSG information (MSID, new added CSG ID of the WFAP 210 and usage duration) may be piggybacked by Radius respectively Diameter messages from the AAA servers 252 and/or 254 to an anchor authenticator. The anchor authenticator can trigger the paging procedure on an anchor paging controller. Thereby, CSG information and new added paging cause may be piggybacked by an R4 Initiate_Paging_Req message, an R4/R6 Paging_Announce message and an R1 MOB_PAG_ADV message.

Alternatively to step S8 and step S8', a step 8'' can be accomplished. Thereby, the updated CSG information is sent as a part of the payload of an Extensible Authentication Protocol (EAP) notification message. Such a notification message can be sent directly by the AAA (MS) server 254, or can be sent by an authenticator (i.e. the ASN GW 270) for this MS 220.

It is mentioned that at the time of network entry of the WFAP 210 (i.e. the WFAP 210 authenticates or re-authenticates to the AAA (WFAP) 252), the AAA (WFAP) 252 may include the latest CSG information in a RADIUS Access-Accept message (or the corresponding Diameter EAP Answer) and may update the Femto GW.

The Femto GW can send this CSG information further to the WFAP Management System 232. Alternatively, the Femto-GW can pass the CSG information across the extended R6 interface, that has to be extended to allow an exchange of CSG information, directly to the WFAP 210 and subsequently the WFAP 210 will update the WFAP Management System 232. Both alternatives

allow to avoid a direct AAA connection between the WFAP Management System 132 and the AAA (WFAP) server 252.

In addition, dynamic mid-session updates of the CSG information can be triggered by the AAA (WFAP) server 252 by sending a change-of-authorization message that carries the latest CSG information, to the Femto GW across the extended R3 interface.

It should be noted that the term "comprising" does not exclude other elements or steps and "a" or "an" does not exclude a plurality. Also elements described in association with different embodiments may be combined. It should also be noted that reference signs in the claims should not be construed as limiting the scope of the claims.

List of reference signs:

100a	telecommunication network / femto system architecture
100b	simplified telecommunication network / simplified femto system architecture
110	WiMAX Femto Access Point
120	Mobile Station
130	network element implementing (a) WiMAX Femto Access Point Management System and (b) Femto Gateway
132	WiMAX Femto Access Point Management System
134	Femto Gateway
140	Connective Service Network
152	AAA (WFAP) server
154	AAA (MS) server
210	WiMAX Femto Access Point
220	Mobile Station
232	WiMAX Femto Access Point Management System
234	Femto Gateway / Access Service Network Gateway and Macro base station
252	AAA (WFAP) server
254	AAA (MS) server
260	Over The Air Server

CLAIMS:

1. A method for performing an update of a closed subscriber group being assigned to a femto access point (110, 210) of a telecommunication network (100a, 100b), wherein the femto access point (110, 210) is coupled to a femto access point management system (130, 132, 232), the method comprising

- receiving by the femto access point management system (130, 132, 232) an update request for updating the closed subscriber group,
- transmitting from the femto access point management system (130, 132, 232) an authorization request for updating the closed subscriber group to an authentication, authorization and accounting server (152, 154, 252, 254) or to a data base,
- receiving by the femto access point management system (130, 132, 232) an authorization message for updating the closed subscriber group from the authentication, authorization and accounting server (152, 154, 252, 254) or from the data base, and
- informing a mobile station (120, 220) being connected to the femto access point (110, 210) or to a macro base station (234) of the telecommunication network about a successful update of the closed subscriber group.

2. The method as set forth in the preceding claim, wherein the authentication, authorization and accounting server comprises
a first server component (152, 252) being used for authentication, authorization and accounting of femto access points (110, 210) and
a second server component (154, 254) being used for authentication, authorization and accounting of mobile stations (120, 220).

3. The method as set forth in any one of the preceding claims, wherein

the update request is transmitted by the femto access point (210) to the femto access point management system (130, 132, 232).

4. The method as set forth in any one of the claims 1 to 2, wherein
the update request is transmitted by the authentication, authorization and accounting server (152, 154, 252, 254) or the data base to the femto access point management system (130, 132, 232).

5. The method as set forth in any one of the preceding claims, wherein
the authorization request is transmitted directly from the femto access point management system (130, 132, 232) to the authentication, authorization and accounting server (152, 154, 252, 254) or to the data base.

6. The method as set forth in any one of the claims 1 to 4, wherein
the authorization request is transmitted indirectly from the femto access point management system (130, 132, 232) via a femto gateway (134) to the authentication, authorization and accounting server (152, 154, 252, 254) or to the data base.

7. The method as set forth in any one of the preceding claims, wherein
informing the mobile station (120, 220) comprises
(a) sending an updated closed subscriber group information from the authentication, authorization and accounting server (152, 154, 252, 254) or from the data base via an over the air server (260) to the mobile station (120, 220) or
(b) piggybacking an updated closed subscriber group information on a paging message to the mobile station (120, 220) or
(c) sending an updated closed subscriber group information as a part of a payload of an extensible authentication protocol notification message to the mobile station (120, 220).

8. The method as set forth in the preceding claim, wherein the updated closed subscriber group information includes at least one of the following information elements:
(a) an identification of the mobile station (120, 220),
(b) an identification of a closed subscriber group the mobile station (120, 220) is added to or removed from,
(c) a usage duration for a closed subscriber group the mobile station (120, 220) is added to and/or
(d) a complete updated list of closed subscriber group identifications the mobile station (120, 220) is assigned to.

9. The method as set forth in any one of the preceding claims, further comprising
- informing the femto access point (110, 210) about a successful update of the closed subscriber group.

10. The method as set forth in any one of the preceding claims, wherein
(a) the femto access point is a WiMAX femto access point (110, 210) and
(b) the femto access point management system is a WiMAX femto access point management system (130, 132, 232).

11. The method as set forth in the preceding claim, wherein the WiMAX femto access point management system and a femto gateway the femto access point (110, 210) is connected to are realized by one network element (130).

12. A femto access point management system for managing at least one femto access point (110, 210) of a telecommunication network (110a, 100b), in particular for managing at least one WiMAX femto access point (110, 210) of a WiMAX telecommunication network (110a, 110b), the femto access point management system (130, 132, 232) comprising
- a first receiving unit for receiving an update request for updating a closed subscriber group being assigned to the femto access point (110, 210),

- a transmitting unit for transmitting an authorization request for updating the closed subscriber group to an authentication, authorization and accounting server (152, 154, 252, 254) or to a data base,
- a second receiving unit for receiving an authorization message for updating the closed subscriber group from the authentication, authorization and accounting server (152, 154, 252, 254) or from a data base, and
- a unit for informing a mobile station (120, 220) being connected to the femto access point (110, 210) or to a macro base station (234) of the telecommunication network about a successful update of the closed subscriber group.

13. A computer-readable medium on which there is stored a computer program for performing an update of a closed subscriber group being assigned to a femto access point (110, 210) of a telecommunication network (110a, 100b), wherein the femto access point (110, 210) is coupled to a femto access point management system (130, 132, 232), the computer program, when being executed by a data processor, is adapted for controlling the method as set forth in any one of the claims 1 to 11.

14. A program element for performing an update of a closed subscriber group being assigned to a femto access point (110, 210) of a telecommunication network (100a, 100b), wherein the femto access point (110, 210) is coupled to a femto access point management system (130, 132, 232), the program element, when being executed by a data processor, is adapted for controlling the method as set forth in any one of the claims 1 to 11.

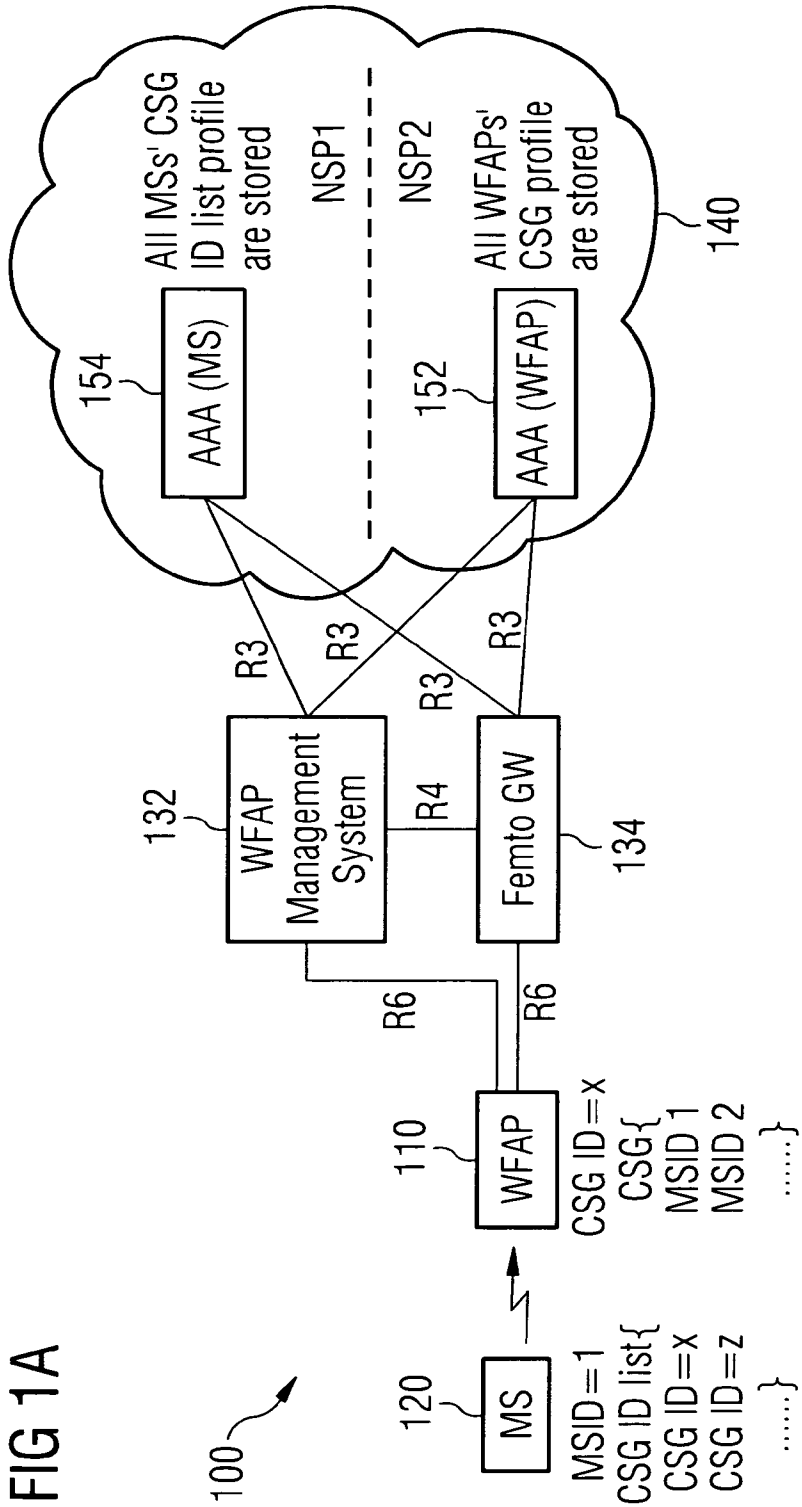

All MSs' CSG ID list profile are stored
NSP1
NSP2
All WFAPs' CSG profile are stored
140
154
AAA (MS)
152
AAA (WFAP)
R3
R3
R3
R3
132
WFAP Management System
R4
Femto GW
134
R6
R6
110
WFAP
CSG ID=x
CSG{
MSID 1
MSID 2
.....}
120
MS
MSID=1
CSG ID list{
CSG ID=x
CSG ID=z
.....}
100

FIG 1A

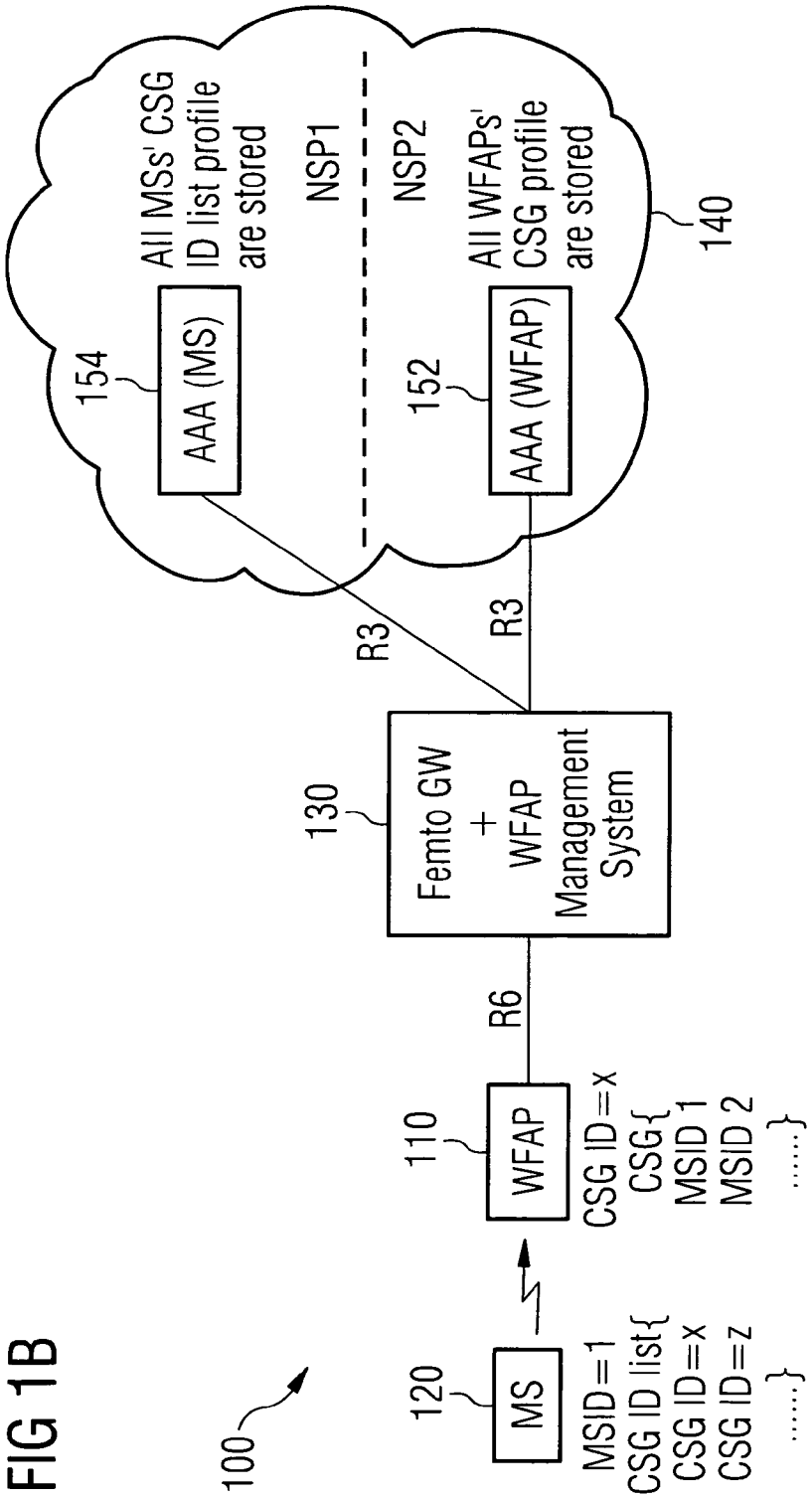
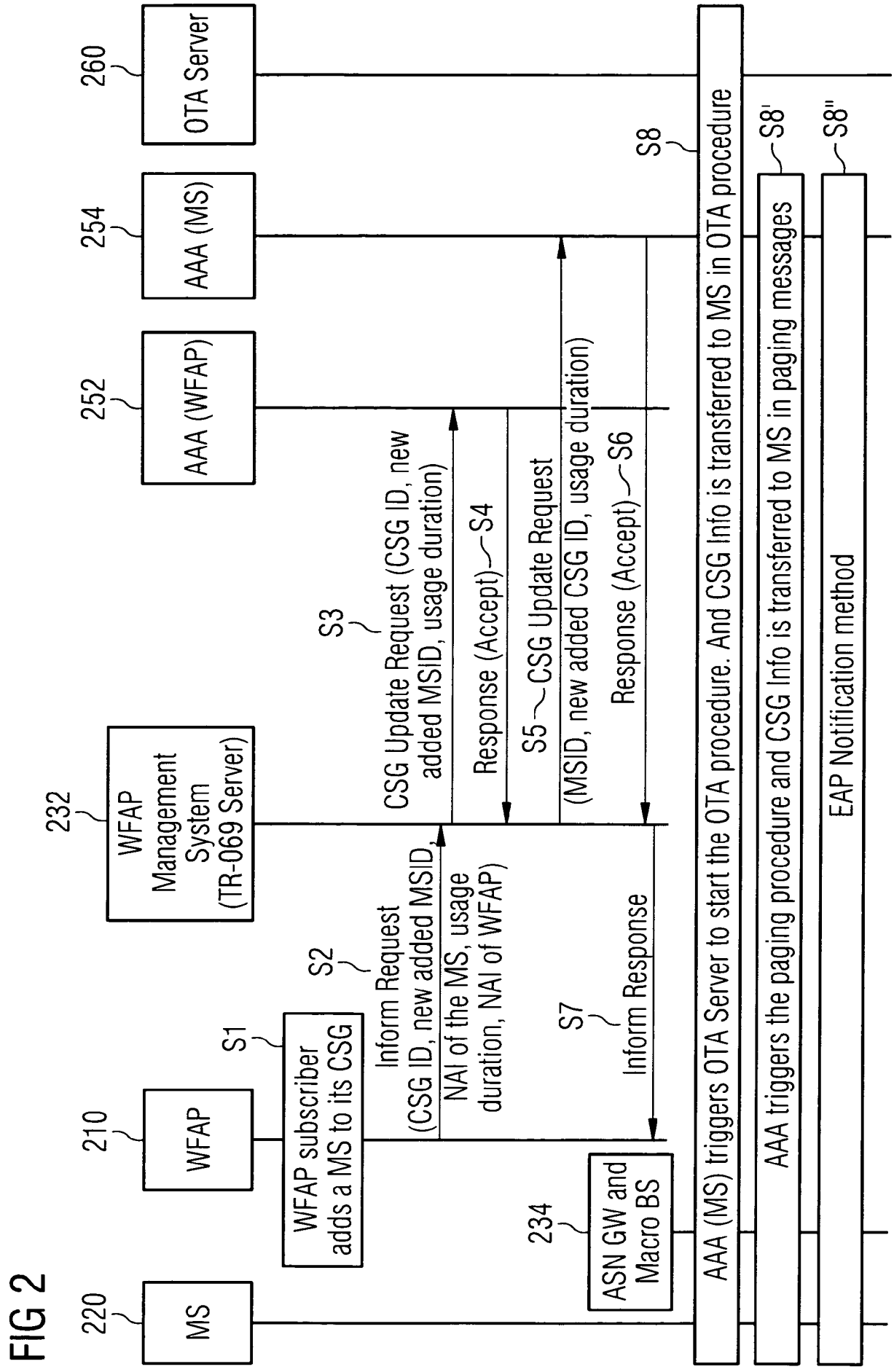

100
120
MS
MSID=1
CSG ID list{
CSG ID=x
CSG ID=z
.....}
110
WFAP
CSG ID=x
CSG{
MSID 1
MSID 2
.....}
R6
130
Femto GW
+
WFAP
Management
System
R3
R3
140
NSP1
NSP2
All MSs' CSG
ID list profile
are stored
All WFAPs'
CSG profile
are stored
154
AAA (MS)
152
AAA (WFAP)

FIG 1B

FIG 2


220
MS
210
WFAP
232
WFAP Management System (TR-069 Server)
234
ASN GW and Macro BS
252
AAA (WFAP)
254
AAA (MS)
260
OTA Server
S1
WFAP subscriber adds a MS to its CSG
S2
Inform Request (CSG ID, new added MSID, NAI of the MS, usage duration, NAI of WFAP)
S3
CSG Update Request (CSG ID, new added MSID, usage duration)
S4
Response (Accept)
S5
CSG Update Request (MSID, new added CSG ID, usage duration)
S6
Response (Accept)
S7
Inform Response
S8
AAA (MS) triggers OTA Server to start the OTA procedure. And CSG Info is transferred to MS in OTA procedure
S8'
AAA triggers the paging procedure and CSG Info is transferred to MS in paging messages
S8''
EAP Notification method

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/054815

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W12/00
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)
H04W H04L

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.
X	WO 2009/045335 A2 (LUCENT TECHNOLOGIES INC [US]; MORGAN TODD CARTWRIGHT [US]; PATEL SARVA) 9 April 2009 (2009-04-09) page 9, line 31 - page 13, line 28; figures 1-3	1-14
A	US 2007/183427 A1 (NYLANDER TOMAS [SE] ET AL) 9 August 2007 (2007-08-09) paragraphs [0075] - [0087]; figure 1C	1-14

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

[X] 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

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 June 2010	23/06/2010

Name and mailing address of the ISA/	Authorized officer
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Form PCT/ISA/210 (second sheet) (April 2005)

International application No
PCT/EP2009/054815

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	"3rd Generation Partnership Project; Technical Specification Group Radio Access Network; UTRAN architecture for 3G Home NodeB; Stage 2 (Release 8)" 3GPP STANDARD; 3GPP TS 25.467, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, no. V8.1.0, 1 March 2009 (2009-03-01), pages 1-26, XP050369092 paragraph [4.1.1.] paragraph [6.1.1.]	1-14
A	"TR-069 CPE WAN Management Protocol v1.1 Issue 1 Amentment 2" BROADBAND FORUM TECHNICAL REPORT,, no. 1 amendment 2, 1 December 2007 (2007-12-01), pages 1-138, XP002493850 paragraph [A.3.3.1.]	1-14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2009/054815

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2009045335 A2	09-04-2009	NONE	
US 2007183427 A1	09-08-2007	NONE	