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For : SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

EXPRESS MAIL CERTIFICATION

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TRANSMITTAL LETTER FOR
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Sir:

Transmitted herewith for filing are the ☒ specification; ☒ claims; ☒ abstract; ☒ executed declaration; and ☒ PrintEFS for the above-identified patent application.

Also transmitted herewith are:

☒ Seventeen (17) sheets of:

☐ Formal drawings.

☒ Informal drawings. Formal drawings will be filed during the pendency of this application.

Google Exhibit 1002
Google v. Mullen

☐ An assignment of the invention to _____
☐ A check in the amount of $40.00 to cover the recording fee.

☐ An associate power of attorney.

☐ A certified copy of the priority document, _____ application, No. _____ , filed _____.

The filing fee has been calculated as shown below:

FOR	NUMBER FILED		NUMBER EXTRA		RATE	=	FEE
BASIC FEE						=	$375.00
TOTAL CLAIMS	2	- 20 =	0	x	$ 9	=	$ 0.00
INDEPENDENT CLAIMS	1	- 3 =	0	x	$ 42	=	$ 0.00
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JDM/002

SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

Background of the Invention

[0001] This invention relates to systems and methods for determining a device's location. More particularly, this invention relates to systems and methods for remotely determining a device's location.

[0002] The Global Positioning System (GPS) has been developed in which a ground-based system can receive GPS signals from satellites and determine its location based on the time that it takes the GPS signals to reach the ground-based system. Generally, three satellite signals are needed to determine where in the world a receiver is located (i.e., position triangulation).

[0003] GPS systems have been integrated into cellular phones. However, these systems are deficient because the location of a device that is determined by these GPS signals are only minimally utilized. It is therefore desirable to provide systems and methods which better utilize the information about a device's location.

Summary of the Invention

[0004] In accordance with the present invention, systems and methods are provided for locating cellular phones. More particularly, the present invention provides systems and methods for allowing a user of a cellular phone (e.g., a requesting user or a requestor) to locate the position of a different user's cellular phone (e.g., a requested user) based upon requestor-assigned access rights.

[0005] One object of the present invention is to provide a security feature which allows a user to limit and/or deny location access to a particular user. In preferred embodiments, only the users that have been granted access to the location of a user's cellular phone can actually locate that user's cellular phone. Furthermore, different types of access levels may be provided that allow a user to filter location information to a different user. In this manner, a cell phone user may give access, through his or her cell phone, to a friend so that the friend can locate him or her dependent on the level of access that is granted to that friend.

[0006] For example, suppose that Phil tells Bill that he will be shopping in Manhattan and that Bill should locate him when Bill gets to Manhattan through their cell phones. In such an example, Phil may grant Bill access the exact location of his cell phone for a specific period of time (e.g., the next two hours). As a result, when Bill tries to access Phil's location, Bill will be told exactly where in Manhattan Phil's cell phone is located. Thus, Bill does not have to contact Phil directly to see where he is and, therefore, Phil does not have to spend any time giving

Bill verbal directions; Bill can simply see what store Phil is currently in and go to it.

[0007] As mentioned previously, levels in the scope of access may be controlled by a user such that, for example, only a user's exact location, approximate location, city, state, or country can be accessed by a particular user.

[0008] Location alerts and monitoring features are also provided. For example, Phil may give Jen, a resident of Pittsburgh, city access so that when Phil travels into Pittsburgh, Jen will be alerted of Phil's presence. Such an alert may take the form of, for example, a display on Jen's cell phone that communicates to Jen "Phil is in Pittsburgh."

[0009] Locating a cellular phone may be accomplished in several ways. For example, satellite positioning systems such as the Global Positional System and the soon to be deployed Galileo system may be used to locate a user's cell phone.

[0010] User positions and security settings may be regularly or manually transmitted to a remote system, such a remote database so that requesting users can locate a requested user's position even if the requested user turns his/her cell phone OFF. Placing the security measures on a remote system (e.g., remote database, computer, or server) provides an information brokering scheme such that the system is still operable even when cell phones are added, removed, or modified from the system.

[0011] Additionally, the present invention may be configured to provide additional information about the location of a user. Such additional information may be, for example, a map, a location marker on a map, a

map that changes as the user moves, a compass, coordinates of the located cell phone, directions to the located cell phone, where a user is in relation to another user, and information about the location the located user is currently positioned in or nearby locations such as landmarks. Such information may be provided by a remote information provider (e.g., a remote map information provider) and accessed by an information broker through a communications network.

[0012] Many other features are also employed that realizes advantageous locating functionality. As per an example, suppose that a wife wants to see if her husband has left work yet. She can locate her husband, without having to talk to him, and realize that he is driving home on a highway. Thus, a travel time option may be provided to the user. This option would compute the distance between the wife's location and husband's location by taking multiple location readings of the husband's location to see how fast the husband is traveling. Alternatively, because the husband's position will map to a highway, the system may assume that the user is driving and may provide the wife with an estimate on the husband's arrival time based on an assumed route. In this manner, the present invention may determine how much time it will take the husband to reach the wife and display this information to the wife.

[0013] As per other examples, a "see my friends" option may also be provided that brings up a map of a desired area. Dots or symbols may be present on the map to signify the location of all user's from which the requesting user has location information for. Similarly, a "find closest friend" option may be

employed which finds the closest user with which the requesting user has location access to.

[0014] A cell phone location may by accessed by a variety of other devices. Alternatively, a cell phone may be used to access the location of a variety of other devices. For example, if the wife was at home, that wife may connect to the internet and access a remote database to either provide the most recent location information about the husband's cell phone to her or request a location update from the husband's cell phone. The wife's location may be already stored in such a database by associating the location to the IP address of the computer or by a manual input of the wife's location. The wife's identity may be determined by, for example, a login and password on a website. Thus, the above-identified security measures are not limited to device-to-device locating rather user to user locating; the wife may only access the husband's location if the husband has granted access for the wife to do so. If, by accident, the wife's cell phone breaks, she may login on a friend's cell phone and determine the husband's location according to the device that the husband is logged into.

[0015] Security is preferably taken into account in the present invention and, therefore, location rights for a specific user may be given to a different user only by that specific user. However, a user may request location access rights from a different user. For example, a user may be provided with a request location screen on his cell phone and that user (e.g., user "X") may enter in the cell phone number of the cell phone whose location is desired. The user associated to the entered cell phone number may then

receive an alert that says "user X has requested access to your location." Location access may then be given or denied on multiple levels and the requesting user notified of the decision.

[0016] The location feature of the present invention may be turned ON or OFF at any time. Users may be added, individually or in groups, to a list of users with location access rights to a specific user by that specific user. A specific user may, at any time, modify, delete, or add users allowed to access his or her location. Login and password information may be included to increase security or to create a user profile, allowing a specific user to log into any cell phone and be recognize by the present invention (and thereby be located with that cell phone or locatable device).

Brief Description of the Drawings

[0017] The principles and advantages of the present invention can be more clearly understood from the following detailed description considered in conjunction with the following drawings, in which the same reference numerals denote the same structural elements throughout, and in which:

[0018] FIG. 1 is a network topology of a cell phone locating network in accordance with the principles of the present invention;

[0019] FIG. 2 is a flow chart of the locating feature in accordance with the principles of the present invention;

[0020] FIG. 3 is an illustration of a cell phone in accordance with the principles of the present invention;

[0021] FIG. 4 is a display screen for a locate feature in accordance with with the principles of the present invention;

[0022] FIG. 5 is a display screen for a retrieving location status feature in accordance with the principles of the present invention;

[0023] FIG. 6 is a display screen for a displaying location feature in accordance with the principles of the present invention;

[0024] FIG. 7 is a display screen listing options for a locate feature in accordance with the principles of the present invention;

[0025] FIG. 8 is a display screen of a failed locate feature due to insufficient rights in accordance with the principles of the present invention;

[0026] FIG. 9 is a display screen of adding and modifying locate rights and options to a user in accordance with the principles of the present invention;

[0027] FIG. 10 is a display screen of assigning location rights to a user in accordance with the principles of the present invention;

[0028] FIG. 11 is a display screen of alert options in accordance with the principles of the present invention;

[0029] FIG. 12 is a display screen of an alert feature in accordance with the principles of the present invention;

[0030] FIG. 13 is a display screen of a login feature in accordance with the principles of the present invention;

[0031] FIG. 14 is a display screen of a login feature in accordance with the principles of the present invention;

[0032] FIG. 15 is a wireless device in accordance with the principles of the present invention;

[0033] FIG. 16 is an embodiment of a network topology in accordance with the principles of the present invention;

[0034] FIG. 17 is an embodiment of a locating feature in accordance with the principles of the present invention; and

[0035] FIG. 18 is an embodiment of a communications signal in accordance with the principles of the present invention.

Detailed Description of the Invention

[0036] FIG. 1 depicts a network topology of device location network 100 incorporating principles of the present invention. Network 100 includes one or more positioning satellites 110, 112, and 114 that can locate the position of one or more cell phones 120, 122, 126, and 124 (and other locatable devices) on Earth 101. Positioning satellites 110, 112, and 114 may be, for example, the Global Positioning System (GPS) or the upcoming Galileo satellite network.

[0037] Preferably, any cell phone in network 100 may locate a different cell phone, as long as access to location information is allowed, through the utilization of positioning satellites 110, 112, and 114. Persons skilled in the art will appreciate that other positioning systems and methods may be used in locating the position of a user on a cell phone of network 100.

[0038] To route information to and from a cell phone of network 100 additional facilities and communication paths may be included. For example, a main facility (not shown in FIG. 1) containing user location access rights may be included in network 100. Such a main facility may retrieve location information directly from a positioning system or a cellular phone and then route this information to a cellular phone or positioning system.

[0039] Persons skilled in the art will appreciate that if the Global Positioning System (GPS) is used as the positioning system then GPS receivers will be incorporated into cellular phones of the present invention. Persons skilled in the art will also appreciate that devices other than cellular phones may include positioning features. For example, watches, clothing, laptop computers, personal digital assistants (PDAs), may all contain location systems (e.g., GPS) and utilize the security principles of the present invention to allow different user's to access these locations.

[0040] FIG. 2 shows flow chart 200 of a simplified locating feature constructed in accordance with the principles of the present invention. Step 202 initiates when a user requests the location of another user's cell phone. Step 206 evaluates if the user initiating the location request has the rights to access the location of the desired user. If no access rights for the requesting user have been granted then step 204 will preferably inform the requesting user that he/she has not been given access to the requested location. In this manner, every user may assign rights (e.g. govern the security) to whom may or may not

locate him/her. In preferred embodiments, these rights will be stored in, or functionality executed from, a remote facility and accessed and utilized by a user's cell phone or other requesting device (e.g., a watch or PDA).

[0041] If access has been given by a particular user that allows for the requesting user to locate that particular user, step 208 is initiated and the allowed location information is provided to the user in step 210. Step 208 may optionally filter the location information such that only a portion information is passed to the requesting user. The requested user may have, for example, defined that the requesting user only can obtain the city, state, or country of his/her location. Persons skilled in the art will appreciate that only the location of the desired user needs to have a cell phone or a positioning system. The requesting user may user other means (e.g., the internet) to request the location of the desired user.

[0042] Persons skilled in the art will appreciate that the location of a user's cell phone may be retrieved, in step 208, from a remote database, facility, distribution center, or any other system. More particularly, a remote database may periodically request the location of a cell phone user with a positioning system and store this information. This database may also keep a record of those people allowed to access that user's location, the extent to which access is allowed, and the extent to which a user has requested a user's location. A user may update, add, manipulate, or remove access at any time by doing so at this database. Thus, a requesting user only has to contact the remote database, have his/her identity

recognized, have his/her access rights for the requested user location determined, and, if the requesting user has the correct access rights, be provided with the requested user's location.

[0043] Instead of a remote database periodically obtaining location information for a user, the database can obtain a user's locations when a request is made for that user's location, providing the requesting user has access to the requested user's location. However, persons skilled in the art will recognize that a remote database is utilized in the above examples that contains the locations, in most circumstances, of a multitude of users. Thus, to increase security even more, a requesting user's cell phone may directly request a user's location from the requested user's cell phone without the need for a database. In such an example a user adds, manipulates, or removes access rights locally on his/her cell phone and does not have to worry about security issues that surround placing his location on a remote database. Furthermore, in such an embodiment a user's location does not have to be saved anywhere, a positioning system can just be "read" by a requesting user with the appropriate access rights.

[0044] However, by recording a user's location on a device, e.g., a cell phone's memory or in a remote database, novel applications may be utilized. For example, whenever a user makes a credit card purchase, a credit card authorization system can record the location of a cell phone associated to the purchasing user. In this manner, a new system and method of fraud protection is introduced. The credit card authorization system may, for example, reject a

purchase if the purchaser's cell phone (or watch, clothing, PDA, or other positioning enabled device) is not in the vicinity of the purchase. Alternatively, the credit card authorization system may request a second form of identification if the purchaser's cell phone location does not correlate to the location of the purchase. Additionally, the credit card authorization system may call the purchaser's cell phone and request authorization for the credit card purchase. However, such features would preferably first involve the user/purchaser giving the credit card authorization system access to the location of his/her cell phone.

[0045] As per another application, a unique dating/matching service could be embodied. For example, a user may store a number of preferences in a matching profile. These preferences may describe what type of person he is interested in meeting. Additionally, a user may store, preferably locally (for the dating/matching feature) but alternatively at a remote location, his/her own profile that has data describing similar attributes for what he/she is looking for. For example, an entry in a user's profile may be "male" and an entry in "looking for" profile may be "female." When a user comes within a certain distance of a user (determined by comparing locations of a user) that fits his/her "looking for" profile, the user may be alerted of the proximity of a matching user. Preferably, the particular user is only alerted if the "looking for" user has entered in attributes similar to the particular user's attributes and is also alerted of the particular user. The next stages of such an application could include, for example,

requesting access to a form of communication. Such a form of communication could be for example, talking on the phone, instant messaging, or delivering an email address. Persons skilled in the art will therefore appreciate that many useful applications may be constructed using the principles of the present invention.

[0046] FIG. 3 depicts cell phone 300 constructed in accordance with the principles of the present invention. Cell Phone 300 preferably includes speaker 330, antenna 310, display screen 320, control keys 360, alpha-numeric keys 350, and microphone 340. Cell phone 300 also preferably may include, for example, a communications transmitter (not shown), communications receiver (not shown), memory (not shown), positioning device (not shown), and a microprocessor (not shown).

[0047] Cell phone 300 may also include locate button 380. Cell phone 300 may be configured such that if locate button 380 is pressed, a locate feature is initiated (e.g., display screen 400 of FIG. 4 is initiated). Alternatively, cell phone 300 may be configured such that if locate button 380 is pressed, a location signal is sent to a remote storage area (e.g., a remote database), thus manually updating the user's location. This latter functionality may be useful when a user does not want his/her location accessed. As in another alternative embodiment, cell phone 380 may be configured such that if locate button 380 is pressed, the locating features of cell phone 300 are toggled between ON and OFF. Person skilled in the art will appreciate that locate button 380 may be configured to produce a variety of useful functionalities.

[0048] FIG. 4 depicts display screen 400 that is displaying a locate feature constructed in accordance with the principles of the present invention. The locate feature of display screen 400 may be included, for example, in cell phone 300 of FIG. 3 and displayed to the user of cell phone 300 of FIG. 3 when that user requests the location of a different user of the present invention. The programming for the feature may, for example, be stored in the memory of the cell phone and executed by the processor at a user's request. Locate Feature 400 includes identifier list 410 of alpha-numeric identifiers for users stored in the memory on cell phone 300 (FIG. 3) or at a remote location. More particularly the user of display 410 may locate a user contained in identifier list 410 by selecting an appropriate user identifier 420.

[0049] The user identifiers (e.g., "Susan Pracht") in identifier list 410 are selectable and may be selected by control keys 360 of FIG. 3. Highlight window 410 may be used to prompt the user what identifier from list 410 is currently selected any may be controlled, for example, by the input keys of the cell phone (e.g., keys 350 and 360 of FIG. 3). Identifiers may be associated to, for example, cellular telephone number, user profiles, or any other identifier that may be associated to a locatable device or user interacting with a locatable device.

[0050] Persons skilled in the art will appreciate that display screen 400 may be provided to a user of devices other than wireless devices. For example, display screen 410 may be provided to a user of a personal computer with no positioning system. Preferably, however, the security measures in

accordance with the principles of the present invention are still abided to (e.g., access has been granted to the identifier associated to the requesting user). In this manner, a user can control who can access his/her wireless device (e.g., cell phone).

[0051] Persons skilled in the art will appreciate that identifier list 410 may be configured, for example, to contain only those users in which the user of cell phone 300 (FIG. 3) has locate access rights to or any user stored in cell phone 300. Persons skilled in the art will also appreciate that devices other than cell phone 300 may be used to incorporate the features of the present invention. Such devices could include, for example, personal digital assistants (PDAs), laptop, GPS pagers, GPS watches, car positioning devices, or any other devices that can be located. One advantage of the present invention is that it allows a mobile device with a positioning system to locate a different mobile device with a positioning system while still retaining a high level of location security and privacy.

[0052] FIG. 5 is display screen 500 for retrieving location status feature in accordance with the principles of the present invention. The selected identifier may be incorporated into display screen 500 through location status display 510 to inform the user of the status of the location retrieval. For example, display screen 500 may display "locating user" while a request is being processed by a remote facility or database.

[0053] FIG. 6 shoes display screen 600 for a display location feature constructed in accordance with the principles of the present invention. When a location

is retrieved for the requested user, the location may be displayed on Display Screen 600 through primary location information 610. Depending on what scope the requesting user has access to primary location information 610 may include, for example, the country, state, city, exact location, or any combination thereof of location information to the user. For example, if the user requesting the location of a desired user has been given unlimited location access by the desired user, primary information 610 may include the exact location of the user.

[0054] Secondary location information 620 may be included to supplement the requested users exact location so that the requesting user may have more of an idea of where the requested user is located. For example, if the desired user is located in a mall, primary location information 610 may be the address of the mall. In such an example, secondary location information 620 may be included and display, to the requesting user, the name of the mall.

[0055] Directional information 630 may also be included on display 600 or any other display of the present invention. Directional information 630 may include a digital compass 632 so that the user of cell phone 300 (FIG. 3) knows what direction he or she is facing in. Digital compass 632 may be connected to a direction sensitive device (e.g, mechanical compass) in order to gather directional information. Directional arrow 633 may also be included in Display 600 to indicate where the requested user's location is relative to the location and direction of cell phone 300 (FIG. 3) (e.g, the requesting user). Persons skilled in the art will appreciate that for some

directional information 630 the location of the requesting user must be obtained. This information may be obtained either from cell phone 300, a remote facility, or by any other suitable means. If the information is gathered from a location gathering device other than the requesting user's device (e.g, cell phone 300 (FIG. 3)), then the user's device may communicate from this other location gathering device. Once both the locations of the requesting and requested/desired users are known, this information may be utilized in a number of features incorporating the principles of the present invention.

[0056] Distance information 634 is one such feature that displays the distance between the locations of the requested and requesting users (e.g., distance between the locations of the requested and requesting devices). Directional information 630 may contain many other elements to enhance the utility of the present invention. For example, a map (not shown in FIG. 6) may be included in display 600. This map may be of the area surrounding either the requested, the requesting user's location or both. Information may be included on the map to show the shortest path between the location as well as information about the surrounding area (e.g, area names, store names, etc.). Other information may include, for example, time to reach the destination according to specific types of travel (e.g, subway, walking, running, driving) and the direction the requested user is traveling in.

[0057] Many uses for this information may be utilized by a user. For example, if Jane calls Bill and Bill says "I am roaming midtown manhattan shopping why don't you join me", no other call to Bill is

needed. Bill simply has to give Jane access to his location and Bill can continue shopping without having to worry about meeting up with Jane at a specific location.

[0058] In some instances, it may be beneficial to find the speed and direction of a requested user. For example, if a wife wants to see how long before her husband arrives home, the wife can use this feature of the present invention. This feature may find the husbands location multiple times in a determined amount of time. Through this information the feature may determine the speed and direction that the user is traveling. Using this speed, for example, this feature may display to the wife that the husband "is 10 minutes away" in directional information 630. In doing so, the need for a call to the husband to determine his location is eliminated.

[0059] Persons skilled in the art that the location of multiple users may be displayed on display screen 600. For example, suppose Jeff, Susan, and Chrissy are at a concert. If all three of these users have unlimited access to the other users, principles of the present invention would allow for a map to be displayed on each of the three locating devices with locator designations for each of the users. Using such map, the group may be able to find themselves in relative location to one another and decide, if need be, on the easiest location for them to meet. Thus map 660 may be included on display screen 600 and display the locations of multiple users (e.g., user's 621 and 622).

[0060] More region 640 designates that more options or information may be retrieved or performed using principles of the present invention. A user may use

control keys 340 (FIG. 3) on cell phone 300 (FIG. 3) to perform the functionality associated with more region 640.

[0061] FIG. 7 shows display screen 700 for locate listing options in accordance with the principles of the present invention. Display screen 700 includes selectable options list 710 and highlight window 720 and may be displayed to the user, for example, through the activation of functionality associated by more region 640 (FIG. 6). Options list 710 may include any of the features of the present invention. For example, options list 710 may include options activating a display screen of a map of the requesting user's location, a map of the requested user's location, directions to the requested user's location from the requesting user's location, travel time for the requesting user, travel time for the requested user, and options to set location alerts.

[0062] FIG. 8 shows display screen 800 of a failed locate feature due to insufficient rights in accordance with the principles of the present invention. Display scree 800 may be displayed if a requesting user attempts to located a requested user but has not been given access rights by the request user to his or her location. In such an instance insufficient rights message 801 may be prompted on display screen 800.

[0063] FIG. 9 shows display screen 900 of adding and modifying locate rights and options to a user in accordance with the principles of the present invention. A user may give or modify access rights through display 900 to a user identifier in selectable user identifier listing 910. Highlight window 920 may be included to enhance the selecting process.

[0064] FIG. 10 shows display screen 1000 of assigning location rights to a user in accordance with the principles of the present invention. Display screen 1000 may be displayed, for example, after a user has been selected to be given location rights. Display screen 1000 contains selectable location rights listing 1010, in which the selecting process may be enhanced by highlight window 1020. Possible location access rights may be, for example, by country, state, city, exact location, or any other scope of location. Other rights may be assigned such as particular times in the day or time periods at which locations may be accessed.

[0065] FIG. 11 shows display screen 1100 of alert options in accordance with the principles of the present invention. Display screen 1100 allows for a user to set up alerts depending on the location of specific users. Selectable alert listings 1110 are included and may be selectable with highlight window 1120. Examples of alerts that may be included in display screen 1100 may occur, for example, if the requested user is in a specific city or the same city as the user of display 1100, is within a certain distance, or if a user located the user of display 1100.

[0066] The alerts of the present invention may realize useful functionality. For example, suppose Susan Pracht lives in Pittsburgh and rarely comes to the city of the user of display screen 1100 on cell phone 300 (FIG. 3) which is New York City. The user of cell phone 300 (FIG. 3) may then use display screen 1100 and set an alert such that if Susan Pracht ever enters New York City, he or she would be alerted of Susan Pracht's presence.

[0067] FIG. 12 shows display screen 1200 of an alert feature in accordance with the principles of the present invention. Display screen 1200 includes an alert message and is displayed to a user when an event occurs that is designated by the user in display screen 1100 (FIG. 11). Continuing the example from FIG. 11, if Susan Pracht enters New York City, alert message 1210 would prompt the user that this event has occured.

[0068] FIG. 13 shows display screen 1300 of a login feature in accordance with the principles of the present invention. In order for users to be identified by other user's cell phones or locating devices a user profile may need to be stored remotely from such devices. In such instances user profiles would be used as the locating identifier and the devices into which these profiles are logged into (recognized by) would allow for the user to be located. Display screen 1300 allows for a user to log into a locating device of the present invention. Logging into a device also adds a level of security to the present invention, especially when combined with a password. A user may use the controls of the device of the present invention to enter login 1310 of display 1300.

[0069] In this manner a user may use another user's location device (e.g., cell phone) to locate a user or may use, for example, the internet to locate a user. Additionally, in this manner, a user may change the device being located. For example, a user may use his or her car GPS system or other systems in accordance with the principles of the present invention to be located instead of his or her cell phone. To further this example, a user may log into a web site on the internet and designate his or her current location as

home, or any other location, thus eliminating the need for locatable device entirely.

[0070] FIG. 14 shows display screen 1400 of a login feature in accordance with the principles of the present invention. Display screen 1400 may be used by a user to enter a password associated to his profile, identity, or cell phone functionality access. A user may enter password 1410 using the controls of the device of display screen 1400 (e.g., cell phone 300 of FIG. 3). By including a login/password scheme a user can be identified by a remote facility (e.g., a remote database) so that the user's location can be recorded/updated by multiple devices. Additionally, a login/password adds an extra level of security.

[0071] FIG. 15 shows cell phone 1500 that may be utilized to carry out the functionality in accordance with the principles of the present invention. Cell phone 1500 includes receiver/transmitter 1510, microprocessor 1520, positioning system 1530, and memory 1540.

[0072] Persons skilled in the art will appreciate that receiver/transmitter 1510 may directly communicate with memory 1540 if receiver/transmitter 1510 does not have its own memory (e.g., if receiver/transmitter 1510 are configured to utilize a buffer for capturing incoming communications bursts before demodulation and decryptions).

[0073] Positioning system 1530 may be, for example, a GPS system or a similar positioning system. Positioning system 1530 may include its own receiver for receiving particular signals utilized in positioning cell phone 1500.

[0074] FIG. 16 shows network topology 1600, in which all components of, or a part of the components of, may be utilized to carry out the features in accordance with the principles of the present invention. In this manner, persons skilled in the art will appreciate that multiple system configurations may be utilized. Topology 1600 introduces the diversity of systems that can be utilized to realize such configurations.

[0075] Generally, topology 1600 includes muliple mobile devices (e.g., multiple instances of mobile device 1601), access control devices and location broker devices (e.g., database 1602 and cell phone base station 1603), and non-mobile devices (e.g., grounded non-wireless device 1605). Persons skilled in the art will appreciate that other devices or facilities may be included in topology 1600. For example, one or more positioning systems 1601 may be included in topology 1600 in order to locate particular devices. For example, a positioning receiver (e.g., GPS receiver) may be included in wireless device 1601 with positing system 1601 being a positioning transmitter (e.g., GPS satellite network).

[0076] One or more wireless devices 1601 may be included in topology 1600 and may be, for example, watches, PDAs, cellular phones, radios, cars, or any other mobile device whose location can be determined.

[0077] As previously mentioned, access control and location broker devices may be included in topology 1600. Such devices may be utilized, for example, to store user access rights for a particular user and may contain functionality to request and route a device's location. These devices may be considered information broker's such that devices may be added, removed, or

modified without creating the necessity of having to modify the other devices of topology 1600.

[0078] Database 1602 is one such information broker. Database 1602 may, for example, be located in cell phone base station 1603 if database 1602 is utilized to assist in cell phone locating. Database 1602 may be utilized, for example, to store a history a of a device's locations, a user's list of assigned access rights to other users, a log of a user's call activity, a log of a location initiations, a user profile, login/password information, or any other sort of information. Many features may be provided that utilize such information, For example, n approximate location may be determined for a device that is turned OFF (e.g., by utilizing the device's location history). As per another example, if a cell phone is lost and a new one replaced, information such as, for example, phone books, activity logs, and assigned user access rights may be downloaded/flashed into the cell phone.

[0079] Database 1602 may be accessed either directly (e.g., manually by an user of the device) or indirectly (e.g., periodically) by a cell phone or other device. Alternatively, a device or cell phone may access database 1602 directly (e.g., manually by an administrator of the database) or indirectly (e.g., periodically) by database 1602.

[0080] A credit card authorization system is an example of additional system 1606 that may be added to topology 1600 to realize new features. Such a credit card authorization system, as described above, could utilize a devices location in order to decrease credit card fraud. System 1600 may also be, for example, systems needed to realize the described dating

functionalities or another information provider (e.g., a map information provider).

[0081] Non-wireless devices 1605 (e.g., a personal computer) may be included in topology 1600. Such devices may have locations associated to them or contain a positioning system. These locations may then be associated to a user that is recognized as using the device. For example, if a particular user logs into a non-mobile personal computer, that user's location will be recognized as being the location associated to the personal computer.

[0082] The devices of topology 1600 communicate with each other through communications network 1610. Communications network 1610 may include, for example, any type of communications, routing, amplification, encryption, decryption, parsing, modulation, or demodulation technologies. For example, positioning system 1601 may communicate with wireless device 1601 by sending multiple wireless positioning signals. At the same time, database 1602 may be providing non-wireless device 1605 with a device's location over conventional telephone wires.

[0083] FIG. 17 shows locating feature 1700 in accordance with the principles of the present invention. Locating feature 1701 starts at step 1701 and waits at step 1702 until a location is requested. As stated, a location can be requested in a number of instances and by a variety of different means.

[0084] For example, a location may be requested by a user of a cell phone that desires to locate a friend by locating that friend's cell phone. Alternatively, a device may be triggered to request a location of a mobile device when an event occurs. For example, a

credit card authorization system may request the location of a user's cell phone and the location of a store that just used a credit card associated to the requested user.

[0085] If a location is requested, access rights to the requested location for the requesting device and/or user are obtained at step 1703. Step 1703 may be employed for example, as a call to a database storing a list of assigned access rights for the requested device/user and finding if any access rights were assigned to the requestor's identity. As per another example, step 1703 may be employed as a direct call to the requested device/user.

[0086] Step 1704 determines if the requestor has been assigned access rights to obtain the requested device/user's location. Persons skilled in the art will appreciate that some devices may always have access to a user's location regardless if a user has assigned access rights to the requesting device. In this manner, a device may be set up to always let a user access a location. For example, a mother may purchase a cell phone for a minor and may configure the cell phone to always allow her location information.

[0087] If access rights do exist for the requesting device/user at step 1704 then step 1705 may be initiated and location information may be provided to the requestor. Such location information may be filtered according to the assigned access rights. For example, if a user has only been assigned access rights to obtain the requested user's city location, only the city that the requested user/device is currently located in (or the last city location available) may be obtained. The process then finishes at step 1707 after

the assigned location information has been delivered to the requestor at step 1705. Persons skilled in the art will appreciate that steps may be added to, removed, or modified from locating feature 1700. For example, instead of finish step 1707, step 1702 may be initiated after step 1706 has completed.

[0088] If a requestor has not been assigned rights to access the requested user/device's location as determined by step 1704, then step 1712 may be initiated. Step 1712 informs the requestor that the requestor does not have access rights to obtain the location of a user/device. Step 1711 may follow and provide an opportunity for the requestor to obtain the access rights. More particularly, step 1711 asks the requestor if the requestor would like to request access rights. If the requestor does not want to request access rights, locating feature 1700 may, for example, return to step 1702. Else, access rights may be requested at step 1721. Step 1722 follows and if access rights were given then step 1705 may be initiated. Else, step 1712 may, for example, be re-initiated.

[0089] FIG. 18 shows one embodiment of a cell phone burst that has been configured to embed a device or user's location 1801 between control signals (e.g., synchronization signals) and data signals. Persons skilled in the art will appreciate that some cell phone burst standards (e.g., TDMA and CDMA) have signal portions that are reserved for future technologies. In one embodiment, this reserved portion is utilized to house location information 1801. A cell phone tower or base information may then strip received signals 1800 of location information 1801, store location

information 1801 into a database or other storage device, and deliver the received signals to its desired location. In this manner, a user may refresh his/her location information every time that a cell phone base station receives or routes information for the user. By stripping location information 1801 from signal 1800, the intended receiver does not have access to the location of the device transmitting signal 1800. A signal similar to signal 1800 may be sent to a cell phone that has requested, and has the appropriate location access rights, to location 1801. Location 1701 may also be stored in other portions of signal 1700 that are not reserved portions. For example, a received signal 1800 may store location information in the data portions of signal 1800. In embodiments where additional information is sent about location 1801 (e.g., a map associated with location 1801) utilizing a main data portion of signal 1800 is preferred. Persons skilled in the art will appreciate that signal burst 1800 may actually be any type of communication signal such as, for example, information returned from a database inquiry.

[0090] Persons skilled in the art will also appreciate that the systems and methods of the present invention may be implemented using other locating features and configurations. For example, a user may be manually requested to allow location access rights every time his/her location is requested. As per another example, a user may organize his/her user list into groups and assign access rights to that group (e.g., family member user group, close friend user group). All such modifications are within the scope of

the present invention, which is limited only by the claims that follow.

What is Claimed is:

1. A method of mobile-to-mobile locating, said method comprising:

requesting a location of a first wireless device by a second wireless device;

assigning location access rights to said second wireless device by said first wireless device;

determining said access rights assigned by said first wireless device to said second wireless device; and

providing said location to said second wireless device dependent upon said access rights.

2. The method of claim 1 wherein said first and second wireless devices are cellular phones.

SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

Abstract of the Disclosure

Systems and methods for locating a cellular phone are provided. More particularly, systems and methods for providing the location of a requested user's cellular phone from a requesting user's device (e.g., a second cellular phone) based on access rights defined by the requested user. Location descriptions may be provided at a multitude of levels. For example, if a cellular phone, or an identity associated to (e.g., logged into) a cellular phone, has been given access rights to a cell phone's exact location for an indefinite amount of time, that cell phone can receive, on command, the exact location of the approved cell phone. Other levels of location information that can be granted include, for example, proximities, states, and countries.

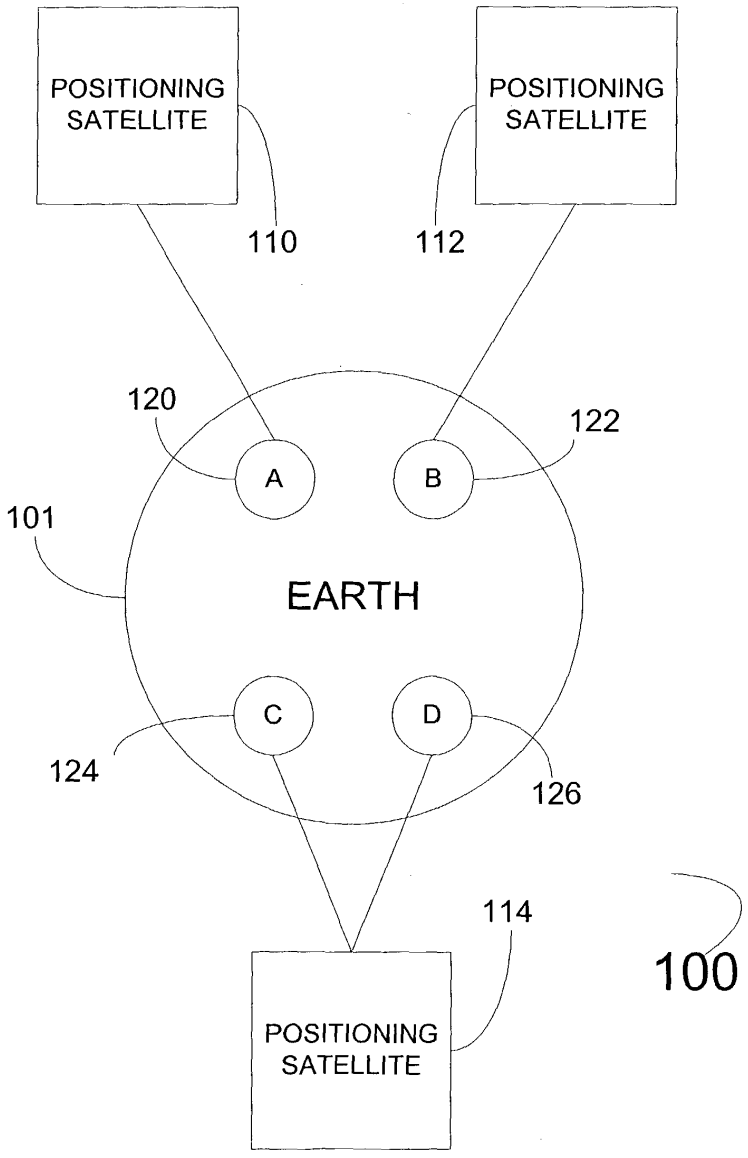

POSITIONING SATELLITE
POSITIONING SATELLITE
110
112
120
122
A
B
101
EARTH
C
D
124
126
114
100
POSITIONING SATELLITE

FIG. 1

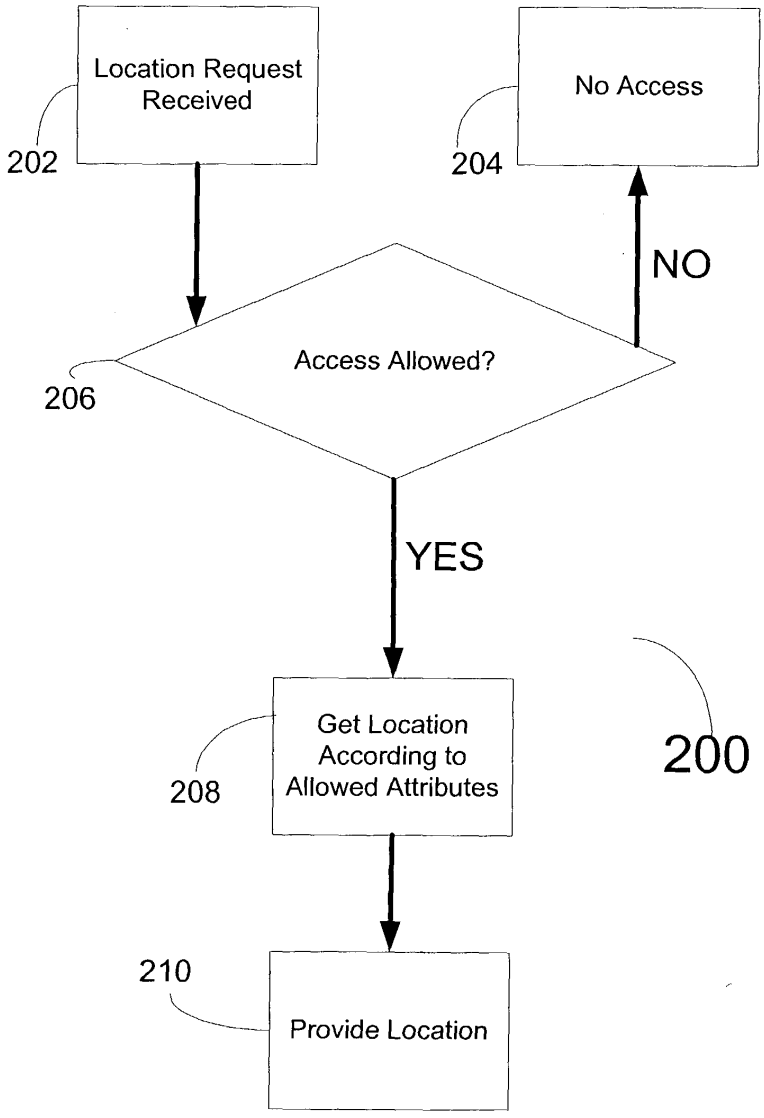

Location Request Received
202
No Access
204
NO
Access Allowed?
206
YES
Get Location According to Allowed Attributes
208
200
210
Provide Location

FIG. 2

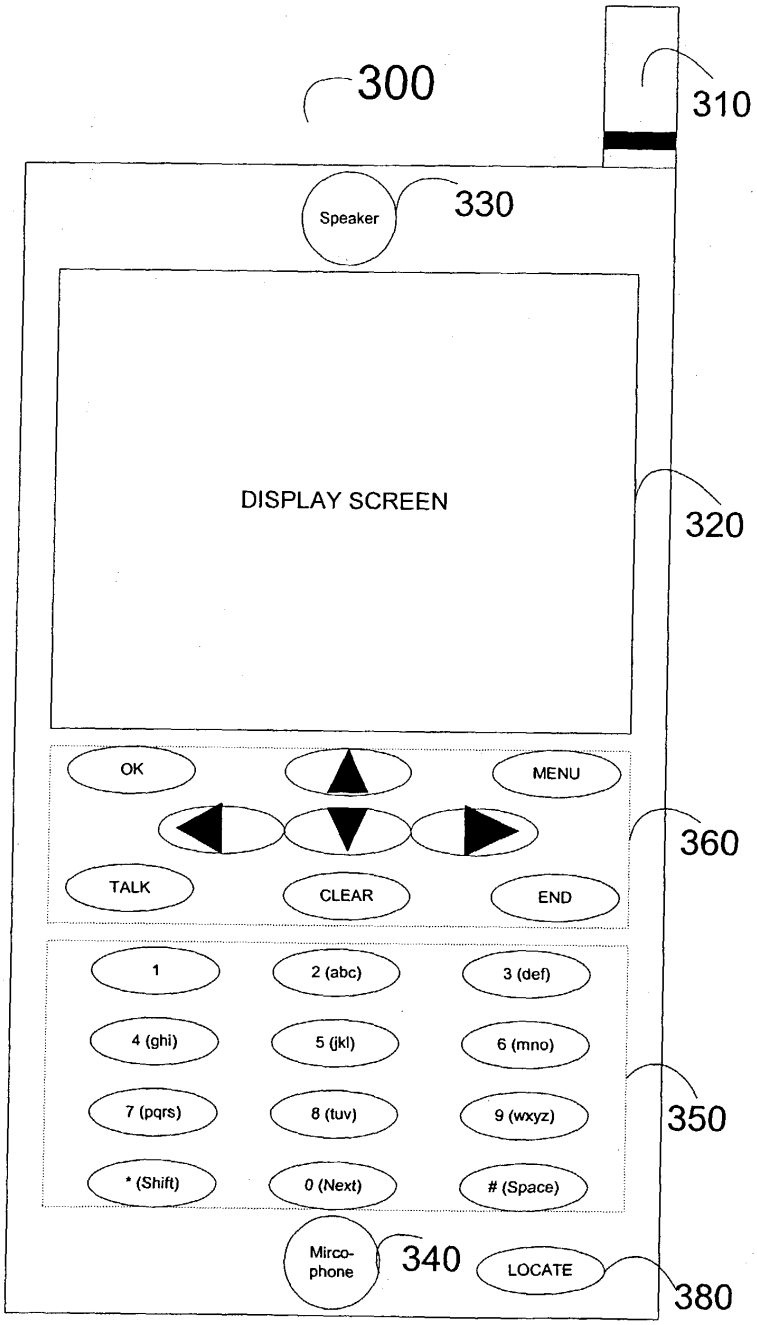

300
310
Speaker
330
DISPLAY SCREEN
320
OK
MENU
360
TALK
CLEAR
END
1
2 (abc)
3 (def)
4 (ghi)
5 (jkl)
6 (mno)
7 (pqrs)
8 (tuv)
9 (wxyz)
350
* (Shift)
0 (Next)
(Space)
Mirco-phone
340
LOCATE
380

FIG. 3

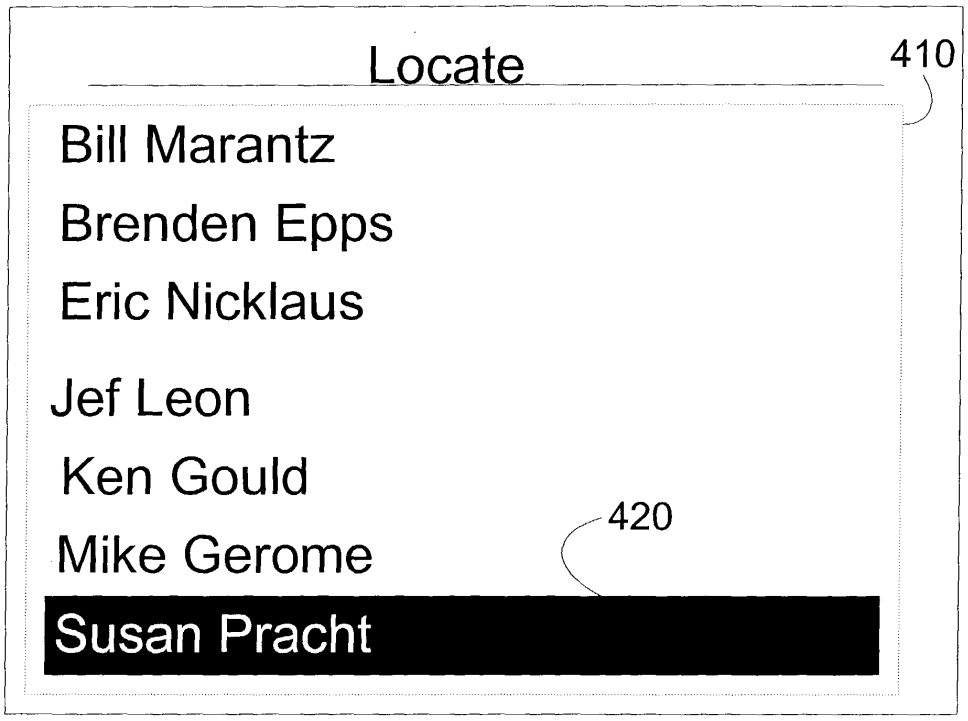

Locate
410
Bill Marantz
Brenden Epps
Eric Nicklaus
Jef Leon
Ken Gould
Mike Gerome
420
Susan Pracht
400

FIG. 4

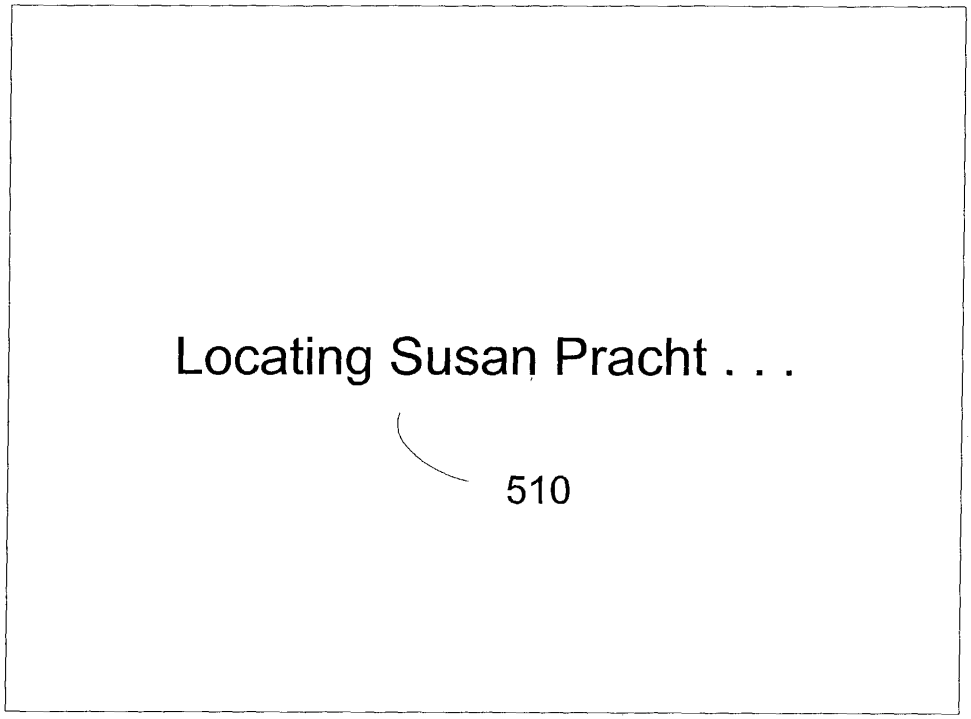


FIG. 5

500

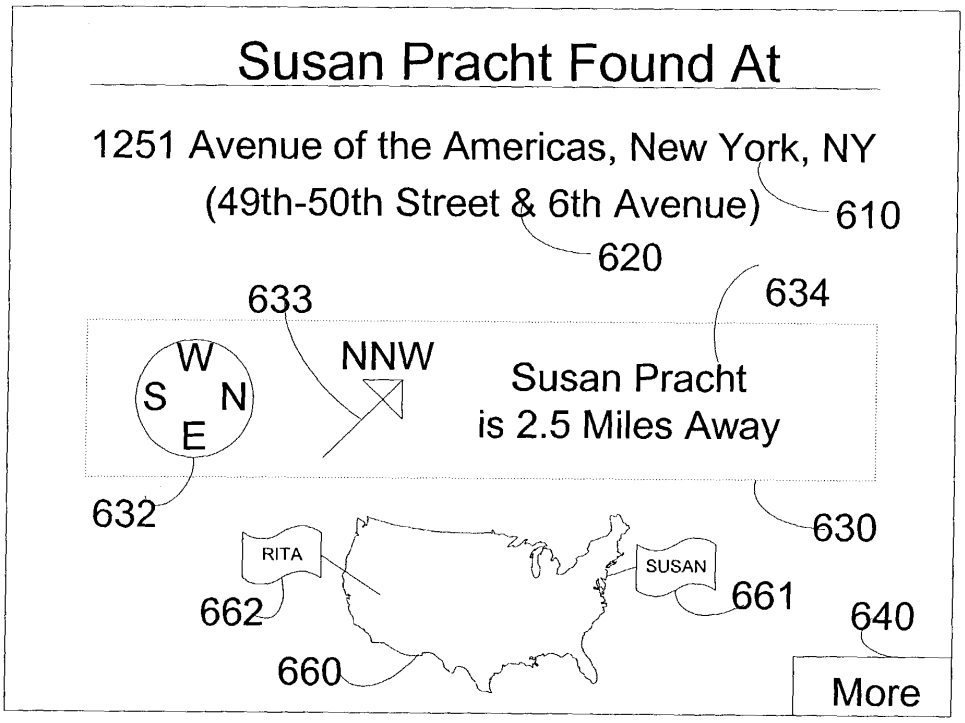

Susan Pracht Found At
1251 Avenue of the Americas, New York, NY
(49th-50th Street & 6th Avenue)
610
620
633
634
W
S
N
E
NNW
Susan Pracht
is 2.5 Miles Away
632
630
RITA
SUSAN
662
661
640
660
More
600

FIG. 6

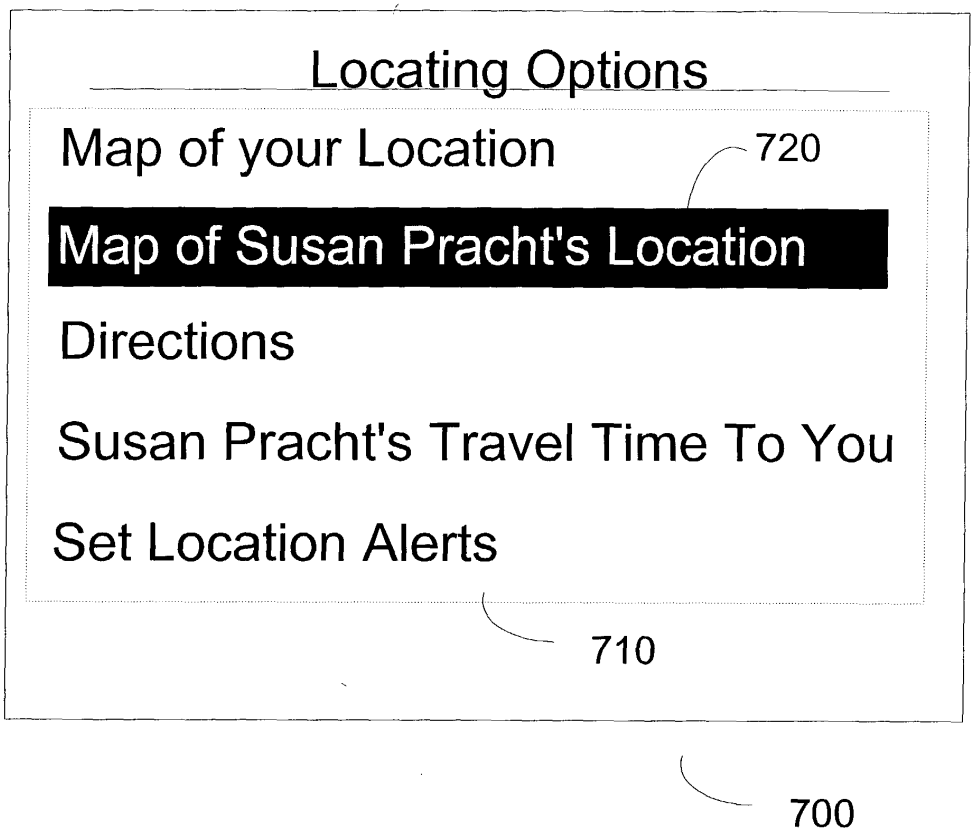

Locating Options
Map of your Location
720
Map of Susan Pracht's Location
Directions
Susan Pracht's Travel Time To You
Set Location Alerts
710
700

FIG. 7

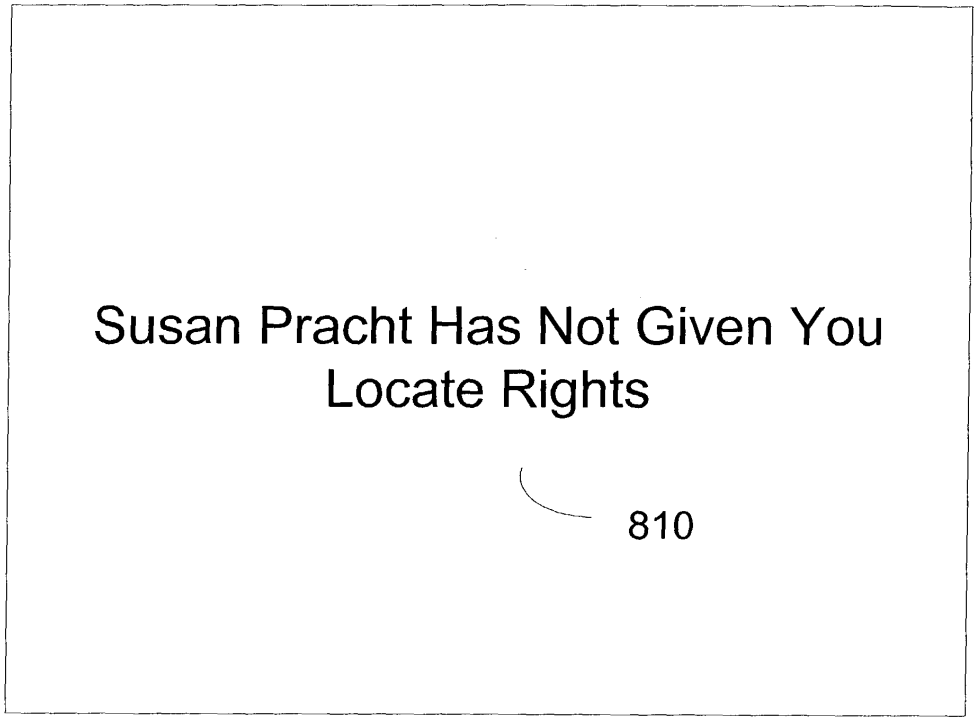


FIG. 8

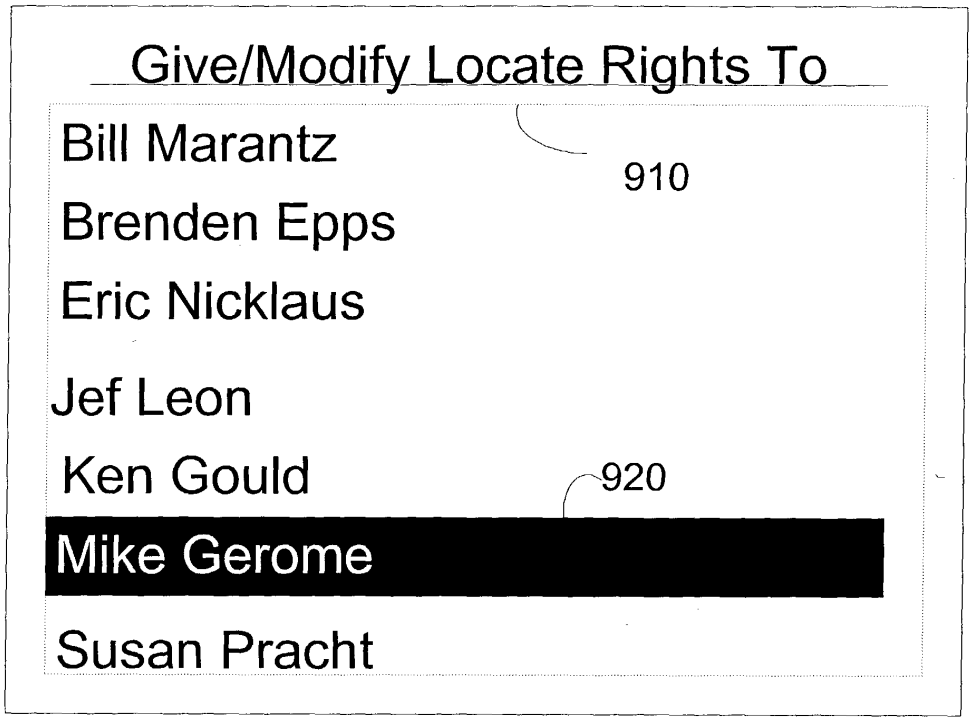

Give/Modify Locate Rights To
Bill Marantz
910
Brenden Epps
Eric Nicklaus
Jef Leon
Ken Gould
920
Mike Gerome
Susan Pracht
900

FIG. 9

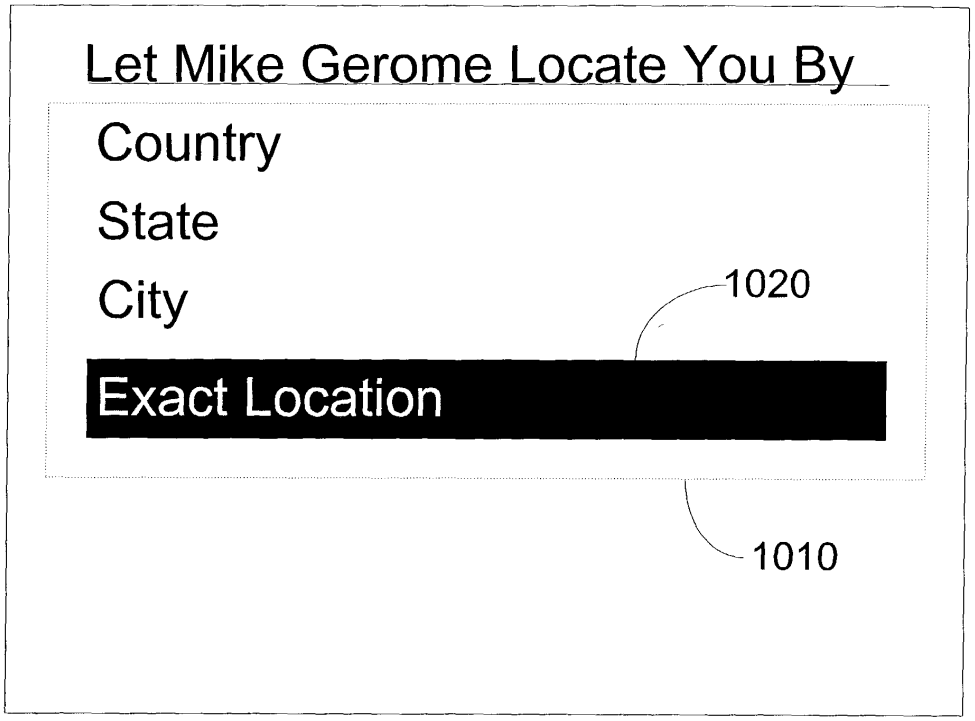

Let Mike Gerome Locate You By
Country
State
City
Exact Location
1020
1010
1000

FIG. 10

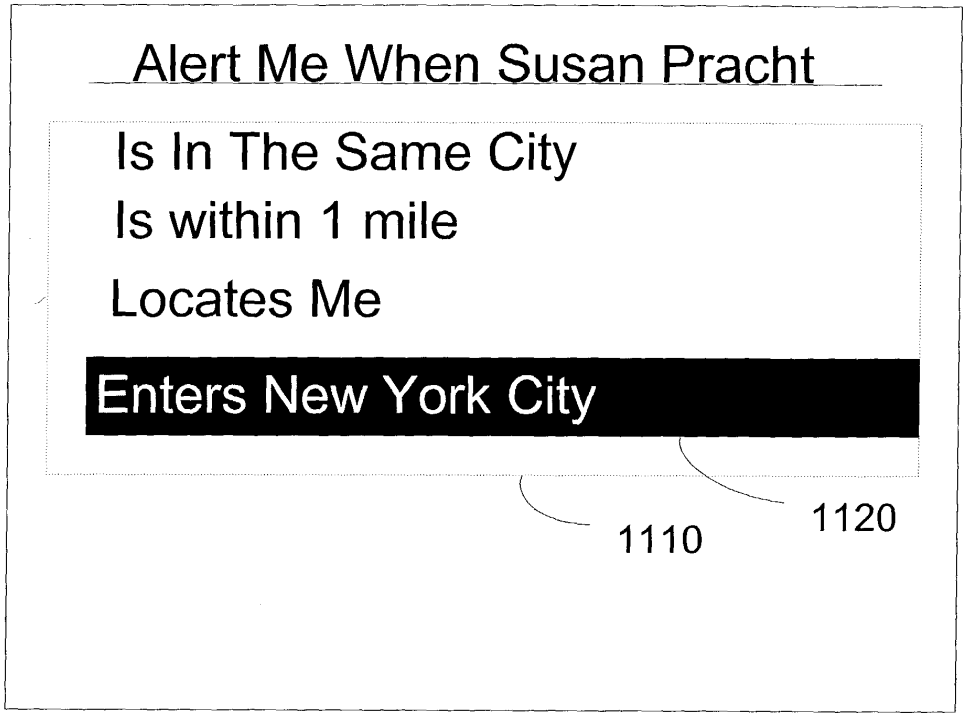

Alert Me When Susan Pracht
Is In The Same City
Is within 1 mile
Locates Me
Enters New York City
1110
1120
1100

FIG. 11

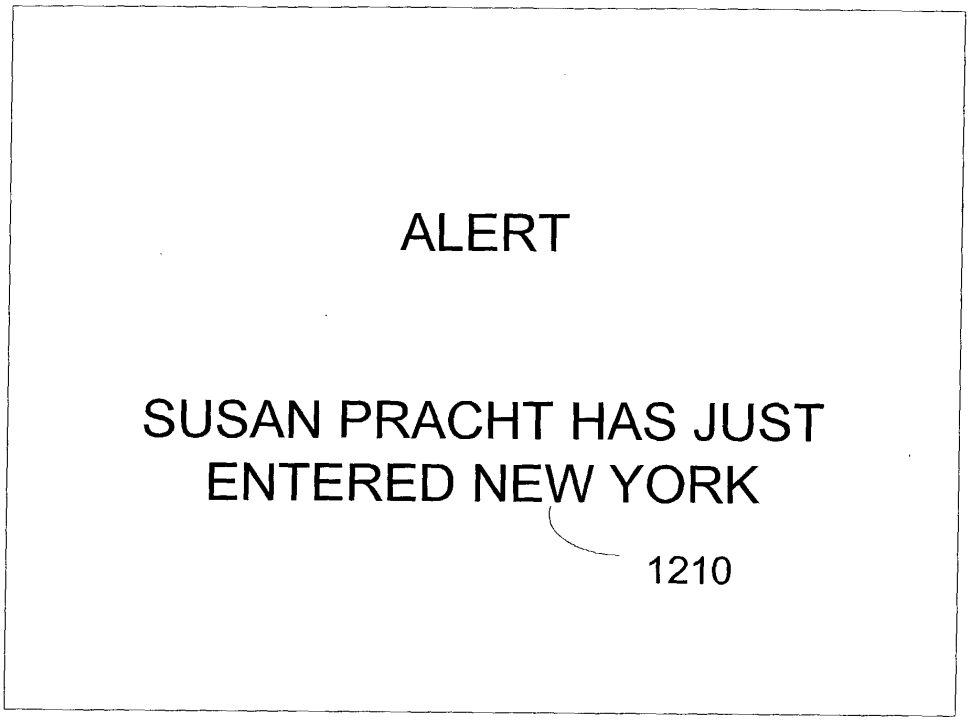


FIG. 12

1200

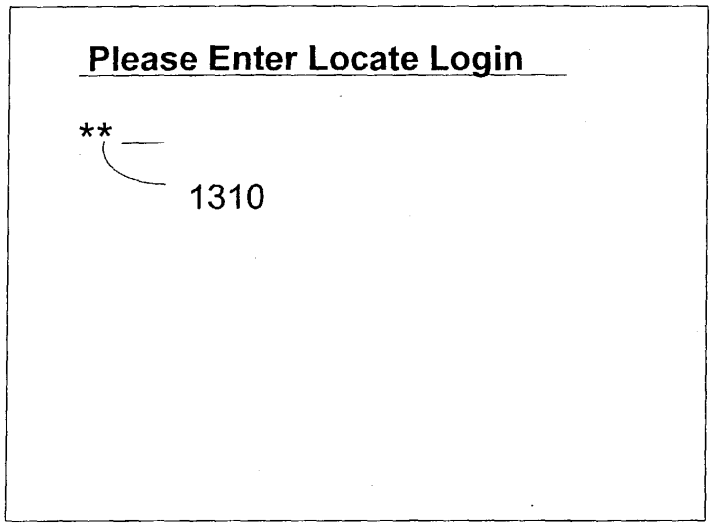

Please Enter Locate Login
**
1310
1300

FIG. 13

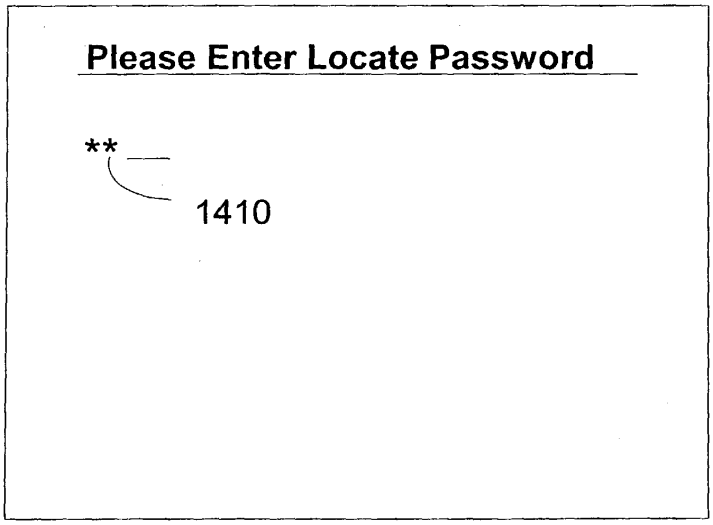

Please Enter Locate Password
**
1410
1400

FIG. 14

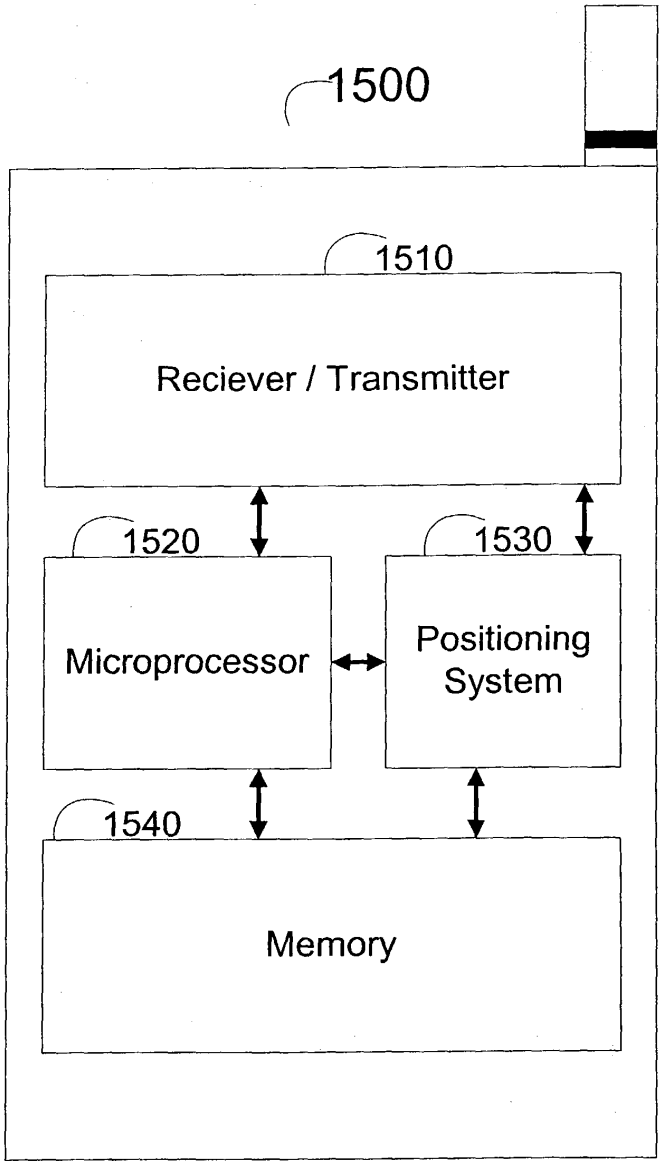

1500
1510
Reciever / Transmitter
1520
1530
Microprocessor
Positioning System
1540
Memory

FIG. 15

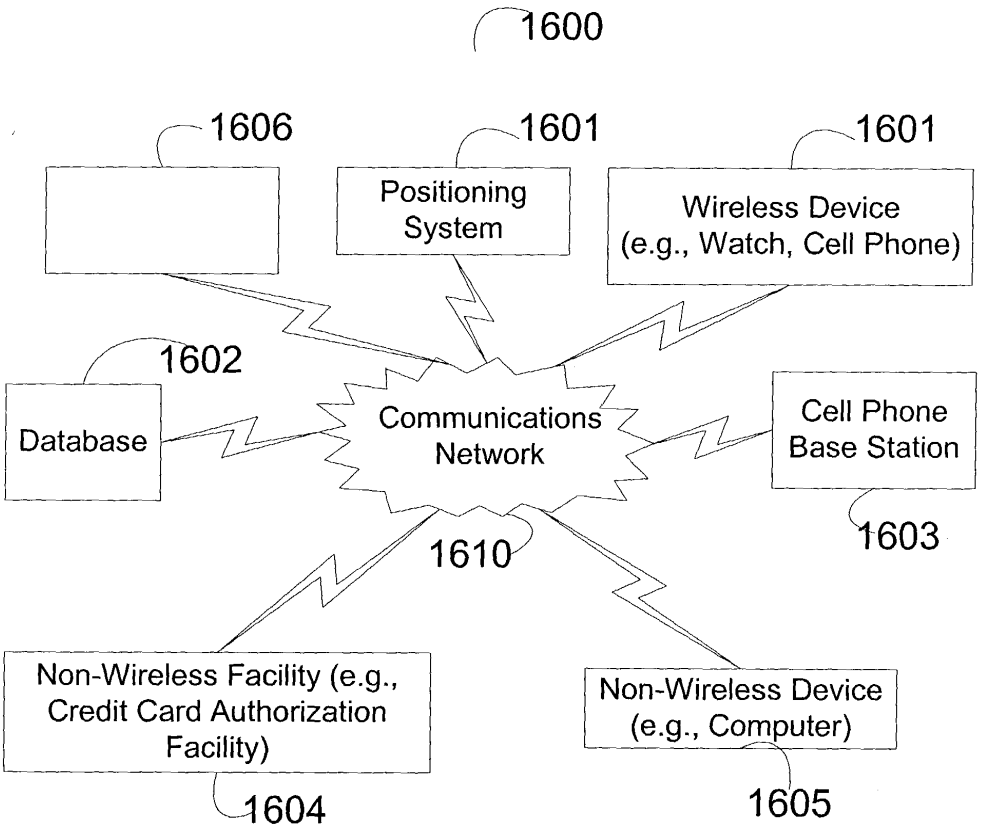

1600
1606
1601
1601
Positioning System
Wireless Device (e.g., Watch, Cell Phone)
1602
Database
Communications Network
Cell Phone Base Station
1603
1610
Non-Wireless Facility (e.g., Credit Card Authorization Facility)
Non-Wireless Device (e.g., Computer)
1604
1605

FIG. 16

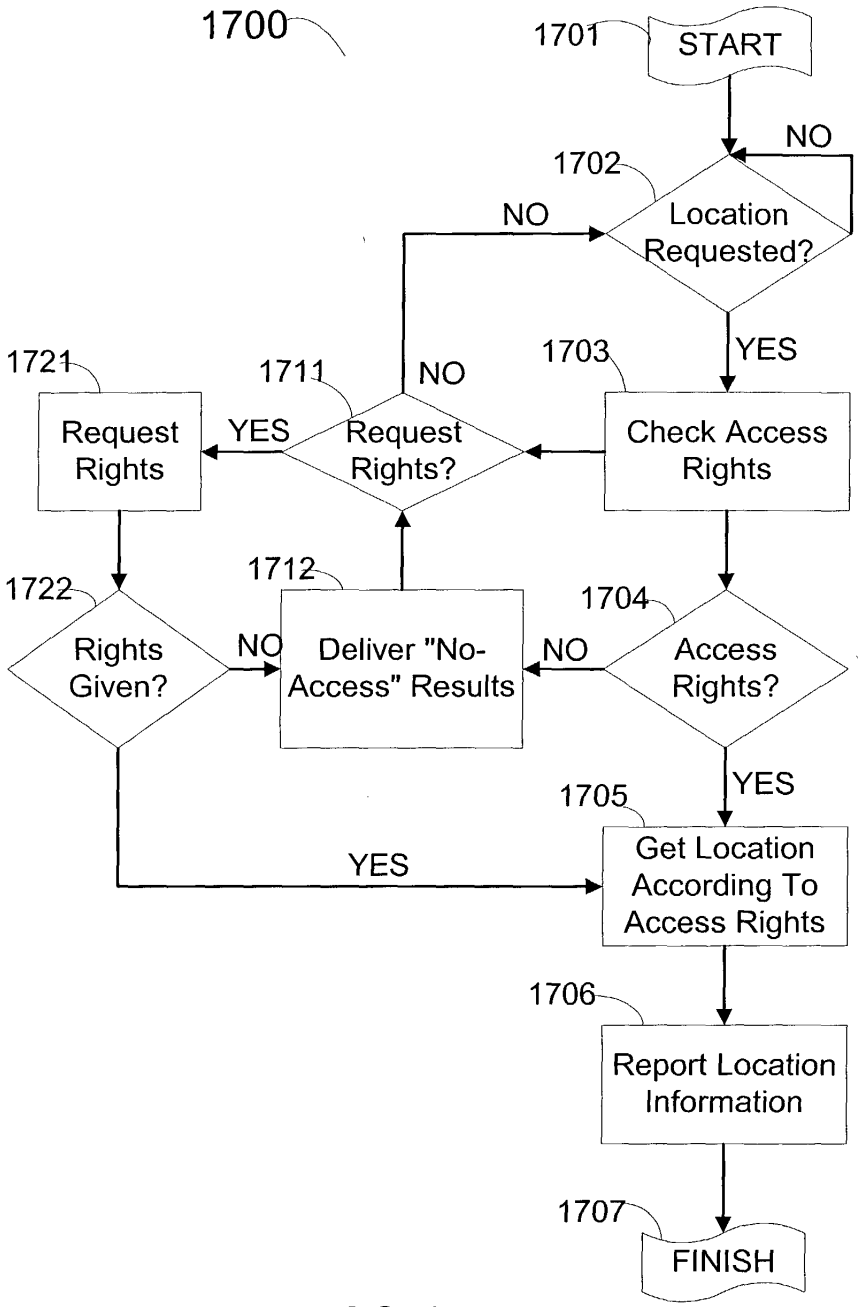

1700
1701
START
NO
1702
Location Requested?
NO
YES
1703
Check Access Rights
1721
Request Rights
YES
1711
Request Rights?
NO
1712
Deliver "No-Access" Results
NO
1704
Access Rights?
YES
1722
Rights Given?
NO
YES
1705
Get Location According To Access Rights
1706
Report Location Information
1707
FINISH

FIG. 17

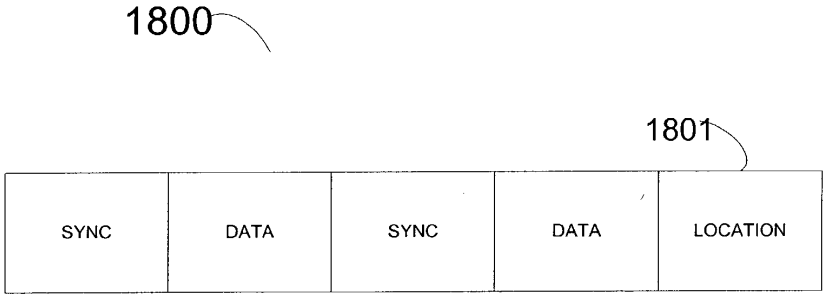


FIG. 18

DECLARATION

I, Jeffrey D. Mullen, declare that I am a citizen of the United States of America, respectively residing at and having post office addresses at 1 Mercer Court, Scarsdale, New York 10583; and

that I verily believe myself to be the original and first inventor of the invention or discovery in:

SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

which is described and claimed in the attached specification, and for which a patent is sought;

that I have reviewed and do understand the content of said specification, including the claims, and acknowledge my duty to disclose to the United States Patent and Trademark Office information known by myself to be material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56;

that I do not know and do not believe that this invention or discovery was ever known or used in the United States of America before my invention or discovery thereof, or patented or described in any printed publication in any country before my invention or discovery thereof, or more than one year prior to this application; or in public use or on sale in the United States of America more than one year prior to this application; that this invention or discovery has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an

application filed by myself or my legal representatives or assigns more than twelve months prior to this application; and that no application for patent or inventor's certificate on this invention or discovery has been filed in any country foreign to the United States of America by myself or my legal representatives or assigns;

I hereby claim the benefit under Title 35, United States Code § 119(e) to the United States provisional application listed below.

60/367,967	March 25, 2002
(Application Serial No.)	(Filing Date)

and I request that communications be sent to:

Jeffrey D. Mullen
1 Mercer Court
Scarsdale, New York 10583

and that telephone calls be directed to:

Jeffrey D. Mullen
(914) 837-7741

Wherefore, I pray that Letters Patent be granted to myself for the invention or discovery described and claimed in the attached specification and claims, and I hereby subscribe my name to the foregoing specification, claims, and declaration.

I declare, further, that I understand the English language and that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and, further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

3/25/03
Date

Jeffrey D. Mullen

PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

04/02/2003 MBIZUNES 00000076 10400296
01 FC:2001 375.00 OP

PTO-1556
(5/87)

*U.S. Government Printing Office: 2002 — 489-267/69033

PATENT APPLICATION FEE DETERMINATION RECORD
Effective January 1, 2003

Application or Docket Number: 5DM/002

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	2	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	2 minus 20=	* 0
INDEPENDENT CLAIMS	1 minus 3 =	* 0
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	375.00	OR	BASIC FEE	750.00
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL	375	OR	TOTAL	

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
***If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1

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OCT 2 4 2003
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#2
S.I
10/29/03

RECEIVED
OCT 2 8 2003
Technology Center 2600

2681

JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
Application No.	:	10/400,296 Confirmation No.: 8666
Filed	:	March 25, 2003
For	:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
Group Art Unit	:	2681

Hon. Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

New York, NY 10020
October 21, 2003

INFORMATION DISCLOSURE STATEMENT

Sir:

Pursuant to 37 C.F.R. §§ 1.56 and 1.97, applicant hereby makes the following documents of record in the above-identified patent application:

U.S. Patents

4,654,879	Goldman et al.	03/31/1987
5,197,092	Bamburak	03/23/1993
5,327,144	Stilp et al.	07/05/1994
5,341,410	Aron et al.	08/23/1994
5,384,824	Alvesalo	01/24/1995
5,338,147	Grimes	02/07/1995
5,479,482	Grimes	12/26/1995
5,502,757	Bales et al.	03/26/1996
5,519,760	Borkowski et al.	05/21/1996
5,537,460	Holliday, Jr. et al.	07/16/1996
5,548,816	DeVaney	08/20/1996
5,551,058	Hutcheson et al.	08/27/1996

5,555,286	Tendler	09/10/1996	
5,767,788	Ness	06/16/1998	
5,778,315	Proietti	07/07/1998	
5,805,999	Inoue	09/08/1998	
5,815,538	Grell et al.	09/29/1998	
5,832,381	Kauppi	11/03/1998	
5,847,976	Lescourret	12/08/1998	
5,875,398	Snapp	02/23/1999	
5,890,062	Courtney et al.	03/30/1999	
5,920,820	Qureshi et al.	07/06/1999	
5,929,752	Janky et al.	07/27/1999	
5,950,125	Buhrmann et al.	09/07/1999	
6,023,241	Clapper	02/08/2000	
6,028,537	Suman et al.	02/22/2000	
6,032,042	Kauppi	02/29/2000	
6,035,198	Wiehe	03/07/2000	
6,038,446	Courtney et al.	03/14/2000	
6,061,561	Alanara et al.	05/21/2000	
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6,173,182	Cha	01/09/2001	
6,201,803	Munday et al.	03/13/2001	
6,208,866	Rouhollahzadeh et al.	03/27/2001	
6,236,359	Watters et al.	05/22/2001	
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6,256,498	Ludwig	07/03/2001	
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6,311,060	Evans et al.	10/30/2001	
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6,374,306	Tognazzini	04/16/2002	102(e) 03/12/1999

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6,400,956	Richton	06/04/2002	102(e) 11/15/1999
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6,449,486	Rao	09/10/2002	102(e) 05/25/1999
6,532,360	Shaffer	03/11/2003	102(e) 12/14/1999
6,564,064	Ciganer et al.	05/13/2003	102(e) 12/01/1999
6,618,671	Dooley et al.	09/09/2003	102(e) 09/20/2001
6,622,020	Seki	09/16/2003	102(e) 07/12/1995
6,628,938	Rachabathuni et al.	09/30/2003	102(e) 08/14/2000
D464,033	Piano Poirier	10/08/2002	102(e) 01/23/2002

These documents are also listed on the attached Form PTO-1449 (submitted in duplicate), and copies of these references are enclosed herewith.

It is respectfully requested that these documents be (1) fully considered by the United States Patent and Trademark Office during examination of this application; and (2) printed on any patent which may issue on this application. Applicant requests that a copy of Form PTO-1449, as considered and initialed by the Examiner, be returned with the next communication.

This Statement is submitted before the mailing of a first Office Action on the merits. In accordance with 37 C.F.R. § 1.97(b)(3), submission of this Statement requires no fee. A duplicate copy of this letter is transmitted herewith.

Consideration of the foregoing in relation to this patent application is respectfully requested.

Respectfully submitted,

Jeffrey D. Mullen
Applicant
Customer No. 32733
1 Mercer Court
Scarsdale, NY 10583
Mobile: (914) 837-7741

I hereby certify that this Correspondence is being deposited with the U.S. Postal Service as First Class Mail in an envelope Addressed to:
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450 on

October 24, 2003

Claire J. Saintil-van Goodman

Signature of Person Signing

FORM PTO-1449 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTY. DOCKET NO. JDM/002	APPLICATION NO. 10/400,296
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	APPLICANT Jeffrey D. Mullen	CONFIRMATION NO. 8666
	FILING DATE March 25, 2003	GROUP 2681

OIPE OCT 24 2003 PATENT & TRADEMARK OFFICE JC22

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	4,654,879	03/31/1987	Goldman et al.			
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EXAMINER DATE CONSIDERED

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	6,173,182	01/09/2001	Cha			
	6,201,803	03/13/2001	Munday et al.			
	6,208,866	03/27/2001	Rouhollahzadeh et al.			
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	6,438,381	08/20/2002	Alberth, Jr. et al.			06/08/2000
	6,449,486	09/10/2002	Rao			05/25/1999
	6,532,360	03/11/2003	Shaffer			12/14/1999
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	6,618,671	09/09/2003	Dooley et al.			09/20/2001
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OIPE OCT 2 4 2003 PATENT & TRADEMARK OFFICE

	6,628,938	09/30/2003	Rachabathuni et al.			08/14/2000
	D464,033	10/08/2002	Piano Poirier			01/23/2002

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Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	2424	location near3 (mobile wireless portable cellular).ab,ti.	US-PGPUB; USPAT	OR	ON	2005/03/01 17:50
S2	2541	455/404.1,404.2,456.1-456.3,457.ccls.	US-PGPUB; USPAT	OR	ON	2005/03/01 17:39
S3	721	S1 and S2	US-PGPUB; USPAT	OR	ON	2005/03/01 17:39
S4	69673	access adj right authoriz$5	US-PGPUB; USPAT	OR	ON	2005/03/01 17:40
S5	163	S3 and S4	US-PGPUB; USPAT	OR	ON	2005/03/01 17:40
S6	6858	access adj right	US-PGPUB; USPAT	OR	ON	2005/03/01 17:40
S7	17	S3 and S6	US-PGPUB; USPAT	OR	ON	2005/03/01 17:47
S8	1442	first adj wireless with second adj wireless	US-PGPUB; USPAT	OR	ON	2005/03/01 17:47
S9	5	S1 with S8	US-PGPUB; USPAT	OR	ON	2005/03/01 17:47
S10	21554	location near3 (mobile wireless portable cellular)	US-PGPUB; USPAT	OR	ON	2005/03/01 17:50
S11	82	S8 with S10	US-PGPUB; USPAT	OR	ON	2005/03/01 17:51
S12	19	S2 and S11	US-PGPUB; USPAT	OR	ON	2005/03/01 17:51



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/400,296	03/25/2003	Jeffrey D. Mullen	JDM/002	8666

32733 7590 03/08/2005

JEFFREY D. MULLEN
1 MERCER COURT
SCARSDALE, NY 10583

EXAMINER	
TIEU, BENNY QUOC	
ART UNIT	**PAPER NUMBER**
2642	

DATE MAILED: 03/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/400,296	MULLEN, JEFFREY D.	
	Examiner	Art Unit	
	Benny Q. Tieu	2642	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 March 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 2* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 2* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *10/24/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1 and 2 are rejected under 35 U.S.C. 102(e) as being anticipated by Geiger et al. (U.S. Patent No. 6,377,810).

Regarding claim 1, Geiger et al. teach a method of mobile-to-mobile locating, said method comprising:

requesting a location of a first wireless device (Fig. 1, 15) by a second wireless device (Fig. 1, 25);

assigning location access rights to said second wireless device by said first wireless device (column 4, lines 7-25);

determining said access rights assigned by said first wireless device to said second wireless device (Fig. 2, 56-64); and

providing said location said second wireless device dependent upon said access rights (Fig. 2, 66).

Regarding claim 2, Geiger et al. further teach the method wherein said first and second wireless devices are cellular phones (column 7, lines 1-8).

Conclusion

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Kingdon et al. (U.S. Patent No. 6,138,003) teach a system and method for authorization of location services. Drutman et al. (U.S. Patent No. 6,618,593) teach a location dependent user matching system. Bade et al. teach a system and method for providing access to mobile devices based on positional data.

4. Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

OR Hand-delivered responses should be brought to:

220 South 20th Street

Crystal Plaza Two, Lobby, Room 1B03

Arlington, VA 22202.

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Benny Q. Tieu whose telephone number is (703) 305-2360. The examiner can normally be reached on Monday-Friday: 6:30AM - 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ahmad Matar can be reached on (703) 305-4731. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Benny Q. Tieu

BENNY TIEU
PRIMARY EXAMINER

Art Unit 2642
March 2, 2005

FORM PTO-1449 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTY. DOCKET NO. JDM/002	APPLICATION NO. 10/400,296
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	FILING DATE March 25, 2003	GROUP ~~2681~~ 2642

OIPE OCT 24 2003 JC22 PATENT & TRADEMARK OFFICE

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BQT	4,654,879	03/31/1987	Goldman et al.			
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BOT	6,628,938	09/30/2003	Rachabathuni et al.	—	—	08/14/2000
BOT	D464,033	10/08/2002	Piano Poirier	—	—	01/23/2002

EXAMINER Benny Q. Tieu DATE CONSIDERED 8/1/5

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not conformance and not considered. Include copy of this form with next communication to applicant.

Notice of References Cited	Application/Control No. 10/400,296	Applicant(s)/Patent Under Reexamination MULLEN, JEFFREY D.	
	Examiner Benny Q. Tieu	Art Unit 2642	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-6,138,003	10-2000	Kingdon et al.	455/410
	B	US-6,377,810	04-2002	Geiger et al.	455/456.2
	C	US-6,618,593	09-2003	Drutman et al.	455/456.3
	D	US-6,778,837	08-2004	Bade et al.	455/456.1
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

BIBDATASHEET

CONFIRMATION NO. 8666

Bib Data Sheet

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/400,296	03/25/2003 RULE	455	2642	JDM/002

APPLICANTS

Jeffrey D. Mullen, Scarsdale, NY;

** CONTINUING DATA ********** Yes PRT

This appln claims benefit of 60/367,967 03/25/2002

** FOREIGN APPLICATIONS ********** None PRT

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** SMALL ENTITY **
** 05/08/2003

Foreign Priority claimed	STATE OR	SHEETS	TOTAL	INDEPENDENT
35 USC 119 (a-d) conditions met	COUNTRY	DRAWING	CLAIMS	CLAIMS
Verified and Acknowledged	NY	17	2	1

☐ yes ☒ no
☐ yes ☒ no ☐ Met after Allowance
Examiner's Signature Initials

ADDRESS
32733
JEFFREY D. MULLEN
1 MERCER COURT
SCARSDALE , NY
10583

TITLE
Systems and methods for locating cellular phones and security measures for the same

FILING FEE	FEES: Authority has been given in Paper	
RECEIVED 375	No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

Index of Claims

Application No.	Applicant(s)	
10/400,296	MULLEN, JEFFREY D.	
Examiner	**Art Unit**	
Benny Q. Tieu	2642	

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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Search Notes	Application No.	Applicant(s)	
	10/400,296	MULLEN, JEFFREY D.	
	Examiner	Art Unit	
	Benny Q. Tieu	2642	

SEARCHED			
Class	Subclass	Date	Examiner
455	404.1 404.2 410 456.1- 456.3 457	3/1/2005	BQT

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
EAST	3/1/2005	BQT



08-10-05

TC 2642

PATENTS
Attorney Docket No. JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
Application No.	:	10/400,296 Confirmation No. : 8666
Filed	:	March 25, 2003
For	:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
Group Art Unit	:	2642
Examiner	:	Benny Quoc Tieu

New York, New York 10020
August 8, 2005

Mail Stop: Amendment
Hon. Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

EXPRESS MAIL CERTIFICATION

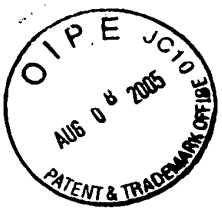
Sir:

"Express Mail" mailing label number EV 619616802US

Date of Deposit August 8, 2005

I hereby certify that the papers and fees identified below are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10 on the date indicated above and are addressed to Mail Stop: Amendment, Commissioner for Patents, P.O. Box 2327, Arlington, Virginia 22202.

1. Transmittal Letter (in duplicate)
2. Reply to Office Action
3. Supplemental Information Disclosure Statement (in duplicate)
4. PTO Form SB/08A (in duplicate)
5. Substitute Specification
6. Substitute Specification Showing Amendments
7. Check No. 1940 in the amount of $805.00 for filing fee, IDS and two-month extension fee
8. Return Postcard



SMALL ENTITY
JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
Application No.	:	10/400,296
Confirmation No.	:	8666
Filed	:	March 25, 2003
For	:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
Group Art Unit	:	2642
Examiner	:	Benny Quoc Tieu

Mail Stop: Amendment
Hon. Commissioner for Patents
P.O. Box 1450 New York, NY 10020
Alexandria, VA 22313-1450 August 8, 2005

TRANSMITTAL LETTER

Sir:

Transmitted herewith to be filed in the above-identified patent application are a:

[X] Reply to Office Action;
[X] Information Disclosure Statement;
[X] Form SB/08A (in duplicate;
[X] Substitute Specification;
[X] Substitute Specification Showing Amendments; and
[X] A check in the amount of $805.00 in payment of the filing fee, IDS, and two-month extension fee.

FEE FOR ADDITIONAL CLAIMS

[ ] A fee for additional claims is not required.

[X] A fee for additional claims is required.

The additional fee has been calculated as shown below:

	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA	RATE	ADDITIONAL FEES
TOTAL CLAIMS	36	-	20	=	16	X $ 25 =	$400.00
INDEPENDENT CLAIMS	1	-	3	=	0	X $100 =	$ 0.00
FIRST PRESENTATION OF A MULTIPLE DEPENDENT CLAIM						+ $180 =	$ 0.00

* If less than 20, insert 20. TOTAL $400.00
** If less than 3, insert 3.

[X] A $225.00 extension fee for response within second month pursuant to 37 C.F.R. § 1.136(a) is applicable to this filing.

[X] A $180.00 fee for submission of a Supplemental Information Disclosure Statement after mailing of a First Office Action on the merits is applicable to this filing.

[X] **A check in the amount of $805.00 in payment of the $400.00 filing fee, $180.00 IDS fee, and $225.00 extension fee is submitted herewith. A duplicate copy of this Transmittal is being submitted herewith.**

Respectfully submitted,

Jeffrey D. Mullen
Applicant
Customer No. 32733
350 West 43rd St., Apt. 5H
New York, NY 10036
Mobile: (914)837-7741



JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
Application No.	:	10/400,296
Confirmation No.	:	8666
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Group Art Unit	:	2642
Examiner	:	Benny Quoc Tieu

Mail Stop: Amendment
Hon. Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

New York, NY 10020
August 8, 2005

REPLY TO OFFICE ACTION

Sir:

Pursuant to 37 C.F.R. § 1.17(a)(2), applicant hereby petitions for a two-month extension of time to reply to the Office Action dated March 8, 2004. With this two-month extension the deadline for replying to the Office Action is August 8, 2005.

In response to the Office Action dated March 8, 2005, please amend the application as follows:

Amendments to the Specification are reflected on page 2.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Remarks/Arguments begin on page 10 of this paper.

08/11/2005 EAYALEW1 00000026 10400296
01 FC:2202 400.00 DP
02 FC:2252 225.00 DP

Amendments to the Specification

A Substitute Specification is being submitted herewith. However, please add the following paragraph after line 2, and before line 3, of specification of this Substitute Specification.

--Cross-Reference to Related Application

This application claims the benefit of U.S. Provisional Application No. 60/367,967, filed on March 25, 2002, which is hereby incorporated by reference herein in its entirety.--

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (currently amended) A method of mobile-to-mobile locating, said method comprising:

requesting a location of a first wireless device by a second wireless device from a server located remotely from said first and second wireless devices;

assigning location access rights on said server to said second wireless device by said first wireless device;

storing said location access rights on said server;

determining said access rights assigned by said first wireless device to said second wireless device on said server; and

providing said location from said server to said second wireless device dependent upon said access rights.

2. (original) The method of claim 1, wherein said first and second wireless devices are cellular phones.

3. (new) The method of claim 1, wherein said location access rights is the ability to obtain said location from said server.

4. (new) The method of claim 1, wherein said location access rights comprise a plurality of access levels.

5. (new) The method of claim 1, wherein said second wireless device uses said location to provide a location marker on a map.

6. (new) The method of claim 1, wherein said second wireless device uses said location to provide directions from said second wireless device to said location.

7. (new) The method of claim 1, wherein said second wireless device uses said location to provide directions from said second wireless device to said location and a travel time.

8. (new) The method of claim 1, further comprising requesting a second location of said first wireless device and using said location and said second location to determine how fast said first wireless device is traveling.

9. (new) The method of claim 1, wherein said location access rights comprise a plurality of levels of access rights, at least one of said plurality of levels of access rights comprise the exact location of said first wireless device, and another one of said plurality of levels of access rights comprise an approximate location of said first wireless device.

10. (new) The method of claim 1, wherein said access rights comprise a plurality of levels of access rights, at least one of said plurality of levels of access rights comprise an approximate location of said first wireless device, and said approximate location comprises a city or state.

11. (new) The method of claim 1, further comprising requesting said location of said first wireless device by a non-wireless device.

12. (new) The method of claim 1, further comprising obtaining a second location from a non-wireless device.

13. (new) The method of claim 1, further comprising receiving a login and password from said second wireless device to identify said second wireless device.

14. (new) The method of claim 1, wherein said location of said first wireless device is requested by receiving input, in the form of a telephone number of said first wireless device, from an interface on said second wireless device.

15. (new) The method of claim 1, further comprising using said first wireless device to modify said location access rights for said second wireless device.

16. (new) The method of claim 1, further comprising using said first wireless device to delete said location access rights for said second wireless device.

17. (new) The method off claim 1, further comprising filtering information about said location such that only a portion of the information is passed to said second wireless device.

18. (new) The method of claim 1, further comprising alerting said second wireless device when said first wireless device is within a distance of second wireless device.

19. (new) The method of claim 1, further comprising selecting said first wireless device from an identifier list.

20. (new) The method of claim 1, further comprising selecting said first wireless device from an identifier list wherein said identifier list comprises a list of telephone numbers.

21. (new) The method of claim 1, further comprising selecting said first wireless device from an identifier list wherein said identifier list comprises a list of user profiles.

22. (new) The method of claim 1, further comprising requesting a second location from said first wireless device from a non-wireless device, wherein said non-wireless device does not comprise a positioning system.

23. (new) The method of claim 1, wherein said location is provided by a positioning system.

24. (new) The method of claim 1, further comprising:

providing a first dating matching profile by said first wireless device;

providing a second dating matching profile by said second wireless device;

obtaining a second location, wherein said second location is the location of said second wireless device; and

utilizing said location, said second location, said first dating matching profile, and said second dating matching profile to provide an alert.

25. (new) The method of claim 1, further comprising providing a compass in said second wireless device.

26. (new) The method of claim 1, further comprising providing a compass in said second wireless device, wherein said compass is utilized to display the location of said first wireless device relative to said location of said second wireless device.

27. (new) The method of claim 1, further comprising providing a compass in said second wireless device, wherein said compass is utilized to display the direction that said second wireless device is traveling in.

28. (new) The method of claim 1, providing an interface on said second wireless device for setting location alerts associated with said first wireless device.

29. (new) The method of claim 1, wherein said location access rights are only assigned for a period of time.

30. (new) The method of claim 1, further comprising alerting said second wireless device when said first wireless device enters a geographic area.

31. (new) The method of claim 1, wherein said server stores a history of locations for said first wireless device.

32. (new) The method of claim 1, wherein said server stores a history of locations for said first wireless device and said history is utilized to provide an approximate location of said first wireless device when said first wireless device is turned OFF.

33. (new) The method of claim 1, further comprising displaying on said second wireless device the opportunity to request said location access rights from said first wireless device.

34. (new) The method of claim 1, further comprising displaying to said second wireless device the opportunity to request said location access rights from said first wireless device after a determination has been made that said second wireless device does not have access to said location.

35. (new) The method of claim 1, wherein said first wireless device is requested to manually allow said location access rights for said second wireless device every time said second wireless device requests said location.

36. (new) The method of claim 1, further comprising requesting, from said first wireless device by

said server, that said location access rights be assigned.

REMARKS

Summary of Office Action

Claims 1-2 are pending in the application.

Claims 1-2 were rejected under U.S.C. § 102(e) as being anticipated by Geiger et al. U.S. Patent No. 6,377,810 (hereinafter "Geiger").

Summary of Applicant's Amendments

Applicant has submitted a Substitute Specification. Applicant has also amended this Substitute Specification by adding a "Cross-Reference To Related Applications" section.

Applicant has amended claim 1 in order to expedite prosecution. Applicant reserves the right to claim the subject matter lost by the amendment of claim 1 in a continuation or a divisional application.

Applicant has added claims 3-36 in order to more particularly point out and distinctly claim the subject matter that applicant regards as the invention. In order to expedite prosecution, claims 3-36 depend from amended claim 1. Applicant respectfully submits, however, that claims 3-36 would be allowable if dependent from claim 1 as originally filed. Applicant reserves the right to claim the subject matter lost by depending claims 3-36 from amended claim 1 in a divisional or continuation application.

Submission of Substitute Specification

Applicant herewith submits a Substitute Specification in connection with the above-identified application. In accordance with 37 C.F.R. § 1.125 and M.P.E.P. § 608.01(q), applicant states that the Substitute Specification contains no new matter.

Submitted herewith is a marked-up copy of the Substitute Specification and a clean copy of the Substitute Specification. In the marked-up copy, additions are underlined and deletions are struck-out.

Applicant's Response to the
Rejections Under 35 U.S.C. 102(b)

Claims 1-2 were rejected under 35 U.S.C. § 102(e) as being anticipated by Geiger.

Applicant's invention of claim 1 teaches a remote server that stores a location for a wireless device. Location access rights for the location are assigned and determined on the server.

Geiger discusses two methods of wireless communication.

In Geiger's first method, a device must request an access permission certificate from another mobile device. Once the requesting device receives the permission certificate, the requesting device must then transmit the received permission certificate to a verification server for verification. After the certificate has been verified, location information is sent to the requesting device.

In Geiger's second method, both the location server and the access control program are located on the mobile device itself.

Applicant's amended claim 1, however, includes requesting a location from a remote server, assigning location access rights on a remote server, storing location access rights on a remote server, determining access rights on a remote server, and providing a information from a remote server.

Regardless of what method in Geiger is evaluated, or how the methods are combined, Geiger does not show or suggest the features of applicant's amended

claim 1.

Particularly, Geiger's first method discusses:

> "a requesting entity 25 that wishes to know the location of the mobile device 15 establishes communication with the mobile device 15 … [and] sends the mobile device 15 a location permission request."
> (Geiger, col. 4, lines 51-56)

> "The mobile device 15 receives the location and permission request and verifies the identity certificate of the requesting entity…. If the user 16 agrees with the request for location information … mobile device 15 [is used] to generate a location access permission attribute certificate granting permission to the requestor…. The mobile device 15 sends this location access permission attribute certificate to the requesting entity 25. On receipt of the … certificate … the requesting entity 25 establishes communication with the location server 21 … and sends the … certificate to the location server 21."
> (Geiger, col. 4, lines 7-28)

Accordingly, Geiger's method provides that the first wireless device must send a permission request directly to the second wireless device, then the second device must send a permission certificate back to the first wireless device. As such, Geiger's method never, for example, assigns location rights on a remote server - one of the numerous features of applicant's claim 1.

As a result of applicant's invention of claim 1, one wireless device never has to directly contact another wireless device in order to initially obtain location information - each wireless device can just independently contact the server.

Geiger's second method, on the other hand, discusses local location servers. Particularly, Geiger discusses:

> "The example where the requesting entity and location server are both located in the mobile device 15 is illustrated in FIG. 4…. The only

part of the … process … which is not entirely within the mobile device … is the client certificate request and reply."
(Geiger, col. 6, lines 7-18)

"In operation, the requesting entity 225 sends its location access permission request 226 to access controller program 227, which responds (if so selected by the user) with a location access permission attribute certificate 228."
(Geiger, col. 6, lines 21-26)

Accordingly, Geiger does not show or suggest in either his first or second method, or any combination of the two, applicant's invention of claim 1 of assigning location rights on a remote server.

For at least the above reasons, applicant respectfully submits that the rejections of claims 1-2 under 35 U.S.C. 102 in view of Geiger be withdrawn.

Conclusion

Applicant respectfully submits that this application, including claims 1-236, is in condition for allowance.

Reconsideration and prompt allowance of this application are respectfully requested.

Respectfully Submitted,

Jeffrey D. Mullen
Applicant
350 West 43rd Street, Apt. 5H
New York, NY 10583
Tel.: (914) 837-7741
Customer No 32733

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JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
Application No.	:	10/400,296
Confirmation No.	:	8666
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Group Art Unit	:	2642
Examiner	:	Benny Quoc Tieu

Mail Stop: Amendment
Hon. Commissioner for Patents
P.O. Box 1450 New York, NY 10020
Alexandria, VA 22313-1450 August 8, 2005

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

In accordance with 37 C.F.R. §§ 1.56 and 1.97, applicant wishes to call the attention of the Examiner to the following documents:

Patent Documents

5,442,805	Sagars et al.	08/15/1995
5,719,563	Thompson	02/17/1998
6,049,711	Ben-Yehezkel	04/11/2000
6,091,959	Souissi et al.	07/18/2000
6,240,069	Alperovich	05/21/2001
6,317,718	Fano	11/13/2001
6,321,092	Fitch et al.	11/20/2001
6,360,167	Millington et al.	03/19/2002

08/11/2005 EAYALEW1 00000026 10400296
03 FC:1806 180.00 OP

6,400,956	Richton	06/02/2002	102(e) is 11/15/1999
6,580,914	Smith	06/17/2004	102(e) is 08/17/1998
6,610,687	Clark	08/26/2003	102(e) is 11/15/1999
6,677,894	Sheynblat	01/13/2004	102(e) is 11/30/1998
6,714,791	Friedman	03/30/2004	102(e) is 02/23/2001
6,795,710	Creemer	09/21/2004	102(e) is 01/05/2001
6,798,358	Joyce et al.	09/28/2004	102(e) is 07/03/2001
6,806,813	Cheng et al.	10/19/2004	102(e) is 06/04/1999
6,816,735	Rayburn et al.	11/09/2004	102(e) is 03/29/2001
6,836,667	Smith	12/28/2004	102(e) is 09/19/2000
6,912,545	Lundy et al.	06/28/2005	102(e) is 06/12/2001
2004/0127231	Dorr	07/01/2004	PCT is 07/23/2001

As all of the above-identified documents are U.S. patent documents, no copies are enclosed. It is respectfully requested that these documents be (1) fully considered by the Patent and Trademark Office during examination of this application; and (2) printed on any patent which may issue on this application. Applicant requests that a copy of Form PTO/SB/08A, as considered and initialed by the Examiner, be returned with the next communication.

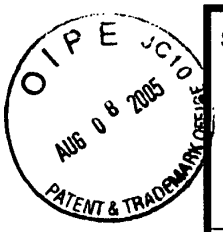
This Statement is being submitted before the mailing of a Final Office Action or a Notice of Allowance on the merits. In accordance with 37 C.F.R. § 1.97(c)(2), the fee of $180 as set forth in 37 C.F.R. 1.17(p) is submitted herewith. Particularly, a check that includes the $180 fee is enclosed herewith. A duplicate copy of this statement is transmitted herewith.

An early and favorable action is respectfully requested.

Respectfully submitted,

Jeffrey D. Mullen
Applicant
350 West 43rd St., Apt. 5H
New York, NY 10036
Mobile: (914)837-7741
Customer No. 32733

PTO/SB/08A (10-01)
Approved for use through 10/31/2002. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.



Substitute for form 1449A/PTO

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 2

Complete if known	
Application Number	10/400,296
Filing Date	March 25, 2003
First Named Inventor	Jeffrey D. Mullen
Art Unit	2642
Examiner Name	Benny Quoc Tieu
Attorney Docket Number	JDM/002

U.S. PATENT DOCUMENTS

Examiner initials*	Cite No.[1]	Document Number Number – Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
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Sheet	2	of	2	**Attorney Docket Number**	JDM/002

FOREIGN PATENT DOCUMENTS						
Examiner initials*	Cite No.[1]	Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

NON PATENT LITERATURE DOCUMENTS			
Examiner initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[2]

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This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

Background of the Invention

[0001] This invention relates to systems and methods for determining a device's location. More particularly, this invention relates to systems and methods for remotely determining a device's location.

[0002] The Global Positioning System (GPS) has been developed in which a ground-based system can receive GPS signals from satellites and use these signals to determine the location of the ground-based system based on the time the GPS signals took to reach the ground-based system. Generally, three satellite signals are needed to determine where in the world a receiver is located (i.e., position triangulation).

[0003] GPS systems have been integrated into cellular phones. However, these systems are deficient because the location of a device, as determined by these GPS signals, is only minimally utilized. It is therefore desirable to provide systems and methods that better utilize the information about a device's location.

Summary of the Invention

[0004] In accordance with the present invention, systems and methods are provided for locating cellular phones. More particularly, the present invention provides systems and methods for allowing a user of a cellular phone (e.g., a requesting user or a requestor) to locate the position of a different user's cellular phone (e.g., a requested user) based upon access rights assigned by the requested user.

[0005] One object of the present invention is to provide a security feature which allows a user to limit and/or deny location access to a particular user. In preferred embodiments, only the users that have been granted access to the location of a user's cellular phone can actually locate that user's cellular phone. Furthermore, different types of access levels may be provided that allow a user to filter location information to a different user. In this manner, a cell phone user may give access, through his or her cell phone, to a friend so that the friend can locate him or her dependent on the level of access that is granted to that friend.

[0006] For example, suppose that Phil tells Bill that he will be shopping in Manhattan and that Bill should locate him when Bill gets to Manhattan through their cell phones. In such an example, Phil may grant Bill access the exact location of his cell phone for a specific period of time (e.g., the next two hours). As a result, when Bill tries to access Phil's location, Bill will be told exactly where in Manhattan Phil's cell phone is located. Thus, Bill does not have to contact Phil directly to see where Phil is located and, therefore, Phil does not have to spend any time giving

Bill verbal directions; Bill can simply see what store Phil is currently in and go to that store.

[0007] As mentioned previously, levels in the scope of access may be controlled by a user such that, for example, only a user's exact location, approximate location, city, state, or country can be accessed by a particular user.

[0008] Location alerts and monitoring features are also provided. For example, Phil may give Jen, a resident of Pittsburgh, city access so that when Phil travels into Pittsburgh, Jen will be alerted of Phil's presence. Such an alert may take the form of, for example, a display on Jen's cell phone that communicates to Jen "Phil is in Pittsburgh."

[0009] Locating a cellular phone may be accomplished in several ways. For example, satellite positioning systems such as the Global Positional System and the soon to be deployed Galileo system may be used to locate a user's cell phone.

[0010] User positions and security settings may be regularly or manually transmitted to a remote system, such as a remote database so that requesting users can locate a requested user's position even if the requested user turns his/her cell phone OFF. Placing the security measures on a remote system (e.g., remote database, computer, or server) provides an information brokering scheme such that the system is still operable even when cell phones are added, removed, or modified from the system.

[0011] Additionally, the present invention may be configured to provide additional information about the location of a user. Such additional information may be, for example, a map, a location marker on a map, a

map that changes as the user moves, a compass, coordinates of the located cell phone, directions to the located cell phone, where a user is in relation to another user, and information about the location the located user is currently positioned in or nearby locations such as landmarks. Such information may be provided by a remote information provider (e.g., a remote map information provider) and accessed by an information broker through a communications network.

[0012] Many other features are also employed that realize advantageous locating functionality. For example, suppose that a wife wants to see if her husband has left work yet. She can locate her husband, without having to talk to him, and realize that he is driving home on a highway. Thus, a travel time option may be provided to the user. This option would compute the distance between the wife's location and husband's location by taking multiple location readings of the husband's location to see how fast the husband is traveling. Alternatively, because the husband's position will map to a highway, the system may assume that the user is driving and may provide the wife with an estimate on the husband's arrival time based on an assumed route. In this manner, the present invention may determine how much time it will take the husband to reach the wife and display this information to the wife.

[0013] As per other examples, a "see my friends" option may also be provided that brings up a map of a desired area. Dots or symbols may be present on the map to signify the location of all users from which the requesting user has location information for. Similarly, a "find closest friend" option may be

employed which finds the closest user with which the requesting user has location access to.

[0014] A cell phone location may by accessed by a variety of other devices. Alternatively, a cell phone may be used to access the location of a variety of other devices. For example, if the wife was at home, that wife may connect to the internet and access a remote database to either provide the most recent location information about the husband's cell phone to her or request a location update from the husband's cell phone. The wife's location may be already stored in such a database by associating the location to the IP address of the computer or by a manual input of the wife's location. The wife's identity may be determined by, for example, a login and password on a website. Thus, the above-identified security measures are not limited to device-to-device locating, but rather user-to-user locating; the wife may only access the husband's location if the husband has granted access for the wife to do so. If, by accident, the wife's cell phone breaks, she may login on a friend's cell phone and determine the husband's location according to the device that the husband is logged into.

[0015] Security is preferably taken into account in the present invention and, therefore, location rights for a specific user may be given to a different user only by that specific user. However, a user may request location access rights from a different user. For example, a user may be provided with a request location screen on his cell phone and that user (e.g., user "X") may enter in the cell phone number of the cell phone whose location is desired. The user associated to the entered cell phone number may then

receive an alert that says "user X has requested access to your location." Location access may then be given or denied on multiple levels and the requesting user notified of the decision.

[0016] The location feature of the present invention may be turned ON or OFF at any time. Users may be added, individually or in groups, to a list of users with location access rights to a specific user by that specific user. A specific user may, at any time, modify, delete, or add users allowed to access his or her location. Login and password information may be included to increase security or to create a user profile, allowing a specific user to log into any cell phone and be recognized (and thereby be located with that cell phone or locatable device).

Brief Description of the Drawings

[0017] The principles and advantages of the present invention can be more clearly understood from the following detailed description considered in conjunction with the following drawings, in which the same reference numerals denote the same structural elements throughout, and in which:

[0018] FIG. 1 is a network topology of a cell phone locating network in accordance with the principles of the present invention;

[0019] FIG. 2 is a flow chart of the locating feature in accordance with the principles of the present invention;

[0020] FIG. 3 is an illustration of a cell phone in accordance with the principles of the present invention;

[0021] FIG. 4 is a display screen for a locate feature in accordance with with the principles of the present invention;

[0022] FIG. 5 is a display screen for a retrieving location status feature in accordance with the principles of the present invention;

[0023] FIG. 6 is a display screen for a displaying location feature in accordance with the principles of the present invention;

[0024] FIG. 7 is a display screen listing options for a locate feature in accordance with the principles of the present invention;

[0025] FIG. 8 is a display screen of a failed locate feature due to insufficient rights in accordance with the principles of the present invention;

[0026] FIG. 9 is a display screen of adding and modifying locate rights and options to a user in accordance with the principles of the present invention;

[0027] FIG. 10 is a display screen of assigning location rights to a user in accordance with the principles of the present invention;

[0028] FIG. 11 is a display screen of alert options in accordance with the principles of the present invention;

[0029] FIG. 12 is a display screen of an alert feature in accordance with the principles of the present invention;

[0030] FIG. 13 is a display screen of a login feature in accordance with the principles of the present invention;

[0031] FIG. 14 is a display screen of a login feature in accordance with the principles of the present invention;

[0032] FIG. 15 is a wireless device in accordance with the principles of the present invention;

[0033] FIG. 16 is an embodiment of a network topology in accordance with the principles of the present invention;

[0034] FIG. 17 is an embodiment of a locating feature in accordance with the principles of the present invention; and

[0035] FIG. 18 is an embodiment of a communications signal in accordance with the principles of the present invention.

Detailed Description of the Invention

[0036] FIG. 1 depicts a network topology of device location network 100 that incorporates principles of the present invention. Network 100 includes one or more positioning satellites 110, 112, and 114 that can locate the position of one or more cell phones 120, 122, 126, and 124 (and other locatable devices) on Earth 101. Positioning satellites 110, 112, and 114 may be, for example, the Global Positioning System (GPS) or the upcoming Galileo satellite network.

[0037] Preferably, any cell phone in network 100 may locate a different cell phone, as long as access to location information is allowed, through the utilization of positioning satellites 110, 112, and 114. Persons skilled in the art will appreciate that other positioning systems and methods may be used in locating the position of a user on a cell phone of network 100.

[0038] To route information to and from a cell phone of network 100 additional facilities and communication paths may be included. For example, a main facility (not shown in FIG. 1) containing user location access rights may be included in network 100. Such a main facility may retrieve location information directly from a positioning system or a cellular phone and then route this information to a cellular phone or positioning system.

[0039] Persons skilled in the art will appreciate that if the Global Positioning System (GPS) is used as the positioning system then GPS receivers will be incorporated into cellular phones of the present invention. Persons skilled in the art will also appreciate that devices other than cellular phones may include positioning features. For example, watches, clothing, laptop computers, personal digital assistants (PDAs), may all contain location systems (e.g., GPS) and utilize the security principles of the present invention to allow different user's to access these locations.

[0040] FIG. 2 shows flow chart 200 of a simplified locating feature constructed in accordance with the principles of the present invention. Step 202 initiates when a user requests the location of another user's cell phone. Step 206 evaluates if the user initiating the location request has the rights to access the location of the desired user. If no access rights for the requesting user have been granted then step 204 will preferably inform the requesting user that he/she has not been given access to the requested location. In this manner, every user may assign rights (e.g. govern the security) to whom may or may not

locate him/her. In preferred embodiments, these rights will be stored in, or functionality executed from, a remote facility and accessed and utilized by a user's cell phone or other requesting device (e.g., a watch or PDA).

[0041] If access has been given by a particular user that allows for the requesting user to locate that particular user, step 208 is initiated and the allowed location information is provided to the user in step 210. Step 208 may optionally filter the location information such that only a portion information is passed to the requesting user. The requested user may have, for example, defined that the requesting user only can obtain the city, state, or country of his/her location. Persons skilled in the art will appreciate that only the location of the desired user needs to have a cell phone or a positioning system. The requesting user may use other means (e.g., the internet) to request the location of the desired user.

[0042] Persons skilled in the art will appreciate that the location of a user's cell phone may be retrieved, in step 208, from a remote database, facility, distribution center, or any other system. More particularly, a remote database may periodically request the location of a cell phone user with a positioning system and store this information. This database may also keep a record of those people allowed to access that user's location, the extent to which access is allowed, and the extent to which a user has requested a user's location. A user may update, add, manipulate, or remove access at any time by doing so at this database. Thus, a requesting user only has to contact the remote database, have his/her identity

recognized, have his/her access rights for the requested user location determined, and, if the requesting user has the correct access rights, be provided with the requested user's location.

[0043] Instead of a remote database periodically obtaining location information for a user, the database can obtain a user's locations when a request is made for that user's location, provided that the requesting user has access to the requested user's location. However, persons skilled in the art will recognize that a remote database is utilized in the above examples to contain the locations, in most circumstances, of a multitude of users. Thus, to increase security even more, a requesting user's cell phone may directly request a user's location from the requested user's cell phone without the need for a database. In such an example a user adds, manipulates, or removes access rights locally on his/her cell phone and does not have to worry about security issues that surround placing his location on a remote database. Furthermore, in such an embodiment a user's location does not have to be saved anywhere, a positioning system can just be "read" by a requesting user with the appropriate access rights.

[0044] However, by recording a user's location on a device, e.g., a cell phone's memory or in a remote database, novel applications may be utilized. For example, whenever a user makes a credit card purchase, a credit card authorization system can record the location of a cell phone associated to the purchasing user. In this manner, a new system and method of fraud protection is introduced. The credit card authorization system may, for example, reject a

purchase if the purchaser's cell phone (or watch, clothing, PDA, or other positioning enabled device) is not in the vicinity of the purchase. Alternatively, the credit card authorization system may request a second form of identification if the purchaser's cell phone location does not correlate to the location of the purchase. Additionally, the credit card authorization system may call the purchaser's cell phone and request authorization for the credit card purchase. However, such features would preferably first involve the user/purchaser giving the credit card authorization system access to the location of his/her cell phone.

[0045] As per another application, a unique dating/matching service could be embodied. For example, a user may store a number of preferences in a matching profile. These preferences may describe what type of person the user is interested in meeting. Additionally, a user may store, preferably locally (for the dating/matching feature), but alternatively at a remote location, the user's own profile that has data describing similar attributes for what the user is looking for. For example, an entry in a user's profile may be "male" and an entry in a "looking for" profile may be "female." When a user comes within a certain distance of a user (determined by comparing locations of a user) that fits his/her "looking for" profile, the user may be alerted of the proximity of a matching user. Preferably, the particular user is only alerted if the "looking for" user has entered in attributes similar to the particular user's attributes and is also alerted of the particular user. The next stages of such an application could include, for example,

requesting access to a form of communication. Such a form of communication could be for example, talking on the phone, instant messaging, or delivering an email address. Persons skilled in the art will therefore appreciate that many useful applications may be constructed using the principles of the present invention.

[0046] FIG. 3 depicts cell phone 300 constructed in accordance with the principles of the present invention. Cell phone 300 preferably includes speaker 330, antenna 310, display screen 320, control keys 360, alpha-numeric keys 350, and microphone 340. Cell phone 300 also preferably may include, for example, a communications transmitter (not shown), communications receiver (not shown), memory (not shown), positioning device (not shown), and a microprocessor (not shown).

[0047] Cell phone 300 may also include locate button 380. Cell phone 300 may be configured such that if locate button 380 is pressed, a locate feature is initiated (e.g., display screen 400 of FIG. 4 is initiated). Alternatively, cell phone 300 may be configured such that if locate button 380 is pressed, a location signal is sent to a remote storage area (e.g., a remote database), thus manually updating the user's location. This latter functionality may be useful when a user does not want his/her location accessed. As in another alternative embodiment, cell phone 380 may be configured such that if locate button 380 is pressed, the locating features of cell phone 300 are toggled between ON and OFF. Person skilled in the art will appreciate that locate button 380 may be configured to produce a variety of useful functionalities.

[0048] FIG. 4 depicts display screen 400 that is displaying a locate feature constructed in accordance with the principles of the present invention. The locate feature of display screen 400 may be included, for example, in cell phone 300 of FIG. 3 and displayed to the user of cell phone 300 of FIG. 3 when that user requests the location of a different user of the present invention. The programming for the feature may, for example, be stored in the memory of the cell phone and executed by the processor at a user's request. Locate feature 400 includes identifier list 410 of alpha-numeric identifiers for users stored in the memory on cell phone 300 (FIG. 3) or at a remote location. More particularly the user of display 410 may locate a user contained in identifier list 410 by selecting an appropriate user identifier 420.

[0049] The user identifiers (e.g., "Susan Pracht") in identifier list 410 are selectable and may be selected by control keys 360 of FIG. 3. Highlight window 410 may be used to prompt the user what identifier from list 410 is currently selected any may be controlled, for example, by the input keys of the cell phone (e.g., keys 350 and 360 of FIG. 3). Identifiers may be associated to, for example, cellular telephone number, user profiles, or any other identifier that may be associated to a locatable device or user interacting with a locatable device.

[0050] Persons skilled in the art will appreciate that display screen 400 may be provided to a user of devices other than wireless devices. For example, display screen 410 may be provided to a user of a personal computer with no positioning system. Preferably, however, the security measures in

accordance with the principles of the present invention are still abided to (e.g., access has been granted to the identifier associated to the requesting user). In this manner, a user can control who can access his/her wireless device (e.g., cell phone).

[0051] Persons skilled in the art will appreciate that identifier list 410 may be configured, for example, to contain only those users in which the user of cell phone 300 (FIG. 3) has locate access rights to or any user stored in cell phone 300. Persons skilled in the art will also appreciate that devices other than cell phone 300 may be used to incorporate the features of the present invention. Such devices could include, for example, personal digital assistants (PDAs), laptop, GPS pagers, GPS watches, car positioning devices, or any other devices that can be located. One advantage of the present invention is that it allows a mobile device with a positioning system to locate a different mobile device with a positioning system while still retaining a high level of location security and privacy.

[0052] FIG. 5 is display screen 500 for retrieving location status feature in accordance with the principles of the present invention. The selected identifier may be incorporated into display screen 500 through location status display 510 to inform the user of the status of the location retrieval. For example, display screen 500 may display "locating user" while a request is being processed by a remote facility or database.

[0053] FIG. 6 shows display screen 600 for a display location feature constructed in accordance with the principles of the present invention. When a location

is retrieved for the requested user, the location may be displayed on Display Screen 600 through primary location information 610. Depending on what scope the requesting user has access to, primary location information 610 may include, for example, the country, state, city, exact location, or any combination thereof of location information to the user. For example, if the user requesting the location of a desired user has been given unlimited location access by the desired user, primary information 610 may include the exact location of the user.

[0054] Secondary location information 620 may be included to supplement the requested users exact location so that the requesting user may have more of an idea of where the requested user is located. For example, if the desired user is located in a mall, primary location information 610 may be the address of the mall. In such an example, secondary location information 620 may be included and display, to the requesting user, the name of the mall.

[0055] Directional information 630 may also be included on display 600 or any other display of the present invention. Directional information 630 may include a digital compass 632 so that the user of cell phone 300 (FIG. 3) knows what direction he or she is facing in. Digital compass 632 may be connected to a direction sensitive device (e.g., mechanical compass) in order to gather directional information. Directional arrow 633 may also be included in Display 600 to indicate where the requested user's location is relative to the location and direction of cell phone 300 (FIG. 3) (e.g., the requesting user). Persons skilled in the art will appreciate that for some

directional information 630 the location of the requesting user must be obtained. This information may be obtained either from cell phone 300, a remote facility, or by any other suitable means. If the information is gathered from a location-gathering device other than the requesting user's device (e.g., cell phone 300 (FIG. 3)), then the user's device may communicate from this other location gathering device. Once both the locations of the requesting and requested/desired users are known, this information may be utilized in a number of features incorporating the principles of the present invention.

[0056] Distance information 634 is one such feature that displays the distance between the locations of the requested and requesting users (e.g., distance between the locations of the requested and requesting devices). Directional information 630 may contain many other elements to enhance the utility of the present invention. For example, a map (not shown in FIG. 6) may be included in display 600. This map may be of the area surrounding either the requested, the requesting user's location or both. Information may be included on the map to show the shortest path between the location as well as information about the surrounding area (e.g., area names, store names, etc.). Other information may include, for example, time to reach the destination according to specific types of travel (e.g., subway, walking, running, driving) and the direction the requested user is traveling in.

[0057] Location information may be utilized by a user in a variety of ways. For example, if Jane calls Bill and Bill says "I am roaming midtown Manhattan shopping why don't you join me", no other call to Bill

is needed. Bill simply has to give Jane access to his location and Bill can continue shopping without having to worry about meeting up with Jane at a specific location.

[0058] In some instances, it may be beneficial to find the speed and direction of a requested user. For example, if a wife wants to see how long before her husband arrives home, the wife can use this feature of the present invention. This feature may find the husbands location multiple times in a determined amount of time. Through this information the feature may determine the speed and direction that the user is traveling. Using this speed, for example, this feature may display to the wife that the husband "is 10 minutes away" in directional information 630. In doing so, the need for a call to the husband to determine his location is eliminated.

[0059] Persons skilled in the art will appreciate that the location of multiple users may be displayed on display screen 600. For example, suppose Jeff, Susan, and Chrissy are at a concert. If all three of these users have unlimited access to the other users, the principles of the present invention would allow for a map to be displayed on each of the three locating devices with locator designations for each of the users. Using such a map, the group may be able to find themselves relative to one another and decide, if need be, on the easiest location for them to meet. Thus map 660 may be included on display screen 600 and display the locations of multiple users (e.g., user's 621 and 622).

[0060] More region 640 designates that more options or information may be retrieved or performed using

principles of the present invention. A user may use control keys 340 (FIG. 3) on cell phone 300 (FIG. 3) to perform the functionality associated with more region 640.

[0061] FIG. 7 shows display screen 700 for locate listing options in accordance with the principles of the present invention. Display screen 700 includes selectable options list 710 and highlight window 720 and may be displayed to the user, for example, through the activation of functionality associated by more region 640 (FIG. 6). Options list 710 may include any of the features of the present invention. For example, options list 710 may include options activating a display screen of a map of the requesting user's location, a map of the requested user's location, directions to the requested user's location from the requesting user's location, travel time for the requesting user, travel time for the requested user, and options to set location alerts.

[0062] FIG. 8 shows display screen 800 of a failed locate feature due to insufficient rights in accordance with the principles of the present invention. Display screen 800 may be displayed if a requesting user attempts to locate a requested user, but has not been given access rights by the requested user to the requested user's location. In such an instance, insufficient rights message 801 may be prompted on display screen 800.

[0063] FIG. 9 shows display screen 900 for adding and modifying locate rights and options to a user in accordance with the principles of the present invention. A user may give or modify access rights through display 900 to a user identifier in selectable

user identifier listing 910. Highlight window 920 may be included to enhance the selecting process.

[0064] FIG. 10 shows display screen 1000 for assigning location rights to a user in accordance with the principles of the present invention. Display screen 1000 may be displayed, for example, after a user has been selected to be given location rights. Display screen 1000 contains selectable location rights listing 1010, in which the selecting process may be enhanced by highlight window 1020. Possible location access rights may be, for example, by country, state, city, exact location, or any other scope of location. Other rights may be assigned such as particular times in the day or time periods at which locations may be accessed.

[0065] FIG. 11 shows display screen 1100 of alert options in accordance with the principles of the present invention. Display screen 1100 allows for a user to set up alerts depending on the location of specific users. Selectable alert listings 1110 are included and may be selectable with highlight window 1120. Examples of alerts that may be included in display screen 1100 may occur, for example, if the requested user is in a specific city or the same city as the user of display 1100, is within a certain distance, or if a user located the user of display 1100.

[0066] The alerts of the present invention may realize useful functionality. For example, suppose Susan Pracht lives in Pittsburgh and rarely comes to the city of the user of display screen 1100 on cell phone 300 (FIG. 3) which is New York City. The user of cell phone 300 (FIG. 3) may then use display screen 1100 and set an alert such that if Susan Pracht ever

enters New York City, he or she would be alerted of Susan Pracht's presence.

[0067] FIG. 12 shows display screen 1200 of an alert feature in accordance with the principles of the present invention. Display screen 1200 includes an alert message and is displayed to a user when an event occurs that is designated by the user in display screen 1100 (FIG. 11). Continuing the example from FIG. 11, if Susan Pracht enters New York City, alert message 1210 would prompt the user that this event has occured.

[0068] FIG. 13 shows display screen 1300 of a login feature in accordance with the principles of the present invention. In order for users to be identified by other user's cell phones or locating devices a user profile may need to be stored remotely from such devices. In such instances user profiles would be used as the locating identifier and the devices into which these profiles are logged into (recognized by) would allow for the user to be located. Display screen 1300 allows for a user to log into a locating device of the present invention. Logging into a device also adds a level of security to the present invention, especially when combined with a password. A user may use the controls of the device of the present invention to enter login 1310 of display 1300.

[0069] In this manner, a user may use another user's location device (e.g., cell phone) to locate a user or may use, for example, the internet to locate a user. Additionally, in this manner, a user may change the device being located. For example, a user may use his or her car GPS system or other systems in accordance with the principles of the present invention to be located instead of his or her cell phone. To further

this example, a user may log into a web site on the internet and designate his or her current location as home, or any other location, thus eliminating the need for a locatable device entirely.

[0070] FIG. 14 shows display screen 1400 of a login feature in accordance with the principles of the present invention. Display screen 1400 may be used by a user to enter a password associated to that user's profile, identity, or cell phone functionality access. A user may enter password 1410 using the controls of the device of display screen 1400 (e.g., cell phone 300 of FIG. 3). By including a login/password scheme a user can be identified by a remote facility (e.g., a remote database) so that the user's location can be recorded/updated by multiple devices. Additionally, a login/password adds an extra level of security.

[0071] FIG. 15 shows cell phone 1500 that may be utilized to carry out the functionality in accordance with the principles of the present invention. Cell phone 1500 includes receiver/transmitter 1510, microprocessor 1520, positioning system 1530, and memory 1540.

[0072] Persons skilled in the art will appreciate that receiver/transmitter 1510 may directly communicate with memory 1540 if receiver/transmitter 1510 does not have its own memory (e.g., if receiver/transmitter 1510 are configured to utilize a buffer for capturing incoming communications bursts before demodulation and decryptions).

[0073] Positioning system 1530 may be, for example, a GPS system or a similar positioning system. Positioning system 1530 may include its own receiver

for receiving particular signals utilized in positioning cell phone 1500.

[0074] FIG. 16 shows network topology 1600 that includes a variety of components, all of which, or some of which, may be utilized to carry out the features in accordance with the principles of the present invention. In this manner, persons skilled in the art will appreciate that multiple system configurations may be utilized. Topology 1600 introduces the diversity of systems that can be utilized to realize such configurations.

[0075] Generally, topology 1600 includes multiple mobile devices (e.g., multiple instances of mobile device 1601), access control devices and location broker devices (e.g., database 1602 and cell phone base station 1603), and non-mobile devices (e.g., grounded non-wireless device 1605). Persons skilled in the art will appreciate that other devices or facilities may be included in topology 1600. For example, one or more positioning systems 1601 may be included in topology 1600 in order to locate particular devices. For example, a positioning receiver (e.g., GPS receiver) may be included in wireless device 1601 with positing system 1601 being a positioning transmitter (e.g., GPS satellite network).

[0076] One or more wireless devices 1601 may be included in topology 1600 and may be, for example, watches, PDAs, cellular phones, radios, cars, or any other mobile device whose location can be determined.

[0077] As previously mentioned, access control and location broker devices may be included in topology 1600. Such devices may be utilized, for example, to store user access rights for a particular user and may

contain functionality to request and route a device's location. These devices may be considered information brokers such that devices may be added, removed, or modified without creating the necessity of having to modify the other devices of topology 1600.

[0078] Database 1602 is one such information broker. Database 1602 may, for example, be located in cell phone base station 1603 if database 1602 is utilized to assist in cell phone locating. Database 1602 may be utilized, for example, to store a history ~~a~~ of a device's locations, a user's list of assigned access rights to other users, a log of a user's call activity, a log of ~~a~~ location initiations, a user profile, login/password information, or any other sort of information. Many features may be provided that utilize such information. For example, an approximate location may be determined for a device that is turned OFF (e.g., by utilizing the device's location history). As per another example, if a cell phone is lost and a new one replaced, information such as, for example, phone books, activity logs, and assigned user access rights may be downloaded/flashed into the cell phone.

[0079] Database 1602 may be accessed either directly (e.g., manually by an user of the device) or indirectly (e.g., periodically) by a cell phone or other device. Alternatively, a device or cell phone may access database 1602 directly (e.g., manually by an ~~administrator of the database~~) or indirectly (e.g., periodically) by database 1602.

[0080] A credit card authorization system is an example of additional system 1606 that may be added to topology 1600 to realize new features. Such a credit card authorization system, as described above, could

utilize a devices location in order to decrease credit card fraud. System 1600 may also be, for example, systems needed to realize the described dating functionalities or another information provider (e.g., a map information provider).

[0081] Non-wireless devices 1605 (e.g., a personal computer) may be included in topology 1600. Such devices may have locations associated to them or contain a positioning system. These locations may then be associated to a user that is recognized as using the device. For example, if a particular user logs into a non-mobile personal computer, that user's location will be recognized as being the location associated to the personal computer.

[0082] The devices of topology 1600 communicate with each other through communications network 1610. Communications network 1610 may include, for example, any type of communications, routing, amplification, encryption, decryption, parsing, modulation, or demodulation technologies. For example, positioning system 1601 may communicate with wireless device 1601 by sending multiple wireless positioning signals. At the same time, database 1602 may be providing non-wireless device 1605 with a device's location over conventional telephone wires.

[0083] FIG. 17 shows locating feature 1700 in accordance with the principles of the present invention. Locating feature 1701 starts at step 1701 and waits at step 1702 until a location is requested. As stated, a location can be requested in a number of instances and by a variety of different means.

[0084] For example, a location may be requested by a user of a cell phone that desires to locate a friend by

locating that friend's cell phone. Alternatively, a device may be triggered to request a location of a mobile device when an event occurs. For example, a credit card authorization system may request the location of a user's cell phone and the location of a store that just used a credit card associated to the requested user.

[0085] If a location is requested, access rights to the requested location for the requesting device and/or user are obtained at step 1703. Step 1703 may be employed for example, as a call to a database storing a list of assigned access rights for the requested device/user and finding if any access rights were assigned to the requestor's identity. As per another example, step 1703 may be employed as a direct call to the requested device/user.

[0086] Step 1704 determines if the requestor has been assigned access rights to obtain the requested device/user's location. Persons skilled in the art will appreciate that some devices may always have access to a user's location regardless if a user has assigned access rights to the requesting device. In this manner, a device may be set up to always let a user access a location. For example, a mother may purchase a cell phone for a minor and may configure the cell phone to always allow her location information.

[0087] If access rights do exist for the requesting device/user at step 1704 then step 1705 may be initiated and location information may be provided to the requestor. Such location information may be filtered according to the assigned access rights. For example, if a user has only been assigned access rights to obtain the requested user's city location, only the

city that the requested user/device is currently located in (or the last city location available) may be obtained. The process then finishes at step 1707 after the assigned location information has been delivered to the requestor at step 1705. Persons skilled in the art will appreciate that steps may be added to, removed, or modified from locating feature 1700. For example, instead of finish step 1707, step 1702 may be initiated after step 1706 has completed.

[0088] If a requestor has not been assigned rights to access the requested user/device's location as determined by step 1704, then step 1712 may be initiated. Step 1712 informs the requestor that the requestor does not have access rights to obtain the location of a user/device. Step 1711 may follow and provide an opportunity for the requestor to obtain the access rights. More particularly, step 1711 asks the requestor if the requestor would like to request access rights. If the requestor does not want to request access rights, locating feature 1700 may, for example, return to step 1702. Else, access rights may be requested at step 1721. Step 1722 follows and if access rights were given then step 1705 may be initiated. Else, step 1712 may, for example, be re-initiated.

[0089] FIG. 18 shows one embodiment of a cell phone burst that has been configured to embed a device or user's location 1801 between control signals (e.g., synchronization signals) and data signals. Persons skilled in the art will appreciate that some cell phone burst standards (e.g., TDMA and CDMA) have signal portions that are reserved for future technologies. In one embodiment, this reserved portion is utilized to

house location information 1801. A cell phone tower or base may then strip received signals 1800 of location information 1801, store location information 1801 into a database or other storage device, and deliver the received signals to its desired location. In this manner, a user may refresh his/her location information every time that a cell phone base station receives or routes information for the user. By stripping location information 1801 from signal 1800, the intended receiver does not have access to the location of the device transmitting signal 1800. A signal similar to signal 1800 may be sent to a cell phone that has requested, and has the appropriate location access rights, to location 1801. Location 1801 may also be stored in other portions of signal 1800 that are not reserved portions. For example, a received signal 1800 may store location information in the data portions of signal 1800. In embodiments where additional information is sent about location 1801 (e.g., a map associated with location 1801) utilizing a main data portion of signal 1800 is preferred. Persons skilled in the art will appreciate that signal burst 1800 may actually be any type of communication signal such as, for example, information returned from a database inquiry.

[0090] Persons skilled in the art will also appreciate that the systems and methods of the present invention may be implemented using other locating features and configurations. For example, a user may be manually requested to allow location access rights every time his/her location is requested. As per another example, a user may organize his/her user list into groups and assign access rights to that group

(e.g., family member user group, close friend user group). All such modifications are within the scope of the present invention, which is limited only by the claims that follow.

5

What is Claimed is:

1. A method of mobile-to-mobile locating, said method comprising:

requesting a location of a first wireless device by a second wireless device;

assigning location access rights to said second wireless device by said first wireless device;

determining said access rights assigned by said first wireless device to said second wireless device; and

providing said location to said second wireless device dependent upon said access rights.

2. The method of claim 1 wherein said first and second wireless devices are cellular phones.

SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

Abstract of the Disclosure

Systems and methods for locating a cellular phone are provided. More particularly, systems and methods are provided that allow the location of a requested user's cellular phone to be provided to a requesting user's device (e.g., a second cellular phone) based on access rights defined by the requested user. Location descriptions may be provided at a multitude of levels. For example, if a cellular phone, or an identity associated to (e.g., logged into) a cellular phone, has been given access rights to a cell phone's exact location for an indefinite amount of time, that cell phone can receive, on command, the exact location of the approved cell phone. Other levels of location information that can be granted

include, for example, proximities, states, and countries.

SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

Background of the Invention

[0001] This invention relates to systems and methods for determining a device's location. More particularly, this invention relates to systems and methods for remotely determining a device's location.

[0002] The Global Positioning System (GPS) has been developed in which a ground-based system can receive GPS signals from satellites and use these signals to determine ~~it's~~ the location of the ground-based system based on the time ~~that it takes~~ the GPS signals took to reach the ground-based system. Generally, three satellite signals are needed to determine where in the world a receiver is located (i.e., position triangulation).

[0003] GPS systems have been integrated into cellular phones. However, these systems are deficient because the location of a device, ~~that is~~ as determined by these GPS signals, ~~are~~ is only minimally utilized. It is therefore desirable to provide systems and methods ~~which~~ that better utilize the information about a device's location.

Summary of the Invention

[0004] In accordance with the present invention, systems and methods are provided for locating cellular phones. More particularly, the present invention provides systems and methods for allowing a user of a cellular phone (e.g., a requesting user or a requestor) to locate the position of a different user's cellular phone (e.g., a requested user) based upon ~~requestor-assigned~~ access rights assigned by the requested user.

[0005] One object of the present invention is to provide a security feature which allows a user to limit and/or deny location access to a particular user. In preferred embodiments, only the users that have been granted access to the location of a user's cellular phone can actually locate that user's cellular phone. Furthermore, different types of access levels may be provided that allow a user to filter location information to a different user. In this manner, a cell phone user may give access, through his or her cell phone, to a friend so that the friend can locate him or her dependent on the level of access that is granted to that friend.

[0006] For example, suppose that Phil tells Bill that he will be shopping in Manhattan and that Bill should locate him when Bill gets to Manhattan through their cell phones. In such an example, Phil may grant Bill access the exact location of his cell phone for a specific period of time (e.g., the next two hours). As a result, when Bill tries to access Phil's location, Bill will be told exactly where in Manhattan Phil's cell phone is located. Thus, Bill does not have to contact Phil directly to see where ~~he~~ Phil is located

and, therefore, Phil does not have to spend any time giving Bill verbal directions; Bill can simply see what store Phil is currently in and go to that store ~~it~~.

[0007] As mentioned previously, levels in the scope of access may be controlled by a user such that, for example, only a user's exact location, approximate location, city, state, or country can be accessed by a particular user.

[0008] Location alerts and monitoring features are also provided. For example, Phil may give Jen, a resident of Pittsburgh, city access so that when Phil travels into Pittsburgh, Jen will be alerted of Phil's presence. Such an alert may take the form of, for example, a display on Jen's cell phone that communicates to Jen "Phil is in Pittsburgh."

[0009] Locating a cellular phone may be accomplished in several ways. For example, satellite positioning systems such as the Global Positional System and the soon to be deployed Galileo system may be used to locate a user's cell phone.

[0010] User positions and security settings may be regularly or manually transmitted to a remote system, such as a remote database so that requesting users can locate a requested user's position even if the requested user turns his/her cell phone OFF. Placing the security measures on a remote system (e.g., remote database, computer, or server) provides an information brokering scheme such that the system is still operable even when cell phones are added, removed, or modified from the system.

[0011] Additionally, the present invention may be configured to provide additional information about the

location of a user. Such additional information may be, for example, a map, a location marker on a map, a map that changes as the user moves, a compass, coordinates of the located cell phone, directions to the located cell phone, where a user is in relation to another user, and information about the location the located user is currently positioned in or nearby locations such as landmarks. Such information may be provided by a remote information provider (e.g., a remote map information provider) and accessed by an information broker through a communications network.

[0012] Many other features are also employed that ~~realizes~~ realize advantageous locating functionality. ~~As per an~~ For example, suppose that a wife wants to see if her husband has left work yet. She can locate her husband, without having to talk to him, and realize that he is driving home on a highway. Thus, a travel time option may be provided to the user. This option would compute the distance between the wife's location and husband's location by taking multiple location readings of the husband's location to see how fast the husband is traveling. Alternatively, because the husband's position will map to a highway, the system may assume that the user is driving and may provide the wife with an estimate on the husband's arrival time based on an assumed route. In this manner, the present invention may determine how much time it will take the husband to reach the wife and display this information to the wife.

[0013] As per other examples, a "see my friends" option may also be provided that brings up a map of a desired area. Dots or symbols may be present on the map to signify the location of all users ~~user's~~ from

which the requesting user has location information for. Similarly, a "find closest friend" option may be employed which finds the closest user with which the requesting user has location access to.

[0014] A cell phone location may by accessed by a variety of other devices. Alternatively, a cell phone may be used to access the location of a variety of other devices. For example, if the wife was at home, that wife may connect to the internet and access a remote database to either provide the most recent location information about the husband's cell phone to her or request a location update from the husband's cell phone. The wife's location may be already stored in such a database by associating the location to the IP address of the computer or by a manual input of the wife's location. The wife's identity may be determined by, for example, a login and password on a website. Thus, the above-identified security measures are not limited to device-to-device locating, but rather user-to-user ~~user to user~~ locating; the wife may only access the husband's location if the husband has granted access for the wife to do so. If, by accident, the wife's cell phone breaks, she may login on a friend's cell phone and determine the husband's location according to the device that the husband is logged into.

[0015] Security is preferably taken into account in the present invention and, therefore, location rights for a specific user may be given to a different user only by that specific user. However, a user may request location access rights from a different user. For example, a user may be provided with a request location screen on his cell phone and that user (e.g.,

user "X") may enter in the cell phone number of the cell phone whose location is desired. The user associated to the entered cell phone number may then receive an alert that says "user X has requested access to your location." Location access may then be given or denied on multiple levels and the requesting user notified of the decision.

[0016] The location feature of the present invention may be turned ON or OFF at any time. Users may be added, individually or in groups, to a list of users with location access rights to a specific user by that specific user. A specific user may, at any time, modify, delete, or add users allowed to access his or her location. Login and password information may be included to increase security or to create a user profile, allowing a specific user to log into any cell phone and be recognized ~~recognize by the present invention~~ (and thereby be located with that cell phone or locatable device).

Brief Description of the Drawings

[0017] The principles and advantages of the present invention can be more clearly understood from the following detailed description considered in conjunction with the following drawings, in which the same reference numerals denote the same structural elements throughout, and in which:

[0018] FIG. 1 is a network topology of a cell phone locating network in accordance with the principles of the present invention;

[0019] FIG. 2 is a flow chart of the locating feature in accordance with the principles of the present invention;

[0020] FIG. 3 is an illustration of a cell phone in accordance with the principles of the present invention;

[0021] FIG. 4 is a display screen for a locate feature in accordance with with the principles of the present invention;

[0022] FIG. 5 is a display screen for a retrieving location status feature in accordance with the principles of the present invention;

[0023] FIG. 6 is a display screen for a displaying location feature in accordance with the principles of the present invention;

[0024] FIG. 7 is a display screen listing options for a locate feature in accordance with the principles of the present invention;

[0025] FIG. 8 is a display screen of a failed locate feature due to insufficient rights in accordance with the principles of the present invention;

[0026] FIG. 9 is a display screen of adding and modifying locate rights and options to a user in accordance with the principles of the present invention;

[0027] FIG. 10 is a display screen of assigning location rights to a user in accordance with the principles of the present invention;

[0028] FIG. 11 is a display screen of alert options in accordance with the principles of the present invention;

[0029] FIG. 12 is a display screen of an alert feature in accordance with the principles of the present invention;

[0030] FIG. 13 is a display screen of a login feature in accordance with the principles of the present invention;

[0031] FIG. 14 is a display screen of a login feature in accordance with the principles of the present invention;

[0032] FIG. 15 is a wireless device in accordance with the principles of the present invention;

[0033] FIG. 16 is an embodiment of a network topology in accordance with the principles of the present invention;

[0034] FIG. 17 is an embodiment of a locating feature in accordance with the principles of the present invention; and

[0035] FIG. 18 is an embodiment of a communications signal in accordance with the principles of the present invention.

Detailed Description of the Invention

[0036] FIG. 1 depicts a network topology of device location network 100 that ~~incorporating~~ incorporates principles of the present invention. Network 100 includes one or more positioning satellites 110, 112, and 114 that can locate the position of one or more cell phones 120, 122, 126, and 124 (and other locatable devices) on Earth 101. Positioning satellites 110, 112, and 114 may be, for example, the Global Positioning System (GPS) or the upcoming Galileo satellite network.

[0037] Preferably, any cell phone in network 100 may locate a different cell phone, as long as access to location information is allowed, through the utilization of positioning satellites 110, 112, and

114. Persons skilled in the art will appreciate that other positioning systems and methods may be used in locating the position of a user on a cell phone of network 100.

[0038] To route information to and from a cell phone of network 100 additional facilities and communication paths may be included. For example, a main facility (not shown in FIG. 1) containing user location access rights may be included in network 100. Such a main facility may retrieve location information directly from a positioning system or a cellular phone and then route this information to a cellular phone or positioning system.

[0039] Persons skilled in the art will appreciate that if the Global Positioning System (GPS) is used as the positioning system then GPS receivers will be incorporated into cellular phones of the present invention. Persons skilled in the art will also appreciate that devices other than cellular phones may include positioning features. For example, watches, clothing, laptop computers, personal digital assistants (PDAs), may all contain location systems (e.g., GPS) and utilize the security principles of the present invention to allow different user's to access these locations.

[0040] FIG. 2 shows flow chart 200 of a simplified locating feature constructed in accordance with the principles of the present invention. Step 202 initiates when a user requests the location of another user's cell phone. Step 206 evaluates if the user initiating the location request has the rights to access the location of the desired user. If no access rights for the requesting user have been granted then

step 204 will preferably inform the requesting user that he/she has not been given access to the requested location. In this manner, every user may assign rights (e.g. govern the security) to whom may or may not locate him/her. In preferred embodiments, these rights will be stored in, or functionality executed from, a remote facility and accessed and utilized by a user's cell phone or other requesting device (e.g., a watch or PDA).

[0041] If access has been given by a particular user that allows for the requesting user to locate that particular user, step 208 is initiated and the allowed location information is provided to the user in step 210. Step 208 may optionally filter the location information such that only a portion information is passed to the requesting user. The requested user may have, for example, defined that the requesting user only can obtain the city, state, or country of his/her location. Persons skilled in the art will appreciate that only the location of the desired user needs to have a cell phone or a positioning system. The requesting user may use ~~user~~ other means (e.g., the internet) to request the location of the desired user.

[0042] Persons skilled in the art will appreciate that the location of a user's cell phone may be retrieved, in step 208, from a remote database, facility, distribution center, or any other system. More particularly, a remote database may periodically request the location of a cell phone user with a positioning system and store this information. This database may also keep a record of those people allowed to access that user's location, the extent to which access is allowed, and the extent to which a user has

requested a user's location. A user may update, add, manipulate, or remove access at any time by doing so at this database. Thus, a requesting user only has to contact the remote database, have his/her identity recognized, have his/her access rights for the requested user location determined, and, if the requesting user has the correct access rights, be provided with the requested user's location.

[0043] Instead of a remote database periodically obtaining location information for a user, the database can obtain a user's locations when a request is made for that user's location, ~~providing~~ provided that the requesting user has access to the requested user's location. However, persons skilled in the art will recognize that a remote database is utilized in the above examples ~~that contains~~ to contain the locations, in most circumstances, of a multitude of users. Thus, to increase security even more, a requesting user's cell phone may directly request a user's location from the requested user's cell phone without the need for a database. In such an example a user adds, manipulates, or removes access rights locally on his/her cell phone and does not have to worry about security issues that surround placing his location on a remote database. Furthermore, in such an embodiment a user's location does not have to be saved anywhere, a positioning system can just be "read" by a requesting user with the appropriate access rights.

[0044] However, by recording a user's location on a device, e.g., a cell phone's memory or in a remote database, novel applications may be utilized. For example, whenever a user makes a credit card purchase, a credit card authorization system can record the

location of a cell phone associated to the purchasing user. In this manner, a new system and method of fraud protection is introduced. The credit card authorization system may, for example, reject a purchase if the purchaser's cell phone (or watch, clothing, PDA, or other positioning enabled device) is not in the vicinity of the purchase. Alternatively, the credit card authorization system may request a second form of identification if the purchaser's cell phone location does not correlate to the location of the purchase. Additionally, the credit card authorization system may call the purchaser's cell phone and request authorization for the credit card purchase. However, such features would preferably first involve the user/purchaser giving the credit card authorization system access to the location of his/her cell phone.

[0045] As per another application, a unique dating/matching service could be embodied. For example, a user may store a number of preferences in a matching profile. These preferences may describe what type of person ~~he~~ the user is interested in meeting. Additionally, a user may store, preferably locally (for the dating/matching feature), but alternatively at a remote location, ~~his/her~~ the user's own profile that has data describing similar attributes for what the user ~~he/she~~ is looking for. For example, an entry in a user's profile may be "male" and an entry in a "looking for" profile may be "female." When a user comes within a certain distance of a user (determined by comparing locations of a user) that fits his/her "looking for" profile, the user may be alerted of the proximity of a matching user. Preferably, the particular user is only

alerted if the "looking for" user has entered in attributes similar to the particular user's attributes and is also alerted of the particular user. The next stages of such an application could include, for example, requesting access to a form of communication. Such a form of communication could be for example, talking on the phone, instant messaging, or delivering an email address. Persons skilled in the art will therefore appreciate that many useful applications may be constructed using the principles of the present invention.

[0046] FIG. 3 depicts cell phone 300 constructed in accordance with the principles of the present invention. Cell phone ~~Phone~~ 300 preferably includes speaker 330, antenna 310, display screen 320, control keys 360, alpha-numeric keys 350, and microphone 340. Cell phone 300 also preferably may include, for example, a communications transmitter (not shown), communications receiver (not shown), memory (not shown), positioning device (not shown), and a microprocessor (not shown). **[0047]** Cell phone 300 may also include locate button 380. Cell phone 300 may be configured such that if locate button 380 is pressed, a locate feature is initiated (e.g., display screen 400 of FIG. 4 is initiated). Alternatively, cell phone 300 may be configured such that if locate button 380 is pressed, a location signal is sent to a remote storage area (e.g., a remote database), thus manually updating the user's location. This latter functionality may be useful when a user does not want his/her location accessed. As in another alternative embodiment, cell phone 380 may be configured such that if locate button 380 is pressed, the locating features

of cell phone 300 are toggled between ON and OFF. Person skilled in the art will appreciate that locate button 380 may be configured to produce a variety of useful functionalities.

[0048] FIG. 4 depicts display screen 400 that is displaying a locate feature constructed in accordance with the principles of the present invention. The locate feature of display screen 400 may be included, for example, in cell phone 300 of FIG. 3 and displayed to the user of cell phone 300 of FIG. 3 when that user requests the location of a different user of the present invention. The programming for the feature may, for example, be stored in the memory of the cell phone and executed by the processor at a user's request. Locate <u>feature</u> ~~Feature~~ 400 includes identifier list 410 of alpha-numeric identifiers for users stored in the memory on cell phone 300 (FIG. 3) or at a remote location. More particularly the user of display 410 may locate a user contained in identifier list 410 by selecting an appropriate user identifier 420.

[0049] The user identifiers (e.g., "Susan Pracht") in identifier list 410 are selectable and may be selected by control keys 360 of FIG. 3. Highlight window 410 may be used to prompt the user what identifier from list 410 is currently selected any may be controlled, for example, by the input keys of the cell phone (e.g., keys 350 and 360 of FIG. 3). Identifiers may be associated to, for example, cellular telephone number, user profiles, or any other identifier that may be associated to a locatable device or user interacting with a locatable device.

[0050] Persons skilled in the art will appreciate that display screen 400 may be provided to a user of devices other than wireless devices. For example, display screen 410 may be provided to a user of a personal computer with no positioning system. Preferably, however, the security measures in accordance with the principles of the present invention are still abided to (e.g., access has been granted to the identifier associated to the requesting user). In this manner, a user can control who can access his/her wireless device (e.g., cell phone).

[0051] Persons skilled in the art will appreciate that identifier list 410 may be configured, for example, to contain only those users in which the user of cell phone 300 (FIG. 3) has locate access rights to or any user stored in cell phone 300. Persons skilled in the art will also appreciate that devices other than cell phone 300 may be used to incorporate the features of the present invention. Such devices could include, for example, personal digital assistants (PDAs), laptop, GPS pagers, GPS watches, car positioning devices, or any other devices that can be located. One advantage of the present invention is that it allows a mobile device with a positioning system to locate a different mobile device with a positioning system while still retaining a high level of location security and privacy.

[0052] FIG. 5 is display screen 500 for retrieving location status feature in accordance with the principles of the present invention. The selected identifier may be incorporated into display screen 500 through location status display 510 to inform the user of the status of the location retrieval. For example,

display screen 500 may display "locating user" while a request is being processed by a remote facility or database.

[0053] FIG. 6 ~~shoes~~ shows display screen 600 for a display location feature constructed in accordance with the principles of the present invention. When a location is retrieved for the requested user, the location may be displayed on Display Screen 600 through primary location information 610. Depending on what scope the requesting user has access to, primary location information 610 may include, for example, the country, state, city, exact location, or any combination thereof of location information to the user. For example, if the user requesting the location of a desired user has been given unlimited location access by the desired user, primary information 610 may include the exact location of the user.

[0054] Secondary location information 620 may be included to supplement the requested users exact location so that the requesting user may have more of an idea of where the requested user is located. For example, if the desired user is located in a mall, primary location information 610 may be the address of the mall. In such an example, secondary location information 620 may be included and display, to the requesting user, the name of the mall.

[0055] Directional information 630 may also be included on display 600 or any other display of the present invention. Directional information 630 may include a digital compass 632 so that the user of cell phone 300 (FIG. 3) knows what direction he or she is facing in. Digital compass 632 may be connected to a direction sensitive device (~~e.g.,~~ e.g., mechanical

compass) in order to gather directional information. Directional arrow 633 may also be included in Display 600 to indicate where the requested user's location is relative to the location and direction of cell phone 300 (FIG. 3) (~~e.g.,~~ e.g., the requesting user). Persons skilled in the art will appreciate that for some directional information 630 the location of the requesting user must be obtained. This information may be obtained either from cell phone 300, a remote facility, or by any other suitable means. If the information is gathered from a location-gathering ~~location gathering~~ device other than the requesting user's device (~~e.g.,~~ e.g., cell phone 300 (FIG. 3)), then the user's device may communicate from this other location gathering device. Once both the locations of the requesting and requested/desired users are known, this information may be utilized in a number of features incorporating the principles of the present invention.

[0056] Distance information 634 is one such feature that displays the distance between the locations of the requested and requesting users (e.g., distance between the locations of the requested and requesting devices). Directional information 630 may contain many other elements to enhance the utility of the present invention. For example, a map (not shown in FIG. 6) may be included in display 600. This map may be of the area surrounding either the requested, the requesting user's location or both. Information may be included on the map to show the shortest path between the location as well as information about the surrounding area (~~e.g.,~~ e.g., area names, store names, etc.). Other information may include, for example, time to reach the

destination according to specific types of travel ~~(e.g.~~ (e.g., subway, walking, running, driving) and the direction the requested user is traveling in.

[0057] ~~Many uses for this~~ Location information may be utilized by a user in a variety of ways. For example, if Jane calls Bill and Bill says "I am roaming midtown Manhattan ~~manhattan~~ shopping why don't you join me", no other call to Bill is needed. Bill simply has to give Jane access to his location and Bill can continue shopping without having to worry about meeting up with Jane at a specific location.

[0058] In some instances, it may be beneficial to find the speed and direction of a requested user. For example, if a wife wants to see how long before her husband arrives home, the wife can use this feature of the present invention. This feature may find the husbands location multiple times in a determined amount of time. Through this information the feature may determine the speed and direction that the user is traveling. Using this speed, for example, this feature may display to the wife that the husband "is 10 minutes away" in directional information 630. In doing so, the need for a call to the husband to determine his location is eliminated.

[0059] Persons skilled in the art will appreciate that the location of multiple users may be displayed on display screen 600. For example, suppose Jeff, Susan, and Chrissy are at a concert. If all three of these users have unlimited access to the other users, the principles of the present invention would allow for a map to be displayed on each of the three locating devices with locator designations for each of the users. Using such a map, the group may be able to find

themselves ~~in~~ relative ~~location~~ to one another and decide, if need be, on the easiest location for them to meet. Thus map 660 may be included on display screen 600 and display the locations of multiple users (e.g., user's 621 and 622).

[0060] More region 640 designates that more options or information may be retrieved or performed using principles of the present invention. A user may use control keys 340 (FIG. 3) on cell phone 300 (FIG. 3) to perform the functionality associated with more region 640.

[0061] FIG. 7 shows display screen 700 for locate listing options in accordance with the principles of the present invention. Display screen 700 includes selectable options list 710 and highlight window 720 and may be displayed to the user, for example, through the activation of functionality associated by more region 640 (FIG. 6). Options list 710 may include any of the features of the present invention. For example, options list 710 may include options activating a display screen of a map of the requesting user's location, a map of the requested user's location, directions to the requested user's location from the requesting user's location, travel time for the requesting user, travel time for the requested user, and options to set location alerts.

[0062] FIG. 8 shows display screen 800 of a failed locate feature due to insufficient rights in accordance with the principles of the present invention. Display ~~seree~~ screen 800 may be displayed if a requesting user attempts to ~~located~~ locate a requested user, but has not been given access rights by the requested ~~request~~ user to ~~his or her~~ the requested user's location. In

such an instance, insufficient rights message 801 may be prompted on display screen 800.

[0063] FIG. 9 shows display screen 900 ~~of~~ for adding and modifying locate rights and options to a user in accordance with the principles of the present invention. A user may give or modify access rights through display 900 to a user identifier in selectable user identifier listing 910. Highlight window 920 may be included to enhance the selecting process.

[0064] FIG. 10 shows display screen 1000 ~~of~~ for assigning location rights to a user in accordance with the principles of the present invention. Display screen 1000 may be displayed, for example, after a user has been selected to be given location rights. Display screen 1000 contains selectable location rights listing 1010, in which the selecting process may be enhanced by highlight window 1020. Possible location access rights may be, for example, by country, state, city, exact location, or any other scope of location. Other rights may be assigned such as particular times in the day or time periods at which locations may be accessed.

[0065] FIG. 11 shows display screen 1100 of alert options in accordance with the principles of the present invention. Display screen 1100 allows for a user to set up alerts depending on the location of specific users. Selectable alert listings 1110 are included and may be selectable with highlight window 1120. Examples of alerts that may be included in display screen 1100 may occur, for example, if the requested user is in a specific city or the same city as the user of display 1100, is within a certain distance, or if a user located the user of display 1100.

[0066] The alerts of the present invention may realize useful functionality. For example, suppose Susan Pracht lives in Pittsburgh and rarely comes to the city of the user of display screen 1100 on cell phone 300 (FIG. 3) which is New York City. The user of cell phone 300 (FIG. 3) may then use display screen 1100 and set an alert such that if Susan Pracht ever enters New York City, he or she would be alerted of Susan Pracht's presence.

[0067] FIG. 12 shows display screen 1200 of an alert feature in accordance with the principles of the present invention. Display screen 1200 includes an alert message and is displayed to a user when an event occurs that is designated by the user in display screen 1100 (FIG. 11). Continuing the example from FIG. 11, if Susan Pracht enters New York City, alert message 1210 would prompt the user that this event has occured.

[0068] FIG. 13 shows display screen 1300 of a login feature in accordance with the principles of the present invention. In order for users to be identified by other user's cell phones or locating devices a user profile may need to be stored remotely from such devices. In such instances user profiles would be used as the locating identifier and the devices into which these profiles are logged into (recognized by) would allow for the user to be located. Display screen 1300 allows for a user to log into a locating device of the present invention. Logging into a device also adds a level of security to the present invention, especially when combined with a password. A user may use the controls of the device of the present invention to enter login 1310 of display 1300.

[0069] In this manner, a user may use another user's location device (e.g., cell phone) to locate a user or may use, for example, the internet to locate a user. Additionally, in this manner, a user may change the device being located. For example, a user may use his or her car GPS system or other systems in accordance with the principles of the present invention to be located instead of his or her cell phone. To further this example, a user may log into a web site on the internet and designate his or her current location as home, or any other location, thus eliminating the need for a locatable device entirely.

[0070] FIG. 14 shows display screen 1400 of a login feature in accordance with the principles of the present invention. Display screen 1400 may be used by a user to enter a password associated to ~~his~~ that user's profile, identity, or cell phone functionality access. A user may enter password 1410 using the controls of the device of display screen 1400 (e.g., cell phone 300 of FIG. 3). By including a login/password scheme a user can be identified by a remote facility (e.g., a remote database) so that the user's location can be recorded/updated by multiple devices. Additionally, a login/password adds an extra level of security.

[0071] FIG. 15 shows cell phone 1500 that may be utilized to carry out the functionality in accordance with the principles of the present invention. Cell phone 1500 includes receiver/transmitter 1510, microprocessor 1520, positioning system 1530, and memory 1540.

[0072] Persons skilled in the art will appreciate that receiver/transmitter 1510 may directly communicate

with memory 1540 if receiver/transmitter 1510 does not have its own memory (e.g., if receiver/transmitter 1510 are configured to utilize a buffer for capturing incoming communications bursts before demodulation and decryptions).

[0073] Positioning system 1530 may be, for example, a GPS system or a similar positioning system. Positioning system 1530 may include its own receiver for receiving particular signals utilized in positioning cell phone 1500.

[0074] FIG. 16 shows network topology 1600 that includes a variety of components, ~~in which~~ all of which ~~components of~~, or some of which ~~a part of the components of~~, may be utilized to carry out the features in accordance with the principles of the present invention. In this manner, persons skilled in the art will appreciate that multiple system configurations may be utilized. Topology 1600 introduces the diversity of systems that can be utilized to realize such configurations.

[0075] Generally, topology 1600 includes multiple ~~muliple~~ mobile devices (e.g., multiple instances of mobile device 1601), access control devices and location broker devices (e.g., database 1602 and cell phone base station 1603), and non-mobile devices (e.g., grounded non-wireless device 1605). Persons skilled in the art will appreciate that other devices or facilities may be included in topology 1600. For example, one or more positioning systems 1601 may be included in topology 1600 in order to locate particular devices. For example, a positioning receiver (e.g., GPS receiver) may be included in wireless device 1601

with positing system 1601 being a positioning transmitter (e.g., GPS satellite network).

[0076] One or more wireless devices 1601 may be included in topology 1600 and may be, for example, watches, PDAs, cellular phones, radios, cars, or any other mobile device whose location can be determined.

[0077] As previously mentioned, access control and location broker devices may be included in topology 1600. Such devices may be utilized, for example, to store user access rights for a particular user and may contain functionality to request and route a device's location. These devices may be considered information ~~broker's~~ brokers such that devices may be added, removed, or modified without creating the necessity of having to modify the other devices of topology 1600.

[0078] Database 1602 is one such information broker. Database 1602 may, for example, be located in cell phone base station 1603 if database 1602 is utilized to assist in cell phone locating. Database 1602 may be utilized, for example, to store a history ~~a~~ of a device's locations, a user's list of assigned access rights to other users, a log of a user's call activity, a log of ~~a~~ location initiations, a user profile, login/password information, or any other sort of information. Many features may be provided that utilize such ~~information,~~ information. For example, ~~a~~ an approximate location may be determined for a device that is turned OFF (e.g., by utilizing the device's location history). As per another example, if a cell phone is lost and a new one replaced, information such as, for example, phone books, activity logs, and assigned user access rights may be downloaded/flashed into the cell phone.

[0079] Database 1602 may be accessed either directly (e.g., manually by an user of the device) or indirectly (e.g., periodically) by a cell phone or other device. Alternatively, a device or cell phone may access database 1602 directly (e.g., manually by an administrator of the database) or indirectly (e.g., periodically) by database 1602.

[0080] A credit card authorization system is an example of additional system 1606 that may be added to topology 1600 to realize new features. Such a credit card authorization system, as described above, could utilize a devices location in order to decrease credit card fraud. System 1600 may also be, for example, systems needed to realize the described dating functionalities or another information provider (e.g., a map information provider).

[0081] Non-wireless devices 1605 (e.g., a personal computer) may be included in topology 1600. Such devices may have locations associated to them or contain a positioning system. These locations may then be associated to a user that is recognized as using the device. For example, if a particular user logs into a non-mobile personal computer, that user's location will be recognized as being the location associated to the personal computer.

[0082] The devices of topology 1600 communicate with each other through communications network 1610. Communications network 1610 may include, for example, any type of communications, routing, amplification, encryption, decryption, parsing, modulation, or demodulation technologies. For example, positioning system 1601 may communicate with wireless device 1601 by sending multiple wireless positioning signals. At

the same time, database 1602 may be providing non-wireless device 1605 with a device's location over conventional telephone wires.

[0083] FIG. 17 shows locating feature 1700 in accordance with the principles of the present invention. Locating feature 1701 starts at step 1701 and waits at step 1702 until a location is requested. As stated, a location can be requested in a number of instances and by a variety of different means.

[0084] For example, a location may be requested by a user of a cell phone that desires to locate a friend by locating that friend's cell phone. Alternatively, a device may be triggered to request a location of a mobile device when an event occurs. For example, a credit card authorization system may request the location of a user's cell phone and the location of a store that just used a credit card associated to the requested user.

[0085] If a location is requested, access rights to the requested location for the requesting device and/or user are obtained at step 1703. Step 1703 may be employed for example, as a call to a database storing a list of assigned access rights for the requested device/user and finding if any access rights were assigned to the requestor's identity. As per another example, step 1703 may be employed as a direct call to the requested device/user.

[0086] Step 1704 determines if the requestor has been assigned access rights to obtain the requested device/user's location. Persons skilled in the art will appreciate that some devices may always have access to a user's location regardless if a user has assigned access rights to the requesting device. In

this manner, a device may be set up to always let a user access a location. For example, a mother may purchase a cell phone for a minor and may configure the cell phone to always allow her location information.

[0087] If access rights do exist for the requesting device/user at step 1704 then step 1705 may be initiated and location information may be provided to the requestor. Such location information may be filtered according to the assigned access rights. For example, if a user has only been assigned access rights to obtain the requested user's city location, only the city that the requested user/device is currently located in (or the last city location available) may be obtained. The process then finishes at step 1707 after the assigned location information has been delivered to the requestor at step 1705. Persons skilled in the art will appreciate that steps may be added to, removed, or modified from locating feature 1700. For example, instead of finish step 1707, step 1702 may be initiated after step 1706 has completed.

[0088] If a requestor has not been assigned rights to access the requested user/device's location as determined by step 1704, then step 1712 may be initiated. Step 1712 informs the requestor that the requestor does not have access rights to obtain the location of a user/device. Step 1711 may follow and provide an opportunity for the requestor to obtain the access rights. More particularly, step 1711 asks the requestor if the requestor would like to request access rights. If the requestor does not want to request access rights, locating feature 1700 may, for example, return to step 1702. Else, access rights may be requested at step 1721. Step 1722 follows and if

access rights were given then step 1705 may be initiated. Else, step 1712 may, for example, be re-initiated.

[0089] FIG. 18 shows one embodiment of a cell phone burst that has been configured to embed a device or user's location 1801 between control signals (e.g., synchronization signals) and data signals. Persons skilled in the art will appreciate that some cell phone burst standards (e.g., TDMA and CDMA) have signal portions that are reserved for future technologies. In one embodiment, this reserved portion is utilized to house location information 1801. A cell phone tower or base ~~information~~ may then strip received signals 1800 of location information 1801, store location information 1801 into a database or other storage device, and deliver the received signals to its desired location. In this manner, a user may refresh his/her location information every time that a cell phone base station receives or routes information for the user. By stripping location information 1801 from signal 1800, the intended receiver does not have access to the location of the device transmitting signal 1800. A signal similar to signal 1800 may be sent to a cell phone that has requested, and has the appropriate location access rights, to location 1801. Location ~~1701~~ 1801 may also be stored in other portions of signal ~~1700~~ 1800 that are not reserved portions. For example, a received signal 1800 may store location information in the data portions of signal 1800. In embodiments where additional information is sent about location 1801 (e.g., a map associated with location 1801) utilizing a main data portion of signal 1800 is preferred. Persons skilled in the art will appreciate

that signal burst 1800 may actually be any type of communication signal such as, for example, information returned from a database inquiry.

[0090] Persons skilled in the art will also appreciate that the systems and methods of the present invention may be implemented using other locating features and configurations. For example, a user may be manually requested to allow location access rights every time his/her location is requested. As per another example, a user may organize his/her user list into groups and assign access rights to that group (e.g., family member user group, close friend user group). All such modifications are within the scope of the present invention, which is limited only by the claims that follow.

What is Claimed is:

1. A method of mobile-to-mobile locating, said method comprising:

requesting a location of a first wireless device by a second wireless device;

assigning location access rights to said second wireless device by said first wireless device;

determining said access rights assigned by said first wireless device to said second wireless device; and

providing said location to said second wireless device dependent upon said access rights.

2. The method of claim 1 wherein said first and second wireless devices are cellular phones.

SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

Abstract of the Disclosure

Systems and methods for locating a cellular phone are provided. More particularly, systems and methods are provided that allow ~~for providing~~ the location of a requested user's cellular phone ~~from~~ to be provided to a requesting user's device (e.g., a second cellular phone) based on access rights defined by the requested user. Location descriptions may be provided at a multitude of levels. For example, if a cellular phone, or an identity associated to (e.g., logged into) a cellular phone, has been given access rights to a cell phone's exact location for an indefinite amount of time, that cell phone can receive, on command, the exact location of the approved cell phone. Other levels of location information that can

be granted include, for example, proximities, states, and countries.

10400296

PATENT APPLICATION FEE DETERMINATION RECORD
Effective January 1, 2003

Application or Docket Number: 5DM/002

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	2	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	2 minus 20=	* 0
INDEPENDENT CLAIMS	1 minus 3 =	* 0
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	375.00	OR	BASIC FEE	750.00
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL	375	OR	TOTAL	

8/8/05

CLAIMS AS AMENDED - PART II

AMENDMENT A	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 36	Minus	** 20	= 16
Independent	* 1	Minus	*** 3	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
~~X$ 9=~~	400	OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE	400	OR	TOTAL ADDIT. FEE	

AMENDMENT B	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
***If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1



8-12-05

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IFW

JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
Application No.	:	10/400,296
Confirmation No.	:	8666
Filed	:	March 25, 2003
For	:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
Group Art Unit	:	2642
Examiner	:	Benny Quoc Tieu

Mail Stop Amendment
Hon. Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

New York, New York 10020
August 10, 2005

SUBMISSION OF FORMAL DRAWINGS

Sir:

Pursuant to 37 C.F.R. § 1.85, applicant herewith furnish seventeen (17) sheets of formal drawings to be substituted for the seventeen (17) sheets of informal drawings currently filed with the above-identified application. Applicant believes that no fee is due with this submission. A duplicate copy is enclosed hereiwth.

Respectfully submitted,

Jeffrey D. Mullen
Applicant
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OIPE JC71
AUG 10 2005
PATENT & TRADEMARK OFFICE

PATENTS
Attorney Docket No. JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
Application No.	:	10/400,296 Confirmation No. : 8666
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For	:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
Group Art Unit	:	2642
Examiner	:	Benny Quoc Tieu

New York, New York 10020
August 10, 2005

Mail Stop: Amendment
Hon. Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

EXPRESS MAIL CERTIFICATION

Sir:

"Express Mail" mailing label number EV619616555US

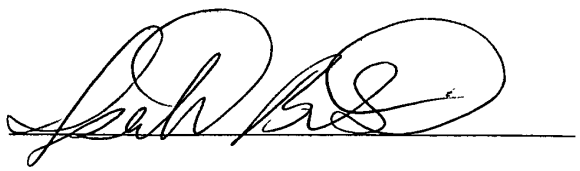
Date of Deposit August 10, 2005

I hereby certify that the papers and fees identified below are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10 on the date indicated above and are addressed to Mail Stop: Amendment, Commissioner for Patents, P.O. Box 2327, Arlington, Virginia 22202.

Submission of Formal Drawings (in duplicate);

Formal Drawings (17 sheets); and

Return Postcard



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AUG 10 2005
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100

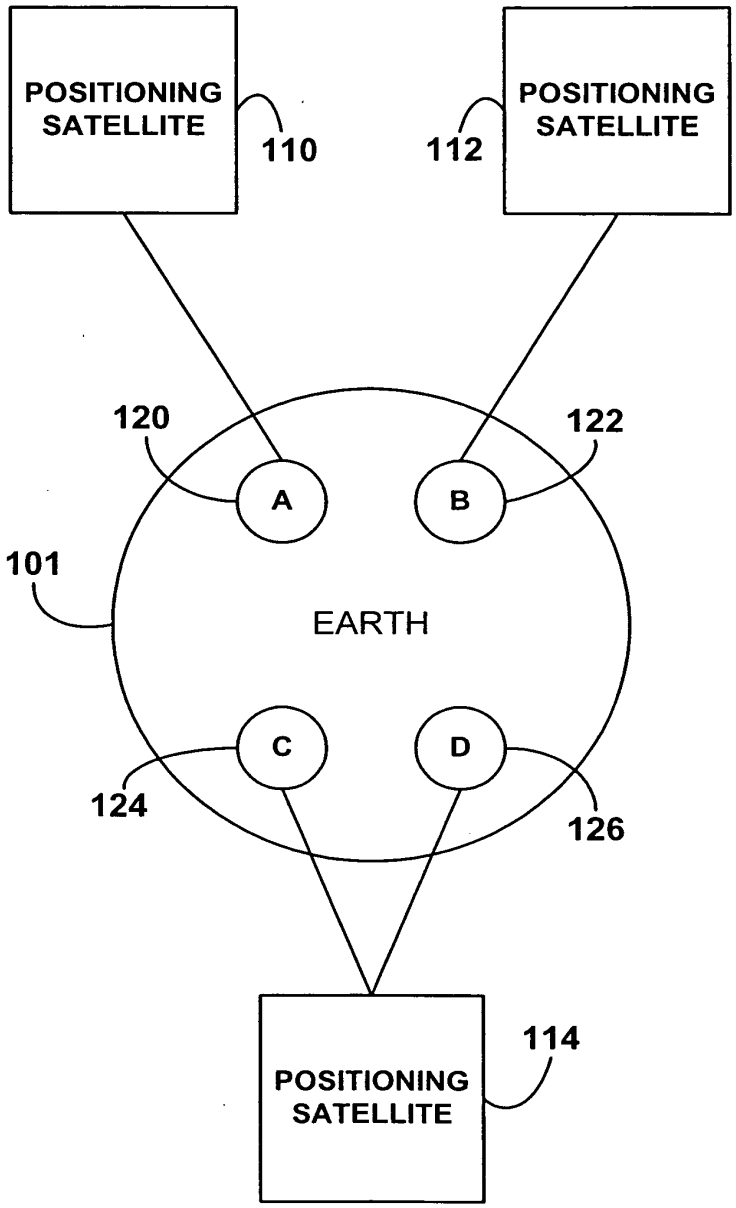


FIG. 1

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200

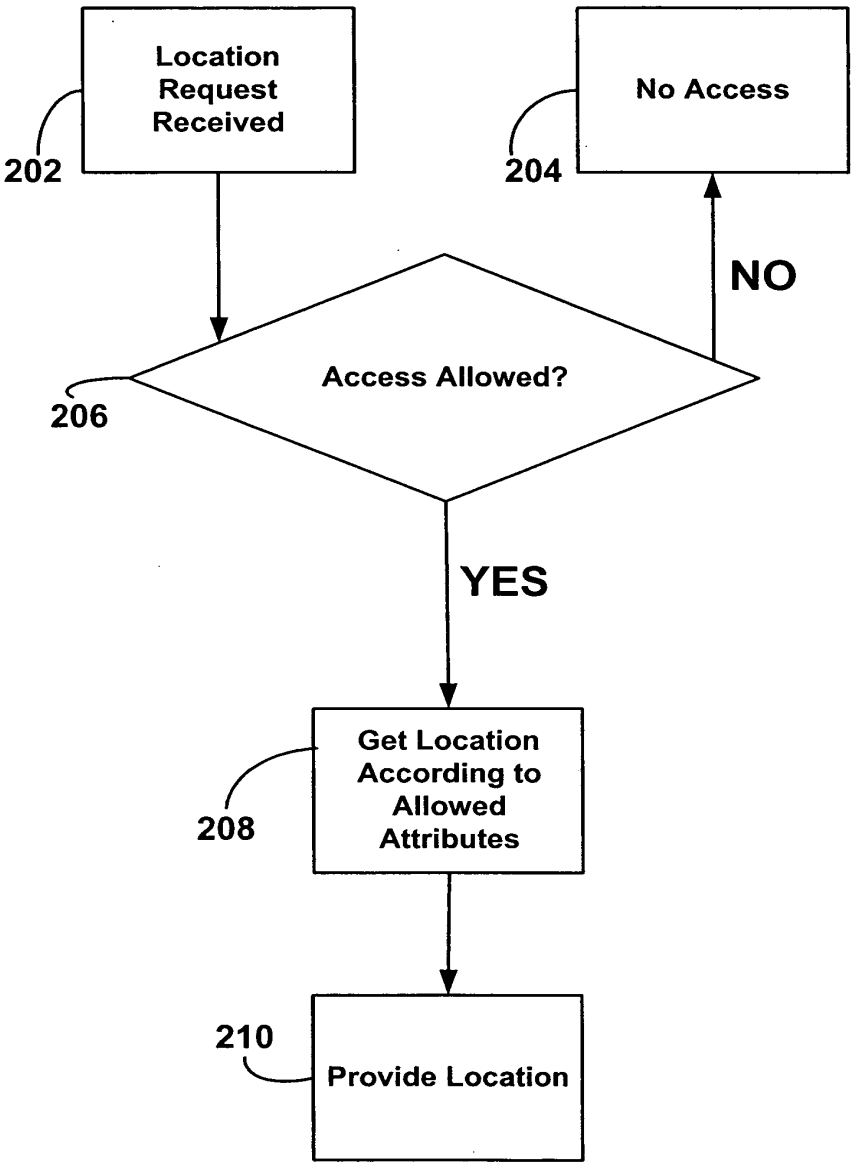


FIG. 2

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300

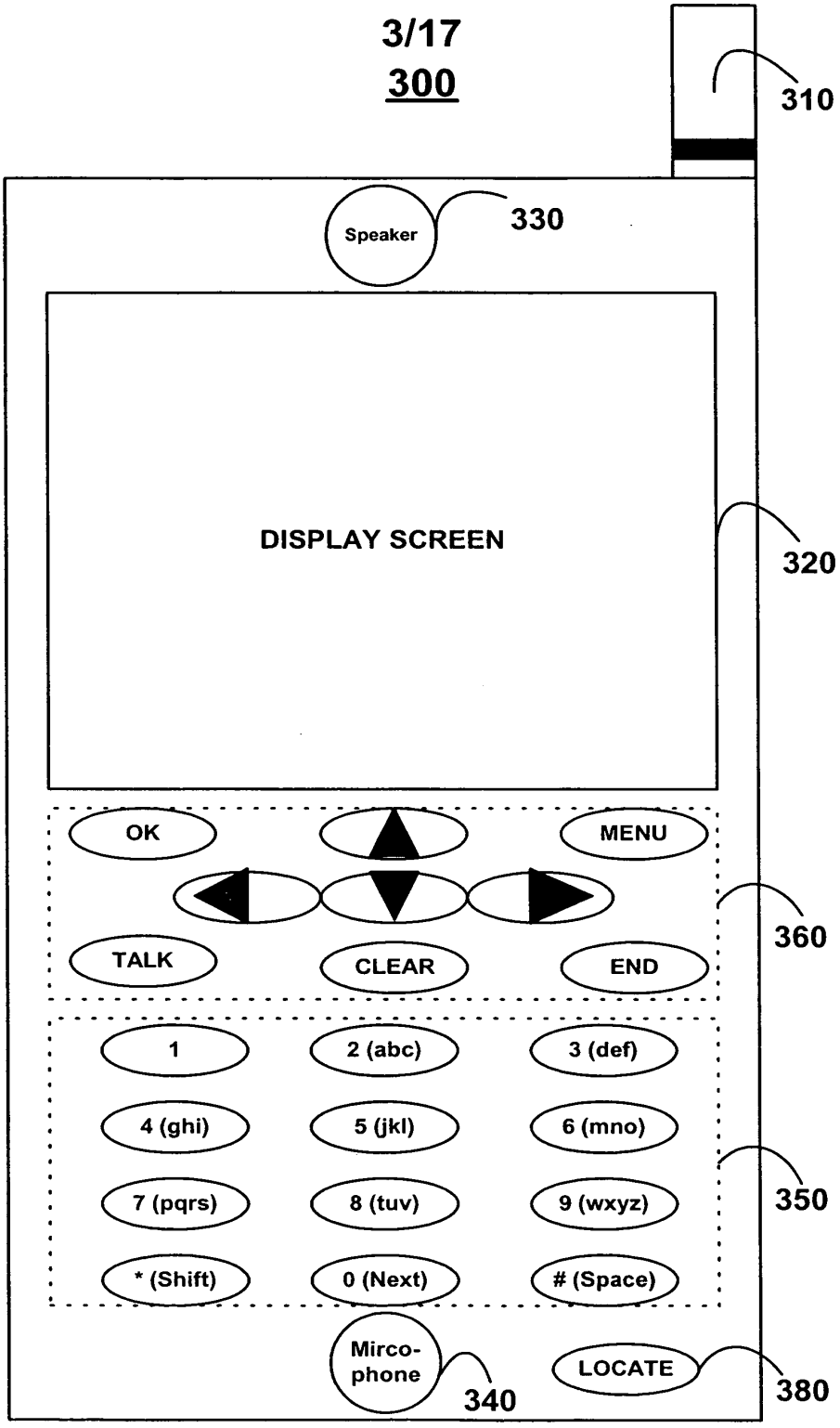


FIG. 3

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400

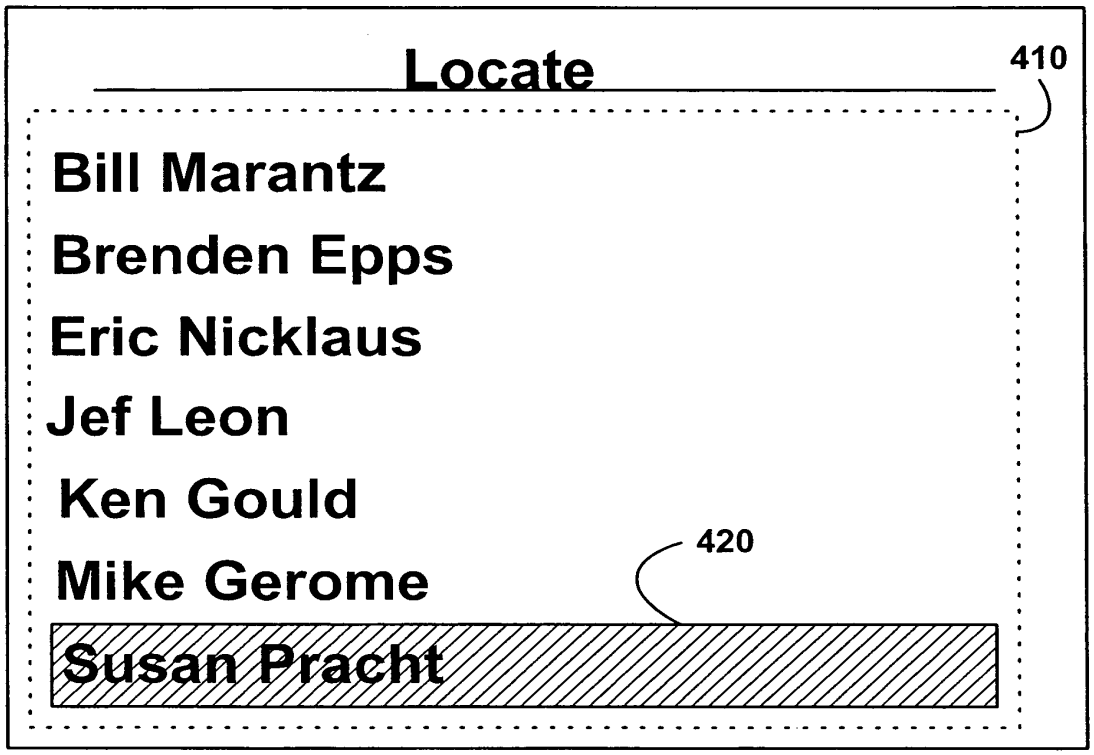


FIG. 4

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5/17

500

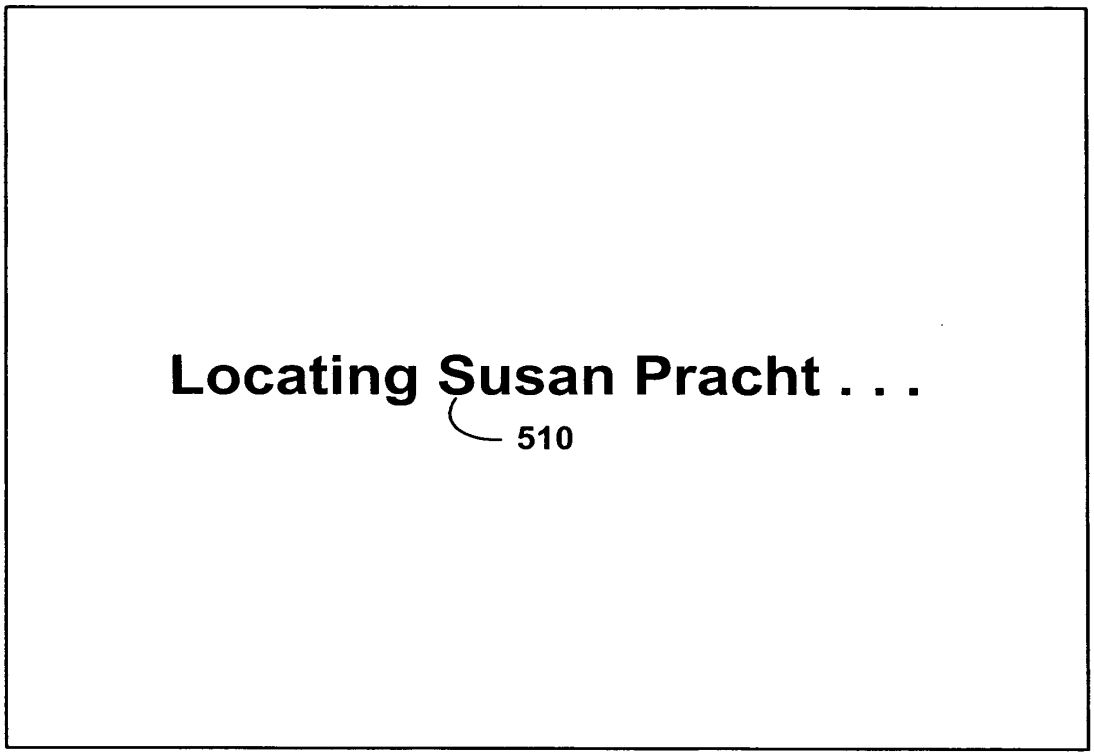


FIG. 5

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600

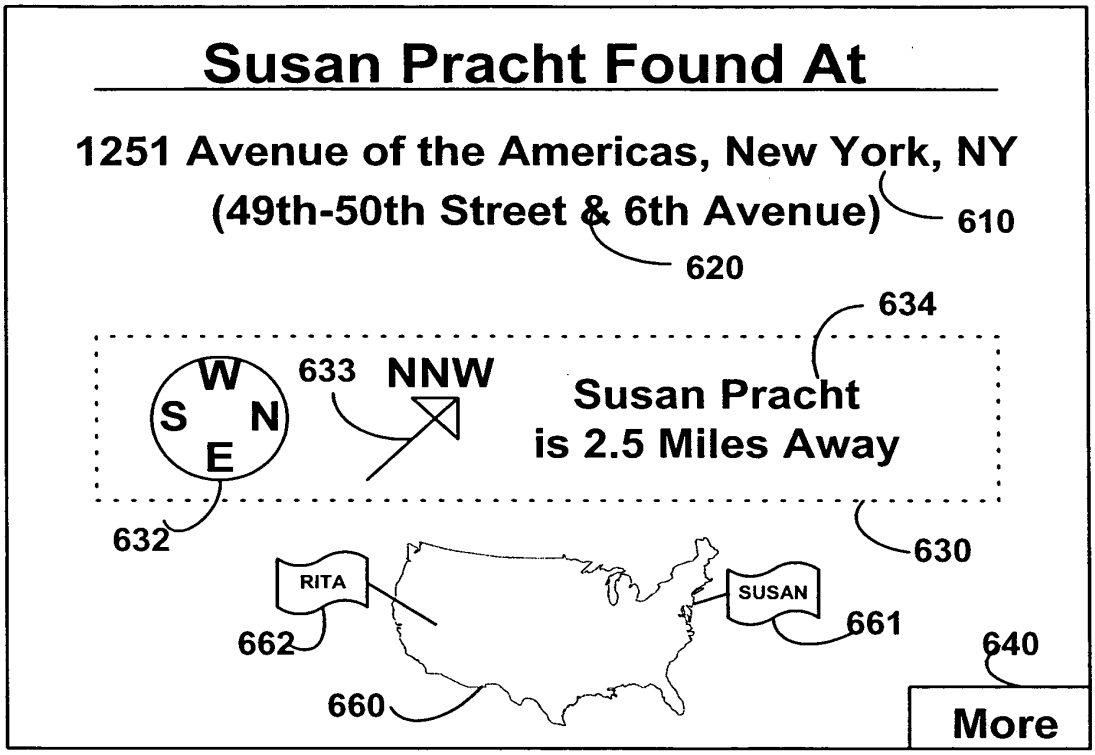


FIG. 6

OIPE JC71
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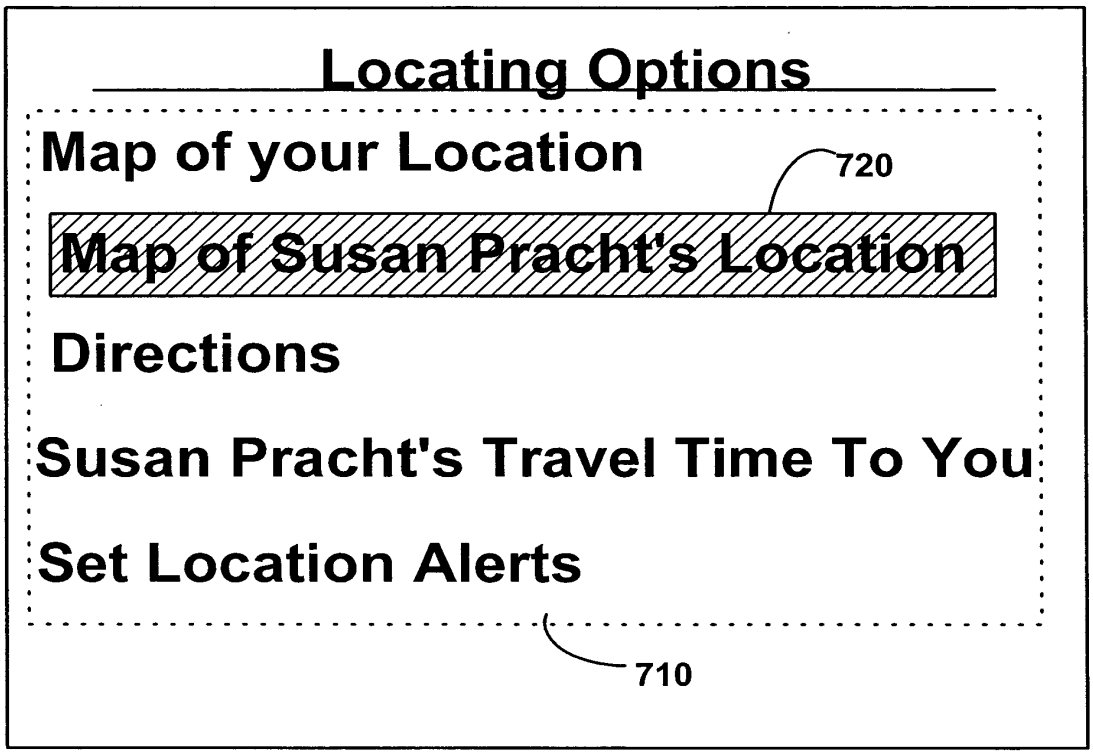


FIG. 7

OIPE JC71
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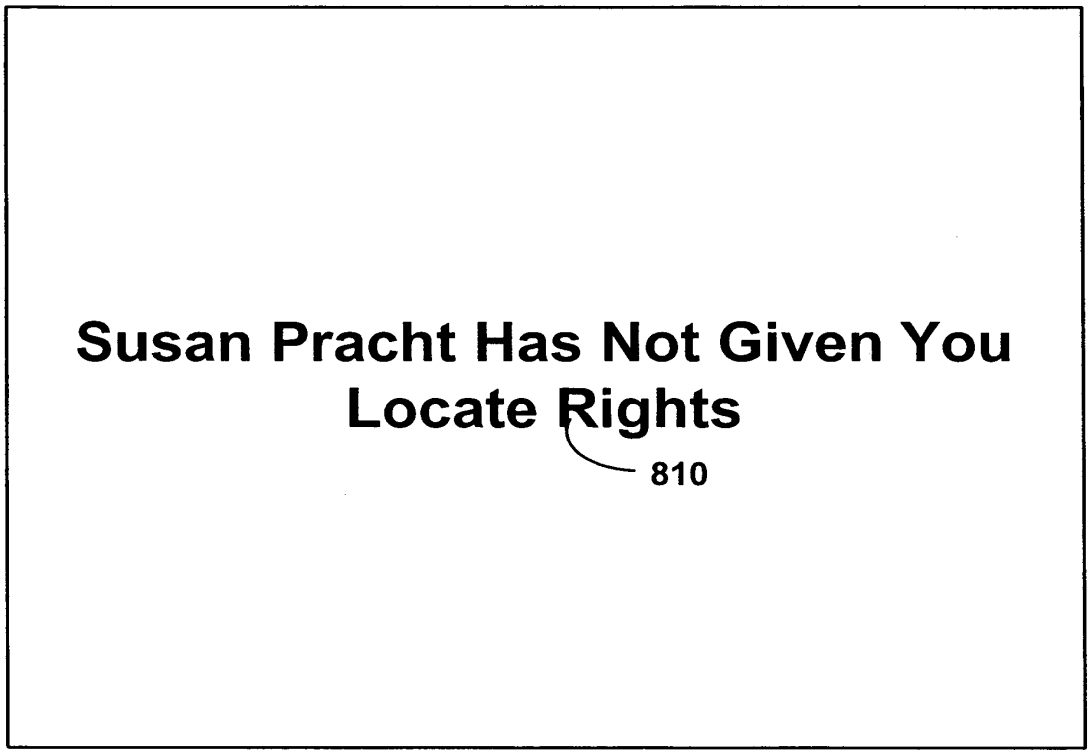


FIG. 8

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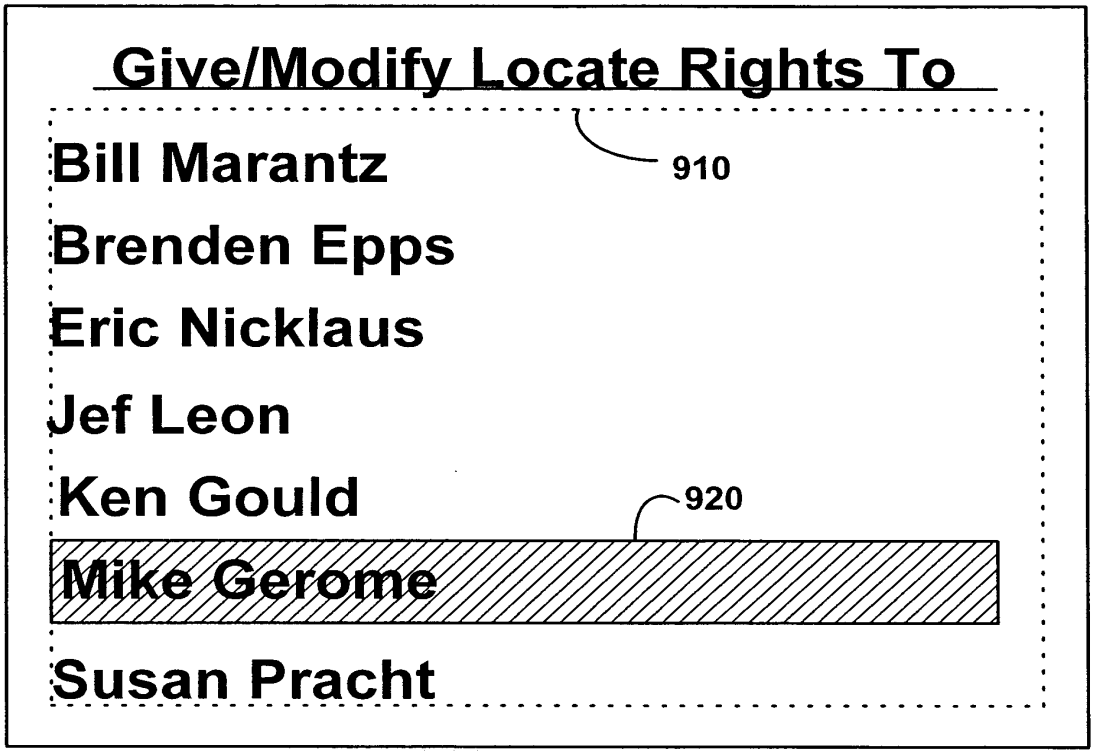


FIG. 9

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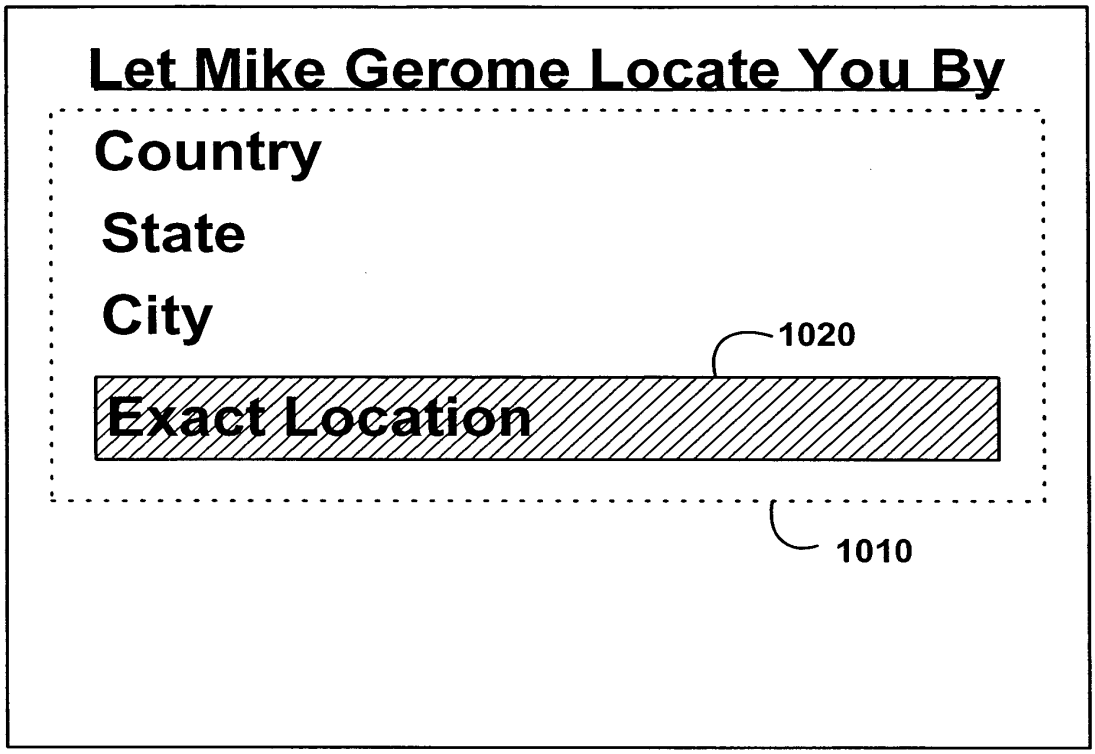


FIG. 10

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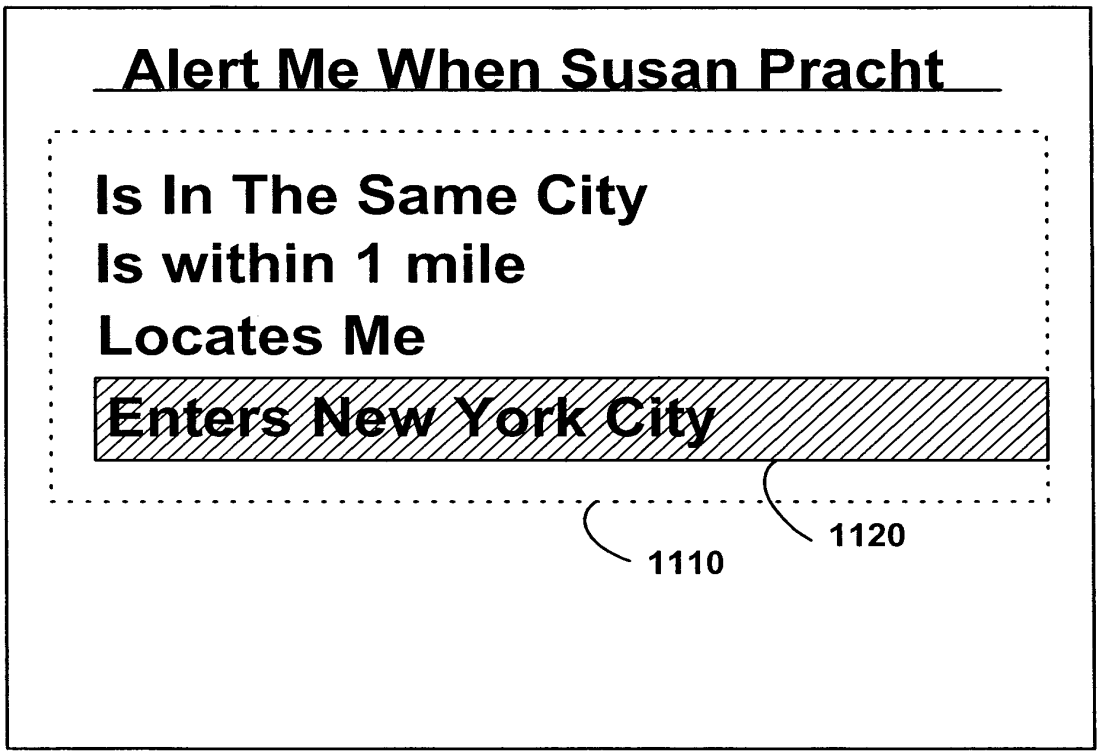


FIG. 11

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12/17

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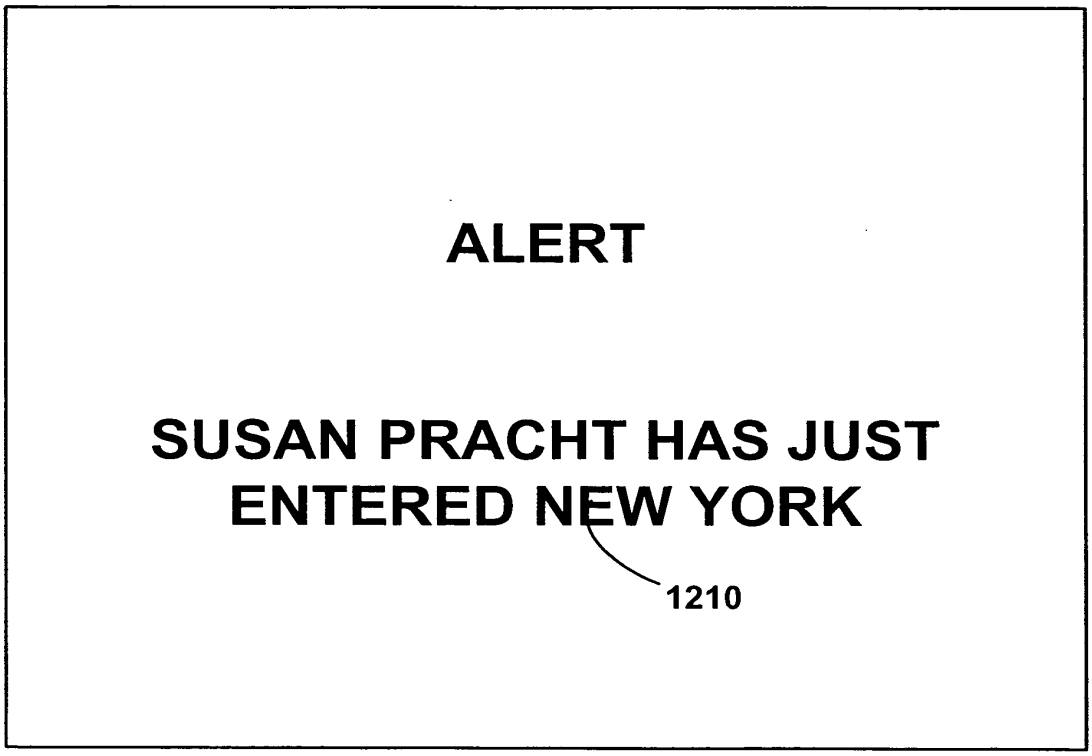


FIG. 12

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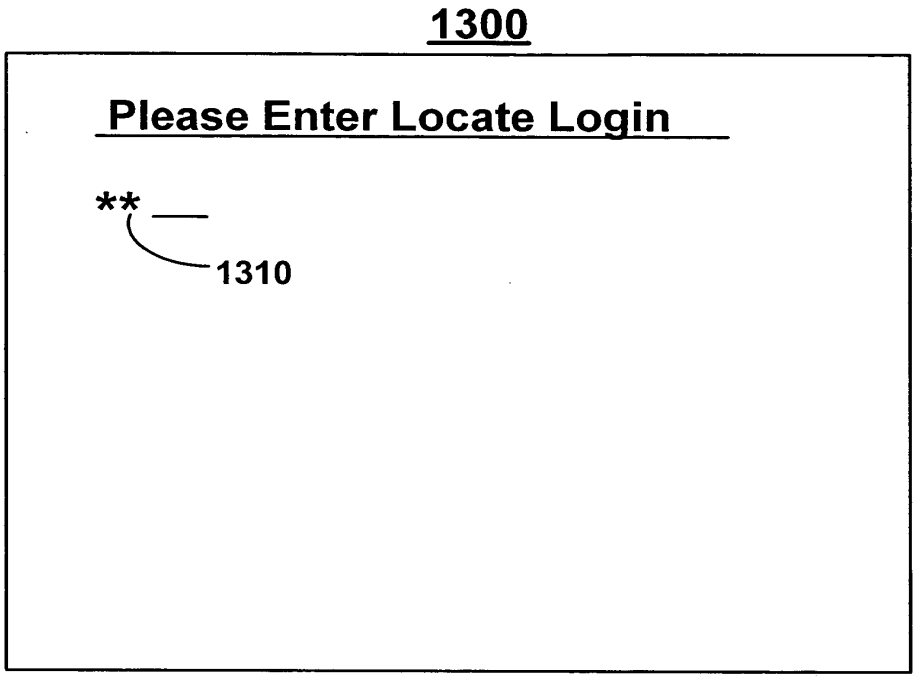


FIG. 13

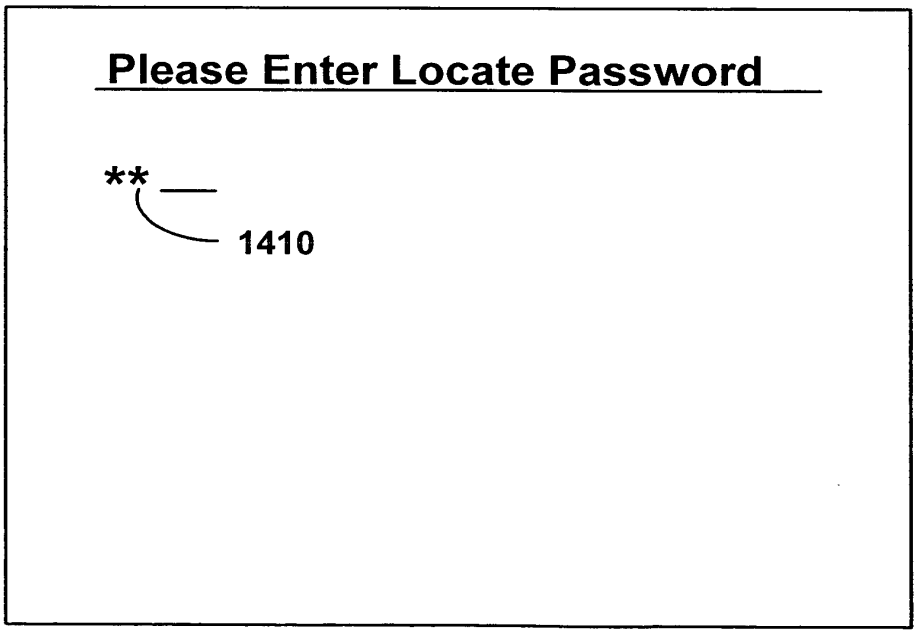


FIG. 14

OIPE JC71
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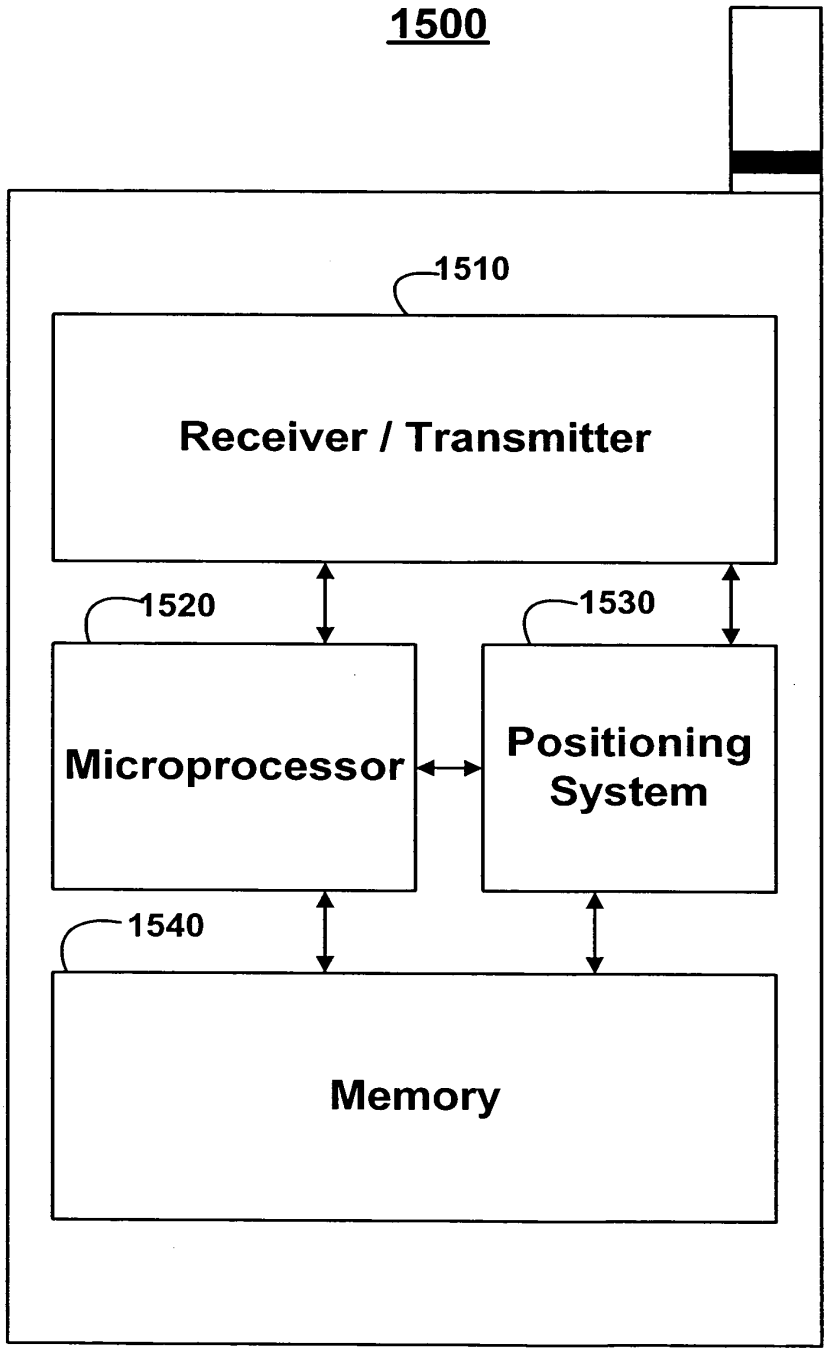


FIG. 15

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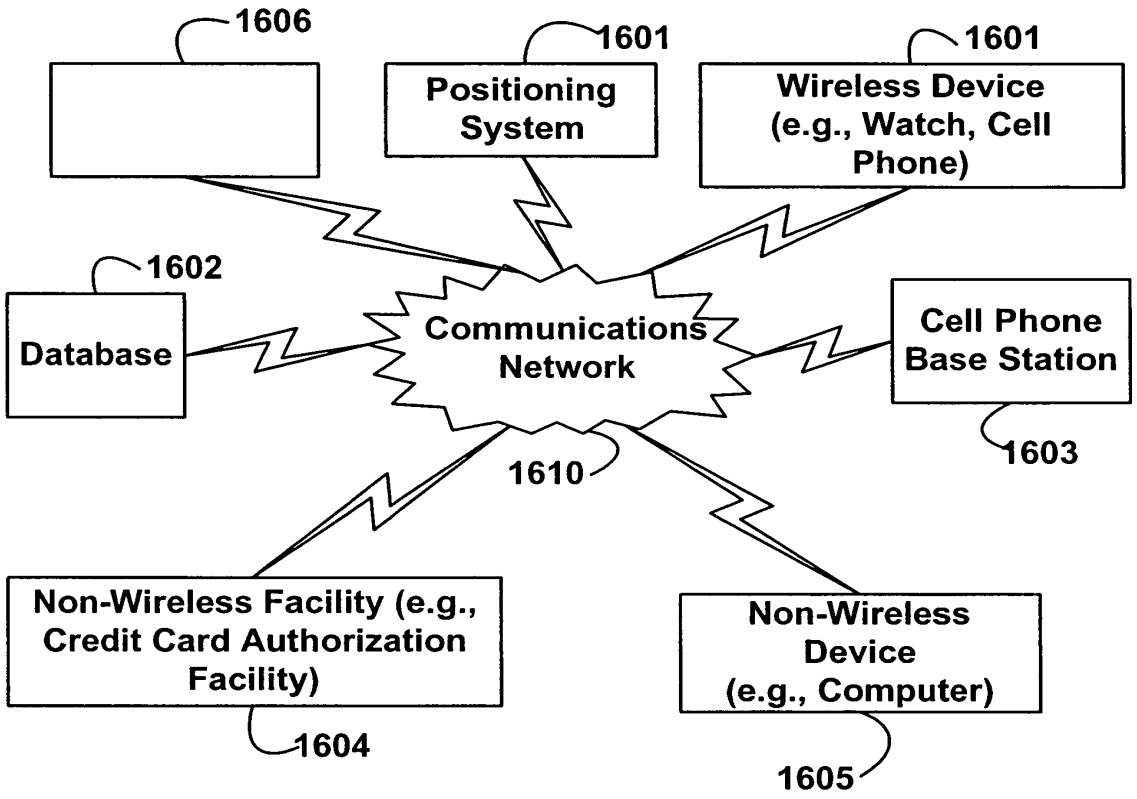


FIG. 16

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16/17

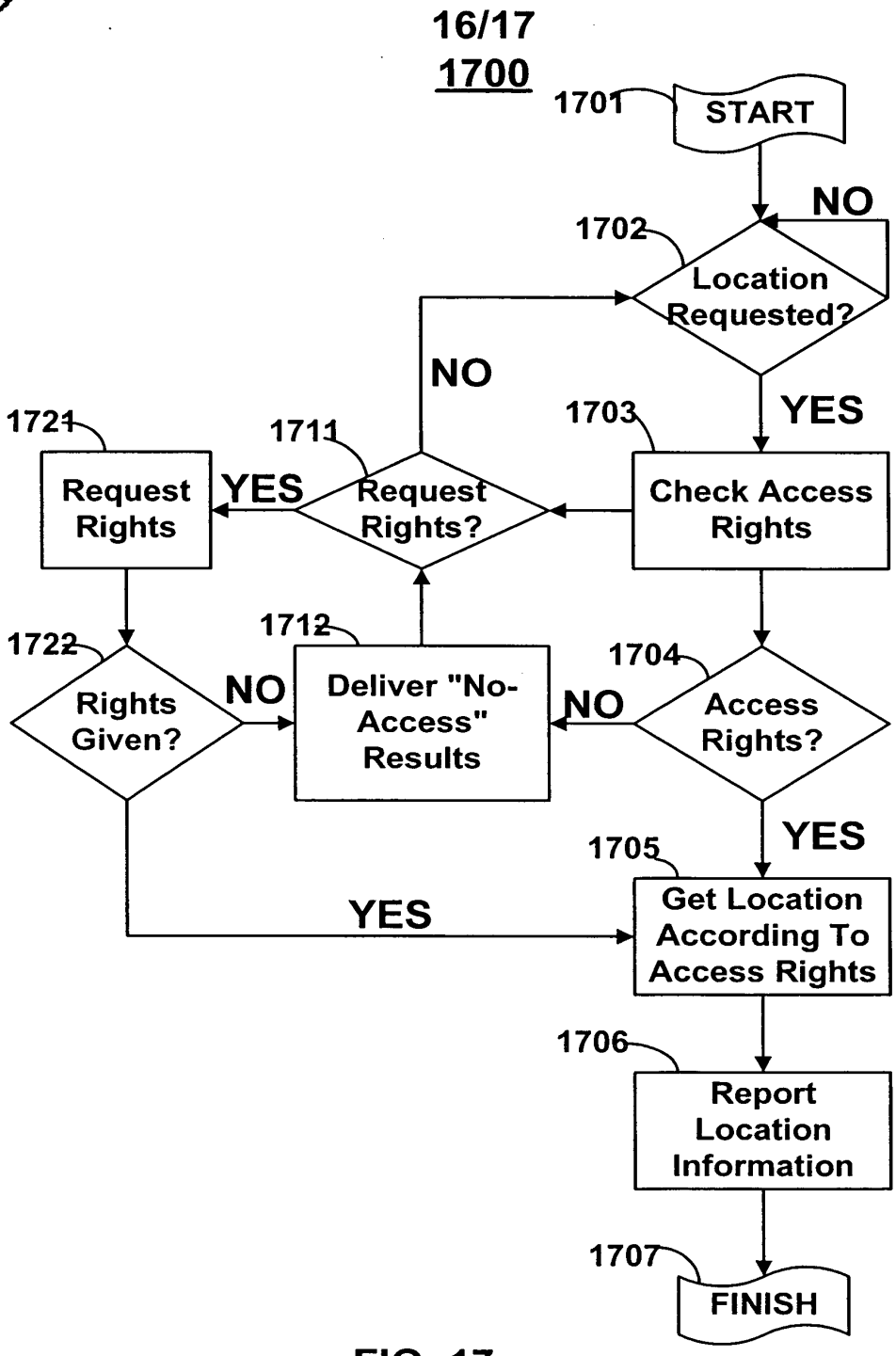


FIG. 17

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AUG 10 2005
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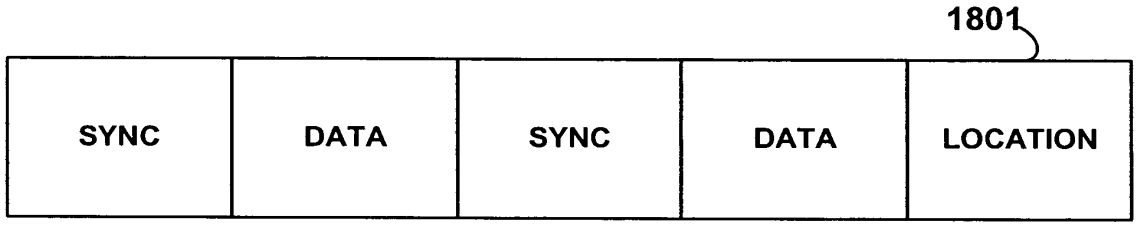


FIG. 18



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/400,296	03/25/2003	Jeffrey D. Mullen	JDM/002	8666

32733 7590 10/13/2005

JEFFREY D. MULLEN
350 WEST 43RD ST., APT. 5H
NEW YORK, NY 10036

EXAMINER	
TIEU, BENNY QUOC	

ART UNIT	PAPER NUMBER
2642	

DATE MAILED: 10/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/400,296	MULLEN, JEFFREY D.	
	Examiner	Art Unit	
	Benny Q. Tieu	2642	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 August 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-36* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 August 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment filed on August 08, 2005 has been entered. Claim 1 has been amended. No claims have been canceled. Claims 3-36 have been added. Claims 1-36 are still pending in this application, with claim 1 being independent

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-5, 9, 10 and 23 are rejected under 35 U.S.C. 102(e) as being anticipated by Kall (U.S. Patent Application Publication No. 2004/0180669).

Regarding claim 1, Kall teaches a method of mobile-to-mobile locating, said method comprising:

requesting a location of a first wireless device (Fig. 3, 20) by a second wireless device (Fig. 3, 8) from a server (Fig. 3, 12) located remotely from said first and second wireless devices (see [0035]);

assigning location access rights on said server to said second wireless device by said first wireless device (see [0037]);

storing said location access rights on said server (12);

determining said access rights assigned by said first wireless device to said second wireless device said server (see [0038]); and

providing said location from said server to said second wireless device dependent upon said access rights (see [0039]).

Regarding claim 2, Kall further teaches the method wherein said first and second wireless devices are cellular phones (Fig. 1).

Regarding claim 3, Kall further teaches the method wherein said location access rights the ability to obtain said location from said server (see [0019]).

Regarding claim 4, Kall further teaches the method wherein said location access rights comprise a plurality of access levels (see [0068] to [0072]).

Regarding claim 5, Kall further teaches the method wherein said second wireless device uses said location to provide a location marker on a map (Fig. 2).

Regarding claim 9, Kall further teaches the method wherein said location access rights comprise a plurality of levels of access rights, at least one of said plurality of levels of access rights comprise the exact location of said first wireless device, and another one of said plurality of levels of access rights comprise an approximate location of said first wireless device (see [0068] to [0072]).

Regarding claim 10, Kall further teaches the method wherein said access rights comprise a plurality of levels of access rights, at least one of said plurality of levels of access rights

comprise an approximate location of said first wireless device, and said approximate location comprises a city or state (see [0068] to [0072]).

Regarding claim 23, Kall further teaches the method wherein said location is provided by a positioning system (Fig. 4, GPS).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 6-8, 11-22 and 24-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kall in view of Meadows et al. (U.S. Patent No. 6,716,101).

Regarding claims 6-8, 11-22 and 24-36, the limitations of the claims cover the features that lies fully under capability of a skilled person in the art at the time the invention was made. For example, one of the features in the claim, e.g. determining how fast said first wireless device is traveling and this feature is taught by Meadows et al. as shown in Fig. 3. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the use of features that already existed in wireless network into the method disclosed by Kall in order to provide wireless subscribers more features in the service thereby benefits the wireless subscribers for the use of those features.

Response to Arguments

6. Applicant's arguments with respect to claims 1 and 2 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Smith (U.S. Patent Application Publication No. 2002/0042277) teaches a subscriber information service center (SISC).

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Benny Q. Tieu whose telephone number is 571-272-7490. The examiner can normally be reached on Monday-Friday: 6:30AM - 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ahmad Matar can be reached on 571-272-7488. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Benny Q. Tieu

Benny Q. Tieu
Primary Examiner
Art Unit 2642

PTO/SB/08A (10-01)
Approved for use through 10/31/2002. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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OIPE JC10 AUG 08 2005 PATENT & TRADEMARK OFFICE

Substitute for form 1449A/PTO

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 2

Complete if known	
Application Number	10/400,296
Filing Date	March 25, 2003
First Named Inventor	Jeffrey D. Mullen
Art Unit	2642
Examiner Name	Benny Quoc Tieu
Attorney Docket Number	JDM/002

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number – Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
BQT		5,442,805	08/15/1995	Sagars et al.	
		5,719,563	02/17/1998	Thompson	
		6,049,711	04/11/2000	Ben-Yehezkel	
		6,091,959	07/18/2000	Souissi et al.	
		6,240,069	05/21/2001	Alperovich	
		6,317,718	11/13/2001	Fano	
		6,321,092	11/20/2001	Fitch et al.	
		6,360,167	03/19/2002	Millington et al.	
		6,400,956	06/02/2002	Richton	11/15/1999 (102(e))
		6,580,914	06/17/2004	Smith	08/17/1998 (102(e))
		6,611,687	08/26/2003	Clark	11/15/1999 (102(e))
		6,677,894	01/13/2004	Sheynblat	11/30/1998 (102(e))
		6,714,791	03/30/2004	Friedman	02/23/2001 (102(e))
		6,795,710	09/21/2004	Creemer	01/05/2001 (102(e))
		6,798,358	09/28/2004	Joyce et al.	07/03/2001 (102(e))
		6,806,813	10/19/2004	Cheng et al.	06/04/1999 (102(e))
		6,816,735	11/09/2004	Rayburn et al.	03/29/2001 (102(e))
		6,836,667	12/28/2004	Smith	09/19/2000 (102(e))
		6,912,545	06/28/2005	Lundy et al.	06/12/2001 (102(e))
BQT		2004/0127231	07/01/2004	Dorr	07/23/2001 (PCT)

Examiner Signature	Benny Q. Tieu	Date Considered	10/8/05

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

PTO/SB/08A (10-01)

Approved for use through 10/31/2002. OMB 0651-0031

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Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449A/PTO **SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (use as many sheets as necessary)				***Complete if known***	
				Application Number	10/400,296
				Filing Date	March 25, 2003
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2642
				Examiner Name	Benny Quoc Tieu
Sheet	2	of	2	**Attorney Docket Number**	JDM/002

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[2]

Examiner Signature	Benny Q. Tieu	Date Considered	10/8/05

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Notice of References Cited	Application/Control No. 10/400,296	Applicant(s)/Patent Under Reexamination MULLEN, JEFFREY D.	
	Examiner Benny Q. Tieu	Art Unit 2642	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-6,716,101	04-2004	Meadows et al.	455/456.1
	B	US-2002/0042277	04-2002	Smith, Steven W.	455/456
	C	US-2004/0180669	09-2004	Kall, Jan	455/456.1
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
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	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
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	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
10/400,296	MULLEN, JEFFREY D.
Examiner	**Art Unit**
Benny Q. Tieu	2642

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date
Final	Original	10/8/05
	1	√
	2	√
	3	√
	4	√
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Claim		Date
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Claim		Date
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Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/400,296	MULLEN, JEFFREY D.	
	Examiner	Art Unit	
	Benny Q. Tieu	2642	

SEARCHED			
Class	Subclass	Date	Examiner
Updated	Search	10/8/2005	BQT

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
EAST	10/8/2005	BQT



JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
Application No.	:	10/400,296
Confirmation No.	:	8666
Filed	:	March 25, 2003
For	:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
Group Art Unit	:	2642
Examiner	:	Benny Quoc Tieu

Mail Stop: RCE
Hon. Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

New York, NY 10020
Febraury 13, 2006

REPLY TO OFFICE ACTION

Sir:

This is in response to the Office Action dated October 13, 2005. A Request for Continued Examination is being submitted herewith. A one-month extension of time is applicable hereto. In response to the Office Action dated October 13, 2005, please amend the application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 12 of this paper.

02/16/2006 CCHAU1 00000025 10400296
03 FC:2251 60.00 OP

EXPRESS MAIL LABEL NO. EV620766557US

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (currently amended) A method of mobile-to-mobile locating, said method comprising:

requesting a location of a first wireless device by a second wireless device from a server located remotely from said first and second wireless devices;

requesting that location access rights be assigned for said second wireless device by said first wireless device if said location access rights have not yet been assigned by said first wireless device for said second wireless device;

assigning said location access rights on said server to said second wireless device by said first wireless device;

storing said location access rights on said server;

determining said access rights assigned by said first wireless device to said second wireless device on said server; and

providing said location from said server to said second wireless device dependent upon said access rights.

2. (previously presented) The method of claim 1, wherein said first and second wireless devices are cellular phones.

3. (currently amended) The method of claim 1, wherein said location access rights ~~is~~ includes the

ability to obtain said location from said server even when said first wireless device is OFF.

4. (previously presented) The method of claim 1, wherein said location access rights comprise a plurality of access levels.

5. (previously presented) The method of claim 1, wherein said second wireless device uses said location to provide a location marker on a map.

6. (previously presented) The method of claim 1, wherein said second wireless device uses said location to provide directions from said second wireless device to said location.

7. (previously presented) The method of claim 1, wherein said second wireless device uses said location to provide directions from said second wireless device to said location and a travel time.

8. (previously presented) The method of claim 1, further comprising requesting a second location of said first wireless device and using said location and said second location to determine how fast said first wireless device is traveling.

9. (previously presented) The method of claim 1, wherein said location access rights comprise a plurality of levels of access rights, at least one of said plurality of levels of access rights comprise the exact location of said first wireless device, and another one of said plurality of levels of access rights comprise an approximate location of said first wireless device.

10. (previously presented) The method of claim 1, wherein said access rights comprise a plurality of levels of access rights, at least one of said plurality of levels of access rights comprise an approximate location of said first wireless device, and said approximate location comprises a city or state.

11. (previously presented) The method of claim 1, further comprising requesting said location of said first wireless device by a non-wireless device.

12. (previously presented) The method of claim 1, further comprising obtaining a second location from a non-wireless device.

13. (previously presented) The method of claim 1, further comprising receiving a login and password from said second wireless device to identify said second wireless device.

14. (previously presented) The method of claim 1, wherein said location of said first wireless device is requested by receiving input, in the form of a telephone number of said first wireless device, from an interface on said second wireless device.

15. (previously presented) The method of claim 1, further comprising using said first wireless device to modify said location access rights for said second wireless device.

16. (currently amended) The method of claim 1, further comprising ~~using~~ the ability to use said first

wireless device to delete said location access rights for said second wireless device.

17. (currently amended) The method of ~~off~~ claim 1, further comprising filtering information about said location such that only a portion of the information is passed to said second wireless device.

18. (previously presented) The method of claim 1, further comprising alerting said second wireless device when said first wireless device is within a distance of second wireless device.

19. (previously presented) The method of claim 1, further comprising selecting said first wireless device from an identifier list.

20. (previously presented) The method of claim 1, further comprising selecting said first wireless device from an identifier list wherein said identifier list comprises a list of telephone numbers.

21. (previously presented) The method of claim 1, further comprising selecting said first wireless device from an identifier list wherein said identifier list comprises a list of user profiles.

22. (previously presented) The method of claim 1, further comprising requesting a second location from said first wireless device from a non-wireless device, wherein said non-wireless device does not comprise a positioning system.

23. (previously presented) The method of claim 1, wherein said location is provided by a positioning system.

24. (previously presented) The method of claim 1, further comprising:

providing a first dating matching profile by said first wireless device;

providing a second dating matching profile by said second wireless device;

obtaining a second location, wherein said second location is the location of said second wireless device; and

utilizing said location, said second location, said first dating matching profile, and said second dating matching profile to provide an alert.

25. (previously presented) The method of claim 1, further comprising providing a compass in said second wireless device.

26. (previously presented) The method of claim 1, further comprising providing a compass in said second wireless device, wherein said compass is utilized to display the location of said first wireless device relative to said location of said second wireless device.

27. (previously presented) The method of claim 1, further comprising providing a compass in said second wireless device, wherein said compass is utilized to display the direction that said second wireless device is traveling in.

28. (currently amended) The method of claim 1, further comprising providing an interface on said second wireless device for setting location alerts associated with said first wireless device.

29. (previously presented) The method of claim 1, wherein said location access rights are only assigned for a period of time.

30. (previously presented) The method of claim 1, further comprising alerting said second wireless device when said first wireless device enters a geographic area.

31. (previously presented) The method of claim 1, wherein said server stores a history of locations for said first wireless device.

32. (previously presented) The method of claim 1, wherein said server stores a history of locations for said first wireless device and said history is utilized to provide an approximate location of said first wireless device when said first wireless device is turned OFF.

33. (previously presented) The method of claim 1, further comprising displaying on said second wireless device the opportunity to request said location access rights from said first wireless device.

34. (previously presented) The method of claim 1, further comprising displaying to said second wireless device the opportunity to request said location access rights from said first wireless device after a

determination has been made that said second wireless device does not have access to said location.

35. (previously presented) The method of claim 1, wherein said first wireless device is requested to manually allow said location access rights for said second wireless device every time said second wireless device requests said location.

36. (cancelled).

37. (new) The method of claim 1, wherein at least one of said location access rights is the ability to not allow said second wireless device to access said location.

38. (new) A method of comprising:

requesting a first location of a first wireless telephone by a second wireless telephone from a server located remotely from said first and second wireless telephones;

requesting a second location of said second wireless telephone by said first wireless telephone from said server;

assigning first location access rights on said server to said second wireless telephone by said first wireless telephone;

assigning second location access rights on said server to said first wireless telephone by said second wireless telephone;

storing said first location access rights and said second location access rights on said server;

providing said first location from said server to said second wireless telephone dependent upon said first access rights; and

providing said second location from said server to said first wireless telephone dependent upon said second access rights.

39. (new) The method of claim 38, further comprising alerting said first wireless telephone when said second wireless telephone is within a distance of said first wireless telephone.

40. (new) The method of claim 38, wherein at least one of said first location access rights is the ability to not allow said second wireless telephone to access said first location.

41. (new) The method of claim 38, wherein said second wireless telephone uses said location to provide a location marker on a map on a graphical user interface.

42. (new) The method of claim 38, further comprising receiving a login and password from said second telephone device to identify said second wireless device

43. (new) The method of claim 38, further comprising providing an interface on said second wireless telephone for setting location alerts associated with said first wireless telephone.

44. (new) The method of claim 38, further comprising setting up an alert for said first wireless

telephone dependent on said second location of said second wireless telephone.

45. (new) A method comprising:

requesting a location of a first wireless telephone by a second wireless telephone from a server located remotely from said first and second wireless telephones;

assigning location access rights on said server to said second wireless telephone by said first wireless telephone;

storing said location access rights on said server;

determining said access rights assigned by said first wireless telephone to said second wireless telephone on said server; and

providing said location from said server to said second wireless telephone dependent upon said access rights even when said first wireless telephone is OFF.

46. (new) The method of claim 45, further comprising alerting said first wireless telephone when said second wireless telephone is within a distance of said first wireless telephone.

47. (new) The method of claim 45, wherein at least one of said first location access rights is the ability to not allow said second wireless telephone to access said first location.

48. (new) The method of claim 45, wherein said second wireless telephone uses said location to provide a location marker on a map on a graphical user interface.

49. (new) The method of claim 45, further comprising setting up an alert for said first wireless telephone dependent on said second location of said second wireless telephone.

REMARKS/ARGUMENTS

Summary of Office Action

Claims 1-36 are pending in the application.

Claims 1-5, 9, 10, and 23 were rejected under 35 U.S.C. § 102(e) as being anticipated by Kall U.S. Patent Application Publication No. 2004/0180669 (hereinafter "Kall").

Claims 6-8, 11-22, and 24-36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kall in view of Meadows et al. U.S. Patent No. 6,716,101 (hereinafter "Meadows").

Summary of Applicant's Amendments

Applicant has cancelled claim 36.

Applicant has amended claims 1, 2, 16, 17, and 28 solely to expedite prosecution.

Applicant has added new claims 37-49 in order to more particularly point out and distinctly claim the subject matter that applicant regards as the invention.

Applicant reserves the right to claim any subject matter lost by any claim cancellations or amendments in a divisional or continuation application.

Applicant's Response to the
Rejections Under 35 U.S.C. § 102(e)

Claims 1-5, 9, 10, and 23 were rejected under 35 U.S.C. § 102(e) as being anticipated by Kall.

Applicant would like to direct the Examiner's attention to the apparent 35 U.S.C. § 371(c) date of Kall - November 11, 2002. Applicant's present application, however, claims the benefit of U.S. Provisional Application No. 60/367,967 that was filed on March 25, 2002. Yet, although Kall does not appear to be

prior art to applicant's present application, the specification of Kall appears to have been published in PCT Publication No. WO 01/41468 on June 7, 2001. Applicant is in the process of compiling a Supplemental Information Disclosure Statement that will be submitted shortly.

Applicant's invention of amended claim 1 includes requesting that location access rights be assigned for a second wireless device by a first wireless device if location access rights have not yet been assigned by the first wireless device for the second wireless device.

Kall generally discusses a location service client that receives location information at an accuracy dependent on the type of application provided by the location service client. The user of the device supplying the location information can allegedly set accuracy classes for particular applications types.

The Examiner stated that Kall discusses "requesting a location of a first wireless device ... by a second wireless device ... from a server" (Office Action, page 2).

Kall, however, does not show or suggest applicant's invention of amended claim 1 of requesting that location access rights be assigned for a second wireless device by a first wireless device if location access rights have not yet been assigned by the first wireless device for the second wireless device.

For at least this reason, applicant respectfully requests that the rejection of claim 1, and any claims dependent therefrom, under 35 U.S.C. § 102(e) as being anticipated by Kall be withdrawn.

Applicant's Response to the
Rejections Under 35 U.S.C. 103(a)

Claims 6-8, 11-22, and 24-36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kall in view of Meadows.

As shown above, claim 1 is patentable. As such, claims 6-8, 11-22, and 24-36 are patentable because these claims depend from patentable claim 1. Accordingly, applicant respectfully requests that the Examiner's rejection under 35 U.S.C. § 103(a) be withdrawn.

Claims 6-8, 11-22, and 24-36 are also patentable for the reasons discussed below.

The Blanket 35 U.S.C. § 103 Rejection

Generally, the Examiner rejected twenty-eight dependent claims under 35 U.S.C. § 103(a) under the blanket statement "the limitations of the claims that the features that lies fully under capability of a skilled person in the art." (Office Action, page 4).

However, for rejections under 35 U.S.C. § 103(a), the Examiner has the burden of showing each and every element of applicant's invention in the prior art combination. Else, Official Notice must be taken. If the Examiner is taking Official Notice, MPEP § 2144.03 requires that the facts of which notice are being taken be capable of instant and unquestionable demonstration as being well known in the art. *See In re Ahlert*, 424 F.2d 1088, 1091, 165 USPQ 418, 420 (CCPA 1970). Applicant believes that the "facts" of which the Examiner may have taken Official Notice do not meet that standard, and invoke his right under MPEP § 2144.03 to have the Examiner provide documentary proof that those facts are actually well known.

As will be discussed in more detail below, applicant has provided numerous examples of claimed features that are not shown or suggested Kall or Meadows.

No Motivation To Combine - Teaches Away

There is no motivation or teaching to combine Kall with Meadows - at all.

Applicant's invention of claim 1, from which claims 6-8, 11-22, and 24-36 depend, includes assigning location access rights on a server by a wireless device. As such, a user of one wireless device can allow a user of a different wireless device to locate him/her.

Kall generally discusses a location service client that receives location information at an accuracy dependent on the type of application provided by the location service client.

Meadows discusses statically monitoring the location of devices. Meadows does not allow for a device to control who can access the location of that device. Instead, Meadows discusses one ultimate authority (e.g., a parent or boss) that is allowed to monitor the location of slave devices (e.g., children or employee devices).

The Examiner stated, however, that "it would have been obvious to one skilled in the art ... to incorporate the use of features ... [of] Kall in order to provide wireless subscribers more features." (Office Action, page 4).

Combining Kall and Meadows, however, would completely eviscerate the spirit of the Meadows system as Meadow's teaches away from allowing the user of a device to assign access rights for that device. For at least this reason, applicant respectfully requests that the Examiner's rejections under 35 U.S.C. § 103(a) be withdrawn.

Examples of Features Not Shown By References

As shown above, neither Meadows or Kall shows or suggests applicant's invention of amended claim 1. Additionally, neither Meadows or Kall, used either alone or in combination, show or suggest many of the features of claims that depend from claim 1. Included below are a few examples of just some of the dependent claims with features not shown or suggested by any combination of Meadows or Kall.

Claim 6

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 6 of providing directions between a location provided from one wireless device to a second wireless device.

Claim 7

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 7 of providing directions between a location provided from one wireless device to a second wireless device as well as a travel time.

Claims 11 and 12

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 11 of obtaining a location from a non-wireless device.

Claim 13

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 13 of using a login and password to identify a wireless device.

Claim 14

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim wherein said location of said first wireless device is requested by receiving input, in the form of a telephone number of said first wireless device, from an interface on said second wireless device.

Claim 16

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 16 of being able to use said first wireless device to delete said location access rights for said second wireless device.

Claim 18

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 18 of alerting said second wireless device when said first wireless device is within a distance of second wireless device.

Claim 20

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 30 of selecting said first wireless device from an identifier list wherein said identifier list comprises a list of telephone numbers.

Claim 22

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 22 of requesting a second location from said first wireless device from a non-

wireless device, wherein said non-wireless device does not comprise a positioning system.

Claim 24

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 24 of providing a first dating matching profile by said first wireless device, providing a second dating matching profile by said second wireless device, obtaining a second location, wherein said second location is the location of said second wireless device, and utilizing said location, said second location, said first dating matching profile, and said second dating matching profile to provide an alert.

Claim 25

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 25 of providing a compass in said second wireless device.

Claim 26

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 26 of providing a compass in said second wireless device, wherein said compass is utilized to display the location of said first wireless device relative to said location of said second wireless device.

Claim 27

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 27 of providing a compass in said second wireless device, wherein said compass is

utilized to display the direction that said second wireless device is traveling in.

Claim 28

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 28 of an interface on said second wireless device for setting location alerts associated with said first wireless device.

Claim 30

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 30 of alerting said second wireless device when said first wireless device enters a geographic area.

Claim 32

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 32 of server stores a history of locations for said first wireless device and said history is utilized to provide an approximate location of said first wireless device when said first wireless device is turned OFF.

Claim 33

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 33 of displaying on said second wireless device the opportunity to request said location access rights from said first wireless device.

Claim 34

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests

applicant's invention of claim 34 of displaying to said second wireless device the opportunity to request said location access rights from said first wireless device after a determination has been made that said second wireless device does not have access to said location.

Claim 35

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 35 where the first wireless device is requested to manually allow said location access rights for said second wireless device every time said second wireless device requests said location.

New Claims 38-44

None of the prior art, especially Meadows, used either alone or in combination, shows or suggests applicant's invention of claim 38, and any claims dependent thereon, of requesting a first location of a first wireless telephone by a second wireless telephone from a server located remotely from the first and second wireless telephones and requesting a second location of the second wireless telephone by the first wireless telephone from the server.

More particularly, Kall generally discusses a location service client that obtains location information at an accuracy needed to provide an application (e.g., weather, traffic, and hotel information applications).

Accordingly, Kall does not show or suggest providing the system of the location service client with a location such that the device that is being located can also locate the system of the location service client.

As such, Kall does not show or suggest applicant's invention of claim 38, and any claims dependent therefrom, of requesting a first location of a first wireless telephone by a second wireless telephone from a server located remotely from the first and second wireless telephones and requesting a second location of the second wireless telephone by the first wireless telephone from the server.

In light of the foregoing, applicant respectfully submits that claim 38, and any claims dependent therefrom, are patentable.

New Claim 45-49

None of the prior art, especially Meadows, used either alone or in combination shows or suggests applicant's invention of claim 45, and any claims dependent thereon, that includes the feature of providing a location from a server to a second wireless telephone dependent upon said access rights even when the first wireless telephone is OFF.

Kall discusses a "location service feature [that] permits the location of a target mobile station to be determined at any time whilst the MS is attached" (Kall, page 3, paragraph 35). Thus Kall does not show or suggest providing a location for a first wireless telephone from a server to a second wireless telephone even when the first wireless telephone is OFF.

In light of the foregoing, applicant respectfully submits that claim 45, and any claims dependent therefrom, are patentable.

Conclusion

Applicant respectfully submits that this application, including claims 1-49, is in condition for allowance.

Reconsideration and prompt allowance of this application are respectfully requested.

Respectfully Submitted,

Jeffrey D. Mullen
Applicant (Reg. No. 52,056)
Customer No. 32733
350 West 43rd Street, Apt. 5H
New York, NY 10583
Tel.: (914) 837-7741



JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Attorney Docket No. JDM/002
Examiner Benny Quoc Tieu
Art Unit 2642

Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR CONTINUED EXAMINATION

Sir:

This is a request for continued examination under 37 C.F.R. § 1.114, of pending prior Application No. 10/400,296 (Confirmation No. 8666), filed on March 25 of 2003 for SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

1. ☐ Please enter the Amendment Pursuant to 37 C.F.R. § 1.116 filed on ____ in Application No. ____, a copy of which is enclosed herewith.

2. ☐ Please consider the arguments in the Appeal Brief or Reply Brief filed on ____ _____ in Application No. _____.

3. ☒ An Amendment/Reply is enclosed in Reply to the Office Action dated October 13, 2005.

4. ☐ Affidavit(s)/Declaration(s) is/are enclosed.

5. ☐ An Information Disclosure Statement (and SB/08A) is enclosed.

6. ☐ A suspension of action on the above-identified patent application is requested under 37 C.F.R. § 1.103(c) for a period of _____ months.

7. ☒ A $395.00 filing fee under 37 C.F.R. § 1.17(e) is applicable hereto. A duplicate copy of this Request is enclosed herewith.

8. ☐ Please charge ____ to Deposit Account No. 06-1075 in payment of the fee under _____. A duplicate copy of this Request is enclosed.

9. ☐ The Director is hereby authorized to charge payment of any additional fees required under 37 C.F.R. § 1.17(e) in connection with this Request, or to credit any overpayment of same, to Deposit Account No. _____,Order No. _____. A duplicate copy of this Request is enclosed.

10. ☒ Please grant a ☒ one-month, ☐ two-month, ☐ three-month, ☐ four-month, extension of time under 37 C.F.R. § 1.136(a) to the Examiner's Action of October 13, 2005 in the above-identified patent application.

11. ☒ A $60.00 extension-of-time fee is applicable hereto.

02/16/2006 CCHAU1 00000025 10400296

01 FC:2801 395.00 OP
02 FC:2202 300.00 OP

EXPRESS MAIL LABEL NO. EV620766557US

12. [X] Additional claim fees have been calculated as shown below:

FOR	CURRENT NUMBER		NUMBER PAID		NUMBER EXTRA		RATE		FEE
BASIC FEE									$000.00
TOTAL CLAIMS	48	-	36	=	12	X	$25	=	$300.00
INDEPENDENT CLAIMS	3	-	3	=	0	X	$100	=	$000.00
[ ] MULTIPLE DEPENDENT CLAIMS						+	$180	=	$000.00
							TOTAL		$300.00

13. [X] A check in the amount of $755.00 in payment of the additional claim fees ($300), the RCE filing fee ($395), and the one-month extension fee ($60) is transmitted herewith. A duplicate copy of this Request is being transmitted herewith.

14. [ ] The Director is hereby authorized to charge payment of any additional extension-of-time fees required under 37 C.F.R. § 1.17, or any other additional fees in connection with this paper, or to credit any overpayment of same, to Deposit Account No. _____, Order No._____. A duplicate copy of this Request is enclosed.

15. [ ] Please charge the extension-of-time fee of $ _____ to Deposit Account _____. A duplicate copy of this Request is enclosed.

February 13, 2006
(Date)

Jeffrey D. Mullen
Applicant (Reg. No. 52,056)
Customer No. 32733
350 West 43rd St., Apt. 5H
New York, NY 10036
Mobile Phone: (914) 837-7741

02-15-06

ZMW
RCE



PATENTS
Attorney Docket No. JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
Application No.	:	10/400,296 Confirmation No. : 8666
Filed	:	March 25, 2003
For	:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
Group Art Unit	:	2642
Examiner	:	Benny Quoc Tieu

New York, New York 10020
February 13, 2006

Mail Stop: RCE
Hon. Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

EXPRESS MAIL CERTIFICATION

Sir:

"Express Mail" mailing label number EV620766557US

Date of Deposit February 13, 2006

I hereby certify that the papers and fees identified below are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10 on the date indicated above and are addressed to Mail Stop: RCE, Commissioner for Patents, P.O. Box 2327, Arlington, Virginia 22202.

Request for Continued Examination (in duplicate);

Reply to Office Action;

Check No. 1762 in the Amount of $755.00; and

Return Postcard

Andrew Shore
Andrew Shore

10400296

PATENT APPLICATION FEE DETERMINATION RECORD
Effective January 1, 2003

Application or Docket Number: 5DM/002

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	2	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	2 minus 20=	* 0
INDEPENDENT CLAIMS	1 minus 3 =	* 0
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐			OR	OTHER THAN SMALL ENTITY	
RATE	FEE			RATE	FEE
BASIC FEE	375.00		OR	BASIC FEE	750.00
X$ 9=			OR	X$18=	
X42=			OR	X84=	
+140=			OR	+280=	
TOTAL	375		OR	TOTAL	

8/8/05

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 36	Minus	** 20	= 16
Independent	* 1	Minus	*** 3	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY			OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE			RATE	ADDITIONAL FEE
~~X$ 9=~~	400		OR	X$18=	
X42=			OR	X84=	
+140=			OR	+280=	
TOTAL ADDIT. FEE	400		OR	TOTAL ADDIT. FEE	

RCE
2/13/06

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 48	Minus	** 36	= 12
Independent	* 3	Minus	*** 3	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE			RATE	ADDITIONAL FEE
X$ 9=			OR	X$18=	300
X42=			OR	X84=	
+140=			OR	+280=	
TOTAL ADDIT. FEE			OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE			RATE	ADDITIONAL FEE
X$ 9=			OR	X$18=	
X42=			OR	X84=	
+140=			OR	+280=	
TOTAL ADDIT FEE			OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1

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EV620766631US

JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
Application No.	:	10/400,296
Confirmation No.	:	8666
Filed	:	March 25, 2003
For	:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
Group Art Unit	:	2642
Examiner	:	Benny Quoc Tieu

Mail Stop: Amendment
Hon. Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

New York, NY 10036
February 16, 2006

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

In accordance with 37 C.F.R. §§ 1.56 and 1.97, applicant wishes to call the attention of the Examiner to the following documents:

Patent Documents

5,337,334	Antero Alvesalo	08/09/1994	
6,035,189	All-Vehmas	03/07/2000	
6,047,051	Ginzboorg	04/04/2000	
6,393,274	Peltonen	05/21/2002	102(e) 06/08/1999
6,400,946	Vazvan	06/04/2002	102(e) 03/08/1996
6,580,918	Leickel	06/17/2003	102(e) 07/23/1998

6,584,314	Haumont	06/24/2003	102(e)	06/09/2000
6,603,969	Vuoristo	08/05/2003	102(e)	11/25/1998
6,735,564	Puhakainen	05/11/2004	102(e)	11/09/2000
6,826,398	Lagerstrom et al.	11/30/2004	102(e)	10/08/1998
6,870,822	Balogh	03/22/2005	102(e)	02/20/2001
6,879,838	Rankin et al.	04/12/2005	102(e)	04/20/2001
6,912,545	Lundy et al.	06/28/2005	102(e)	06/21/2001
6,920,319	Knutsson et al.	07/19/2005	102(e)	05/07/2001
6,928,279	Seligmann et al.	08/09/2005	102(e)	02/27/2003
6,932,698	Sprogis	08/23/2005	102(e)	01/31/2002
6,944,447	Portman et al.	09/13/2005	102(e)	09/04/2001

Foreign Patent Documents

WO 99/007170	02-11-1999	Nokia Telecommunications
WO 99/009775	02-25-1999	Nokia Telecommunications
WO 99/051051	03-31-1999	Nokia Telecommunications
WO 00/028760	05-18-2000	Nokia Networks
WO 00/035228	06-15-2000	Nokia Networks
WO 00/038350	06-29-2000	Nokia Networks
WO 00/064075	10-26-2000	Nokia Networks
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WO 01/033885	05-10-2001	Nokia Networks
WO 01/039525	05-31-2001	Nokia Networks
WO 01/039528	05-31-2001	Nokia Networks

WO 01/041468	06-07-2001	Nokia Networks
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WO 01/089251	11-22-2001	Nokia Networks
WO 02/003718	01-10-2002	Nokia Networks

Non-Patent Documents

ETSI TS 101 513. "Digital Cellular Telecommunications System (Phase 2): Location Services (LCS)," GSM 12.71, version 8.0.1. 1999.

ETSI TS 101 527 "Digital Cellular Telecommunications System (Phase 2+): Location Services (LCS): Mobile Station (MS): Serving Mobile Location Centre (SMLC)," Radio Resource LCS Protocol (RRLP), GSM 04.31, version 8.1.0. 1999.

Copies of the non U.S. patent documents are enclosed. It is respectfully requested that these documents be (1) fully considered by the Patent and Trademark Office during examination of this application; and (2) printed on any patent which may issue on this application. Applicant requests that a copy of Form PTO/SB/08A, as considered and initialed by the Examiner, be returned with the next communication.

This Statement is being submitted after the filing of a Request for Continued Examination and before the mailing of a first Office Action on the merits. In accordance with 37 C.F.R. § 1.97(a)(4), no fee is required. A duplicate copy of this Statement is transmitted herewith.

An early and favorable action is respectfully requested.

Respectfully submitted,

Jeffrey D. Mullen
Applicant (Reg. No. 52,056)
Customer No. 32733
350 West 43rd St., Apt. 5H
New York, NY 10036
Mobile: (914)837-7741

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SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 3

Complete if known	
Application Number	10/400,296
Filing Date	March 25, 2003
First Named Inventor	Jeffrey D. Mullen
Art Unit	2642
Examiner Name	Benny Quoc Tieu
Attorney Docket Number	JDM/002

U.S. PATENT DOCUMENTS

Examiner initials*	Cite No.[1]	Document Number Number – Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		5,337,334	08/09/1994	Antero Alvesalo	
		6,035,189	03/07/2000	All-Vehmas	
		6,047,051	04/04/2000	Ginzboorg	
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		6,870,822	03/22/2005	Balogh	102(e) 02/20/2001
		6,879,838	04/12/2005	Rankin et al.	102(e) 04/20/2001
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		6,932,698	08/23/2005	Sprogis	102(e) 01/31/2002
		6,944,447	09/13/2005	Portman et al.	102(e) 09/04/2001

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Examiner Signature		Date Considered	

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Sheet 2 of 3

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Examiner Name	Benny Quoc Tieu
Attorney Docket Number	JDM/002

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		WO 01/050544	07-12-2001	Nokia Networks		
		WO 01/086834	11-15-2001	Nokia Networks		

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SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 3 of 3

Complete if known	
Application Number	10/400,296
Filing Date	March 25, 2003
First Named Inventor	Jeffrey D. Mullen
Art Unit	2642
Examiner Name	Benny Quoc Tieu
Attorney Docket Number	JDM/002

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		WO 01/089251	11-22-2001	Nokia Networks		
		WO 02/003718	01-10-2002	Nokia Networks		

NON PATENT LITERATURE DOCUMENTS

Examiner initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[2]
		ETSI TS 101 513. "Digital Cellular Telecommunications System (Phase 2): Location Services (LCS)," GSM 12.71, version 8.0.1. 1999.	
		ETSI TS 101 527 "Digital Cellular Telecommunications System (Phase 2+): Location Services (LCS): Mobile Station (MS): Serving Mobile Location Centre (SMLC)," Radio Resource LCS Protocol (RRLP), GSM 04.31, version 8.1.0. 1999.	

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SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet	1	of	3

Complete if known	
Application Number	10/400,296
Filing Date	March 25, 2003
First Named Inventor	Jeffrey D. Mullen
Art Unit	2642
Examiner Name	Benny Quoc Tieu
Attorney Docket Number	JDM/002

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		6,035,189	03/07/2000	All-Vehmas	
		6,047,051	04/04/2000	Ginzboorg	
		6,393,274	05/21/2002	Peltonen	102(e) 06/08/1999
		6,400,946	06/04/2002	Vazvan	102(e) 03/08/1996
		6,580,918	06/17/2003	Leickel	102(e) 07/23/1998
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		6,603,969	08/05/2003	Vuoristo	102(e) 11/25/1998
		6,735,564	05/11/2004	Puhakainen	102(e) 11/09/2000
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		6,870,822	03/22/2005	Balogh	102(e) 02/20/2001
		6,879,838	04/12/2005	Rankin et al.	102(e) 04/20/2001
		6,912,545	06/28/2005	Lundy et al.	102(e) 06/21/2001
		6,920,319	07/19/2005	Knutsson et al.	102(e) 05/07/2001
		6,928,279	08/09/2005	Seligmann et al.	102(e) 02/27/2003
		6,932,698	08/23/2005	Sprogis	102(e) 01/31/2002
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SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 2 of 3

Complete if known	
Application Number	10/400,296
Filing Date	March 25, 2003
First Named Inventor	Jeffrey D. Mullen
Art Unit	2642
Examiner Name	Benny Quoc Tieu
Attorney Docket Number	JDM/002

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		WO 99/00[illegible]7170	02-11-1999	Nokia Telecommunications		
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Sheet 3 of 3

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		ETSI TS 101 527 "Digital Cellular Telecommunications System (Phase 2+): Location Services (LCS): Mobile Station (MS): Serving Mobile Location Centre (SMLC)," Radio Resource LCS Protocol (RRLP), GSM 04.31, version 8.1.0. 1999.	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**



02-21-06 AF. IFW 2642

PATENTS
Attorney Docket No. JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
Application No.	:	10/400,296 Confirmation No. : 8666
Filed	:	March 25, 2003
For	:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
Group Art Unit	:	2642
Examiner	:	Benny Quoc Tieu

New York, New York 10020
February 16, 2006

Mail Stop: Amendment
Hon. Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

EXPRESS MAIL CERTIFICATION

Sir:

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I hereby certify that the papers and fees identified below are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10 on the date indicated above and are addressed to Mail Stop: Amendment, Commissioner for Patents, P.O. Box1450, Alexandria, VA 22313-1450.

Second Supplemental Information Disclosure Statement (in duplicate);

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Copies of cited foreign patent documents;

Copies of cited non-patent literature documents; and

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
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Alexandria, VA 22313-1450

New York, NY 10036
February 16, 2006

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

In accordance with 37 C.F.R. §§ 1.56 and 1.97, applicant wishes to call the attention of the Examiner to the following documents:

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Non-Patent Documents

ETSI TS 101 513. "Digital Cellular Telecommunications System (Phase 2): Location Services (LCS)," GSM 12.71, version 8.0.1. 1999.

ETSI TS 101 527 "Digital Cellular Telecommunications System (Phase 2+): Location Services (LCS): Mobile Station (MS): Serving Mobile Location Centre (SMLC)," Radio Resource LCS Protocol (RRLP), GSM 04.31, version 8.1.0. 1999.

Copies of the non U.S. patent documents are enclosed. It is respectfully requested that these documents be (1) fully considered by the Patent and Trademark Office during examination of this application; and (2) printed on any patent which may issue on this application. Applicant requests that a copy of Form PTO/SB/08A, as considered and initialed by the Examiner, be returned with the next communication.

This Statement is being submitted after the filing of a Request for Continued Examination and before the mailing of a first Office Action on the merits. In accordance with 37 C.F.R. § 1.97(a)(4), no fee is required. A duplicate copy of this Statement is transmitted herewith.

An early and favorable action is respectfully requested.

Respectfully submitted,

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(54) Title: TELEPHONY SERVICES IN MOBILE IP NETWORKS

(57) Abstract: An emergency telephone call is supported and routed to a Public Safety Answering Point (PAP) in an IP based packet Switched wireless communications network. An activate PDP context request is sent from a user equipment to the network. A parameter in said activate PDP context request indicates that the PDP context will be used to transfer an emergency call. An activate PDP context accept message is returned from said support node to said user equipment. Said activate PDP context accept message acknowledges said activate PDP context request message and provides the address of a call state control function. A call setup request transferred to the call state control function includes the Service Area Identity (SAI). The call state control function selects a PSAP based, at least in part, on the SAI included in the call setup request and forwards the emergency call to the selected PSAP.

TELEPHONY SERVICES IN MOBILE IP NETWORKS

TECHNICAL FIELD

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. Patent Application No. 09/546,207 and of U.S. Patent Application No. 09/546,208, both of which were filed on April 10, 2000 and which hereby have their disclosures incorporated by reference into this application.

The present invention relates generally to methods and systems providing telephony communications through packet-switched communication networks. Particular aspects of the invention relate to location-based services in Internet Protocol (IP) based packet switched mobile communication networks, a method of making location-based services available to network subscribers when roaming between or within such communication networks, and the support and routing of emergency calls in such communication networks.

Communications services have historically been provided over circuit-switched networks such as the Public Switched Telephone Network (PSTN), but now they can also be provided over packet switched networks, such as the Internet. These packet-switched networks are commonly referred to as IP networks because the Internet Protocol is the most commonly used primary protocol. Many modem wireless networks utilize a combination of telephony equipment (such as conventional cellular phones) and packet switched equipment (usually network traffic routing equipment) compliant with one or more IP telephony standards such as, for example, the International Telecommunications

Union (ITU) H.323 standard or the Internet Engineering Task Force (IETF) Session Initiation Protocol (SIP) specification, RFC 2543.

There have been several proposals for a new 3rd generation of IP based mobile networks in which the user equipment (UE) as well as the network equipment (NE) is compliant with one or more IP standards for packet switched networks. However, when providing voice call services, such Mobile IP Telephony (MIPT) networks have several problems which are not present in conventional 2nd generation cellular networks. For example, while cellular subscribers can often roam between 2nd generation cellular networks, it is difficult for IP Telephony (IPT) subscribers of MIPT networks to easily access the same services available in their home network when they are visiting in other networks.

There is, for example, the Mobile IP Protocol to enable mobility. As an example, it is possible that an IPT subscriber, with General Packet Radio Service (GPRS) access in the visited network (see 3G TS 23.060, Stage 2, version 3.3.0), uses voice call services in their home network, so the subscriber is registered in a call control entity (such as a call state control function (CSCF)) in the home network. However, for certain services, such as emergency 911 calls, it is necessary to use voice call services in the visited network and to provide location-based services for successful implementation. Therefore, there is a need for a technique that allows roaming IPT subscribers to easily access and utilize location-based services, and to make emergency calls, in MIPT networks.

In particular, when an emergency call setup request is received by a call control entity in a 2nd generation cellular network, it selects a Public Safety Access Point (PSAP) to route the call to based on the Cell ID or the location information provided during the

call setup. However, this method cannot always be performed in 3rd generation mobile IP networks based on the UMTS standard, since the Cell ID or location information may not always be available to a call control entity due to the way the emergency calls are setup. Therefore, there needs to be a method to support the selection of the PSAP in 3rd generation mobile IP networks based on the UMTS standard.

The present invention addresses the disadvantages of MIPT networks discussed above. It broadly relates to systems and methods of providing, initiating, accessing, utilizing or managing location-based services and/or emergency calls in a 3rd generation Mobile IP Telephony network. One application of the invention relates to a service in which a subscriber visiting a network other than their own network uses their mobile terminal to make an emergency call. The emergency call is connected to a CSCF which then forwards the emergency call to a PSAP without authentication or billing and the approximate geographic location of the subscriber is transferred to the CSCF or to the PSAP at the same time that the emergency call is connected.

The example embodiments of the invention offer a selection mechanism which provides controlled access to the CSCF of a local network so that an emergency call can be easily set up. When the emergency call is initiated, a Gateway GPRS Service Node (GGSN) provides the address of a Call State Control Function (CSCF). An emergency call setup request is sent to the Call State Control Function (CSCF). The emergency call setup request includes the Service Area Identification (SAI) of GPRS. The CSCF selects a Public Safety Answering Point (PSAP) to route the call to, based at least in part on the Service Area Identity, and forwards the emergency call to the selected PSAP without authentication or billing. Preferably, the approximate geographic location of the

subscriber is transferred to the CSCF or to the PSAP at the same time that the emergency call is connected. It thus becomes possible to make an emergency call without a Subscriber Identification Module (SIM) and without any charges. The access network in the example embodiments is able to control the PDP contexts which are used for emergency calls so that they can't be misused or that they are not subject to fraud.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing parts of the architecture of an example embodiment 3rd generation Mobile IP Telephony network.

Fig. 2 is an expanded block diagram of an example 3rd generation IP network additionally showing connections to other networks.

Fig. 3 is a simplified block diagram depicting an example of location service entities and components of a 3rd generation Mobile IP Telephony network according to example embodiments of the invention.

Fig. 4 is a general signaling diagram of an example embodiment of the invention in which an emergency call is made by a subscriber with a Subscriber Identification Module (SIM).

Fig. 5 is a general signaling diagram of an example embodiment of the invention in which an emergency call is made by a subscriber without a Subscriber Identification Module (SIM).

Fig. 6 is a signaling diagram of example embodiment of the invention in which the location information for an emergency call is obtained during the call.

Fig. 7 is a signaling diagram of another example embodiment of the invention in which the location information for an emergency call is obtained during the call.

Fig. 8 is a signaling diagram of an example embodiment of the invention in which the location estimate is obtained before PDP Context Activation acceptance.

Fig. 9 is a signaling diagram of an example embodiment of the invention in which the location estimate is provided to the mobile terminal.

Fig. 10 is a signaling diagram of an example embodiment of the invention in which the SGSN knows the current Service Area Identification when it receives the Activate PDP Context Request.

Fig. 11 is a signaling diagram of an example embodiment of the invention in which the mobile terminal originates the positioning method.

BEST MODE(S) FOR CARRYING OUT THE INVENTION

The foregoing and a better understanding of the present invention will become apparent from the following detailed description of example embodiments and the claims when read in connection with the accompanying drawings, all forming a part of the disclosure of the invention. While the foregoing and following written and illustrated disclosure focuses on disclosing example embodiments of the invention, it should be clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of the present invention being set forth by the claims in the patent issuing from this application.

Fig. 1 is a block diagram of a typical 3rd generation Mobile IP Telephony network based on the UMTS standard. The detailed technical specifications for a UMTS network have been published by the 3rd Generation Partnership Project in Release 1999 (www.3gpp.org). The blocks in Fig. 1 represent different functionalities and do not necessarily correspond to different discrete network elements or equipment.

The location services are supported by elements throughout the network. Some services are embedded in conventional network elements, such as the Radio Network (Controller (RNC), Mobile Services Switching Center (MSSC) and Service GPRS Support Node (SGSN). In addition, some new network elements and interfaces are provided to support location services.

One new functionality element in the network is the Location Measurement Unit (LMU), which may or may not be integrated (LMU is not shown in Fig. 1, but is included as element 301 in Fig. 3) within each one of Base Station Subsystems (BSS) in Node B 101-1 to Node B 101-n, preferably without technical restrictions, at least when an Idle Slot Forward Link - Time Difference of Arrival (ISFL-TDOA) positioning method or an Observed Time Difference Of Arrival – Idle Period Downlink (OTDOA-IPDL) positioning method is used. LMU 301 primarily measures the Real Time Differences (RTD), Absolute Time Difference (ATD), or any other kind of radio interface timing of the signals transmitted by the base stations. These assistance measurements obtained by the LMU 301 are generic status information and can be used by more than one positioning method. The measurements may consist of location measurements specific to one mobile used to compute the location of that mobile or assistance measurements specific to all mobiles in a certain geographic area.

All location, timing difference and assistance measurements obtained by LMU 301 are supplied to a particular Serving RNC 102 (SRNC) associated with the base station having the functionality of LMU 301. Instructions concerning the timing, the nature and any periodicity of those measurements are either provided by the SRNC 102 or are pre-administered in the base station.

In GSM location services, the LMU is a separate element from the GSM network. The communication between the GSM network and LMU is done through the GSM air interface. In the UMTS location services, the LMU functionality is integrated into the base station, preferably without technical restrictions, at least when an Idle Slot Forward Link - Time Difference of Arrival (ISFL-TDOA) method or an Observed Time Difference Of Arrival – Idle Period Downlink (OTDOA-IPDL) method is used.

The Mobile Terminal (MT) 100 may be involved in various levels in the positioning procedures depending on the positioning method employed. In addition, the role of MT 100 is closely related to the positioning approach used in the system. For example, the functionality of MT 100 may or may not encompass location calculation. Preferably, it can initiate a location service by making a request to the network for positioning (network assisted positioning). If it supports the use of Idle Slot Downlink (IS-DL) sets, then it also performs the following functions:

1) measures and stores the signal during idle periods;

2) correlates with different BCH codes between the idle periods;

3) determines the arrival time of the first detectable path, both for the serving Base Station Subsystem (BSS) and other BSSs that it detects;

4) determines when the idle period occurs; and

5) reports the results back to the network.

Each Node-B is able to shut down transmission during the idle period. This function can be predefined in Node B or can be controlled by the corresponding RNC 102. Each Node-B also can handle the functionality of LMU 301 including the functionality of the Positioning Signal Measurement Function (PSMF) and Location

System Operation Function (LSOF). Thus, it is responsible for gathering uplink/downlink radio signal measurements for calculation of a mobile's position. It is also involved in overall operating of location services in the network.

The SRNC 102 in the Universal Terrestrial Radio Access Network (UTRAN) 103 contains functionality required to support location services and procedures between LMU 301 and location service entities in one Public Land Mobile Network (PLMN). It preferably controls the TDOA IS-DL procedures periodically or according to predetermined parameters, handles each Node-B's power ceasing period and performs the Location System Operation Function (LSOF), Positioning Radio Coordination Function (PRCF), Position Calculation Function (PCF), and Positioning Radio Resource Management (PRRM) entities. This includes provisioning of data, positioning capabilities, location services operation, location calculation, gathering uplink or downlink radio signal measurements for mobile position calculation, managing the positioning of a mobile through overall coordination, reservation and scheduling of resources (including Forward Access Channel/Random Access Channel (FACH/RACH) or Dedicated Channel (DCH)) required to perform positioning measurements of a mobile terminal 100, and controlling the location services radio accesses. SRNC 102 also calculates the final location estimate and accuracy.

The SRNC 102 controls each LMU 301 of a number of LMUs for the purpose of obtaining radio interface measurements to locate or help locate MT 100 in the area that it serves. The SRNC 102 is administered with capabilities and types of measurements produced by each of its LMUs. The location measurements returned by an LMU 301 to

an SRNC 102 have a generic status and can be used for more than one positioning method (including Time of Arrival (TOA)).

Signaling between an SRNC 102 and each LMU 301 is transferred via the Iub interface, and in some specific periods, via Iur interfaces. The Iur interface supports inter-RNC soft handovers, including location services. Whenever an inter-RNC soft handover occurs Iur supports the functionality of the positioning entities in RNCs, including PCF, PRRM, Positioning Signal Measurement Function (PSMF) and LSOF. In case of SRNC relocation, Iur supports the relocation mechanisms to transfer the PCF, PRRM, PSMF and LSOF functionality from SRNC to Drift RNC (DRNC) in order for DRNCs to be able to handle the responsibility of SRNC in location service processes.

UTRAN 103 is involved in the handling of various positioning procedures and RAN level overall controlling of location services. It controls an Idle Slot Downlink (IS-DL) method and manages overall coordination and scheduling of resources required to perform positioning of the mobile. In a network based positioning approach, UTRAN 103 calculates the final location estimate and accuracy and controls a number of LMU/Node B101-1 to 101-n for the purpose of obtaining radio interface measurements to locate or help locate mobile terminal 100 in the serving area.

Generally, UTRAN 103 provides Cell-ID and timing related data to 3G-MSC 104. According to the example embodiment of the invention described below, it may instead provide a Service Area Identification (SAI) code to 3G-MSC 104. The 3G-MSC 104 is similar to the MSC in a GSM network, but the functionality of the Serving Mobile Location Center (SMLC) (element 302 in Fig. 3) may be integrated into SRNC 102. The functions of 3G-MSC 104 are billing, coordination, location requests, authorizations of

mobile terminals and managing call-related and non-call related positioning requests and operations for location services.

Since 3G-SGSN 105 has independent mobility management, UTRAN 103 instead generally provides a Cell-ID to SGSN 105. In the example embodiment of the invention described below, UTRAN 103 may instead provide SAI to SGSN 105. The location services parameters are included in the Iu interface between RNCs 102 and 3G-MSC 104 and 3G-SGSN 105. 3G-SGSN 105 is similar to MSC 104. The functions of SGSN 105 are charging, coordination, authorizations of mobile terminals and managing positioning requests and operations of the location services as far as the packet switch accesses are concerned. If mobile terminals 100 support both network-based and mobile-based positioning, each RNC 102 calculates the position of each mobile terminal 100 when a mobile-based positioning is applied by gathering uplink/downlink.(UL/DL) radio signal measurements. Then RNC 102 sends the location information to the UE or to SGSN. If the SGSN 105 receives the location information, it sends the location information to CSCF (element 304 in Fig. 3), to the PSAP (element 305 in Fig. 3), or to GMLC 106.

The Iu interface transforms coordinate estimates of Mobile Terminal 100 over Radio Access Network Application Part (RANAP) protocol from each RNC 102 to 3G-MSC 104 and SGSN 105 and Mobile Terminal 100 positioning related NAS messages, including paging, authentication, etc. messages over RANAP protocol. The interface also maps the location service Quality of Service (QoS) attributes and handles states information between UTRAN 103 and 3G-MSC 104.

In a situation where Mobile Terminal 100 is connected to an external server via IP, the server might want to locate Mobile Terminal 100. If Mobile Terminal 100 is

using dynamic IP addressing, the address has to be translated to an understandable address or the location request has to be otherwise processed.

The external server could request the GGSN (element 303 in Fig. 3) to provide the identity behind the given dynamic IP address. The GGSN 303 can map the dynamic IP address to a MS-ISDN number, which is used by the external server to locate Mobile Terminal 100 via normal positioning methods. Alternatively, an IP port number can be reserved for allocation request use in Mobile Terminal 100. The external application can then use the dynamic IP address and known (standardized) port number to deliver a positioning request to Mobile Terminal I 00. Mobile Terminal I 00 then requests its own position via normal positioning procedures, and delivers the result to the external terminal.

Another entirely new functional block is the Gateway Mobile Location Center (GMLC) 106, which acts as a gateway between Location Service (LCS) clients, such as PSAP 305, and the rest of the network. GMLC 106 receives and handles service requests for location information for an indicated mobile terminal 100 from external LCS clients, activates the location systems, if needed, and returns the result to the LCS client. GMLC 106 may request routing information from HLR 107 or SGSN 104. After performing registration authorization, it sends a positioning request to and receives final location estimates from 3G-MSC 105 and SGSN 104.

Home Location Register 107 contains location services subscription data and routing information concerning subscriber calls. HLR 107 is accessible from GMLC 106 via a Mobile Application Part (MAP) interface.

PSAP 305 is preferably a conventional PSAP and may be connected to GMLC 106 via the PSTN. The external LCS client(s) 108 may be any sort of service application offered by a service provider or content provider. LCS Client(s) 108 is closely related to the variety of available services. Sometime Mobile Terminal 100 or a service application in Mobile Terminal 100 is the client. In addition to changes in the main interfaces (i.e., Uu, lub, lur and Iu) of the network, there are also some interfaces defined to support location services. The Le interface provides the reference point for transforming information transferred between GMLC 106 and PSAP 305 and other external LCS clients 108. This information includes the positioning request and the final result of the positioning process.

The Lh interface passes routing information from HLR 107 to GMLC 106 and supports any mobility management related database in HLR 107. It can also be used by GMLC 106 to request the address of a visited MSC or SGSN for a particular Mobile Terminal 100 whose location has been requested. It is preferably a type of MAP interface and may be implemented over a SS7 signaling network or possibly over IP protocol (MAP over IP). The Lg interface allows 3G-MSC 105 to access GMLC 106 (Home PLMN or Visited PLMN). The interface transforms subscriber information needed, for example, for authorization and positioning access routing. It can be used by GMLC 106 to convey a location request to the MSC or SGSN currently serving a particular Mobile Terminal 100 whose location was requested or by an MSC or SGSN to return location results to GMLC 106. It is preferably a type of MAP interface and may be implemented over a SS7 signaling network or possibly over IP protocol (MAP over IP).

The Lg' interface allows SGSN 104 to access GMLC 106 (Home PLMN or Visited PLMN). It may be identical to the Lg interface, but is labeled differently in Fig.1 to show that it may also be different. The interface transforms subscriber information needed, for example, for authorization and positioning access routing. It is preferably a type of MAP interface and may be implemented over a SS7 signaling network or possibly over IP protocol (MAP over IP). Preferably, the MAP interfaces are as similar as possible to the MAP interfaces defined for location services in the GSM network. Because there is no Serving MLC (SMLC) in UMTS, the MAP interface between SMLC and VMSC is not needed. The locations services for GSM do not yet include GPRS, so the GPRS part of the UMTS network is added to the MAP signaling. It is feasible to use the same MAP interface between GMLC 106 and 3G-SGSN 105, and between GMLC 106 and 3G-MSC 104.

Fig. 2 is an additional block diagram showing connections to other networks and, in particular, the Gateway GPRS Support Node (GGSN) 108 and Call State Control Function (CSCF) 109.

Fig. 3 is a simplified block diagrams showing the connections between network element functionalities and, in particular, the Gateway GPRS Support Node (GGSN) 303 and Call State Control Function (CSCF) 304. There is also shown in Fig. 3, the Public Safety Answering Point (PSAP) 305 to which emergency calls are connected through CSCF 304 according to the example method embodiments described below.

GGSN 303 and CSCF 304 are instrumental in implementing the example mechanisms illustrated in Figs. 4-11 for reliably transferring emergency calls to an appropriate PSAP without abuse or fraud. In the following description of the example

embodiments, GGSN 303 and CSCF 304 are elements located in a network in which a subscriber is visiting. They utilize a signaling PDP context supported in 3rd generation MIPT networks. Although not shown in Figs. 1-3 for the sake of clarity, it should be understood that there may be a plurality of different CSCFs and connected PSAPS. Preferably, each CSCF 304 maintains a database of the connected PSAPs (or equivalent capability) which includes a correspondence between the PSAPs for each Service Area Identification (SAI) code it may receive for an emergency call such as in one of the example method embodiments described below. When a CSCF receives an SAI code in an emergency call setup request, it connects the emergency call to a PSAP based, at least in part, on the correspondence between the SAI code and the PSAPs stored in the database. The selection of an appropriate PSAP by CSCF may ultimately be effected by other factors in addition to the SAI code. For example, load balancing or other procedures may effect the selection of a PSAP in order to attempt to ensure that the emergency call can be promptly answered at the PSAP to which it is connected.

The specifications for a UMTS network have been released by the 3rd Generation Partnership Projection (www.3gpp.org). Release 1999 provides that a network subscriber can have one or more packet data protocol (PDP) addresses. The General Packet Radio Service (GPRS) Service Description, Stage 2, 3G TS 23.060, Version 3.3.0, is hereby incorporated by reference. Each PDP address is described by one or more PDP contexts in the Mobile Terminal (MT) 100, SGSN 105, and GGSN 303. Each PDP context may have forwarding and mapping information for directing the transfer of data to and from its associated PDP address and a traffic flow template (TFT) for filtering the transferred data.

Each PDP context can be selectively and independently activated, modified and deactivated. The activation state of a PDP context indicates whether or not data transfer is enabled for a corresponding PDP address and TFT. If all PDP contexts associated with the same PDP address are inactive or deactivated, then all data transfer for that PDP address is disabled. All PDP contexts of a subscriber are associated with the same Mobility Management (MM) context for the International Mobile Subscriber Identity (IMSI) of that subscriber.

While network support for location services has been described above, the invention is not dependent on any particular positioning method and can be used generically with any standardized or proprietary positioning method. Preferably, the positioning methods and network location services capabilities used in the example embodiments of the invention for supporting and routing an emergency call to a PSAP are the same positioning methods and network location services capabilities used for other location services clients. A number of different method embodiments, differing primarily in their positioning process, are described below with reference to the architecture of the network shown in Figs. 1 and 3. These method embodiments are merely non-limiting illustrative examples and the network is merely a non-limiting illustrative example of a network in which the method embodiments may be practiced. Of course, there may be other method embodiments and other networks in which the methods may be carried out.

Fig. 4 shows the application of the PDP context activation procedure of the UMTS network in a example embodiment of the invention where a subscriber has a Subscriber Identification Module (SIM). First, Mobile Terminal 100 initiates a PDP

context activation. For example, the subscriber may dial 9-1-1. The Activate PDP Context Request sent to SGSN 105 in step 1 includes a number of parameters. These parameters include a PDP address and an Access Point Name (APN). The PDP address is used to indicate whether a static PDP or dynamic PDP address is required. The APN is conventionally a logical name referring to the GGSN to be used. The GGSN is a gateway to connected external networks. In this example embodiments of the invention, the APN is instead used to indicate that the service required is an emergency call.

In step 2, SGSN 105 selects a suitable GGSN 303 according to the APN and sends a Create PDP Context Request message to the selected GGSN 303. GGSN 303 decides whether to accept or reject the request. If it accepts the request, GGSN 303 sets a traffic flow template (TFT) to allow only emergency call related traffic to be transferred on the PDP context. For example, a separate IP address or port number may be used for normal calls and for emergency calls, and GGSN 303 can set the TFT according to the information on the IP address or the port number.

If GGSN 303 accepts the request, it modifies its PDP context table and returns a Create PDP Context Response message to SGSN 105 in step 3. It includes the address of a suitable CSCF 304 in the Create PDP Context Response. Preferably, the address of CSCF 304 is sent in the Protocol Configuration Options parameter, but it can also be sent in another parameter or as a new parameter.

If the address of CSCF 304 is present in the Create PDP Context Response, SGSN 105 copies it to an Activate PDP Context Accept message relayed to MT 100 in step 4. MT 100 must contact the CSCF 304 specified in step 4. MT 100 may send location information to CSCF 304 in step 5. If for some reason the address of CSCF 304 is not

sent to MT 100, then the GGSN 303 may need to change the destination IP address in the call setup message in order to use a local CSCF for the emergency call. This is shown as step 5 in Fig. 4. For the actual voice traffic, a secondary PDP context with correspondingly different Quality of Service (QoS) may be needed. If needed, MT 100 initiates a secondary PDP context activation.

Preferably, the call setup request sent in step 5 of Fig. 4 includes the Service Area Identification (SAI) of MT 100. The Service Area Identification is used to uniquely identify an area consisting of one or more cells belonging to the same location area and to indicate the location of MT 100. The Service Area Code (SAC) together with the PLMN identity and the LAC constitutes the Service Area Identification: SAI = MCC + MNC + LAC + SAC. See the General Packet Radio Service (GPRS) Service Description, Stage 2, Release 1999, 3G TS 23.060, Version 3.3.0, Section 14.10. CSCF 304 uses the SAI code, at least in part, to select an appropriate PSAP to which to connect the emergency call.

The example embodiment in Fig. 5 is substantially the same as that set forth above with respect to Fig. 4 except that it is carried out for a subscriber without a Subscriber Identification Module (SIM). In this case, the UE sends an Activate Anonymous Access (AA) PDP Context Request. The rest of the procedure is in Fig. 4.

Another example embodiment, in which a location calculation is triggered by the emergency call, is illustrated in Fig. 6. Like the other example embodiments, the embodiment in Fig. 6 takes advantage of the PDP Context available in UMTS networks. In particular, it may use the APN parameter of the Activate PDP Context Request to indicate that the call is to be serviced as an emergency call as indicated at step 2. Unlike

the other example embodiments however, MT 100 sends an SM Service Request message before sending the Activate PDP Context Request as indicated at step 1. The SM Service Request message is sent to establish a secure signaling connection.

A key feature of the example embodiment in Fig. 6 is that SGSN 303 sends a Location Reporting Control message to the RNC 102 in response to the emergency call. Specifically, the SGSN 303 can initiate the location reporting procedure at step 3 immediately upon receiving the SM Service Request message where the parameter Service Type indicates an emergency call, or a request to activate a PDP context (the Activate PDP Context Request, the Activate Secondary PDP Context Request, or the Activate AA PDP Context Request) where the parameter APN indicates an emergency call. This feature has the advantage that location services are quickly performed for emergency calls, but are not unnecessarily performed for other types of calls.

The RNC 102 is responsible for calculating the location information for MT 100 at step 4. The location of MT 100 is reported to the SGSN 303 in step 5 and relayed to GMLC 106 at step 6. An acknowledgement of the location report is sent back to SGSN 105 at step 7 and then the location information is transferred to a PSAP selected by CSCF 304 either on request or independently at step 8.

Fig. 7 illustrates an example method embodiment similar to that of Fig. 6 except that the Mobile Terminal 100 (referred to as "UE" in Figs. 7-11) does not send a SM Service Request before sending the Activate PDP Context Request in step 1. SGSN 303 sends a location reporting control message (step 2), as soon as it receives the PDP context activation procedure (step 1), to request the Service Area ID from the Radio Access Network (UTRAN in the example network of Figs. 1 and 2) and to start the positioning

procedure (step 4'). This may, but need not, be done by sending two separate location reporting control messages to request the Service Area ID and to start positioning according to the current RANAP specification (3G TS 25.413). For an emergency call a temporary PS Domain Identifier (PSDI) can be allocated. Such an identifier may be, for example, a MS IP Address, PTMSI or MSISDN. SGSN 303 also assigns a PS Domain Identifier to the emergency call that is used to identify (e.g. route to) both the emergency services provider and the switch in the VPLNIN currently serving the emergency caller, and possibly the emergency caller, for the duration of the call.

While carrying out positioning, the RAN 103 returns the Service Area ID to SGSN 303 (step 3). SGSN 105 sends a Create PDP Context Request to GGSN 203 as described above with respect to Fig. 3 (step 4). GGSN 303 accepts the request, modifies its PDP context table and returns a Create PDP Context Response message (including the address of suitable CSCF) to SGSN 105 (step 5). SGSN copies the CSCF address within an Activate PDP Context Accept message relayed to MT 100 along with the Service Area ID and the PSDI telephone number assigned to the emergency call (step 6).

When positioning is completed, RAN 103 returns a location estimate within a Location Report message to SGSN 105 (step 6'). SGSN 105 forwards a Subscriber Location Report (which includes the location estimate, an identifier (IMSI or IP address) and the PSDI) to GMLC 106 (step 7'). Preferably, the location estimate is associated with a time stamp which, together, mark the "initial location" of MT 100. After the PDP context has been activated, MT 100 sends a Invite message (containing the Service Area ID, the identifier and the PSSDI) to CSCF 304 (step 7). Based at least in part on the Service Area ID, CSCF 304 selects a suitable PSAP (preferably using a database of

PSAPs and their correspondence to Service Area IDs) and sends a setup message (containing the PSDI) to PSAP 305 (Figs. 7-11 refer to the PSAP as an EC (emergency center) rather than PSAP) (steps 8 & 9).

As soon as the emergency call is connected, the selected PSAP sends a LCS Service Request to obtain the initial location to GMLC 106 and GMLC 106 sends a LCS Service Response containing the initial location (steps 10 & 11). The emergency call is identified in the request and the response by its PSDI. Similarly, throughout the duration of the emergency call, the selected PSAP may request and receive updates on the current location of mobile terminal 100 using normal Mobile Terminated Location Requests (MT-LR) defined in 3G TS 23.171 v3.0.0 (Release 1999). Fig. 8 illustrates a method similar to that in Fig. 7 except that the positioning procedure is finalized, and a location estimate is obtained, before PDP Context Activation acceptance. Steps 1-4 are the same as the method in Fig. 7. However, the SGSN 105 receives the Location Report (step 5'), containing the location estimate, from RAN 103 before GGSN 303 returns a Create PDP Context Response message to SGSN 105 (step 6).

Instead of forwarding the location estimate to GMLC 106 in a Subscriber Location Report (step 7' of Fig. 6), SGSN 105 includes the location estimate within the Activate PDP Context Accept message relayed to MT 100 along with the Service Area ID, PSDI and CSCF address (step 7). MT 100, in turn, includes the location estimate (along with the Service Area ID, identifier, and PSDI) in the Invite message sent to CSCF 304 (step 8). After selecting the PSAP (step 9), CSCF 304 includes the location estimate in the setup message sent to PSAP 305 (instead of the PSDI). This eliminates the need for the two steps for PSAP 305 to request and receive the initial location from GMLC

106 (steps 10 & 11 in Fig. 7) when the emergency call is connected. Of course, the selected PSAP may continue to request and receive updates on the current location of MT 100 in the same manner as in the example embodiment of Fig. 7 (steps 11-13).

Fig. 9 illustrates a method embodiment similar to that of Figs. 7 and 8, except that RAN 103 provides the location estimate to MT 100 instead of making a Location Report to SGSN 105. Steps 1-6 in the embodiment of Fig. 9 are the same as steps 1-6 in the embodiment of Fig. 7. MT 100 must receive the location estimate from 103 in some manner, perhaps, but not necessarily, by using Radio Resource Control (RRC) messages. The manner in which the location estimate is reported by RAN 103 (according to either the embodiment of Fig. 7 or the embodiment of Fig. 9) may be predetermined or it may be controlled, for example in the Location Reporting Control message sent by SGSN 105 to RAN 103 in step 2.

In the example embodiment of Fig. 9, the positioning procedure should be finished before the Activate PDP Context Accept message is received by MT 100 in step 6. If it is not, then MT 100 delays the Invite message until the location estimate is received from RAN 103. Once the location estimate is received, MT 100 sends an Invite message (containing Service Area ID, the location estimate and the identifier) to CSCF 304 (steps 7). The remainder of the steps in the example embodiment of Fig. 9 (steps 8-12) are the same as steps 9-13 in Fig. 17.

Fig. 10 illustrates an example embodiment similar to that of Fig. 7 except that SGSN 105 already knows the current Service Area ID when it receives the Activate PDP Context Request in step 1. In such an embodiment, SGSN 105 need not request the Service Area ID from RAN 103 and RAN 103 need not return the Service Area ID as in

steps 2 and 3 of Fig. 4. The remainder of the steps in the embodiment of Fig. 10 are the same as the remainder of the steps in Fig. 7.

The example embodiment illustrated in Fig. 11 differs significantly from the other example embodiments insofar as MT 100 itself originates the positioning method (step 2') as soon as the Activate PDP Context Request is sent to SGSN 105 (step 1). It can either perform its own MT based positioning calculation or request that a positioning method be performed using Mobile Originated Location Requests (MO-LR) procedures. The example embodiment in Fig. 10 thus avoids the need for the Location Reporting Control message from SGSN 105 or the Location Report from RAN 103. It also simplifies the Activate PDP Context Accept message sent from SGSN 105 since it only needs to include the address of the CSCF (step 4). Similarly, the Invite message sent from MT 100 to CSCF 304 need only contain the location estimate and the Service Area ID (step 6). The service areas have to be coordinated between MT 100 and SGSN 105 in order to ensure that the Service Area ID provided by MT 100 is consistent with the Service Area ID expected by SGSN 105 and CSCF 304. The remainder of the steps in the example embodiment of Fig. 11 (steps 7-1 1) are the same as steps 9-13 in Fig. 9.

The example embodiments of Figs. 7-11 show a variety of methods, each with their own advantages and disadvantages. For example, in the example embodiments of Fig. 7 and 10, the emergency call can be connected without regards to delays in the positioning procedure because the initial location is delivered by GMLC 106 upon request from PSAP 305 after the emergency call is connected. In the example embodiment of Fig. 10, the MT 100 must have a Subscriber Identification Module (SIM) in order to interface with CSCF 304.

While the foregoing has described what are considered to be example embodiments of the invention. It is understood that various modifications may be made therein and that the invention may be implemented in various forms and embodiments, and that it may be applied in numerous applications, only some of which have been described herein. For example, the SAI could be made available directly to the mobile terminal by the RAN instead of, or in addition to, the SGSN within a PDP context acceptance message. For example, RNC 102 could make SAI directly available by broadcast and/or point to point RRC messages. It is intended by the following claims to claim all such modifications and variations.

CLAIMS

1. A method of providing location-based services for a call in a packet switched wireless communications network, the method comprising the steps of:

sending a request to setup a communication channel from a first network element to a second network element, said request having an indication in said request indicating that the communication channel will be used for transferring a call which requires location-based services.

2. A method as recited in claim 1, wherein said first network element contacts a local entity which is capable of handling set calls.

3. The method recited in claim 2, further comprising the step of returning an accept message from said second network element to said first network element, said accept message acknowledging said request and providing the address of an entity handling said call.

4. The method recited in claim 2 or 3, further comprising the step of transferring said call to said entity.

5. The method recited in claim 4, wherein said second network element selects a third network element according to said indication in said request.

6. The method recited in claim 5, wherein data traffic on said communication channel is filtered according to filtering information set by said second network element or said third network element.

7. The method recited in claim 4, wherein the second network element sends a request to start location measuring when receiving said request from said first network element.

8. The method recited in claim 7, wherein the request is a SM Service Request.

9. The method recited in claim 4, wherein said second network element sends a request to setup said communication channel to a third network element.

10. The method recited in claim 9, wherein said third network client gets a traffic flow template (TFT) as filtering information in response to said request to setup said communication channel.

11. The method recited in claim 10, wherein said third network element is a Gateway GPRS Support Node (GGSN).

12. The method of any of the preceding claims, wherein said second network element is a Serving GPRS Support Node (SGSN)

13. The method recited in claim 4, wherein said second network element is an Internet GPRS Service Node (IGSN) which sets a traffic flow template (TFT) as filtering information in response to said request to setup said communication channel.

14. The method recited in claim 4, wherein a parameter in said request is used to indicate that said communication channel will be used for transferring an emergency call.

15. The method recited in claim 13, wherein said parameter in said request is the Access Point Name (APN).

16. The method recited in claim 7, wherein the request is an Activate PDP Context Request.

17. The method recited in claim 7, wherein the request is an Activate Secondary PDP Context Request.

18. The method recited in claim 7, wherein the request is an Activate AA PDP Context Request.

19. The method recited in claim 7, wherein the request is an Activate Emergency PDP Context Request.

20. The method recited in claim 4, wherein said first network element sends location information to said entity handling said call.

21. The method of claim 20, wherein said location information is Service Area Identification (SAI), Routing Area Identity (RAI), Cell –ID , coordinate information or any combination of these.

22. The method recited in claim 4, wherein said second network element sends location information to said entity handling said call.

23. The method recited in claim 4, wherein said entity handling said call may request location information from a location calculation entity.

24. The method recited in claim 4, wherein said location calculating entity is a Radio Network Controller (RNC).

25. The method recited in claim 13, wherein a first network element generates said request message and includes said parameter in said request message.

26. The method recited in claim 3, wherein said entity handling said call comprises a Call State Control Function (CSCF) or a Public Safety Answering Point (PSAP).

27. The method recited in claim 3, wherein said first network element sends a request to setup a secure communication channel for signaling prior to said request to setup said communication channel indicating that said call is a call requiring location-based services.

28. The method recited in claim 25, wherein said request to setup a secure communication channel for signaling is an SM Service Request.

29. The method recited in claim 26, wherein the second network element sends a request to initiate location measuring in response to said request to setup secure communication channel for signaling.

30. A packet switched wireless communication network, comprising:

a first network element; and

a second network element, said first network element generating and sending a request to setup a communication channel to said second network element, said request having an indication indicating that the communication channel will be used for transferring call related control messages to or from said first network element.

31. A packet switched wireless communication network according to claim 28, wherein said second network element is a serving GPRS support node (SGSN).

32. A packet switched wireless communication network according to claim 29, wherein said second network element is an Internet GPRS support node (IGSN).

33. A method of routing a call from a first network element (UE) in a packet switched wireless communications network, the method comprising the steps of:

providing location information for the said first network element (UE) from a second network element;

sending request to setup a call from the said first network element (UE) to a third network element (CSCF), said request including the said location information for the first network element(UE);

34. A method of claim 33, wherein the said location information is provided to the first network element (UE) from a network element (RNC) in the radio access network.

35. A method of claim 34, wherein the location information is provided in a RRC message.

36. A method of claim 34, wherein the location information is broadcasted to the first network element (UE).

37. A method of claim 33, wherein the location information is forwarded to the second network element (SGSN) from a network element in the radio access network (RNC).

38. A method of claims 37, wherein the second network element (SGSN) sends the location information in an acceptance message to a request to establish a communication connection (PDP Context) for the first network element (UE) before the said request to set up a call.

39. A method of claim 38, wherein the communication connection is a PDP context and the acceptance message is the Accept PDP Context Activation message.

40. A method of claim 33, wherein the location information is provided to the first network element as a part of a positioning method.

41. The method recited in claim 33, comprising a further step of selecting an entity (PSAP) in the second network based at least in part, on the said location information included in the said request.

42. A method of claim 33, wherein the call is an emergency call.

43. A method of claim 33, wherein the second network element (SGSN) allocates a temporary PS Domain Identifier for the call.

44. A method of claim 43, wherein the second network element (SGSN) sends the said temporary PS Domain identifier to an entity maintaining location information (GLMC).

45. A method of claim 43 or 44, wherein the said temporary PS Domain Identifier is sent from the second network element (SGSN) to the first network element (UE), from the first network element (UE) to the third network element (CSCF,PSAP) and from the third network element (CSCF,PSAP) to an entity handling emergency calls (EC).

46. A method of 43, wherein the temporary PS Domain identifier is used to identify an emergency call, when an entity handling emergency calls (EC) requests location information from an entity maintaining location information (GLMC).

47. The method recited in claim 33, wherein said third network element is a call control local entity which is capable of handling call set up (CSCF, PSAP).

48. The method recited in claim 42, further comprising the step of returning an accept message in response to a request for an emergency call from the first network element, said accept message acknowledging said request and providing the address of said call control entity.

49. The method recited in claim 41, further comprising the step of transferring said emergency call to said selected PSAP.

50. The method recited in claim 33, wherein the second network element (SGSN) indicates to the radio access network to start a positioning method in order to get location estimates in response to receiving said request for a call from said first network element.

51. The method recited in claim 37, wherein said second network element requests the location information from the radio access network corresponding to the mobile terminal in response to receiving said request for an emergency call from said first network element.

52. The method recited in claim 50, wherein the location estimate obtained by said positioning method is provided to a Gateway Mobile Location Center (GMLC).

53. The method recited in claim 51, wherein said selected PSAP obtains said location estimate from said GMLC.

54. The method recited in claim 53, wherein said selected PSAP obtains said location estimate from said GMLC after the emergency call is transferred to said selected PSAP.

55. The method recited in claim 53, wherein the emergency call is identified using an assigned phone number when said selected PSAP obtains said location estimate from said GMLC.

56. The method recited in claim 47, wherein the positioning method is performed in the first network element.

57. The method recited in claim 33, wherein the first network element requests that a positioning method be started at the same time that it sends the call setup request.

58. A method of any one of claims 33 to 57, wherein the first network element is a user equipment(UE, MS).

59. A method of any one of claim 33 to 57, wherein the second network element is a SGSN

60. The method of any one of claims 33 to 57, wherein the said location information is Service Area Identification (SAI), Routing Area Identity (RAI), Cell –ID , coordinate information or any combination of these.

61. A packet switched wireless communication network, comprising:

a user equipment;

a radio access network; and

a network element, wherein location information is sent from said radio access network to said user equipment and when the user equipment sends a request to set up a call to said network element, the request comprises said location information.

62. A packet switched wireless communication network according to claim 61, wherein said network element is a CSCF or a PSAP

63. A packet switched wireless communication network according to claim 62, wherein said SGSN receives said Serving Area ID and forwards said Service Area ID to said mobile terminal.

64. A packet switched wireless communication network according to claim 63, further comprising a call control entity receiving said Service Area ID in an emergency call setup request from mobile terminal.

65. A packet switched wireless communication network according to claim 64, wherein said call control entity has a database identifying a plurality of Public Safety Answering Points (PSAPS) and corresponding said plurality of PSAPs with Service Area IDs.

66. A packet switched wireless communication network according to claim 64, wherein said call control entity selects a PSAP based, at least in part, on said Service Area ID.

FIG. 1

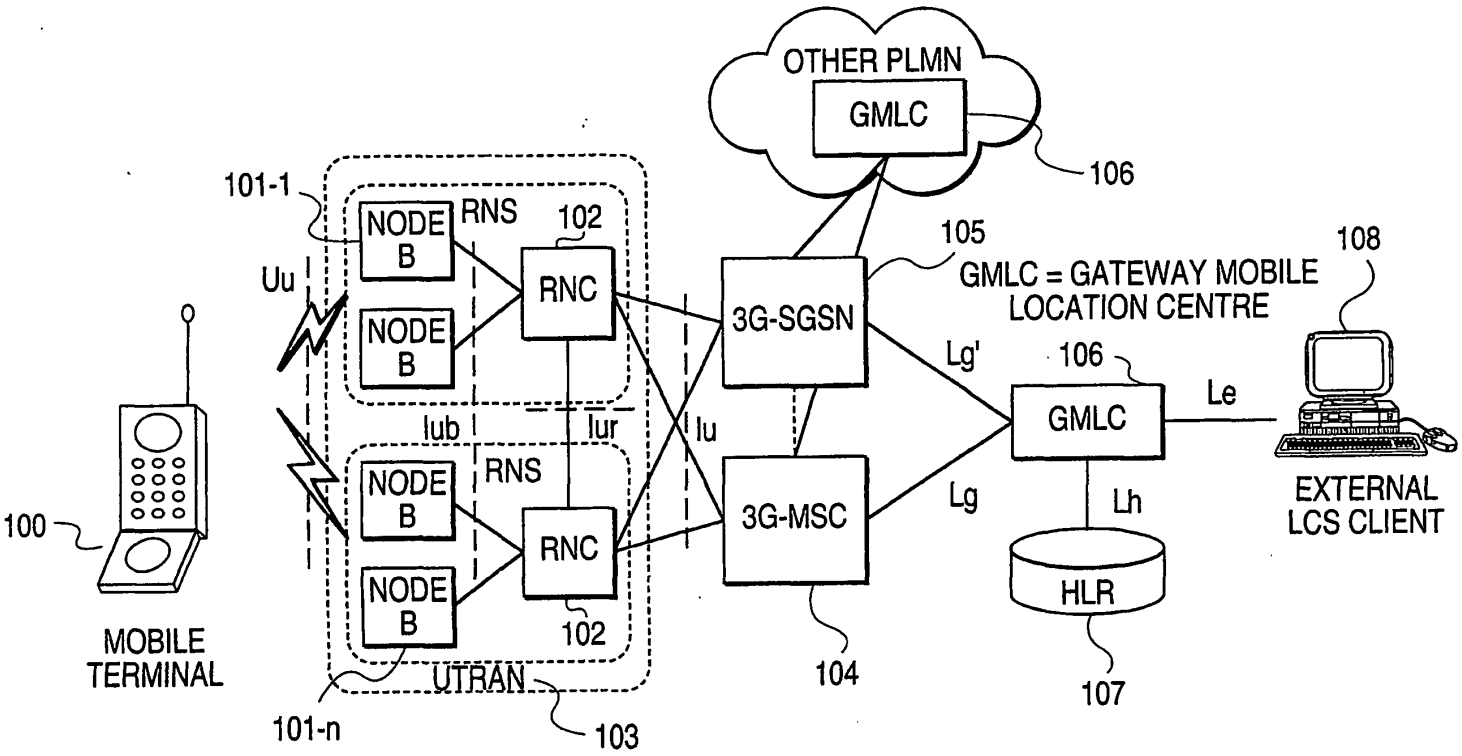

OTHER PLMN
GMLC
106
101-1
NODE B
RNS
102
Uu
RNC
NODE B
105
GMLC = GATEWAY MOBILE LOCATION CENTRE
108
3G-SGSN
Lg'
106
GMLC
Le
Iub
Iur
Iu
NODE B
RNS
3G-MSC
Lg
Lh
EXTERNAL LCS CLIENT
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RNC
NODE B
HLR
MOBILE TERMINAL
102
104
107
UTRAN
101-n
103

FIG. 2

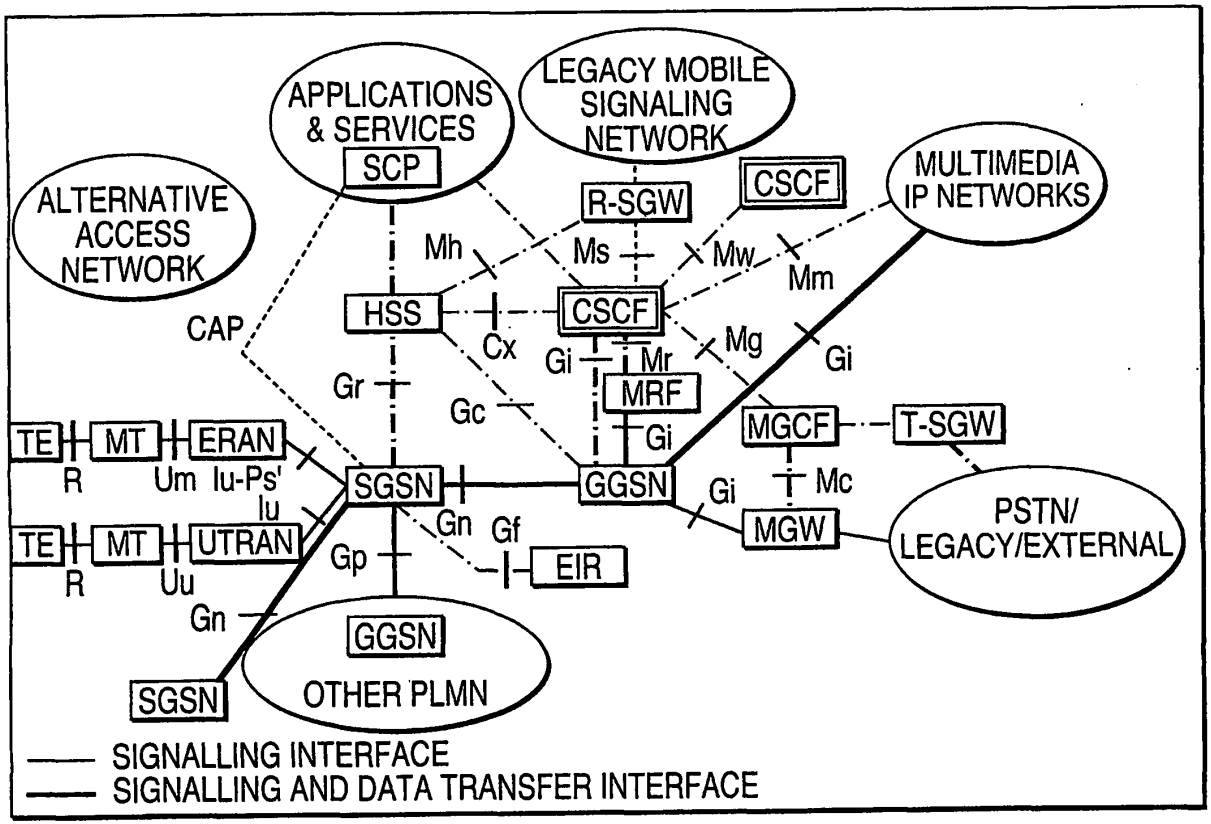
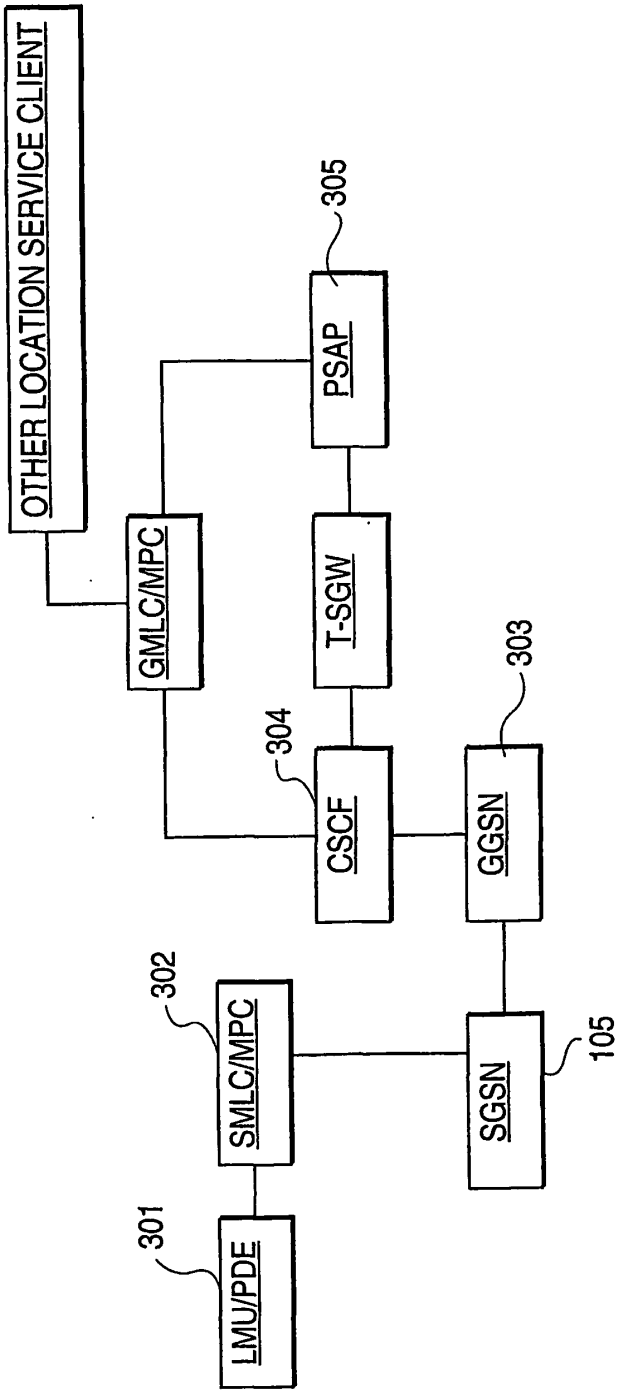

APPLICATIONS & SERVICES
SCP
LEGACY MOBILE SIGNALING NETWORK
ALTERNATIVE ACCESS NETWORK
MULTIMEDIA IP NETWORKS
R-SGW
CSCF
Mh
Ms
Mw
Mm
HSS
CSCF
CAP
Cx
Gi
Mr
Mg
Gi
Gr
MRF
Gc
Gi
MGCF
T-SGW
TE
MT
ERAN
R
Um
Iu-Ps'
Iu
SGSN
GGSN
Gi
Mc
Gn
Gf
TE
MT
UTRAN
R
Uu
Gp
EIR
MGW
PSTN/ LEGACY/EXTERNAL
Gn
GGSN
SGSN
OTHER PLMN
SIGNALLING INTERFACE
SIGNALLING AND DATA TRANSFER INTERFACE

FIG. 3



EX1002 - Page 270

FIG. 4

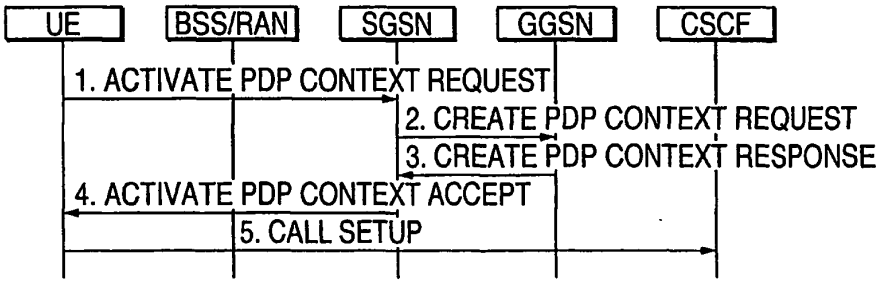

UE
BSS/RAN
SGSN
GGSN
CSCF
1. ACTIVATE PDP CONTEXT REQUEST
2. CREATE PDP CONTEXT REQUEST
3. CREATE PDP CONTEXT RESPONSE
4. ACTIVATE PDP CONTEXT ACCEPT
5. CALL SETUP

FIG. 5

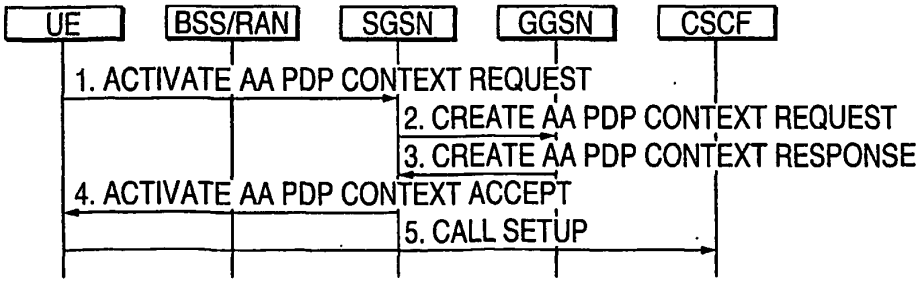

UE
BSS/RAN
SGSN
GGSN
CSCF
1. ACTIVATE AA PDP CONTEXT REQUEST
2. CREATE AA PDP CONTEXT REQUEST
3. CREATE AA PDP CONTEXT RESPONSE
4. ACTIVATE AA PDP CONTEXT ACCEPT
5. CALL SETUP

FIG. 6

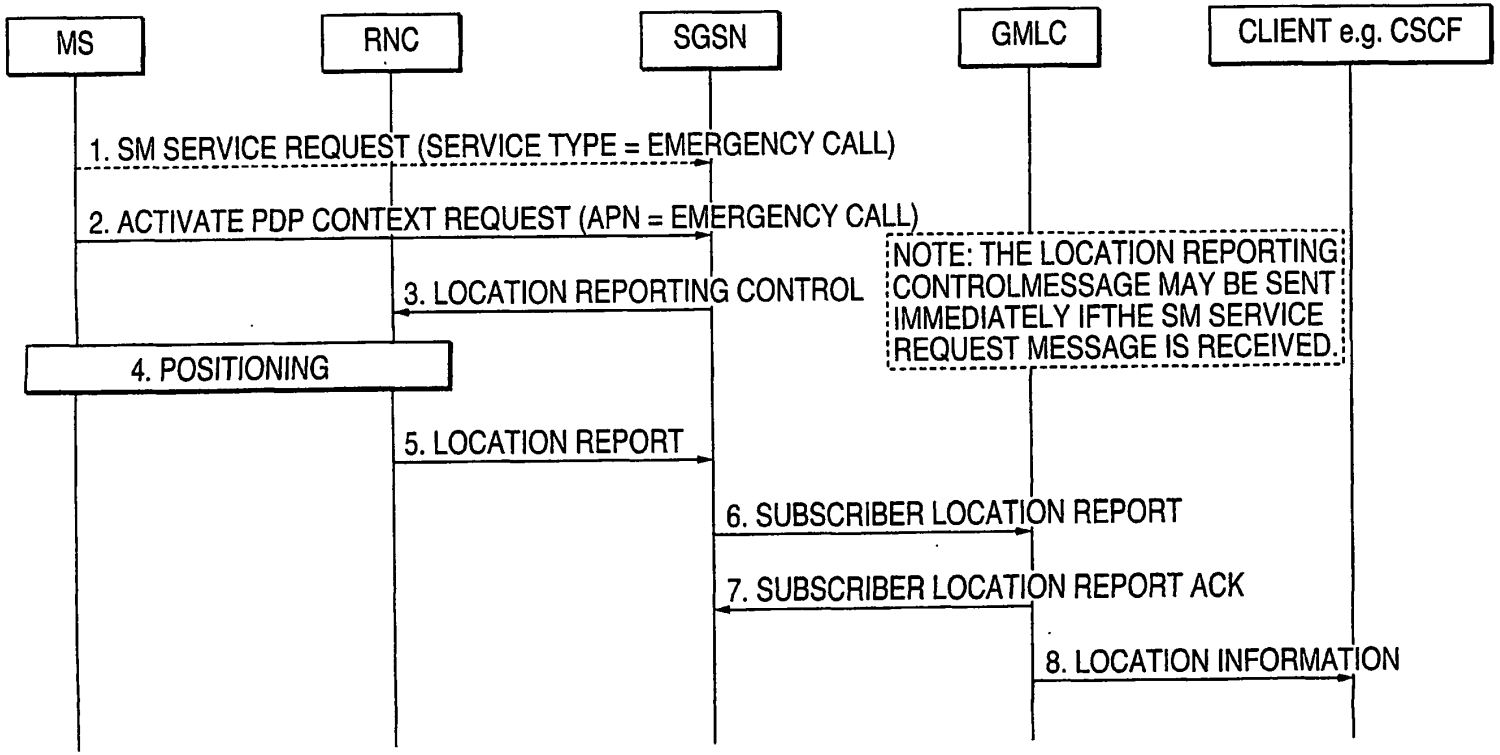

MS
RNC
SGSN
GMLC
CLIENT e.g. CSCF
1. SM SERVICE REQUEST (SERVICE TYPE = EMERGENCY CALL)
2. ACTIVATE PDP CONTEXT REQUEST (APN = EMERGENCY CALL)
3. LOCATION REPORTING CONTROL
NOTE: THE LOCATION REPORTING CONTROLMESSAGE MAY BE SENT IMMEDIATELY IFTHE SM SERVICE REQUEST MESSAGE IS RECEIVED.
4. POSITIONING
5. LOCATION REPORT
6. SUBSCRIBER LOCATION REPORT
7. SUBSCRIBER LOCATION REPORT ACK
8. LOCATION INFORMATION

FIG. 7

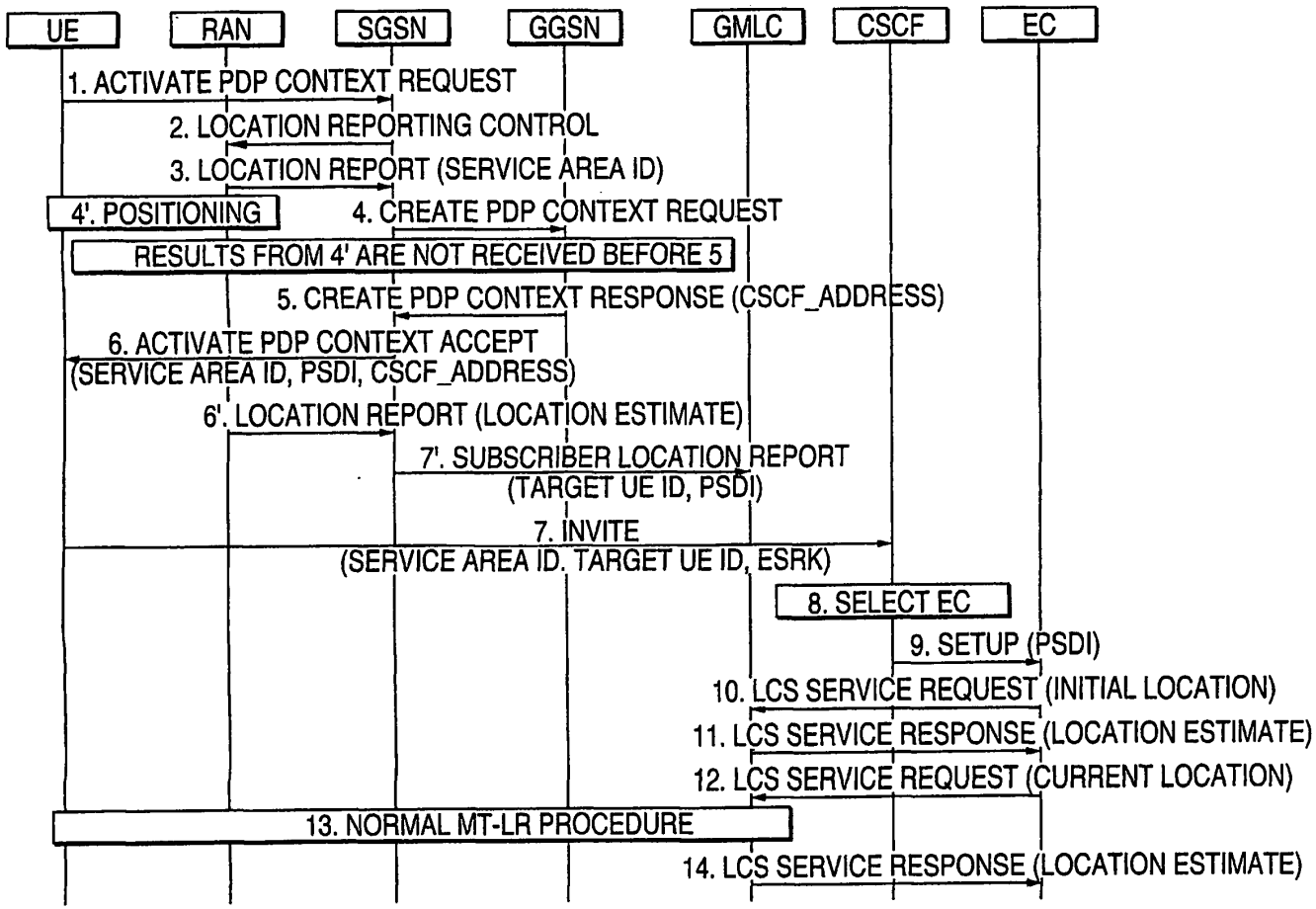

UE
RAN
SGSN
GGSN
GMLC
CSCF
EC
1. ACTIVATE PDP CONTEXT REQUEST
2. LOCATION REPORTING CONTROL
3. LOCATION REPORT (SERVICE AREA ID)
4'. POSITIONING
4. CREATE PDP CONTEXT REQUEST
RESULTS FROM 4' ARE NOT RECEIVED BEFORE 5
5. CREATE PDP CONTEXT RESPONSE (CSCF_ADDRESS)
6. ACTIVATE PDP CONTEXT ACCEPT
(SERVICE AREA ID, PSDI, CSCF_ADDRESS)
6'. LOCATION REPORT (LOCATION ESTIMATE)
7'. SUBSCRIBER LOCATION REPORT
(TARGET UE ID, PSDI)
7. INVITE
(SERVICE AREA ID, TARGET UE ID, ESRK)
8. SELECT EC
9. SETUP (PSDI)
10. LCS SERVICE REQUEST (INITIAL LOCATION)
11. LCS SERVICE RESPONSE (LOCATION ESTIMATE)
12. LCS SERVICE REQUEST (CURRENT LOCATION)
13. NORMAL MT-LR PROCEDURE
14. LCS SERVICE RESPONSE (LOCATION ESTIMATE)

FIG. 8

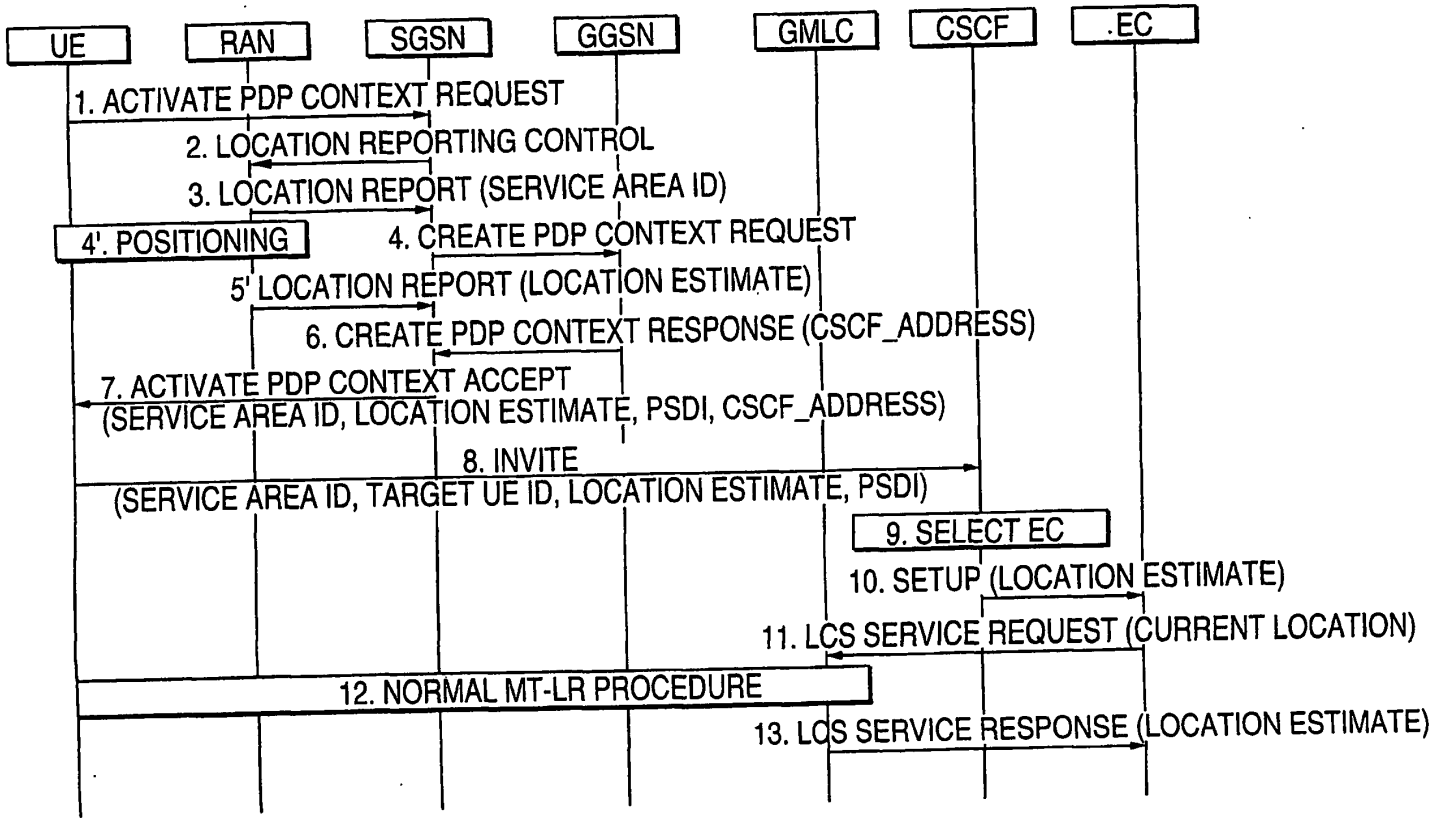

UE
RAN
SGSN
GGSN
GMLC
CSCF
EC
1. ACTIVATE PDP CONTEXT REQUEST
2. LOCATION REPORTING CONTROL
3. LOCATION REPORT (SERVICE AREA ID)
4'. POSITIONING
4. CREATE PDP CONTEXT REQUEST
5' LOCATION REPORT (LOCATION ESTIMATE)
6. CREATE PDP CONTEXT RESPONSE (CSCF_ADDRESS)
7. ACTIVATE PDP CONTEXT ACCEPT
(SERVICE AREA ID, LOCATION ESTIMATE, PSDI, CSCF_ADDRESS)
8. INVITE
(SERVICE AREA ID, TARGET UE ID, LOCATION ESTIMATE, PSDI)
9. SELECT EC
10. SETUP (LOCATION ESTIMATE)
11. LCS SERVICE REQUEST (CURRENT LOCATION)
12. NORMAL MT-LR PROCEDURE
13. LCS SERVICE RESPONSE (LOCATION ESTIMATE)

FIG. 9

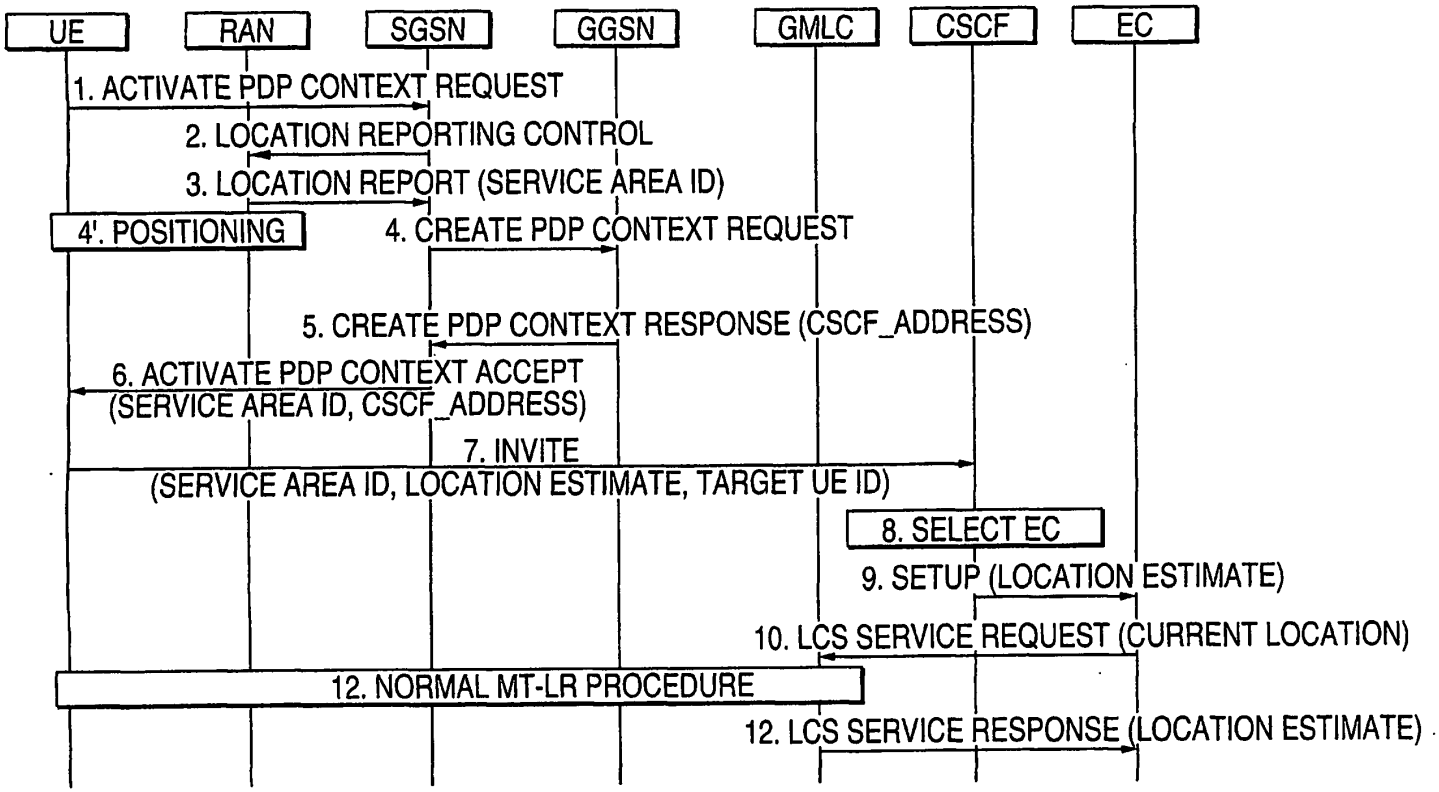

UE
RAN
SGSN
GGSN
GMLC
CSCF
EC
1. ACTIVATE PDP CONTEXT REQUEST
2. LOCATION REPORTING CONTROL
3. LOCATION REPORT (SERVICE AREA ID)
4'. POSITIONING
4. CREATE PDP CONTEXT REQUEST
5. CREATE PDP CONTEXT RESPONSE (CSCF_ADDRESS)
6. ACTIVATE PDP CONTEXT ACCEPT
(SERVICE AREA ID, CSCF_ADDRESS)
7. INVITE
(SERVICE AREA ID, LOCATION ESTIMATE, TARGET UE ID)
8. SELECT EC
9. SETUP (LOCATION ESTIMATE)
10. LCS SERVICE REQUEST (CURRENT LOCATION)
12. NORMAL MT-LR PROCEDURE
12. LCS SERVICE RESPONSE (LOCATION ESTIMATE)

FIG. 10

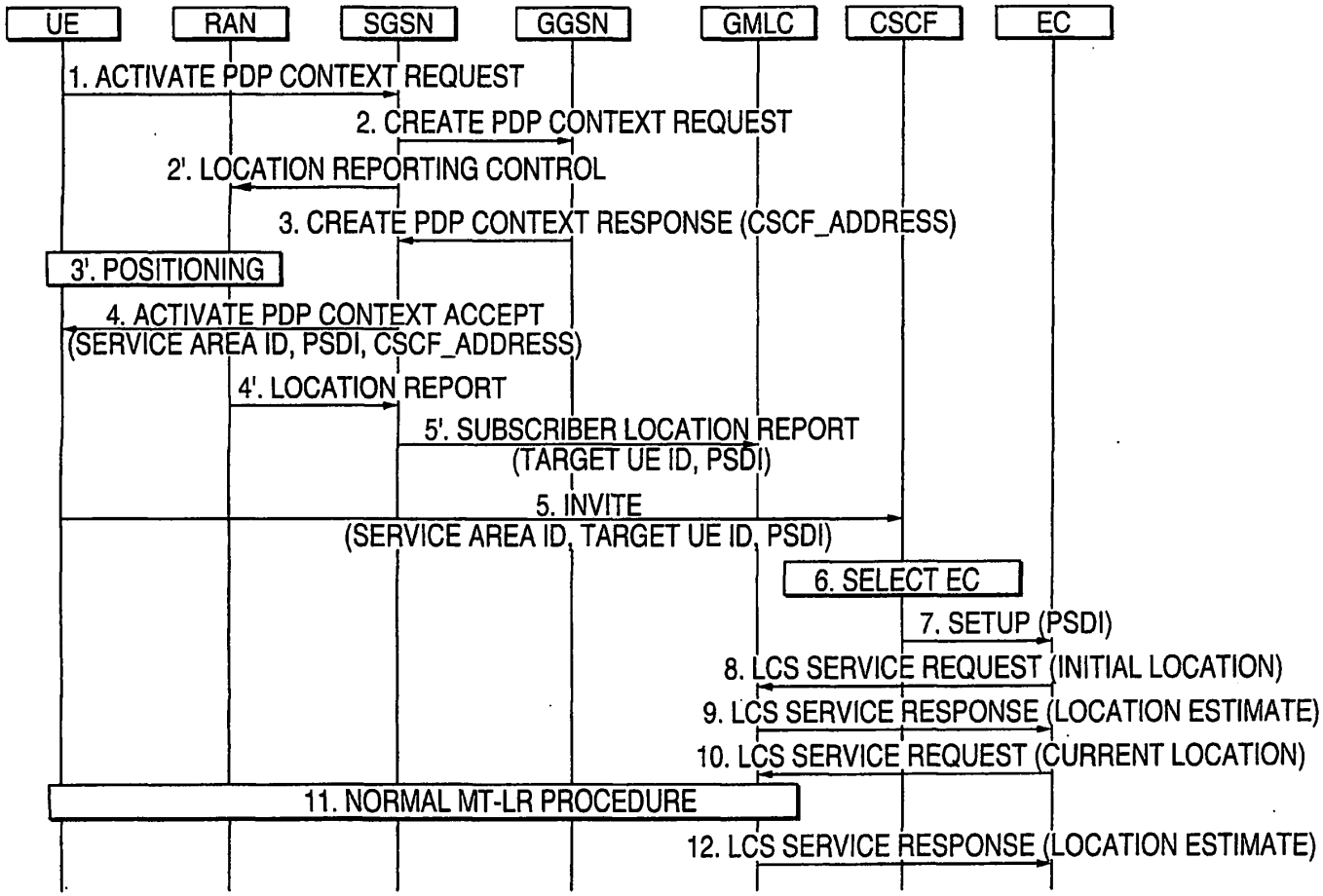
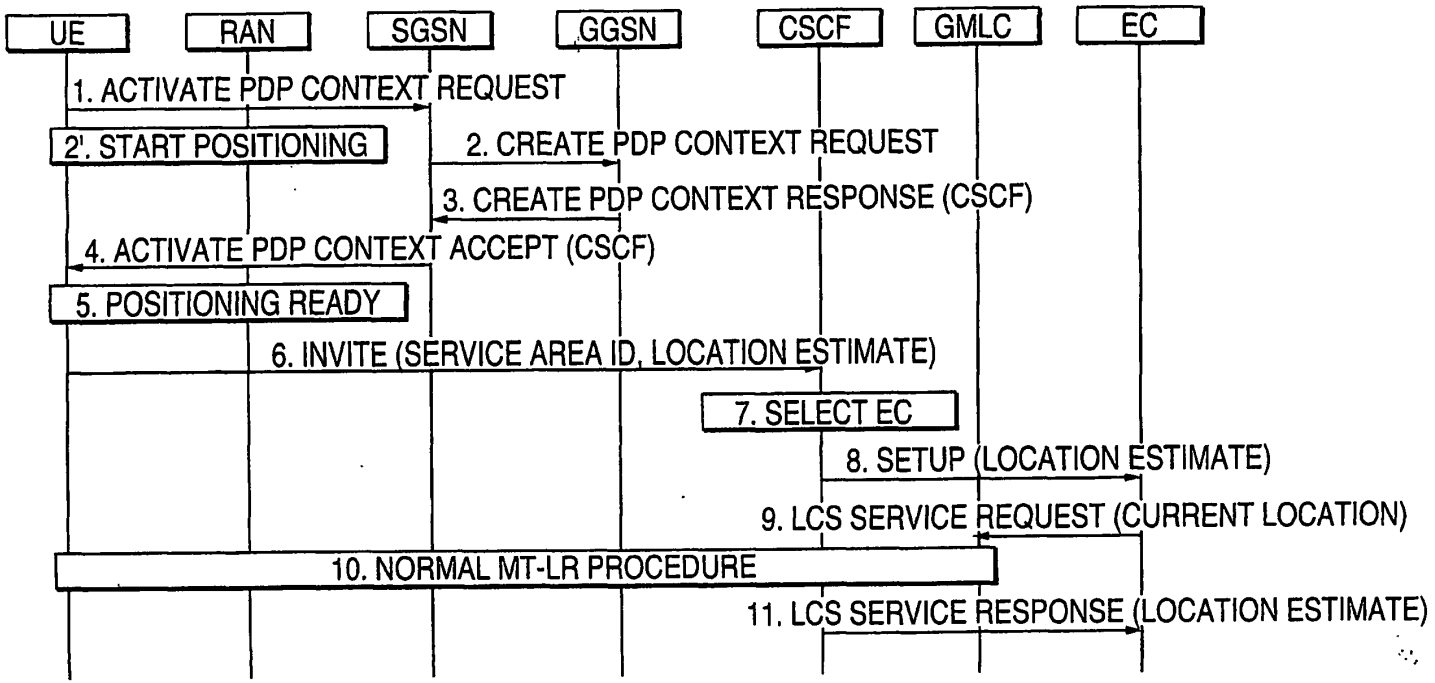

UE
RAN
SGSN
GGSN
GMLC
CSCF
EC
1. ACTIVATE PDP CONTEXT REQUEST
2. CREATE PDP CONTEXT REQUEST
2'. LOCATION REPORTING CONTROL
3. CREATE PDP CONTEXT RESPONSE (CSCF_ADDRESS)
3'. POSITIONING
4. ACTIVATE PDP CONTEXT ACCEPT
(SERVICE AREA ID, PSDI, CSCF_ADDRESS)
4'. LOCATION REPORT
5'. SUBSCRIBER LOCATION REPORT
(TARGET UE ID, PSDI)
5. INVITE
(SERVICE AREA ID, TARGET UE ID, PSDI)
6. SELECT EC
7. SETUP (PSDI)
8. LCS SERVICE REQUEST (INITIAL LOCATION)
9. LCS SERVICE RESPONSE (LOCATION ESTIMATE)
10. LCS SERVICE REQUEST (CURRENT LOCATION)
11. NORMAL MT-LR PROCEDURE
12. LCS SERVICE RESPONSE (LOCATION ESTIMATE)

FIG. 11


UE
RAN
SGSN
GGSN
CSCF
GMLC
EC
1. ACTIVATE PDP CONTEXT REQUEST
2'. START POSITIONING
2. CREATE PDP CONTEXT REQUEST
3. CREATE PDP CONTEXT RESPONSE (CSCF)
4. ACTIVATE PDP CONTEXT ACCEPT (CSCF)
5. POSITIONING READY
6. INVITE (SERVICE AREA ID, LOCATION ESTIMATE)
7. SELECT EC
8. SETUP (LOCATION ESTIMATE)
9. LCS SERVICE REQUEST (CURRENT LOCATION)
10. NORMAL MT-LR PROCEDURE
11. LCS SERVICE RESPONSE (LOCATION ESTIMATE)

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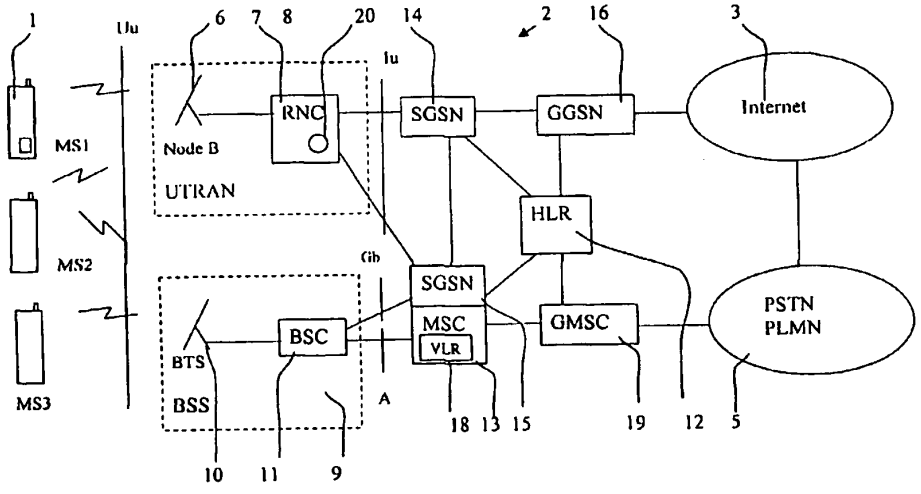
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(54) Title: CONNECTIONS IN A COMMUNICATION SYSTEM



(57) Abstract: The present invention relates to a communication system and a method for the same. In the method simultaneous circuit switched and packet switched connections are established between a user equipment and a first element of the communication system. A predefined event is monitored for after initiation of a procedure for handing the circuit switched connection over from the first element to a second element of the communication system. The event is defined to indicate a need for release of resources reserved by the packet switched connection. Subsequent to detection of the event, resources reserved by said packet switched connection at the network side of the system are released.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Connections in a communication system

Field of the Invention

The present invention relates to connections in a communications system, and in particular, but not exclusively, to handover of connections from a node of the system to another node of the system.

Background of the Invention

Communication networks typically operate in accordance with a given standard or specification which sets out what the various elements of the network are permitted to do and how that should be achieved, i.e. the technology on which the communication is based on in the network. The standard may define whether a user of the system or more precisely, a user equipment is provided with a circuit switched service and/or a packet switched service. The standard may also define the communication protocols which shall be used for the connection. One or more of the required connection parameters are also typically defined. In other words, the standard defines the "rules" and parameters the on which the communication within the communication system can be based on. Examples of the different standards and/or specifications defining communication technologies include, without limiting to these, specifications such as GSM (Global System for Mobile communications) or various GSM based systems (such as GPRS: General Packet Radio Service), EDGE (Enhanced Data rate for GSM Evolution), AMPS (American Mobile Phone System), DAMPS (Digital AMPS), WCDMA (Wideband Code Division Multiple Access) or CDMA (Code Division Multiple Access) or TDMA (Time Division Multiple Access) based 3rd generation (3G) telecommunication

systems. Examples of the 3G systems include Universal Mobile Telecommunication System (UMTS), i-Phone and IMT 2000 (International Mobile Telecommunication System 2000).

User equipment, such as a fixed line or wireless terminal, that is to be used for communication over a particular communication network has to be implemented in accordance with the predefined "rules" of the network. A terminal may also be arranged to be compatible with more than one technology, i.e. the terminal may communicate in accordance with several different types of communication services. These user equipment are often called as multi-mode terminals. The basic example of the multi-mode terminals is a dual-mode mobile station arranged to operate in two different telecommunications networks.

A communication network is a cellular radio network consisting of cells. In most cases the cell can be defined as a certain area covered by one or several base transceiver stations (BTS) serving user equipment (UE) via a wireless interface. The wireless interface may sometimes be referred to as a radio link. The base station forms a part of an radio access network (RAN). Several cells may cover a larger service area than one cell. In the circuit switched (CS) systems the radio service area is typically referred to as a location area (LA). In the packet switched (PS) systems the service area is often referred to as a routing area (RA). It should be appreciated that the size of the location area or routing area depends on the system and circumstances, and may equal to one cell or be even smaller, such a part of a coverage area of a base station.

The user equipment (UE) within one of the access entities (such as the cells) of the cellular system may be controlled by one or several controllers. Examples of the controller nodes include radio network controllers such as a base station controller (BSC) of the GSM system or a radio network controller (RNC) of the packet switched 3rd generation systems and core network controllers such as a mobile switching center (MSC) of the GSM system and a serving GPRS support node (SGSN), but other control nodes may also be implemented in the network. The controller can be connected further to a gateway or linking node, for example a gateway GPRS support node (GGSN) or gateway mobile switching center (GMSC), linking the controller nodes to other parts of the communication system and/or to other communication networks, such as to a PSTN (Public Switched Telecommunications Network) or to a data network, such as to a X.25 based network or to an IP (Internet Protocol) based network. The network may also include nodes for storing information of mobile stations subscribing the network or visiting the network, such as appropriate home location registers (HLR) and visitor location registers (VLR). Depending the implementation, the register nodes may be integrated with a control node.

When user equipment communicates with a communication network, a communication path has been established between the user equipment and one or more of the elements of the network. Typically at least a part of the communication between the user equipment and a destination node or terminal then pass through the controller node.

A feature of the cellular system is that it provides mobility for the mobile stations, i.e. the mobile stations are enabled to move from a location area to another (e.g. when the mobile

station moves i.e. roams from a cell to another cell) and even from a network to another network that is compatible with the standard the mobile station is adapted to. In order to be able to provide the mobility for user equipment with an ongoing (active) connection, the system needs to be capable of accomplishing a handover of the connection from a node thereof to another node. The handover of the connection may also be required for other reasons, such as when the quality of the packet switched connection drops below a predefined threshold level or when the cell becomes too congested.

The handover should also be possible between two nodes that belong to different networks. If the new cell is not served by a similar system as the previous cell, then handover needs to be accomplished between communication systems that are based on different communication technologies. A simultaneous handover of a packet switched connection and a circuit switched connection from a terminal may also be required in some occasions.

When a handover is to be accomplished between nodes of different communications systems (i.e. systems that are based on different communication technologies), it is possible that the "new" connection cannot be properly set-up due to differences in the operation of the various elements of the "new" (i.e. target) and the "old" (i.e. previous) communication systems. For example, if a packet data communication handover is to be accomplished between two different packet data networks, such as from a third generation UMTS network to a GSM based second generation GPRS network, the user equipment (e.g. a Class B mobile station) may not be guaranteed to perform an immediate routing area update (RAU) with the controller of the new network, such as a

2G-SGSN (2nd generation SGSN) of the GPRS network. However, the radio network controller resources, like the RNC context and Iu bearers in the UMTS, may not be released in the old controller until the user equipment performs said routing area update (RAU) with the target (i.e. new) SGSN in the GPRS network. At an intersystem change from the UMTS to the GPRS an appropriate element of the UMTS system (e.g. a 3rd generation 3G-SGSN node) releases the controller entity and Iu interface only after the user equipment has generated and send the RAU request message. In the GSM based systems the routing area update (RAU) may be performed only after the circuit switched (CS) call is finished (i.e. the circuit switched connection is released). In addition, the 2nd generation SGSN may not be able to remove the Iu resources between the radio network controller and the 3rd generation SGSN, since the 2nd generation SGSN may not have an Iu interface or a capability to control any Iu interfaces. Therefore, it may take a substantially long period of time before the RAU procedure is completed. All that time the old RNC needs to keep the resources reserved by the packet switched connection (e.g. Iu and RNC contexts). If the routing area update is not performed immediately, these resources are unnecessarily maintained and may thus be wasted for a substantially long period of time.

Summary of the Invention

The embodiments of the present invention aim to address one or several of the above problems.

According to one aspect of the present invention, there is provided a method in a communication system comprising: establishing simultaneous circuit switched and packet switched connections between a user equipment and a first element of

the communication system; initiating a procedure to hand the circuit switched connection over from the first element to a second element of the communication system; monitoring for a predefined event, the event being defined to indicate a need for release of resources reserved by the packet switched connection; and subsequent to detection of the event, releasing resources reserved by said packed switched connection.

According to another aspect of the present invention there is provided a communication system comprising user equipment; a first controller, wherein simultaneous circuit switched and packet switched connections are enabled between the user equipment and the first controller; a second controller, wherein the circuit switched connection can be handed over from the first controller to the second controller; and means for detecting a predefined event, wherein the system is arranged, in response to the detection of the event, to release resources reserved by the packet switched connection.

In more specific embodiments of the invention the resources to be released comprise resources such as resources reserved by an interface between the first element and an element in the core network side of the packet switched connection and/or resources reserved in the first element by the packet switched connection. The event may comprise a request to release resources which associate with the circuit switched connection. The first element may be arranged to generate a request for release of resources in response to detection of the event. The event may be detected before the user equipment generates a request for an update of information that associates with the radio access entity serving the user equipment. The resources are released at the network side of

the communication system. The resources may be resources provided by the first elements and/or communication resources between the first element and an element at the core network side of the system. The first element may be a radio network controller of a first communication network and the second element may be a radio network controller of a second communication network. The first element and the second element may operate based on different technologies. The system may comprise at least one timer for providing the triggering event. The timer function may be dynamic. Data that associates with the connection to be released may be stored in the system.

The embodiments of the invention may provide a scheme for efficient use of the resources of a communication system. Resources that may be reserved in the present proposals for substantially long periods may be released sooner than in the prior art solutions.

Brief Description of Drawings

For better understanding of the present invention, reference will now be made by way of example to the accompanying drawings in which:

Figure 1 shows a communication system in which an embodiment of the present invention can be implemented;

Figure 2 is a flowchart illustrating the main steps of an embodiment of the present invention; and

Figure 3 is a signalling chart illustrating in detail message flows in accordance with an embodiment of the present invention.

Description of Preferred Embodiments of the Invention

Reference is made to Figure 1 which is a block diagram illustrating a communication system in which the present invention may be employed. That is, a cellular telecommunication system providing both packet switched (PS) service and circuit switched (CS) services for user equipment (UE). The system allows a plurality of mobile stations MS1, MS2, MS3 to communicate with base (transceiver) stations via respective wireless connections. Each base station has a radio transceiver capable of transmitting radio signals in downlink to the mobile stations within the cell area and receiving radio signals in uplink from the cell area next to the base station. By means of these signals the base station can communicate with the mobile station (MS) in that cell, which itself includes a radio transceiver.

The illustrated system comprises a core network (CN) 2, a UMTS terrestrial radio access network (UTRAN) 8, and a GSM radio access network 9. The interfaces between the various element and the core network of the system will be described in more detail below. The core network (CN) 2 can be connected to external networks, which can be either circuit switched (CS) networks 5 (e.g. public land mobile network PLMN, public circuit switched network PSTN, integrated services digital network ISDN) or packet switched (PS) networks 3 (e.g. the Internet protocol (IP) based data networks).

The core network (CN) of Figure 1 includes both UMTS elements and GSM elements. The Figure 1 core network is composed of a Home Location Register (HLR) 10, a Mobile Services Switching Centre (MSC) 13 comprising a Visitor Location Register (VLR) 18, a Serving GPRS (General Packet Radio Service) Support Node (SGSN) 15 of the GPRS system, a Serving GPRS (General Packet Radio Service) Support Node (SGSN) 14 of the UMTS system, a

Gateway GPRS Support Node (GGSN) 16, and a Gateway Mobile Services Switching Centre (GMSC) 19.

The interface between the SGSN nodes 14 and 15 of the core network and the radio access network 8 may be provided by a so called Iu interface. The BSS 8 may interface the SGSN 15 via a Gb interface. The Gb interface provides the packet switched part of the GSM system. This packet part may be provided e.g. by the GPRS. The interface between the BSS 8 and the MSC 13 for the circuit switched connections may be provided by means of an A interface.

It should be appreciated that in some systems the functions of the two SGSNs 14 and 15 may be provided by one SGSN. In this case the single SGSN may have an Iu Interface towards the UTRAN 8 and a Gb interface towards the BSS 9.

The UTRAN access network 8 may be composed of more than one radio network subsystem (RNS: not shown). Each radio network subsystem is composed of a radio network controller (RNC) 7 and one or more base stations (BTS) 6. The base stations of the UMTS network may be called to as node B, and thus this term is to be used, for clarity reasons, in the following to distinguish the UMTS base stations from the base stations of the GSM radio access network 9. The interface between the radio network controller RNC and node B may be provided by means of an Iub interface.

The mobile stations may have a radio connection with the base station 10 of the GSM access network 9 or with the Node B 6 of the UMTS access network 8. It should be appreciated that the functions of the base station BTS and the Node B may also be implemented by means of one entity, i.e. that a base

transceiver station may serve both the GSM system and the UMTS system. The main function of the Node B is to perform the air interface L1 (Layer 1) processing (channel coding and interleaving, rate adaptation, spreading, etc). It also performs some basic Radio Resource Management operation such as the inner loop power control. The operation of the Node B and the base station BTS may logically correspond to each other.

The base station BTS 10 and the Node B 6 are shown to be controlled by respective radio access network (RAN) controller nodes 11 and 7. More particularly, the radio access network controller of the UTRAN 8 is controlled by a radio network controller RNC 7. The base station subsystem (BSS) 9 of the GSM network comprises a base station controller (BSC) 11 for controlling the base station 10. The RNC 7 of the UMTS radio access network 8 and the base station controller BSC 11 of the GSM access network 9 may logically correspond to each other. The Radio Network Controller (RNC) is responsible for the control of the radio resources of the UTRAN 8. The RNC interfaces the core network (CN) 2 and also terminates the Radio Resource Control (RRC) protocol that defines the messages and procedures between the user equipment 1 and the UTRAN 8. It should be appreciated that other control nodes may also be used for the implementation of the radio network control function.

During a radio connection over the Uu interface between the mobile station 1 and the appropriate radio station, the mobile station has a connection with the respective controller node via the GSM base station 10 or the UMTS Node B 6. In Figure 1 each of the radio access network controllers 7 and 11 may have a simultaneous packet switched and circuit switched connection

with the nodes of the core network. However, it should be appreciated that in some network topologies it may be possible that an access network controller is connected only to one node of the core network.

The user equipment (UE) 1 may comprise a mobile station that is adapted to communicate via the BTS of the GMS system and also via the Node B of the UMTS system. The operation of the various functions of the mobile station may be controlled by an appropriate processor means. The user equipment 1 may have simultaneously a packet switched connection and a circuit switched connection which may both be handed over to the new radio station. The location of the mobile station 1 could be fixed (for example if it is providing radio communications for a fixed site) or the mobile station could be moveable (for example if it is a hand portable transceiver or "mobile phone").

The user equipment 1 may be used simultaneously for a speech call with another user terminal of the network 5 via a circuit switched connection and for surfing the data network 3 via a packet switched connection. It should be noted that although the packet switched traffic and the circuit switched traffic employ each their own radio bearers, they can be seen as a logical wireless connection between the user equipment 1 and the base station 10 or node B 6. The logical connection will be controlled by the same radio network controller of the respective access network.

If the mobile station moves from one cell ("old cell") to another cell ("new cell") there is a need to hand the mobile station over from communication with the base station and associated network apparatus of the old cell to the base

station and associated network apparatus of the new cell without dropping the call. It should be appreciated that there may be various other reasons than roaming for the handover, such as overload and/or congestion and/or higher priority calls forcing a handover of earlier connections with lower priority.

It is possible that the new radio access network does not support all the features of the previous access network, or that it supports different features or provides the support based on different parameters. The embodiments of the invention will address a situation where the handover occurs between the base stations of two different access networks, for example a handover of a logical connection from the UMTS radio access network 8 to the GSM radio access network 9 of Figure 1.

Referring now to the flowchart of Figure 2, in the preferred embodiments the RNC and Iu resources are released in the beginning of an intersystem handover after detection of an event that triggers the release. Thus the RNC and/or Iu resources are not reserved for the time period they might be if the release thereof could be done only after the mobile station or another element of the system initiates the routing area update (RAU) procedure, in which case the resources could be dropped only after the prosecution of the RAU request. The monitoring of the event may be accomplished by an element that associates with the communications before the handover, e.g. by the old radio network controller or the SGSN. The monitoring may also be accomplished by an entity that associates with the control of the communications after the handover. The release of at least part of the resources may be advantageous e.g. if the packet switched connection cannot be

handed over to the new controller, and/or the new controller cannot send a request to remove the existing resources reserved in the previous controller. Some of the possible event will be discussed below in the context of the exemplifying embodiments of the present invention.

With regard to the term 'connection', it should be appreciated that the same connection will continue after the handover through the new radio access network, but that it is the resources and a part of the connection (e.g. the radio part) that are then controlled by new entities. A logical connection is not necessarily dropped when Iu and RNC resources are released, but the connection is still logically kept on 'higher' layers.

According to a further embodiment data to be transported via one or more of the connections may be temporarily stored or buffered in an appropriate node of the system. The storing procedure may be started after the initiation of the handover proceedings. The data is preferably stored in a node of the core network, such as the SGSN 14 of Figure 1, during the handover period. The data may comprise user data, such as any data that has been or is to be transported via the packet switched radio bearer to be handed over. After the connection has been successfully handed over, the stored data is transported to the new controller node and further via the new communication connection to the final destination. The data may be transported to the mobile station or to the other end of the connection, such as to a IP data network server.

It is possible to buffer all user data that is to be transported between the user terminal and the other end of the connection. However, this may not be appropriate in all

occasions, for instance when the node that is indented to be used for the buffering has only limited data storage resources. In addition, it may not be possible to predict the time how long the data is to be stored, which may make the resource management of the node difficult to accomplish. Therefore it may be advantageous to buffer only that user data that has been partially send, i.e. packets of a transmission that was not completed or acknowledged by the receiving node before the initiation of the handover procedures. It is also possible to establish other predefined rules regarding the data that is to be stored, e.g. based on different priority or quality of service parameters.

An embodiment that relates to a UMTS to GPRS Intersystem change in a simultaneous mode will be described in more detail with reference to the signalling flow chart of Figure 3. An intersystem change from a UMTS network to a GPRS network for simultaneous circuit switched and packet switched connection mode may take place e.g. when a UMTS to GSM handover is performed to the CS connection for a mobile station (MS) that is in a mode where the packet connections have resources allocated for the radio, RNC and Iu functions thereof. In the 3GPP specifications this mode is referred to as 'PMM-Connected' mode (Packet Mobility Management). In this case a mobile station in the class-A mode of operation may initiate a GPRS routing area update (RAU) procedure and a mobile station in the class-B mode of operation may initiate a GPRS routing area update procedure only after the CS connection is released in order to continue with the PS connections. The class-A mode refers to a mobile station that may handle simultaneously both the packet switched and circuit switched connections. Although the class-B mode mobile station may also provide simultaneous support for the packet switched and circuit switched

connections, it may need to put the other connection on hold fore the time it is processing the other connections. For example, the class-B station may not be able to receive or transmit any new data packets while it is communicating through a circuit switched connection.

A possible sequence for the intersystem change from the UMTS to the GPRS handover for simultaneous CS and PS communication is described in the following with reference to the signalling or messaging step numbers that correspond to the message numbers of Figure 3.

At step 1 the UTRAN decides to perform an intersystem change. Thus the UTRAN, and more particularly, the RNC controlling the connections, initiates a SRNC (serving RNC) relocation procedure for the circuit switched (CS) and packet switched (PS) connections by sending appropriate relocation request messages to the MSC node. The RNC controlling the connections, may also initiate the SRNC (serving RNC) relocation procedure for the packet switched (PS) connections by sending appropriate relocation request messages to the 3G-SGSN node. The initiation of the handover procedure may be triggered by the mobile station. For example, the initiation may be triggered based on connection quality measurement reports received from the mobile station.

According to a possibility the 3G-SGSN node serving the mobile determines that the requested relocation of the packet switched connection cannot be performed (for example, the new node i.e. the target 2G-SGSN does not support the PS connection), and therefore rejects the SRNC relocation by sending a 'SRNC Relocation Failure' (Relocation Not Supported) message 2 back to the "old" RNC. The decision may be based on

information stored in the 3G-SGSN, e.g. in the form of a table, regarding the possible nodes that support and/or do not support the packet switched connection. The 3G-SGSN may also send a message to the new 2G-SGSN for obtaining confirmation whether the 2G-SGSN may provide support for the packet switched connection or not.

The circuit switched connection relocation is supported, and thus the MSC sends a 'Relocation Command' message 3 to the old RNC to inform that resources for the relocation are allocated in the target base station subsystem (BSS). The old RNC may then send a 'Handover Command' to the mobile station.

After an inter-system handover has been performed for the CS connection the MSC may send an 'Iu Release Command' at message step 4. The SRNS responds with an 'Iu Release Complete' message. These messages are indicated by the double headed arrow 4 in Figure 3. The message 4 requesting for the release of Iu resources triggers the SRNC to generate and send an 'Iu Release Request' (CS Handover to the GSM system) 5 to the 3G-SGSN. In the Figure 3 embodiment the receipt of message 5 then triggers the release of the resources. To release the resources, the 3G-SGSN sends an 'Iu Release Command' message 6 to the RNC of the SRNS. Upon reception of this message the SRNS may buffer and stop sending downlink PDUs (Protocol Data Units) to the MS and returns an 'SRNS Context Response' (this may include information such as an IMSI (International Mobile Subscriber Identity), GTP-SNDs (GPRS Tunnelling Protocol - downlink sequence number), GTP-SNUs (uplink sequence number), PDCP-SNDs (Packet Data Compression Protocol - downlink sequence number), PDCP-SNUs message 7. The SRNS shall include for each PDP context the next in-sequence a GTP sequence number to be sent to the mobile station and the GTP sequence

number of the next uplink packet data unit (PDU) to be tunnelled to the gateway node (e.g. the GGSN).

The term 'PDP context' refers to the part of the data connection or data bearer that goes through the packet switched network (e.g. the GPRS/UMTS network). The PDP context can be seen as a logical connection from the wireless station to the access point of a gateway node, such as the GGSN, the access point being the connection point between the e.g. GPRS/UMTS mobile network and an external data network. The PDP context may also be referred to, instead of the term logical connection, as a logical association between the access point and the user.

For each active PDP context using acknowledged mode, the SRNS may also include the uplink PDCP sequence number (PDCP-SNU) and the downlink PDCP sequence number (PDCP-SND). PDCP-SNU shall be the next in-sequence PDCP sequence number expected from the MS (per each active radio bearer). PDCP-SND shall be the next in-sequence PDCP sequence number to be sent to the mobile station (per each active radio bearer). Because the PDCP sequence number is typically 8 bits long, the PDCP sequence number is equal to a SNDCP PDCP-PDU number (in the acknowledged mode).

At messaging stage 8 the SRNS may start tunnelling the partly transmitted and the transmitted but not acknowledged N-PDUs (Network PDUs) together with the PDCP downlink sequence number of the last PDCP segment of that N-PDU, and start duplicating and tunnelling the buffered GTP PDUs to the 3G-SGSN. At stage 9 the circuit switched connection may be released between the MSC and the mobile station.

It is only now when the mobile station may send a 'Routing Area Update Request' message 10 to the new 2G-SGSN. Therefore the above described message 5 may expedite the release of the resources in an earlier stage of the handover procedure as in the prior art solutions.

For the sake of completeness, the following will describe the next stages of the handover procedures so as to clarify length and various steps of the of the handover procedure. Message 10 may include information such as the old RAI (routing area identity), old P-TMSI Signature (Packet - Temporary Mobile Subscriber Identity), and the Update Type. The Update Type may indicate whether the update is a requested RA update or a periodic RA update. The BSS may add to the message a Cell Global Identity (CGI) including the RAC (Routing Area Code: for the packet switched connection) and LAC (Location Area Code: for the circuit switched connection) of the cell where the message was received before passing the message to the new 2G-SGSN.

The new 2G-SGSN sends an 'SGSN Context Request' (including old RAI, TLLI (Temporary Logical Link Identity), old P-TMSI Signature, New SGSN Address) message 11 to the old 3G-SGSN to get the MM context and PDP context for the mobile station. The MM context comprises a GPRS mobility management information entity containing subscriber related information such as the IMSI, encryption keys and so on. The old SGSN may then validate the old P-TMSI Signature and may respond with an appropriate error cause if the signature does not match the value stored in the old 3G-SGSN. The old 3G-SGSN may also start a timer. If the mobile station is not known in the old 3G-SGSN, the old 3G-SGSN may respond with an appropriate error cause.

In the Figure 3 embodiment the old 3G-SGSN responds with an 'SGSN Context Response' (including the MM Context and the PDP Context) message 12. For each PDP context the old 3G-SGSN may include the GTP sequence number for the next uplink GTP PDU to be tunnelled to the GGSN and the next donwlink GTP sequence number for the next in-sequence N-PDU to be sent to the MS. Each PDP Context may include a SNDCP (GPRS Subnetwork Dependent Convergence Protocol) 'Send N-PDU Number' request for the next in-sequence downlink N-PDU to be sent in an acknowledged mode to the mobile station and the SNDCP 'Receive N-PDU Number' request for the next in-sequence uplink N-PDU to be received in acknowledged mode from the mobile station.

Appropriate security functions may be executed at stage 13. The security function may include various verification and/or authentication procedures wherein user data may be verified against the data stored in the HLR of the user.

After the security functions have confirmed that the connection may continue, the new 2G-SGSN may send an 'SGSN Context Acknowledge' message 14 to the old 3G-SGSN. This informs the old 3G-SGSN that the new 2G-SGSN is ready to receive data packets belonging to the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. The marking may be used to trigger the MSC/VLR, the GGSNs, and the HLR to be updated if the mobile station initiates a RA update procedure back to the old SGSN before completing the ongoing RA update procedure.

If the buffering of data is employed, the old 3G-SGSN may duplicate the buffered N-PDUs and start tunnelling them to the

new 2G-SGSN at messaging stage 15. Additional N-PDUs received from the GGSN may also be duplicated and tunnelled to the new SGSN. The duplication may be accomplished before a timer function that may have been described in the message step 2 expires. The N-PDUs that were already sent to the mobile station in the acknowledged mode and that are not yet acknowledged by the mobile station are tunnelled together with the SNDCP N-PDU number. No N-PDUs may be forwarded to the new SGSN after the expiry of said timer. The old 3G-SGSN tunnels the GTP PDUs to the new 2G-SGSN. The SNDCP sequence numbers shall not be modified in the GTP header of the tunnelled PDUs.

The new 2G-SGSN may then send an 'Update PDP Context Request' (new SGSN Address, TEID, QoS Negotiated) message at stage 16 to each of the GGSNs that associate with the connection. Each GGSN may then update their PDP context fields and return an 'Update PDP Context Response' (TEID) message.

The new 2G-SGSN typically informs the HLR of the change of SGSN by sending an 'Update GPRS Location' message 17 to the HLR. The message 17 may include e.g. SGSN Number, SGSN Address, and the IMSI of the mobile station. In response, the HLR sends a 'Cancel Location (IMSI)' message at stage 18 to the old 3G-SGSN. The old 3G-SGSN may then acknowledge this with a 'Cancel Location Ack (IMSI)' message. The old 3G-SGSN removes the MM and PDP contexts if a timer that may have been described in message step 3 is not running. If the timer is running then the MM and PDP contexts shall be removed when the timer expires. The timer function may be implemented in the old RNC of the old RNS, or in the 3G-SGSN.

At stage 19 the HLR may send an 'Insert Subscriber Data' (e.g. IMSI and/or GPRS Subscription Data) message to the new

2G-SGSN. The new 2G-SGSN constructs an MM context and an PDP context for the mobile station and returns an 'Insert Subscriber Data Ack' (including the IMSI) message to the HLR.

The HLR acknowledges the 'Update GPRS Location' message by returning an 'Update GPRS Location Ack' (IMSI) message 20 to the new 2G-SGSN. The new 2G-SGSN may then validate the presence of the mobile station (MS) in the new routing area (RA). If the mobile station is not allowed to be attached in the new 2G-SGSN (e.g. due to roaming restrictions) or if the authentication of the subscription fails, then the new 2G-SGSN may reject the routing area update with an appropriate cause. If all checks are successful then the new 2G-SGSN may construct MM and PDP contexts for the mobile station. A logical link is thereafter established between the new 2G-SGSN and the mobile station. The new 2G-SGSN responds to the mobile station with a 'Routing Area Update Accept' message 21. This message may include information such as the P-TMSI, P-TMSI Signature, and/or Receive N-PDU Number. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI (Network layer Service Access Point Identifier) used by the mobile station, thereby confirming that all mobile-originated N-PDUs are successfully transferred before the start of the update procedure.

The MS acknowledges the new P-TMSI by returning a 'Routing Area Update Complete' (Receive N-PDU Number) message 22 to the SGSN. Received N-PDU Number message contains the acknowledgements for each acknowledged-mode NSAPI used by the mobile station, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. The MS deducts Receive N-PDU number from the downlink RLC (Radio Link Control) sequence number by stripping

off the four most significant bits of the RLC sequence number of the next expected in-sequence RLC frame.

For a mobile station with GPRS-CSI defined, customised applications for mobile network enhanced logic (CAMEL) interaction may be performed. For a more detailed description thereof, see 3rd Generation Partnership Project specification No. 3G TS 23.078. If such a mobile station is used, the C1 box designates 'CAMEL-GPRS-SGSN-Context-Acknowledge' message and the C2 box designates 'CAMEL-GPRS-Routing-Area-Update' message.

The messaging steps 1 - 7 may alternatively be accomplished such that the source RNC directly releases the Iu connection to the 3G-SGSN when it has noticed that the circuit switched connection has been successfully handed over. The release may also be done before the handover of the circuit switched connection or during the handover proceedings. The radio network controller 7 of Figure 7 can be made aware that the mobile station 1 has been handed over to another node that operates in accordance with a GSM standard or other standard not supporting the UMTS packet switched service, and may thus initiate the release of the packet switched resources.

The radio network controller may also be provided with a timer function which releases the Iu and RNC if there is no activity in a predefined period of time. In Figure 1 the timer function is designated by 20. The timer 20 may be used to provide the event for triggering the release of e.g. the Iu interface resources or other resources reserved by the packet switched part if the logical connection is to be handed over from the UMTS to the GPRS system. The timer function 20 may provide a predefined indication to the radio network controller, the

indication triggering the release procedure. The radio network controller may not need to have any beforehand information of the handover, but may initiate the release solely based on information from the timer 20.

The timer may have a fixed expiry period, e.g. such that after a predefined time period (e.g. 10 or 20 minutes) within which there has been no activity in the packet switched side of the logical connection the timer function will provide the indication. According to an alternative the timer function is dynamic. The adjustment of the timer (e.g. the expiry period) may be based on information of the available resources. The timer may also have different setting depending on the time of the day, week, year and so on. The network operator may change the settings of the timer.

The timer function may alternatively be provided in the SGSN 14 of Figure 1. According to an embodiment the RNC 7 and the SGSN 14 are both provided with timer functions. The operation of the latter embodiment may be such that the first timer expiry provides the event. According to another possibility the latest of the timers to expire provides the event that triggers the release of the resources.

It is also possible to have a system which may initiate the release procedure based on more than one event. The arrangement may be such that more than one event is required before initiation of the release procedure. The arrangement may be such that that the release of resources is always initiated when any one of the predefined events is detected.

It should be appreciated that whilst embodiments of the present invention have been described in relation to mobile stations, embodiments of the present invention are applicable to any other suitable type of user equipment.

The term circuit switched is intended to refer to any communications that is based on connection oriented communications. The term packet switched is intended to refer to any communications that can be considered as "connectionless" (i.e. no circuit is set-up for the communication, but the data units to be transported in the system are provided with an address).

The data is described as being in packet form. In alternative embodiments of the invention the data may be sent in any suitable format. Data to be transmitted between the user equipment and the radio stations, respectively, may be speech data, video data or other data. Any packet data transmission may be encoded into a form suitable for transmission at a bit rate which is dependent on the application and the source of the data.

The embodiment of the present invention has been described in the context of a UMTS and GSM systems. This invention is also applicable to any other communication network where the connection may be handed over between two or more nodes.

It is also noted herein that while the above describes exemplifying embodiments of the invention, there are several variations and modifications which may be made to the disclosed solution without departing from the scope of the present invention as defined in the appended claims.

Claims

1. A method in a communication system comprising:

establishing simultaneous circuit switched and packet switched connections between an user equipment and a first element of the communication system;

initiating a procedure to hand the circuit switched connection over from the first element to a second element of the communication system;

monitoring for a predefined event, the event being defined to indicate a need for release of resources reserved by the packet switched connection; and

subsequent to detection of the event, releasing resources reserved by said packed switched connection.

2. A method as claimed in claim 1, wherein the resources to be released comprise resources reserved by an interface between the first element and an element in the core network side of the packet switched connection.

3. A method as claimed in claim 1 or 2, wherein the resources to be released comprise resources reserved in the first element by the packet switched connection.

4. A method as claimed in any preceding claim, wherein the event is detected before the user equipment generates a request for an update of information that associates with the radio access entity serving the user equipment.

5. A method as claimed in claim 4, wherein the request comprises a request for routing area update.

6. A method as claimed in any preceding claim, wherein the first element is a radio network controller of a first communication network and the second element is a radio network controller of a second communication network.

7. A method as claimed in any preceding claim, wherein the first element and the second element operate based on different technologies.

8. A method as claimed in claim 6 or 7, wherein the first element is a radio network controller of a third generation cellular telecommunications system.

9. A method as claimed in any of claims 6 to 8, wherein the second element is a radio network controller of a second generation cellular telecommunications system.

10. A method as claimed in any preceding claim, wherein the event comprises a request to release resources which associate with the circuit switched connection.

11. A method as claimed in claim 12, wherein the request is generated by an element of the core network of the communication system.

12. A method as claimed in any of the preceding claims, wherein the first element generates a request for release of resources in response to detection of the event.

13. A method as claimed in any preceding claim, wherein the event comprises a decision to release the resources, said decision being based on information of the capabilities of the communication network to which the second element belongs.

14. A method as claimed in claim 13, wherein said information is retrieved from a table.

15. A method as claimed in claim 13 or 14, wherein the information is obtained by transporting an inquiry in the communication network of the second element.

16. A method as claimed in any of claims 13 to 15, wherein the decision is made by the first element.

17. A method as claimed in any of claims 13 to 15, wherein the decision is made by a controller in the core network of the communication system.

18. A method as claimed in any preceding claim, wherein the event comprises an indication from a timer function.

19. A method as claimed in claim 19, wherein the timer function is implemented in the first element.

20. A method as claimed in claim 18 or 19, wherein the timer function is implemented in the core network side of the communication system.

21. A method as claimed in any of claims 18 to 20, wherein the timer function is dynamic.

22. A method as claimed in any preceding claim, comprising step of storing data that associates with the connection to be released.

23. A method as claimed in claim 22, wherein the data to be stored comprises user data.

24. A method as claimed in claim 22 or 23, wherein only predefined data is stored.

25. A method as claimed in claim 24, wherein only such data is stored that has been transmitted before the initiation of the handover but that has not been acknowledged as received by that time.

26. A method as claimed in any of claims 22 to 25, wherein the stored data is transported to the addressed destination after completion of the handover procedure.

27. A communication system comprising:

user equipment;

a first controller, wherein simultaneous circuit switched and packet switched connections are enabled between the user equipment and the first controller;

a second controller, wherein the circuit switched connection can be handed over from the first controller to the second controller; and

means for detecting a predefined event, wherein the system is arranged, in response to the detection of the event, to release resources reserved by the packet switched connection.

28. A communication system as claimed in claim 27, wherein the resources to be released comprise resources reserved by an interface between the first element and an element in the core network of the system.

29. A communication system as claimed in claim 27 or 28, wherein the system is arranged to release resources in the first element.

30. A communication system as claimed in any of claims 27 to 29, wherein the event is detected before the user equipment generates a request for an update of information that associates with the radio access entity serving the user equipment.

31. A communication system as claimed in any of claims 27 to 30, wherein the first element is a radio network controller of a first communication network and the second element is a radio network controller of a second communication network.

32. A communication system as claimed in any of claims 27 to 31, wherein the first element and the second element operate based on different technologies.

33. A communication system as claimed in any of claims 27 to 32, wherein the first element is adapted to generate a request to release the resources in response to a message which associates with the circuit switched connection.

34. A communication system as claimed in claim 33, wherein said message comprises a request to release circuit switched resources.

35. A communication system as claimed in any of claims 27 to 34, wherein the event comprises a decision to release the resources, said decision being based on information of the capabilities of the communication network to which the second element belongs.

36. A communication system as claimed in any of claims to 27 to 35, wherein the first element is adapted to make the decision to release the resources.

37. A communication system as claimed in any of claims 27 to 35, wherein a controller in the core network of the communication system is adapted to make the decision.

38. A communication system as claimed in any of claims 27 to 37, comprising at least one timer.

39. A communication system as claimed in claim 38, wherein the at least one timer is dynamic.

40. A communication system as claimed in any of claims 27 to 39, comprising memory means for storing data that associates with the connection to be released.

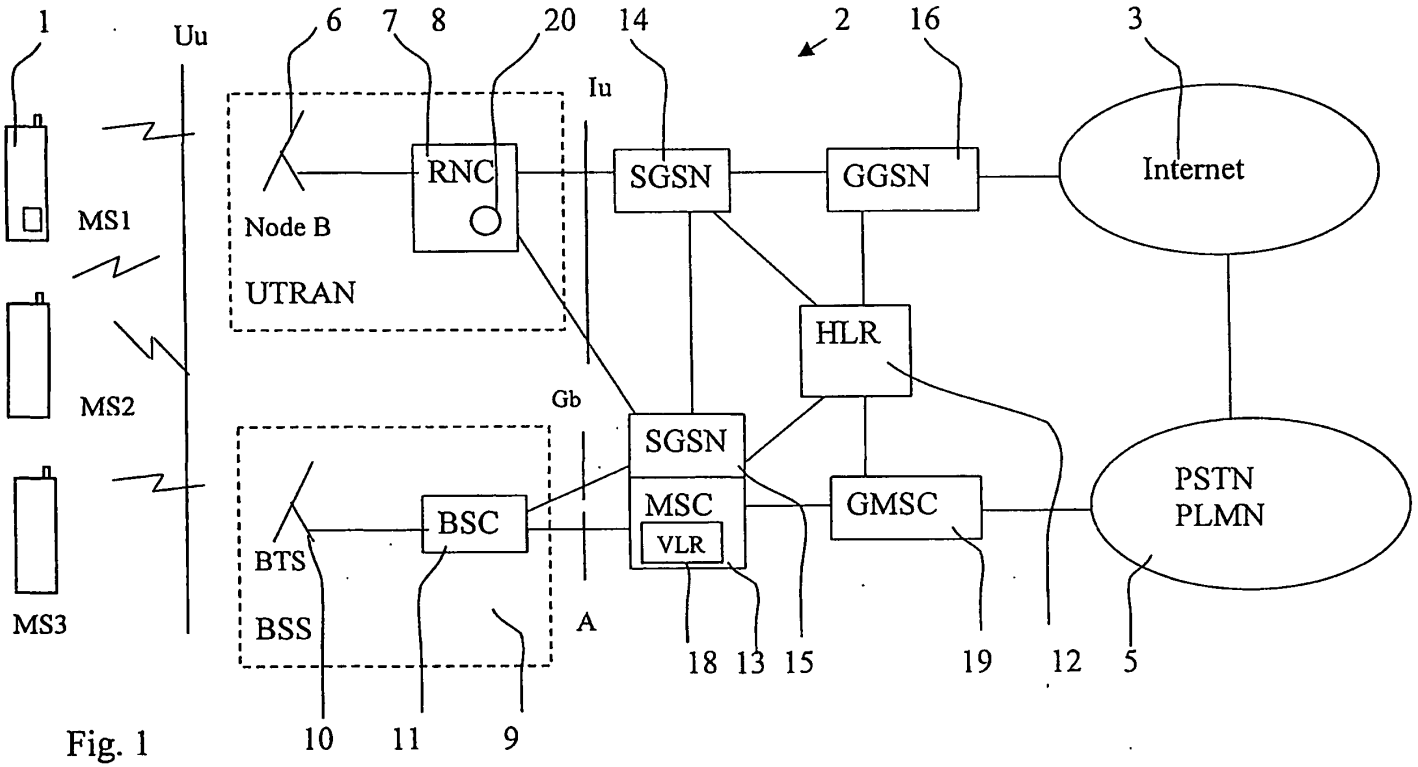

1
Uu
6
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SGSN
GGSN
Internet
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Node B
UTRAN
HLR
MS2
Gb
SGSN
MSC
VLR
GMSC
PSTN
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BTS
BSS
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MS3
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Fig. 1

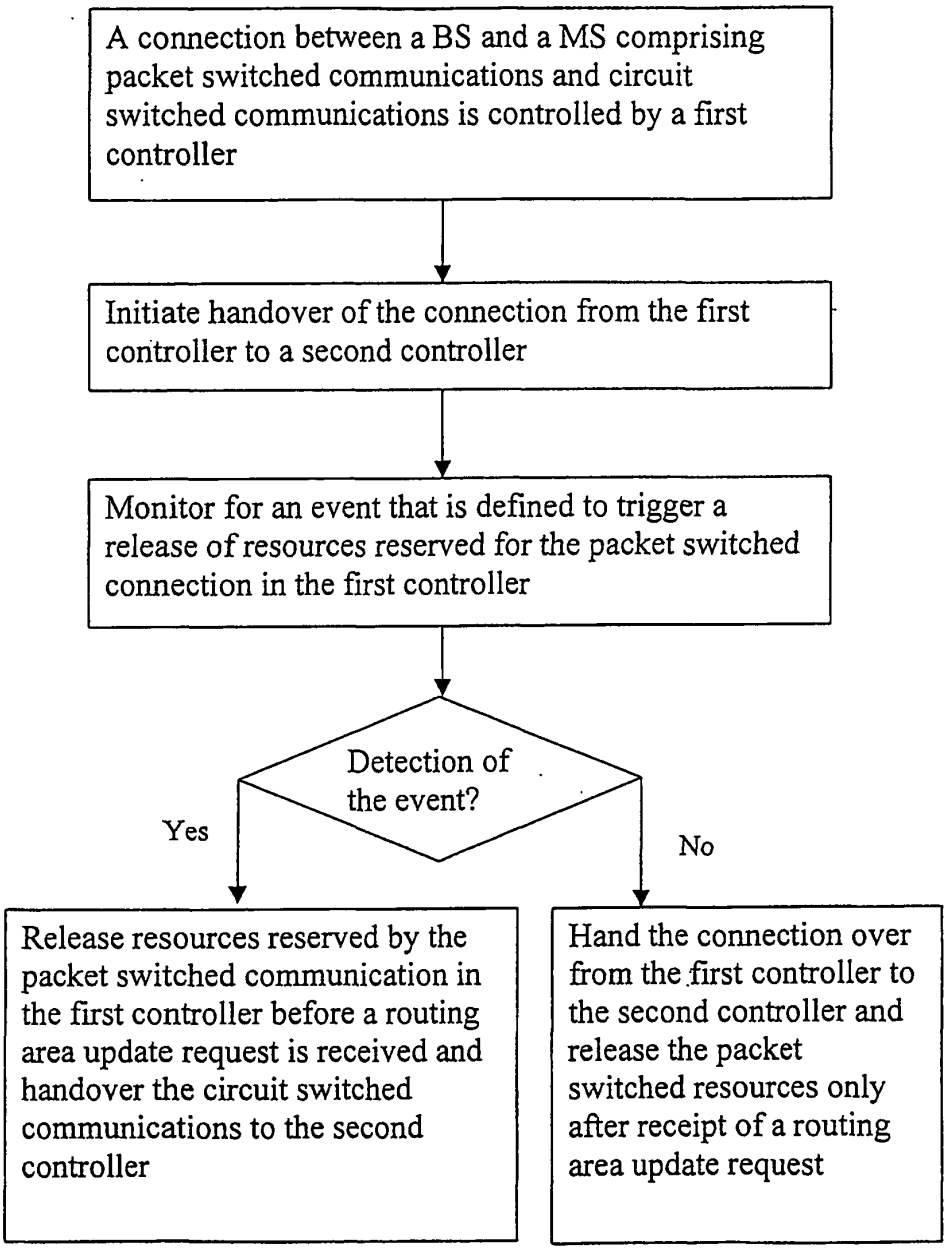

A connection between a BS and a MS comprising packet switched communications and circuit switched communications is controlled by a first controller
Initiate handover of the connection from the first controller to a second controller
Monitor for an event that is defined to trigger a release of resources reserved for the packet switched connection in the first controller
Detection of the event?
Yes
No
Release resources reserved by the packet switched communication in the first controller before a routing area update request is received and handover the circuit switched communications to the second controller
Hand the connection over from the first controller to the second controller and release the packet switched resources only after receipt of a routing area update request

Fig. 2

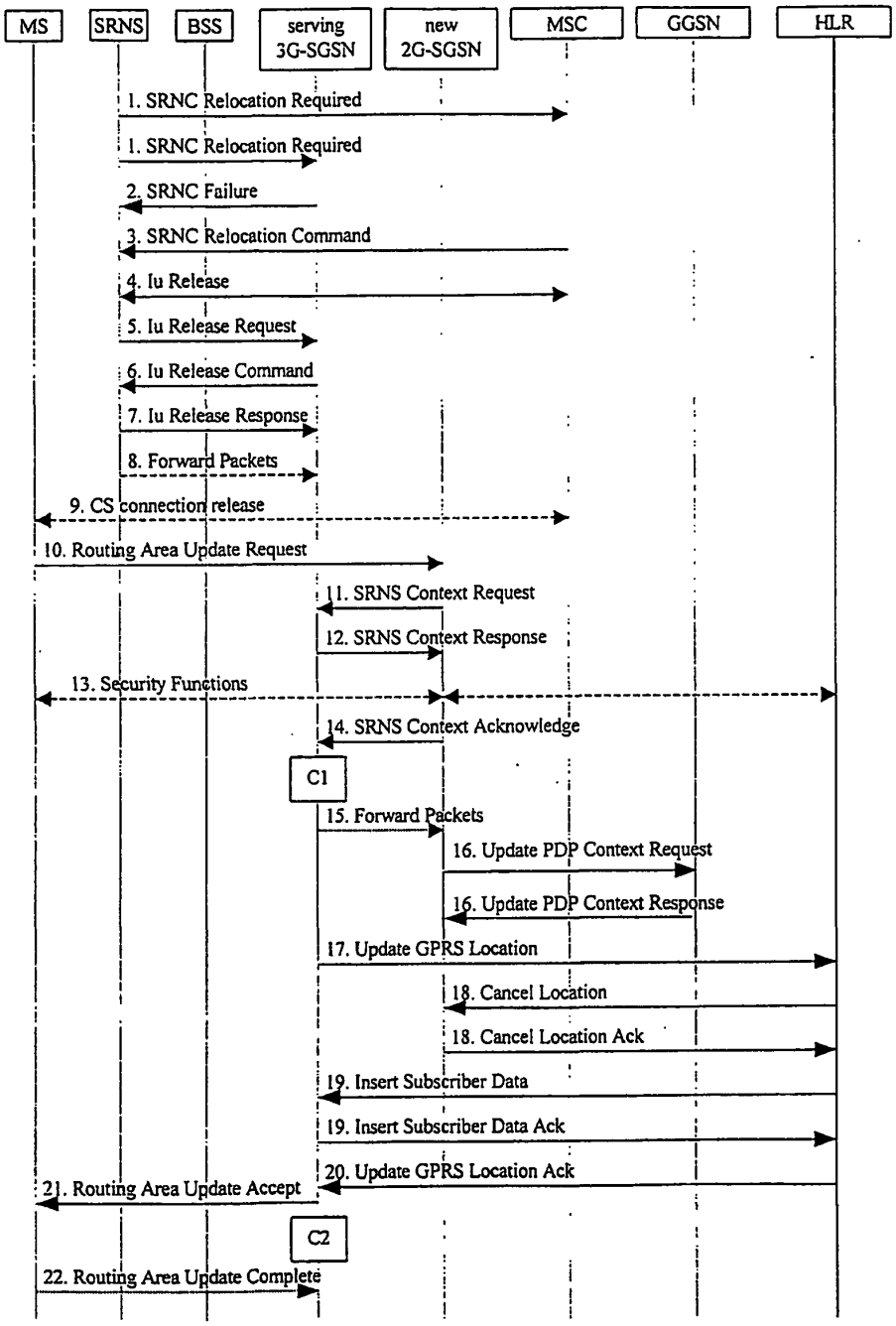

MS
SRNS
BSS
serving 3G-SGSN
new 2G-SGSN
MSC
GGSN
HLR
1. SRNC Relocation Required
1. SRNC Relocation Required
2. SRNC Failure
3. SRNC Relocation Command
4. Iu Release
5. Iu Release Request
6. Iu Release Command
7. Iu Release Response
8. Forward Packets
9. CS connection release
10. Routing Area Update Request
11. SRNS Context Request
12. SRNS Context Response
13. Security Functions
14. SRNS Context Acknowledge
C1
15. Forward Packets
16. Update PDP Context Request
16. Update PDP Context Response
17. Update GPRS Location
18. Cancel Location
18. Cancel Location Ack
19. Insert Subscriber Data
19. Insert Subscriber Data Ack
20. Update GPRS Location Ack
21. Routing Area Update Accept
C2
22. Routing Area Update Complete

Fig. 3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 01/05306

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/38

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)
IPC 7 H04Q

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	ETSI: " Handover Requirements between UMTS and GSM or other Radio Systems (3G TS 22.129 version 3.2.0)" TECHNICAL SPECIFICATION, December 1999 (1999-12), pages 1-20, XP002143722 Sophia Antipolis, Valbonne , France page 15, line 1 - line 37	1,6-10, 27,31-34
A	WO 98 32294 A (ERICSSON) 23 July 1998 (1998-07-23) page 5, line 1 -page 14, line 27; figures	1-40

-/--

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

[X] Patent family members are listed in annex.

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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

"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	Date of mailing of the international search report
1 October 2001	08/10/2001

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

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 01/05306

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INTERNATIONAL SEARCH REPORT

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International Application No
PCT/EP 01/05306

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		EP 1021053 A2	19-07-2000

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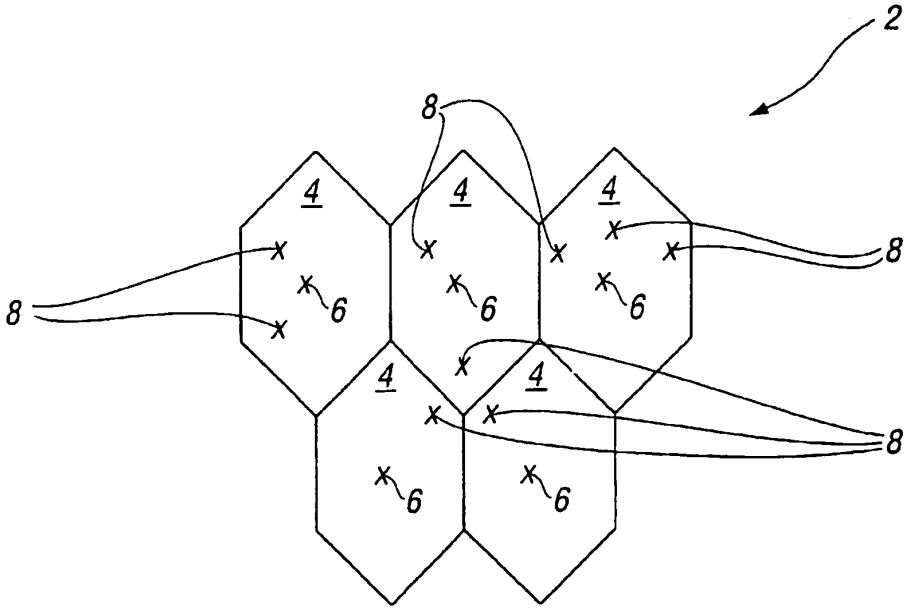
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(54) Title: COMMUNICATION DEVICES AND METHOD OF COMMUNICATION



(57) Abstract: A communications device comprising means for transmitting a signal to another party; and means for controlling the signal level with which said transmitting means transmits, wherein said signal level is initially relatively low and when a connection is established with said another party, said signal level is increased.

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COMMUNICATION DEVICES AND METHOD OF COMMUNICATION

Field of the Invention

The present invention relates to communication devices and a method of communication. In particular, but not exclusively, the present invention relates to wireless communications devices and a method of wireless communications.

Background of the Invention

It has been proposed to use mobile stations instead of credit cards at a point of sale. In this proposal, it has been suggested that a wireless link be established between the point of sale device and the mobile station. The mobile station may provide the point of sale device with similar information to that provided by a credit card.

One problem with this proposal is how to ensure that the correct mobile station is connected to the point of sale device. For example, in a busy supermarket, there may be a large number of point of sale devices and a large number of mobile stations. It is important that the right point of sale device be connected to the right mobile station. Clearly, considerable problems would be caused if the wrong mobile station were connected to the wrong point of sale device. The user of a mobile station could be charged for goods not purchased by the user.

Summary of the Invention

It is an aim of embodiments of the present invention to address the above problems.

According to a first aspect of the present invention, there is provided a communications device comprising means for transmitting a signal to another party; and means for controlling the signal level with which said transmitting means transmits, wherein said signal level is initially relatively low and when a connection is established with said another party, said signal level is increased.

The control means may be arranged to control the power of the signal. The control means may be arranged to control the signal level of the transmitted signal to be one of only two levels, the initially low level and the increased level. Alternatively, the signal level may be initially at a starting level and be increased at a relatively low level. The starting point may be no signal. The signal level may be increased until a connection is established with said another party. The signal level may have a maximum value to which it can be increased when no connection has been established with the another party. The maximum value may be less than the signal level used when a connection with another party has been established.

According to a second aspect of the present invention, there is provided a communications device comprising means for receiving a signal from another party; and means for controlling the signal level with which said signal is received, wherein said signal level is initially relatively low and when a connection is established with said another party, said signal level is increased.

According to a third aspect of the present invention, there is provided a communications method comprising the steps of transmitting initially a signal to another party at a relatively low signal level; establishing a connection with the another party; and increasing the signal level with which signals are transmitted to said another party after said connection has been established.

According to a fourth aspect of the present invention, there is provided a communications method comprising the steps of receiving a signal from another party; attenuating said received signal by a first amount; establishing a connection with the another party; decreasing or removing the attenuation applied to said received signals when a connection has been established.

Brief Description of Drawings

For a better understanding of the present invention and as to how the same may be carried into effect, reference will now be made by way of example only to the accompanying drawings in which:-

Figure 1 shows a typical cellular telecommunications network;
Figure 2 shows a block diagram of an embodiment of the present invention;
Figure 3 shows the structure of the mobile station of Figure 2;
Figure 4 shows a service access point with attenuation of the received and transmitted signals;
Figure 5 shows a service access point with attenuation of the transmitted signals only; and
Figure 6 shows a service access point with attenuation of the received signals only.

Detailed Description of Embodiments of the Invention

Reference is made to Figure 1 which shows a typical cellular telecommunications network. The area covered by the network 2 is divided into a plurality of cells 4. Each cell 4 is served by a base transceiver station 6. Each base transceiver station 6 is arranged to communicate with mobile stations 8 in the cell associated with that base transceiver station 6.

The cellular network 2 can use any suitable method of communication. Known methods of communication include those based on time division multiple access, frequency division multiple access and spread spectrum techniques such as code division multiple access. Hybrids of two or more of these access techniques can also be used. In the following description, the mobile station is described as operating in accordance with the UMTS (Universal Mobile Telephone System) standard, which uses code division multiple access. However, the mobile station can operate in accordance with any other suitable standard, for example GSM (Global System for Mobile Communications). GSM uses a time/frequency division multiple access technique.

Reference will now be made to Figure 2 which shows a block diagram of an embodiment of the present invention. Shown in Figure 2 is a service access point 10. The service access point, as will be discussed in more detail late, may be a point of sale device, a ticket gate, an information kiosk, ATM or any other suitable service access point.

The service access point 10 has an antenna 12. The antenna 12 is arranged to receive signals from a mobile station. The received signals are passed to an adjustable attenuator 13. The function of the attenuator 13 will be described in more detail hereinafter. The output of the attenuator 13 is connected to a wireless link 14. The wireless link 14 processes the received signals and puts the received data into a format which can be used by the main part 16 of the service access point. The wireless link may convert the received signal to a base band frequency and may carry out decoding and demodulation, as is well known.

The antenna 12 is also arranged to transmit signals to a mobile station. The wireless link 14 receives the data to be transmitted and puts it into a format suitable for transmission. The wireless link 14 may up convert the signals, encode and modulate the data before passing it to the adjustable attenuator 13. The

signals are attenuated, if necessary by the attenuator 13 before being passed to the antenna 12 for transmission.

Figure 2 illustrates how embodiments of the invention are able to overcome the difficulties described earlier. In the arrangement shown in Figure 2, four mobile stations 8a-d are provided. Each of these four mobile stations is reasonably close to the service access point. In the embodiment of the invention, it is desired to establish a connection between the first mobile station 8a and the service access point. It is extremely disadvantageous if, by mistake, a connection were to be established with any of the other three mobile stations 8b to 8d.

The service access point 10 is able to adjust, using the adjustable attenuator 13, the power with which the antenna 12 transmits. The service access point is arranged, in preferred embodiments of the present invention to receive and transmit signals in accordance with the Bluetooth standard. The Bluetooth standard uses low power and high frequency signals (of the order of Giga Hertz).

If the Bluetooth signal were transmitted with its normal range of power, all of the four mobile stations 8a-d would be able to receive the Bluetooth signal from the service access point and accordingly a connection could be set up with any of the four mobile stations. To avoid this, the attenuator 13 is controlled so as to transmit initially with a very low power. This power is low enough such that the range of the signal is very small. For example, the signal may have a range of the order of a few centimetres, perhaps 10 or so centimetres. However this is an implementation issue and the initial range of the signals can have any suitable value.

This low level of power is maintained until a mobile station is within the short range of the service access point 10. A Bluetooth connection is then established between the mobile station and the service access point. Once the connection

has been established, the attenuator 13 is controlled to increase the power of the signal transmitted by the antenna to more usual levels. Typically, the signal will then be strong enough to be received by the all of the four mobile stations. However as a connection has already been established with the correct mobile station, no further connection is established with any of the other mobile stations. Once a connection has been established, the communication link can optionally be encrypted if desired.

The attenuator 13 may have no attenuation effect on the signal to be transmitted once the connection with the correct mobile station has been established. The attenuator may simply have two modes. In the initial mode, the signal to be transmitted is attenuated by a fixed amount so that the signal has only the very short range A. In the second mode, the attenuator provides no attenuation and the signals have a longer range B. When a connection has been broken, the attenuator reverts to the initial mode.

In an alternative embodiment of the present invention, the initially transmitted signals may have the smallest range. If a connection is not established when the service access point is transmitting with the lowest power, the power may be increased by the attenuator until a connection is established. The increase in power may be gradual or stepwise. The power may be gradually increased from nothing. The attenuator may be controlled so that the signals are transmitted with up to a maximum power when no connection has been established. The maximum power may be the same as the power used when a connection has been established. However in preferred embodiments of the present invention, the maximum power is less than the power used when a connection has been established.

In preferred embodiments of the present invention, the attenuator has no effect on the received signals, only on the signals to be transmitted. However in

alternative embodiments of the present invention the attenuator may attenuate the received signals some or all of the time.

The structure of the mobile station 8 is shown in Figure 3. The mobile station 8 has a first antenna 20 and a second antenna 22. The first antenna 20 is connected to a UMTS transceiver 24. The UMTS transceiver 24 is arranged to receive signals from the antenna 20 at a UMTS frequency. The UMTS transceiver 24 decodes the signals, demodulates them and also reduces them to the base band frequency. The output of the UMTS transceiver 24 thus consists of a stream of data. That stream of data may require further processing by the processor 26.

The UMTS transceiver also receives data from the processor 26 which is to be transmitted by the mobile station. The UMTS transceiver 24 encodes, modulates and up converts the signal to the radio frequency which is to be used. The radio frequency signal is then transmitted by the antenna 20.

The second antenna 22 is connected to a Bluetooth transceiver. Bluetooth is a proposed new standard that uses relatively low power radio frequency signals. The frequency may be in the GHz range. This is quite different to the UMTS frequencies. For this reason, separate antennas 20 and 22 are usually provided for the two different types of signal. The Bluetooth transceiver 28 receives Bluetooth frequency signals from the second antenna 22 and decodes, demodulates and down converts those signals. The data output by the Bluetooth transceiver 28 is input to the processor 26. The processor 26 is also arranged to provide data to the Bluetooth transceiver 28 which is to be transmitted by the Bluetooth antenna 22. This data is up converted to the Bluetooth frequency, modulated and encoded before being transmitted by the second antenna 22.

The mobile station 8 also has a display 30. The display is controlled by the processor 26 and provides information for the user. A keypad 32 is provided to

allow the user to input numbers and other information. The information input via the keypad 32 is input to the processor 26 which may be controlled in accordance with the input information. The mobile station has a speaker 34. This is controlled by the processor 26 and outputs audio signals which can be heard by the user. A microphone 36 is provided to pick up the user's voice. The microphone signals are input to the processor 26 which converts the signals into a format suitable for output to the UMTS transceiver 24.

Reference will now be made to Figures 4, 5 and 6. In Figure 4, the service access point 10a is arranged to attenuate signals that are both received and transmitted by the antenna 13a. The signals to be transmitted are input to a duplex filter 50. The transmit signals are output by a wireless link, as shown in Figure 2 to the duplex filter 50. The signals to be transmitted are attenuated by the attenuator 13a as described in relation to Figure 2 before being transmitted by the antenna 12.

The signals, which are received by the antenna 12, are also input to the attenuator 13a which attenuates them. This means that signals from mobile stations further away from the service access point are not output from the attenuator or have a very low power. The attenuator 13a can be controlled to attenuate the received signals in a similar way to that described in relation to the transmitted signals. The attenuation of received signals may therefore be greater when the connection is being established and less when the connection has been established.

Reference is made to Figure 5 which shows for comparative purposes part of the arrangement of Figure 2. The service access point 10b is arranged to attenuate only the transmitted signals. The signals to be transmitted are attenuated by the attenuator 13b after the wireless link circuitry and before the signals are input to the duplex filter 50.

Reference is made to Figure 6 which shows a service access point 10c where only the received signals are attenuated. The attenuator 13c is arranged to received signals received by the antenna 12 via the duplex filter 50. The attenuator attenuates the signals which are received before they are processed further. The attenuator may be controlled in a similar manner to the attenuator described in relation to Figure 2. When a connection is established the received signals are attenuated to remove the signals other than from a very close mobile station. The attenuation may be removed or reduced once a connection has been established,

The preferred embodiments of the present invention have been described as using a Bluetooth link. However, it should be appreciated that any other suitable radio frequency can be used. For example, infrared frequencies may be used. Preferred embodiments of the present invention use a short range connection between the mobile station and the service access point. However, this may not be required in certain embodiments of the present invention.

Embodiments of the present invention have a number of different applications. In one embodiment, the mobile station is used to make a transaction a point of sale or similar device and effectively acts as a credit card, a debit card or an electronic purse. Credit card information for money transfer is provided to the point of sale or similar device using the Bluetooth connection link which is established between the service access point and the mobile station. For example once the link has been established, the mobile station provides the point of sale device with credit card details of the user and authorisation for the transaction. Other information such as the identity of the user may also be provided.

Embodiments of the present invention can for example be used at ticket gates. The mobile station includes a ticket to go to a film, concert, sports match or the

like. The Bluetooth connection is established between the mobile station and the ticket gate using the identification information. The confirmation of the ticket details is then provided to the ticket gate from the mobile station via the Bluetooth link.

Embodiments of the invention can be used to obtain information from an information station. The link is established and the information is exchanged using the Bluetooth connection. For example, the user can obtain train times etc from the information kiosk.

In an alternative embodiment of the present invention, the mobile station can be used to communicate with an automatic teller machine ATM to complete financial operations such as the loading of cash to an electronic purse, the withdrawal of cash or the like. The secure communication link between the station and the ATM is established with the ATM as discussed hereinbefore.

In some embodiments of the present invention, the mobile station may be arranged to act solely as a credit card or the like. In that case the UMTS circuitry can be omitted. The mobile station may thus include only the Bluetooth related circuitry. The display, keypad, speaker and/or microphone may therefore be omitted.

The described embodiments of the present invention have used a technique for establishing a connection between a service access point and a mobile station. It should be appreciated that embodiments of the present invention can be used to establish communication between any two or more communication devices. For example, embodiments of the present invention can be used to establish a connection between two or more mobile stations.

In preferred embodiments of the present invention, the mobile station may be replaced by any suitable communication device. Likewise the service access point can be replaced by any suitable communication device. In some embodiments of the present invention the communication capabilities of the communication device and/or the service access point may be very limited. In alternative embodiments of the present invention, the communication capabilities of the communication device and/or the service access point may be more extensive.

In some embodiments of the present invention, the antenna of the service access point may be omni directional. In other embodiments of the present invention, the antenna may be directional.

The normal range of the antenna of the service access point may be of the order of 10 meters. However this is an implementation issue and the normal range may be any suitable value.

CLAIMS

1. A communications device comprising:

means for transmitting a signal to another party; and

means for controlling the signal level with which said transmitting means transmits, wherein said signal level is initially relatively low and when a connection is established with said another party, said signal level is increased.

2. A communications device as claimed in claim 1, wherein said control means is arranged to control the power of said signal.

3. A communications device as claimed in claim 1 or 2, wherein said control means is arranged to control the signal level of the transmitted signal to be one of only two levels, the initially relatively low level and the increased level.

4. A communications device as claimed in claim 1 or 2, wherein said signal level is initially at a starting level and is increased to the relatively low level.

5. A communications device as claimed in claim , wherein said starting point is no signal.

6. A communications device as claimed in claim 1, 2, 4 or 5, wherein said signal level is increased until a connection is established with said another party.

7. A communications device as claimed in claim 6, wherein said signal level has a maximum value to which it can be increased when no connection has been established with said another party.

8. A communications device as claimed in claim 7, wherein said maximum value is less than the signal level used when a connection with the another party has been established.

9. A communications device comprising:

means for receiving a signal from another party; and

means for controlling the signal level with which said signal is received, wherein said signal level is initially relatively low and when a connection is established with said another party, said signal level is increased.

10. A communications device as claimed in claim 9, wherein said control means is arranged to attenuate the signal level of the received signal by a first amount or a second amount only to provide the initially relatively low level and the increased level.

11. A communications device as claimed in claim 9, wherein said signal is arranged to be attenuated by a starting amount and the attenuation is reduced to provide signals at the relatively low level.

12. A communications device as claimed in claim 11, wherein said starting point is maximum attenuation.

13. A communications device as claimed in claim 9, 11 or 12, wherein attenuation of the received signal level is decreased until a connection is established with said another party.

14. A communications device as claimed in claim 13, wherein said attenuation has a minimum value to which it can be decreased when no connection has been established with said another party.

15. A communications device as claimed in claim 14, wherein said minimum value is greater than the attenuation used when a connection with the another party has been established.

16. A communications device as claimed in any of claims 9 to 15, wherein no attenuation is applied to the received signals when a connection has been established.

17. A communications device as claimed in any preceding claim, wherein said control means comprises an attenuator.

18. A communications device as claimed in any preceding claim, wherein when a plurality of another parties are provided, said communications device is arranged to establish a connection with the closest another party.

19. A communications device as claimed in any preceding claim, wherein said communications device is one of the following devices:
point of sale device; ticket gate device; and information kiosk; ATM.

20. A communications device as claimed in any preceding claim, wherein said connection with said another party is a wireless connection.

21. A communications device as claimed in claim 20, wherein said wireless connection is a high frequency connection.

22. A communications device as claimed in claim 21, wherein said high frequency connection is of the order of giga Hertz.

23. A communications device as claimed in claim 22, wherein said wireless connection is a Bluetooth link.

24. A communications device as claimed in claim 20, wherein the wireless connection is an infrared connection.

25. A communications device as claimed in any preceding claim, wherein said another party is a mobile telephone.

26. A communications method comprising the steps of:

transmitting initially a signal to another party at a relatively low signal level;

establishing a connection with the another party; and

increasing the signal level with which signals are transmitted to said another party after said connection has been established.

27. A communications method comprising the steps of:

receiving a signal from another party;

attenuating said received signal by a first amount;

establishing a connection with the another party;

decreasing or removing the attenuation applied to said received signals when a connection has been established.

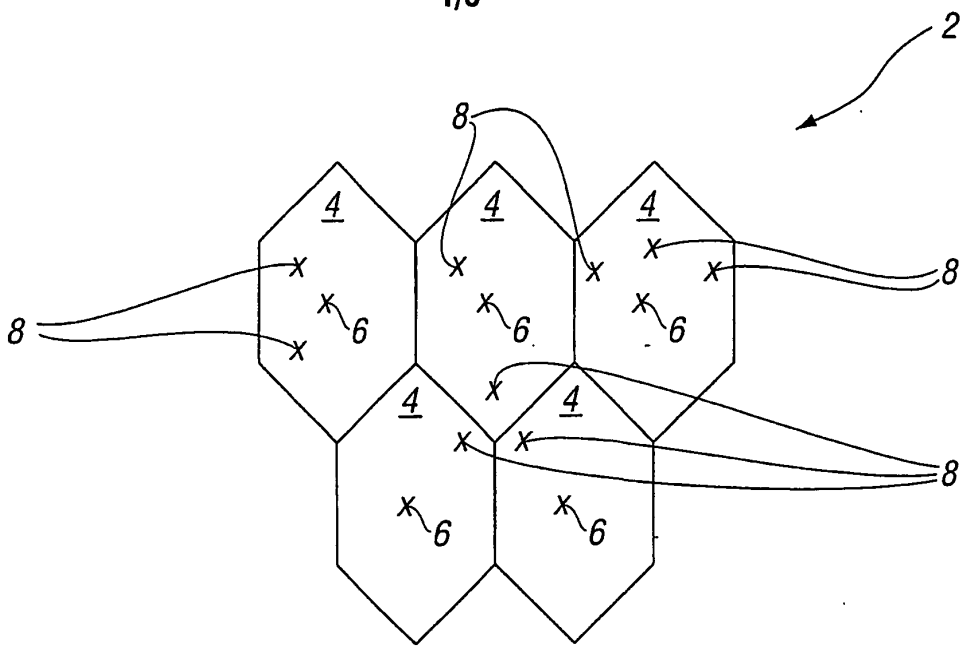

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6
6

FIG. 1

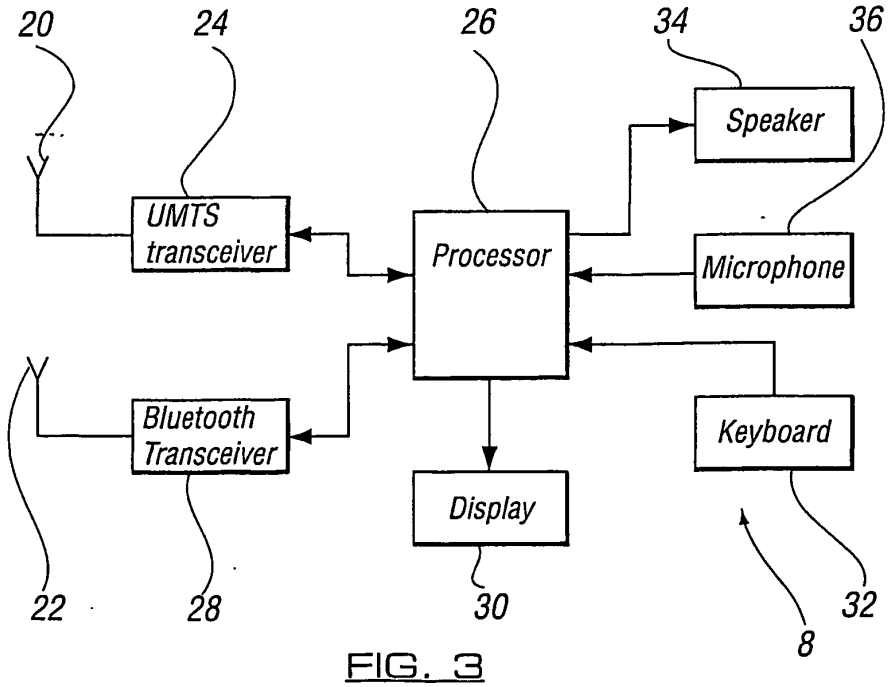

20
24
26
34
36
Speaker
UMTS transceiver
Processor
Microphone
Bluetooth Transceiver
Keyboard
Display
22
28
30
32
8

FIG. 3

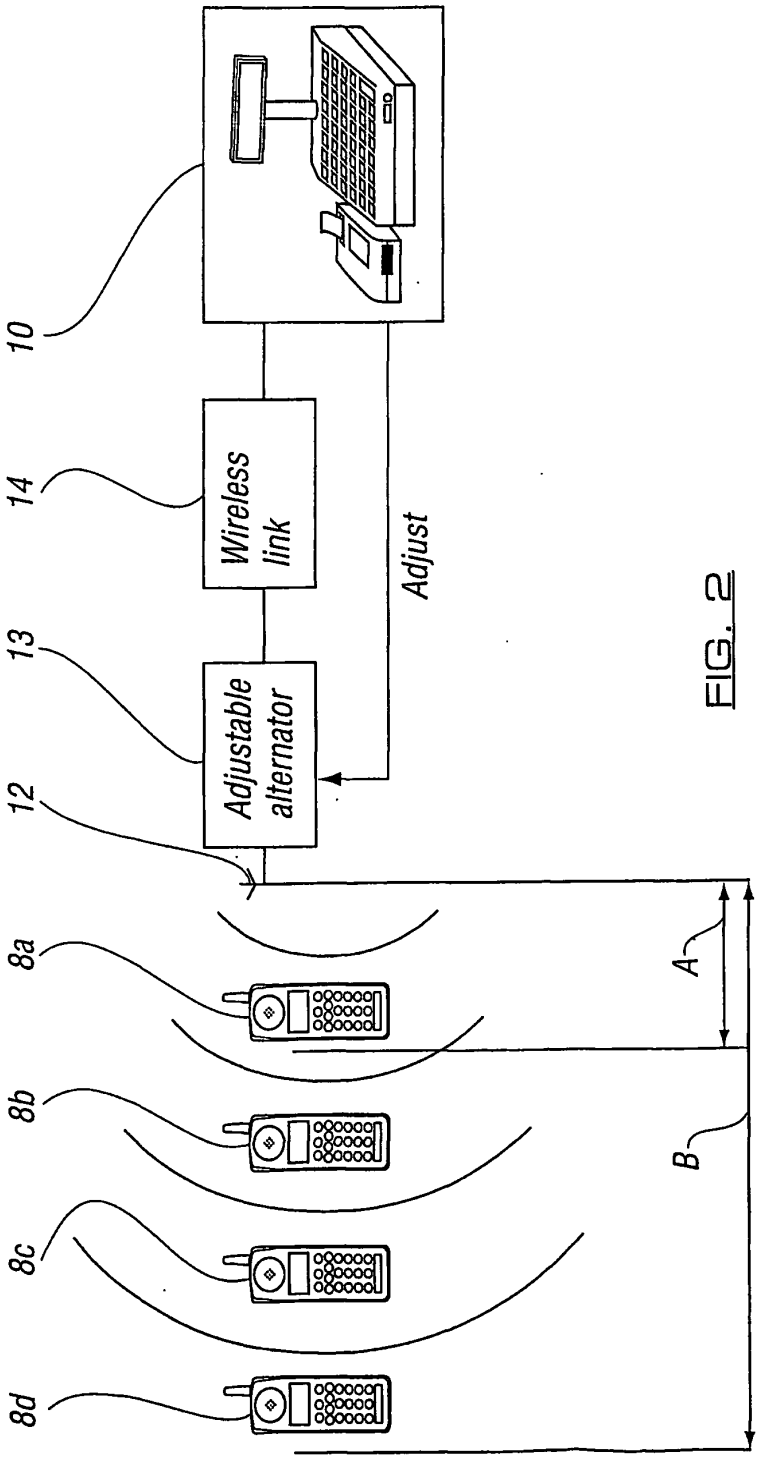

10
14
Wireless link
13
Adjustable alternator
12
Adjust
8a
8b
8c
8d
A
B

FIG. 2

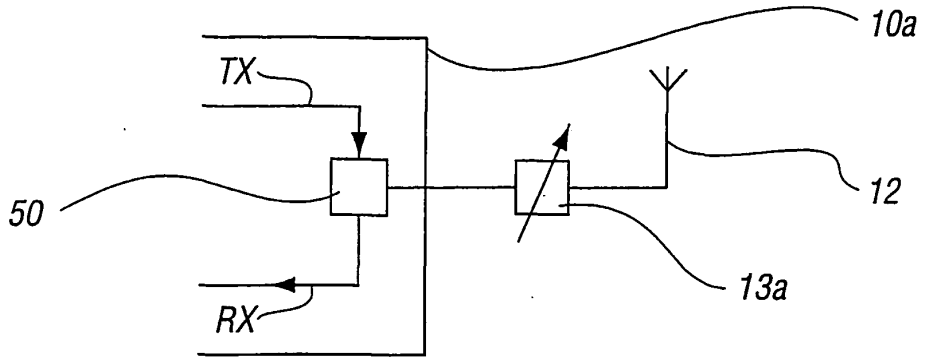


FIG. 4

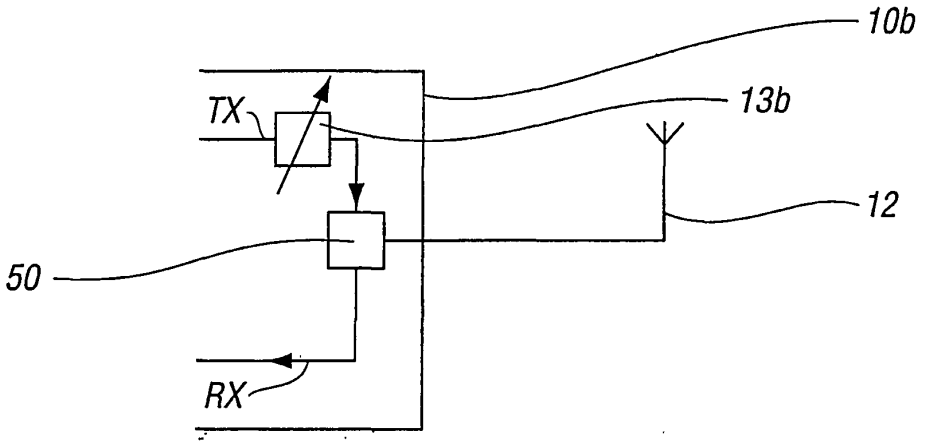


FIG. 5

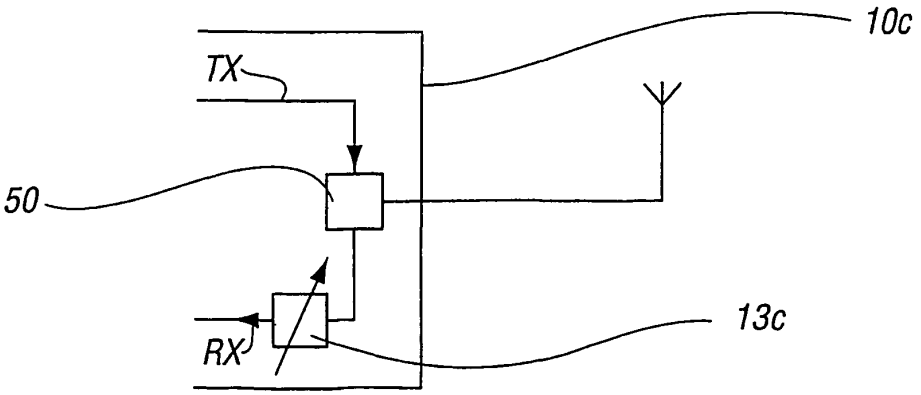


FIG. 6

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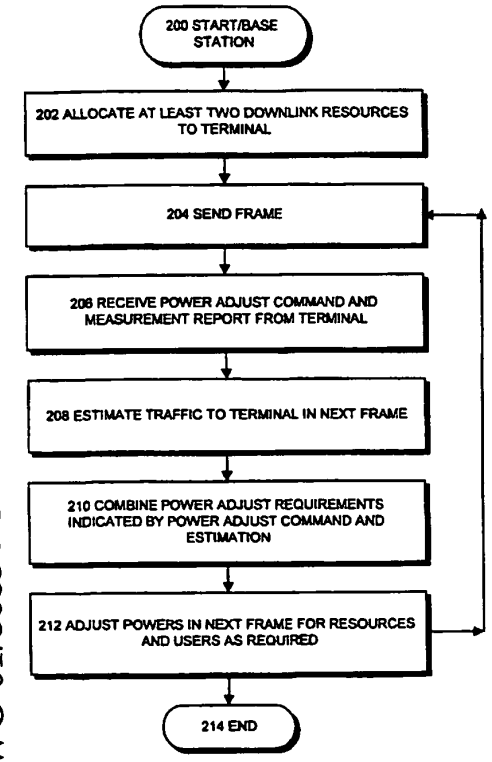
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[Continued on next page]

(54) Title: POWER CONTROL IN RADIO SYSTEM



(57) Abstract: A radio system comprising one or more network parts and one or more terminals in radio connection to the network part, radio traffic on the radio connection between the network part and the terminal being transmitted in a frame, the network part being arranged to allocate downlink transmission power in at least two timeslots to a given terminal from timeslots determined by said frame. The network part of the radio system is arranged to produce the transmission power of a transmission to a terminal timeslot-specifically such that the power ratio of the transmission power of a radio transmission to the terminal in each timeslot and the interference power caused by transmissions to other terminals exceeds a threshold value preset on the power ratio in the timeslot.

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patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

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— *with international search report*

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POWER CONTROL IN RADIO SYSTEM

FIELD OF THE INVENTION

[0001] The invention relates to radio systems and particularly to power control in radio transmission between a base station in a radio system and a terminal in the coverage area of the base station.

BACKGROUND OF THE INVENTION

[0002] In a radio system, power control refers to adjusting the transmission power of a radio transmission within a given range of variation. Power control is primarily needed to minimize interference caused to each other by terminals located within the coverage areas of base stations in a radio system and to optimize power consumption in terminals. The transmission power of both a base station in a radio network and a terminal in the coverage area of the base station can be adjusted. Transmission power can be adjusted for example in accordance with the principles of an open loop or a closed loop. For example, in the UMTS (Universal Mobile Telephony System) cellular radio system using code division multiple access (CDMA), the closed loop method is used in the downlink TDD (Time Division Duplex) mode, whereby a terminal uses a special power control command (TPC, Transmission Power Control) to state the need to adjust the power of a received transmission. In this case, the terminal can for example notify the base station that the following transmission should have a 1-dB higher power level than a recently received transmission. In uplink TDD in UMTS, the open loop power control principle is used, whereby the receiver, i.e. a terminal, knows which transmission power the base station used in transmitting the transmission, and, having measured the reception power, is able to deduce the attenuation on the radio path and, consequently, based on the reception power, adjust its transmission power utilizing the reciprocity of the link.

[0003] Services transferred in radio networks, such as mobile networks, require different quality characteristics of a radio transmission. For example, speech transfer does not need much bandwidth but is sensitive to the delay characteristics of the transmission. A video image, in turn, requires abundantly bandwidth, but the quality of the transmission is not as critical to the delay in the transmission as is speech. For example in the TDD mode in UMTS, bandwidth is allocated by allocating data transfer capacity to users in several timeslots of a transmission frame. In a prior art solution, downlink

transmission power is the same for all user data transfer resources within one frame.

[0004] It is thus apparent that the prior art involves drawbacks. A downlink radio transmission does not take into account the different quality requirements since the transmission has the same transmission power in all the user's timeslots. The prior art does not either take into account the number of users or the variation of services in timeslots.

BRIEF DESCRIPTION OF THE INVENTION

[0005] The object of the invention is to provide an improved method for power control in a radio system. This is achieved by the method for power control in a radio system to the described next. In the method, a radio transmission between a network part in the radio system and terminals located in the coverage area of the network part is transmitted in a frame, downlink transmission power being allocated in at least two timeslots to the terminals from timeslots determined by said frame. The method comprises producing the transmission power of a transmission to a terminal timeslot-specifically such that the power ratio of the transmission power of a radio transmission to the terminal in each timeslot and the interference power caused by transmissions to other terminals exceeds a threshold value set on the power ratio in the timeslot.

[0006] The invention also relates to a network part in a radio system, arranged to transmit radio traffic to terminals located in the coverage area of the network part in a frame, the network part being arranged to allocate downlink transmission power in at least two timeslots to a given terminal from timeslots determined by said frame. The network part is arranged to produce the transmission power of a transmission to a terminal timeslot-specifically such that the power ratio of the transmission power of a radio transmission to the terminal in each timeslot and the interference power caused by transmissions to other terminals exceeds a threshold value preset on the power ratio in the timeslot.

[0007] A radio system comprising a network part and one or more terminals in radio connection to the network part, radio traffic on the radio connection between the network part and the terminal being transmitted in a frame, the network part being arranged to allocate downlink transmission power in at least two timeslots to a given terminal from timeslots determined

by said frame. The network part is arranged to produce the transmission power of a transmission to a terminal timeslot-specifically such that the power ratio of the transmission power of a radio transmission to the terminal in each timeslot and the interference power caused by transmissions to other terminals exceeds a threshold value preset on the power ratio in the timeslot.

[0008] Thus, the invention relates to a method and an apparatus for power control in a radio system. In the description of the invention, a radio system preferably refers to a mobile network, even though the invention is not restricted thereto. In the method, the transmission power of a downlink transmission of a network part in the radio system and terminals located in the coverage area of the network, i.e. a transmission from the network part to the terminals, is adjusted. In the description of the invention, a network part refers to an entity formed from one or more base stations and/or one or more base station controllers controlling a base station. The terminal is preferably a mobile station but may also be some other radio receiver and/or device provided with transmitter characteristics, such as a computer, domestic appliance or the like. In connection with UMTS, a terminal refers for example to a device comprising both TE (Terminal Equipment) and UE (User Equipment) functionalities.

[0009] The invention relates to radio systems in which at least two downlink data transfer resources can be allocated time-dividedly to each terminal. The invention preferably relates to a radio system that is a hybrid system using code division (CDMA) and time division (TDMA) multiple access methods, whereby a data transfer resource refers to a combination of a timeslot and a spreading code. Furthermore, the invention is preferably applied to a radio system using time division duplex (TDD) without, however, being restricted thereto, but the invention is also applicable to a radio system using frequency division duplex (FDD), provided it comprises TDMA type of characteristics, i.e. resources are allocated time-dividedly or discontinuously.

[0010] In a preferred embodiment of the invention, radio traffic is sent to a terminal in a frame, transmission power being allocated to the terminal in at least two timeslots from the timeslots determined by said frame. Before transmission, a threshold value for the quality of the connection is generated in the base station timeslot-specifically and terminal-specifically. Quality is determined for example as a power ratio P_w/P_i, wherein P_w refers to the transmission power of a transmission addressed to a user in a timeslot and

P_i refers to the transmission powers of transmissions addressed to other users in said timeslot. The threshold value 0.10, for example, may be set on the power ratio, whereby the power P_w of a transmission addressed to a terminal is 1/10 of the entire transmission power of the timeslot. In an embodiment of the invention, the setting of the threshold value is affected by the service to be sent in the timeslot, for example such that the threshold value is higher for a data transmission than for a video image. In a preferred embodiment of the invention, the service class of the terminal affects the determination of the threshold value. In this case, for example, higher threshold values for the transmission power in a timeslot are set on a terminal subscriber who wants to be placed in a higher service class. Before the frame is sent, the base station equalizes the transmission powers of the frame based on traffic timed, i.e. scheduled, to the frame. The base station uses the scheduled traffic to equalize the transmission power of a transmission to the terminal such that the threshold value for the terminal in the timeslot is fulfilled. Said power level threshold value and estimates of scheduled traffic are an important tool when the radio network estimates if new terminals requesting connection can be offered the services desired by them.

[0011] In a preferred embodiment of the invention, the base station uses for transmission power determination, not only estimates of scheduled traffic, but also information obtained from the terminal, such as power control commands and measurement reports related to connection quality. In an embodiment of the invention, the downlink closed power control loop implemented by means of a power control command is implemented by the terminal measuring the signal-to-interference ratio in one such timeslot in which transmission power is allocated to the terminal and transmits a power control command in an uplink transmission to the base station, should power need to be adjusted. The need to adjust power can be determined in the terminal for example by comparing the signal-to-interference radio with the threshold value of the signal-to-interference ratio, which is received for example from the base station upon set-up of the connection or which is generated in the terminal. It is essential to the invention that the power control command related to one timeslot and received from the terminal is utilized in the base station for power control in all the timeslots in which transmission power is allocated to the terminal. In this case, one power control command can be used to handle several downlink resources in different timeslots. In an

embodiment of the invention, the timeslot in which the measurements are made in the terminal is the last timeslot in the frame wherein transmission power is allocated to the terminal. The timeslot in which the measurements are made can also be signalled from the base station to the terminal upon set-up of the connection. Power control may continue in the base station based on measurement reports sent by the terminal. In an embodiment, the measurement report contains the measurement results of the signal-to-interference ratio of all timeslots of a previous frame.

[0012] The invention provides significant advantages in reducing interference in a radio network, since the transmission power of each timeslot is set separately, whereby transmission to all timeslots does not have to be at the same power level.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] In the following, the invention will be described in detail in connection with preferred embodiments with reference to the accompanying drawings, in which

Figure 1 shows a mobile network,

Figure 2 is a method diagram of an embodiment of the method of the invention,

Figure 3 is a structural view of a data transfer frame,

Figure 4 shows an embodiment of the method of the invention,

Figure 5 shows a base station according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0014] In the following, the invention will be described in detail in connection with preferred embodiments with reference to the attached figures 1 to 5. The description is based on a wideband UMTS system implemented with the direct sequence technique and employing the code division multiple access method, without, however, restricting the invention thereto. The invention is also preferably usable in other radio systems using for example a combination of the time and code division multiple access methods (TDMA/CDMA). The description of the invention is based on the TDD mode of the terrestrial radio network UTRAN of UMTS, operation being in one frequency band, wherein uplink and downlink utilize the same radio frequency but different timeslots in said frequency band. The invention is also usable in

systems using FDD, wherein different frequency ranges are defined for uplink and downlink. In the following description, the term base station refers to an entity formed by one or more base stations and/or one or more base station controllers.

[0015] Figure 1 is a schematic view of a mobile system, i.e. a cellular radio system comprising base stations 100A to 100D. The coverage area of a base station is called a cell, which is denoted by C1 to C4 in the figure, corresponding to base stations 100A to 100D. Cells may overlap, such as cell C2 in the figure, which partly overlaps cells C1 and C3. The figure shows one or more receivers 102A to 102F in the area of each cell C1 to C4, the receivers being e.g. mobile stations, but they may be other apparatuses too, which are provided with radio receiver and/or transmitter characteristics and TE/UE functionality. In a radio network using the code division multiple access method (CDMA), such as a mobile network, all users use the same frequency band simultaneously. Users are distinguished from each other based on a spreading code by which the information sent by the user is multiplied. In this case, information, such as a bit stream containing speech, is spread into a wide frequency band. The bit rates of the spreading codes used are significantly higher then that of the data stream to be sent, e.g. 4, 8 or 16. The aim is to select orthogonal spreading codes for users, whereby they do not correlate. In practice, spreading codes are not completely orthogonal, and hence users interfere with each other's transmissions. Interference is caused for example to users communicating in the same timeslot and being located in the same cell or in adjacent cells. The transmission of a user communicating in an adjacent timeslot may also be interfered with. In Figure 1, receivers 102D to 102F in cell C4 interfere with one another and experience interference from terminals 102A to 102C located in the areas of the other cells C1 to C3. Additional interference between terminals 102A to 102F is caused by the signal transmitted by each terminal propagating along several different paths to the receiver. Due to this multipath propagation, a user signal arrives at the receiver as signal components delayed in several different ways thus causing interference to other users.

[0016] Figure 1 shows a bi-directional radio link 104A to 106A between terminal 102A and base station 100A in cell C1. Transmission from terminal 102A to base station 100A is called uplink 104A and transmission from base station 100A to terminal 102A downlink 106A. In the TDD mode of

UMTS, the power of a radio transmission of terminals 102A to 102F and base stations 100A to 100D is adjusted in downlink using a closed loop and in uplink using an open loop. Downlink closed loop power control means that terminal 102A sends a power control command to the base station, based on which base station 100A adapts its transmission to terminal 102A. Uplink open loop power control, in turn, means that terminal 102A measures the transmission power of a transmission received from base station 100A, uses the reception power to deduce the propagation loss and, based on this, adjusts the uplink transmission power to optimal.

[0017] Figure 2 describes an embodiment of the method of the invention. In the initial method step, a terminal is within the coverage area of a base station and requests a data transfer connection, or, alternatively, the base station requests connection set-up from the terminal. In accordance with step 202, the connection to be set up is such that at least two downlink data transfer resources are allocated. In the TDD mode of UMTS, for example, this would mean that a downlink data transfer frame to be transmitted from the base station, at least two time-dividedly spread data transfer resources are reserved for the terminal. Spreading codes are preferably allocated to different timeslots of the frame, but may be in the same timeslot. Since services requiring different quality characteristics may be transferred in the resources to be allocated, the quality criteria set on the different resources may differ from each other. Services are allocable to timeslots for example by transferring services requiring similar quality characteristics in timeslots. This allows a quality criterion to be preferably set for a timeslot, for example such that the desired transmission power P_w of the timeslot is to be at least 5% of the power P_i allocated to other users in the timeslot. In method step 204, the base station sends to terminals within its coverage area a data transfer frame whose structure is described in detail in Figure 3. In method step 206, the base station receives a power adjust command and/or a measurement report on the quality of the connection from the terminal. Said power adjust command is separately received at the base station, for example by receiving the power adjust command in connection with an uplink timeslot of a traffic channel, whereas measurement reports are preferably sent on control channels. A power adjust command is preferably based on a given timeslot that is known in both the base station and the terminal. In a preferred embodiment, the timeslot to which the power adjust command sent by the terminal relates is the last

timeslot in a frame from which transmission power is allocated to the terminal. Furthermore, in an embodiment, the base station sends an indication to the terminal about the timeslot concerning which the power adjust command is to be sent in closed loop power control. In a measurement report concerning a radio link, the terminal sends for example signal-to-noise ratios experienced in all timeslots of a frame.

[0018] In method step 208 in Figure 2, the traffic of the frame to be sent next is estimated at the base station. As regards a given terminal, this means for example that in each timeslot, the power ratio P_w/p_i exceeds a base station threshold value preset for the timeslot. For example, the service to be sent in the timeslot affects the base station threshold value of the timeslot. In method step 210, the power change requirements created by the power adjust command and the estimate of traffic carried out in method step 208 are combined. Power adjustment requirements can be combined in several ways, and the invention is not restricted to one manner of combination. An example is, for example, that the power adjustment requirements caused by the estimation are created first, and the power adjust commands sent by the terminal are added to them or subtracted from them. In a second preferred embodiment, the power adjust commands sent by the terminal are primarily taken into account, and the power adjustment requirements caused by the estimation are then taken care of, if need be. However, as far as the invention is concerned, it is essential that one power control command per frame be received at the base station. The received power control command is extended to cover all those timeslots in the frame to be sent next, in which resources are allocated to the terminal. For example, power control command +1 dB received at the base station related to timeslot 5, but the +1-dB power control is carried out on all timeslots, e.g. 3, 4 and 5, in which transmission power is reserved for the terminal. This power control is described in detail in connection with Figure 4. The actual power control is carried out in method step 212 before the next frame is sent by returning to step 204.

[0019] In digital radio systems, the radio interface between a terminal and a base station is implemented with logical radio channels, which are physically implemented by means of physical radio channels. Logical channels can be divided into dedicated and common channels, dedicated channels being reserved particularly for communication between a given terminal and base station. An example of a dedicated channel is a dedicated

traffic channel DCH (Dedicated Channel). A common channel is used for example to transfer information from a base station to several terminals at the same time. Examples of common channels include BCCH (Broadcast Channel), which is used for downlink transfer of information about a cell to terminals; PCCH (Paging Channel), which is used to request location data from a terminal when the system is not aware of the location of the terminal; RACH (Random Access Channel), which a terminal can be used for uplink transfer of control information for example relating to the set-up of a connection.

[0020] Logical channels are implemented with physical channels, whose implementation in a TDMA-based system is a timeslot and a burst to be sent in the timeslot. The frame and burst structures used on physical channels differ depending on the physical channel the transmission takes place on. The frame structure of a physical channel of the TDD mode DPCH (Downlink Dedicated Physical Channel) of UMTS will be described by way of example with reference to Figure 3. The transmission duration of frame 300 is 10 milliseconds and it is divided into 15 timeslots 302A to 302D, each timeslot, e.g. 302C, having a duration in time of 0.666 milliseconds. Each timeslot 302A to 302D can be allocated simultaneously to several different users who are distinguished from each other by spreading codes. Each timeslot 302A to 302D of a frame can be allocated for either uplink or downlink transmission, which is illustrated by two-headed arrows in timeslots 302A to 302D. However, in each frame preferably at least one timeslot is allocated to the uplink and one to the downlink transmission direction. A data packet to be sent in timeslots 302A to 302D is called a burst, which comprises 2560 chips, i.e. units of the spreading code used. The bursts in one timeslot can be addressed to different users according to spreading codes, but they can also all be addressed to the same user. Eight bursts belonging to different users can be placed in one uplink timeslot. Nine or ten bursts can be placed in one downlink timeslot. In a DPCH burst according to Figure 3, chips 0 to 1103 contain a first data partition 304A, chips 1104 to 1359 contain a midamble 306, chips 1360 to 2463 a second data partition 304B and at the end of the burst is a 96-chip long guard period 308. The TPC is placed in the middle of midamble 306 and the second data partition 304B, if it is used on the connection. A burst including the described contents is usable for example on a downlink channel. The middle of a burst used on an uplink channel is usually longer in order to

facilitate the sorting of bursts coming to a base station from different users and to identify interference caused on the radio path.

[0021] Figure 4 illustrates the efficiency of the method of the invention in practice. Uppermost in the figure is frame 300A, which is sent from base station 100A to terminals communicating with it, such as terminal 102A. Frame 300A is composed of 16 timeslots, of which timeslots 1 to 13 are reserved for downlink and timeslots 14 to 16 above duplex limit 400 to uplink. Transmission power is allocated to terminal 102A from timeslots 3, 6 and 12. Different services, for example, are sent in said timeslots, whereby the target values set on the signal-to-interference ratio SIR of the timeslots are different. In measuring the SIR, the terminal measures the signal power of a transmission directed to a terminal to the power of a interfering signal, i.e. the power of transmissions directed to other users. It is apparent that the same service, such as speech, video image or the like, can be addressed to a terminal in the timeslots, and yet the SIR target values of the timeslots are different. In a preferred embodiment of the invention, a base station and a terminal communicate on a control cannel a SIR target value and the timeslot the target value relates to. The measurement can also be carried out without separate notification from base station 100A for example such that it is always the last timeslot in which transmission power is allocated to the terminal. This is the situation for example in Figure 4, wherein terminal 102A measures timeslot 13. In the example of Figure 4, while measuring timeslot 13, terminal 102A notices that the ratio of signal power to interference power is only 2 dB, although the SIR target is 3 dB. In this case, terminal 102A sends a request to increase the transmission power of the timeslot by +1 dB in the next uplink timeslot 15, which belongs to frame 300B. In the TDD mode of UMTS, the terminal sends the power adjust command in a TPC indicator (Transmission Power Control). Base station 100A receives timeslot 15 belonging to frame 300B and adjusts the transmission power to be transmitted to the terminal by +1 dB in the next frame 300C in all timeslots 3, 6 and 13 to be sent to the terminal. According to an embodiment of the inventive idea of the present invention, base station 100A thus adjusts transmission power in all timeslots of terminal 102A based on the TPC value based on the measurements of one timeslot. In this case it should be noted that if the SIR experienced by the terminal in some timeslot changes, a significant reason for an impaired SIR is a change in the location of the terminal with respect to the base station,

whereby the terminal is likely to experience similar weakening of the SIR also in other timeslots.

[0022] In a preferred embodiment of the invention, the terminal sends measurement reports on connection quality to the base station. A measurement report is sent for example once per each frame in those timeslots of the reported SIR, in which transmission power is allocated to the user. Furthermore, the interference level of each timeslot in a frame can be reported in the measurement reports. In a preferred embodiment, the base station uses the measurement reports for adjusting the power of the following frame(s). With reference to for example Figure 4, let us assume that terminal 102A is the only user in timeslots 3, 6 and 13 and sends to the base station a measurement report including interference levels 90 dBm, -120 dBm, -120 dBm, respectively. In this case, the base station preferably increases the power level of timeslot 3 more than the power ratio estimates and power control command indicate.

[0023] In an embodiment of the invention, base station 100A also estimates the relationship between transmission power and interference power based on estimated traffic. In practice, this means that, having sent frame 300A, base station 100A starts to keep a record of traffic that is to be sent in the next frame 300C. In the example of Figure 4, base station 100A notices in timeslot 6 that the power P_w of a transmission directed to terminal 102A has dropped too low with respect to the interference power P_i, which refers to traffic predicted, i.e. scheduled to other terminals than terminal 102A. Since base station 100A already received a command to raise transmission power by +1 dB from terminal 102A, for example +1 dB more transmission power is enough to raise the power ratio P_w/P_i to the desired level. In a preferred embodiment of the invention, the base station first evens out the ratio P_w/P_i to the right level, such as to the level of a preset threshold value. A threshold value may for example determine that the power ratio is 0.10. The TPC command issued by a user is not taken into account until after the power ratio is calculated.

[0024] In the following, the invention will be described with reference to Figure 5, which shows the block diagram of a CDMA transmitter and receiver by means of an embodiment. The transmitter is shown by means of blocks 500-510 and the receiver by means of blocks 530-540. Since the radio connection between transmitter 500-510 and receiver 530-540 is bi-

directional, in practice both the base station of the mobile network and the terminal act as transmitter and receiver. For the sake of clarity, Figure 5 only shows a situation wherein the base station acts as transmitter and the terminal, such as a mobile station, as receiver, i.e. downlink transmission. Data block 500 shows the hardware parts of the base station that are needed to generate user speech or data in the transmitter. In block 502, channel coding and interleaving, for example, are adapted to the information, composed of symbols. Channel coding and interleaving are used to ensure that the transmitted information can be restored in the receiver although not all information bits are received. Block 504 shows multiplication by spreading code and spreading into wideband performed on the information to be sent. Conversion from digital into analog form takes place in block 506. Before being converted into analog, a signal is subjected to power control. Power control is carried out for example such that the higher the transmission power used for sending a user signal, the higher the coefficient by which user signal chips are multiplied before a combination signal to be sent to radio path 104A is created. In unit 506, power levels of the user signal and interfering signals are compared with each other and with a threshold value, and, when threshold value comparison so indicates, the power level of the user signal is adjusted so that it fulfils the threshold value. After radio frequency parts 508, the combination signal is transferred by antenna parts 510 for transmission to downlink radio path 104A.

[0025] Figure 5 shows a CDMA receiver 530-540 comprising antenna parts 530 for receiving a wideband signal. From antenna 530, the signal is transferred to radio frequency parts 532, from where the signal is transferred to A/D converter 534 for conversion from analog to digital form. In receiver block 536, attempts are made to separate the user signal from the received CDMA signal. Separation takes place for example by composing symbol estimates from the user signal, and the symbol estimates can be improved by subjecting the information to one or more interference cancellation steps. In a preferred embodiment, receiver block 536 in for example a RAKE type of receiver comprises a delay estimator for estimating the delays of multipath-propagated components and allocating the strongest of them to RAKE branches. In receiver block 536, user signals are regenerated and combined into an interfering signal that can be subtracted from the received combination signal. Herein, the signal-to-interference ratio is also

estimated in unit 534 by comparing the power level of the user signal with the power level of the interfering signal. Once final symbol estimates are generated from the signal, it is directed to block 538 for removal of deinterleaving and channel coding. User data is then directed in the receiver to data processing routines 540, which in the case of for example a mobile station means a handset for presenting speech to a user. It is apparent that the transmitter and the receiver also comprise other parts than those described above in connection with Figure 5, but their explanation is not relevant to describing the invention.

[0026] The invention is preferably implemented in a network part of a radio system using software, whereby for example base station 100A to 100D comprises a microprocessor, wherein the functionalities of the described method are implemented as software. It is apparent to a person skilled in the art that a network part can also refer to a disintegrated system, whereby the method steps are implemented in one or more base stations and/or base station controllers. The invention can also be implemented for example using hardware solutions providing the required functionality, e.g. as ASIC (Application Specific Integrated Circuit) or utilizing separate logics components.

[0027] Although the invention is described above with reference to examples according to the accompanying drawings, it is apparent that the invention is not limited thereto, but can be modified in a variety of ways within the scope of the inventive idea disclosed in the attached claims.

CLAIMS

1. A method for power control in a radio system, in which method (202 to 204) a radio transmission between a network part in the radio system and terminals located in the coverage area of the network part is transmitted in a frame, downlink transmission power being allocated in at least two timeslots to the terminals from timeslots determined by said frame,

characterized by

(208 to 212) producing the transmission power of a transmission to a terminal timeslot-specifically such that the power ratio of the transmission power of a radio transmission to the terminal in each timeslot and the interference power caused by transmissions to other terminals exceeds a threshold value set on the power ratio in the timeslot.

2. A method as claimed in claim 1, **characterized** by the network part comprising one or more of the following: one or more base stations, one or more base station controllers.

3. A method as claimed in claim 1, **characterized** by the threshold value set on the power ratio being determined based on the service to be sent in the timeslot.

4. A method as claimed in claim 1, **characterized** by the threshold value set on the power ratio being determined based on the service class of the terminal.

5. A method as claimed in claim 1, **characterized** by

measuring the signal strength of a transmission addressed to a terminal and the interfering signal strength of the timeslot in the terminal in a timeslot in which transmission power is allocated to the terminal;

creating the signal-to-interference ratio of signal strength to interfering signal strength in the terminal;

comparing the signal-to-interference ratio in the terminal with a preset threshold value, and if the signal-to-interference ratio is at least equal to the threshold value, sending a power adjust command from the terminal to the network part;

adjusting the transmission power of transmissions addressed to the terminal in the network part based on the power adjust command in all those timeslots of the next frame in which transmission power is allocated to the terminal.

6. A method as claimed in claim 5, **characterized** by sending information from the network part to the terminal indicating in which timeslot the signal-to-interference ratio is to be measured.

7. A method as claimed in claim 1, **characterized** by the radio system being a radio system using the code division multiple access method (CDMA), wherein the transmissions of different terminals in a timeslot are separated based on individual spreading codes allocated to the terminals.

8. A method as claimed in claim 1, **characterized** by the uplink and downlink transmission directions being separated from one another in the radio system using time division duplex (TDD).

9. A method as claimed in claim 1, **characterized** by sending a measurement report on the signal-to-interference ratio (SIR) from the terminal to the network part regarding all timeslots in which transmission power is allocated to the terminal;

using the measurement report received from the terminal in the network part in determining the transmission power of the transmission of the frame to be sent next and directed to the terminal.

10. A network part (100A to 100D) in a radio system, arranged to transmit radio traffic to terminals (102A to 102F) located in the coverage area of the network part (100A to 100D) in a frame (300), the network part (100A to 100D) being arranged to allocate downlink transmission power in at least two timeslots (302A to 302D) to a given terminal (102A) from timeslots determined by said frame (300),

characterized in that:

the network part (100A to 100D) is arranged to produce the transmission power of a transmission to a terminal (102A to 102F) timeslot-specifically such that the power ratio of the transmission power of a radio transmission to the terminal (102A to 102F) in each timeslot (302A to 302D) and the interference power caused by transmissions to other terminals (102A to 102F) exceeds a threshold value preset on the power ratio in the timeslot (302A to 302D).

11. A network part as claimed in claim 10, **characterized** in that the network part comprises one or more of the following: one or more base stations, one or more base station controllers.

12. A network part as claimed in claim 10, **characterized** in that the network part is arranged to determine the threshold value set on the

power ratio based on the service to be sent in the timeslot.

13. A network part as claimed in claim 10, **characterized** in that the network part is arranged to determine the threshold value set on the power ratio based on the service class of the terminal.

14. A network part as claimed in claim 10, **characterized** in that:

the network part is arranged to receive a power adjust command from the terminal, related to one such timeslot in which transmission power is allocated to the terminal;

the network part is arranged to use the power adjust command to adjust the transmission power of transmissions directed to the terminal in all those timeslots of the next frame wherein transmission power is allocated to the terminal.

15. A network part as claimed in claim 14, **characterized** in that the network part is arranged to send information to the terminal about the timeslot of the frame wherein the power ratio will be measured.

16. A network part as claimed in claim 10, **characterized** in that the radio system is a radio system using the code division multiple access method, wherein the transmissions of different terminals in a timeslot are separated based on individual spreading codes allocated to the terminals.

17. A network part as claimed in claim 10, **characterized** in that the uplink and downlink transmission directions are separated from one another in the radio system using time division duplex (TDD).

18. A network part as claimed in claim 10, **characterized** in that the network part is arranged to receive a measurement report on the signal-to-interference ratio (SIR) from the terminal regarding all timeslots in which transmission power is allocated to the terminal;

the network part is arranged to use the measurement report received from the terminal in determining the transmission power of the transmission of the frame to be sent next and directed to the terminal.

19. A radio system comprising a network part (100A to 100D) and one or more terminals (102A to 102F) in radio connection to the network part (100A to 100D), radio traffic on the radio connection between the network part (100A to 100D) and the terminal (102A to 102F) being transmitted in a frame (300), the network part (100A to 100D) being arranged to allocate downlink transmission power in at least two timeslots (302A to 302D) to a given terminal

(102A to 102F) from timeslots (302A to 302D) determined by said frame (300), **characterized** in that:

the network part (100A to 100D) is arranged to produce the transmission power of a transmission to a terminal (102A to 102F) timeslot-specifically such that the power ratio of the transmission power of a radio transmission to the terminal (102A to 102F) in each timeslot (302A to 302D) and the interference power caused by transmissions to other terminals (102A to 102F) exceeds a threshold value preset on the power ratio in the timeslot (302A to 302D).

20. A radio system as claimed in claim 19, **characterized** in that the network part comprises one or more of the following: one or more base stations, one or more base station controllers.

21. A radio system as claimed in claim 19, **characterized** in that the network part is arranged to determine the threshold value set on the power ratio based on the service to be sent in the timeslot.

22. A radio system as claimed in claim 19, **characterized** in that the network part is arranged to determine the threshold value set on the power ratio based on the service class of the terminal.

23. A radio system as claimed in claim 19, **characterized** in that:

the terminal is arranged to measure, in a timeslot in which transmission power is allocated to the terminal, the signal strength of a transmission directed to the terminal and the interfering signal strength of the timeslot;

the terminal is arranged to measure the signal-to-interference ratio of signal strength to interfering signal strength;

the terminal is arranged to compare the signal-to-interference ratio with a preset threshold value, and if the signal-to-interference ratio is at least equal to the threshold value, to send a power adjust command to the network part;

the network part is arranged to adjust the transmission power of transmissions addressed to the terminal based on the power adjust command in all those timeslots of the next frame in which transmission power is allocated to the terminal.

24. A radio system as claimed in claim 23, **characterized** in that the network part is arranged to send information to the terminal and the terminal is arranged to receive information from the network part indicating in

which timeslot the signal-to-interference ratio is to be measured.

25. A radio system as claimed in claim 19, **characterized** in that the radio system is a radio system using the code division multiple access method, wherein the transmissions of different terminals in a timeslot are separated based on individual spreading codes allocated to the terminals.

26. A radio system as claimed in claim 19, **characterized** in that the uplink and downlink transmission directions are separated from one another in the radio system using time division duplex (TDD).

27. A radio system as claimed in claim 19, **characterized** in that the network part is arranged to receive a measurement report on the signal-to-interference ratio (SIR) from the terminal regarding all those timeslots in a frame in which transmission power is allocated to the terminal;

the network part is arranged to use the measurement report received from the terminal in determining the transmission power of the transmission of the frame to be sent next and directed to the terminal.

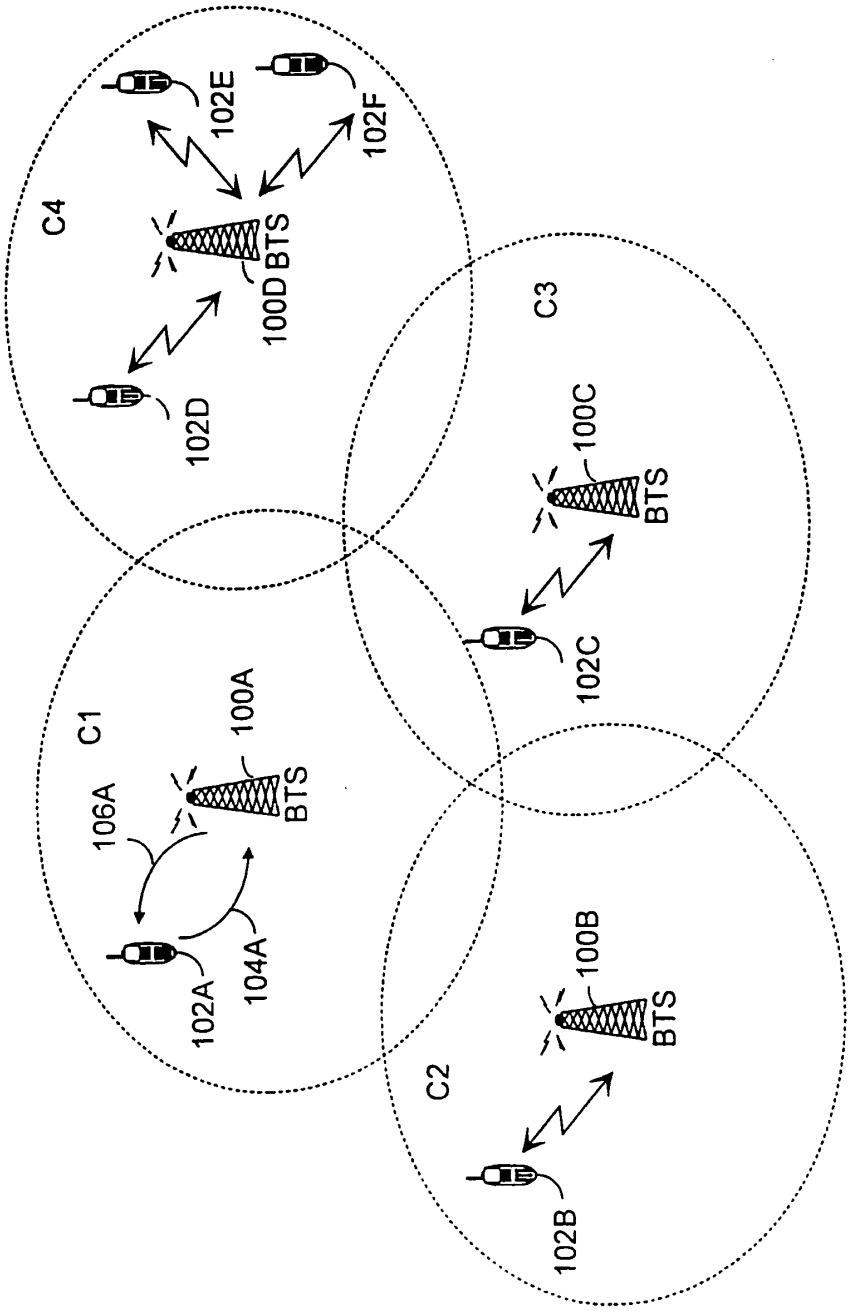


FIG. 1

EX1002 - Page 356

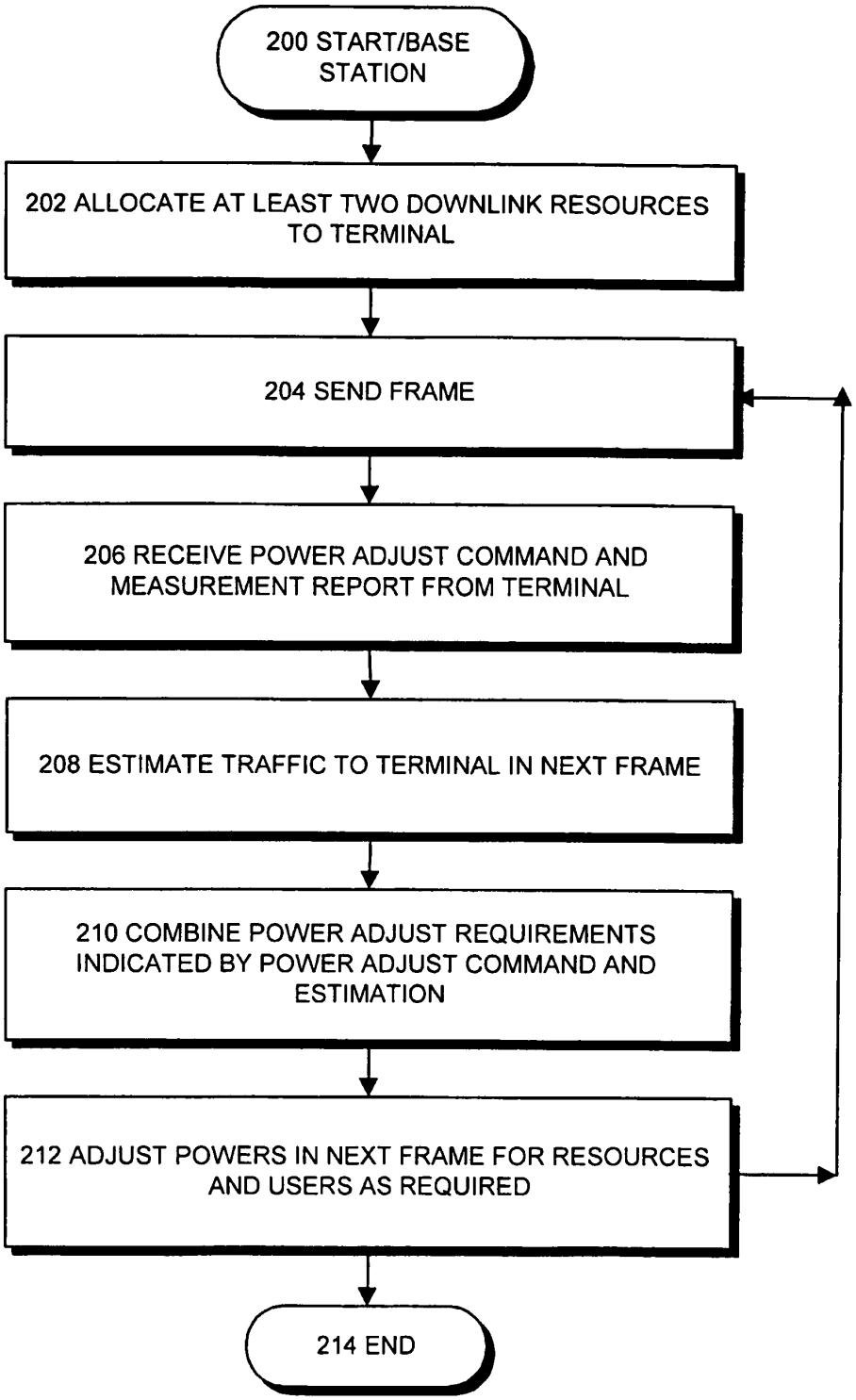

200 START/BASE STATION
202 ALLOCATE AT LEAST TWO DOWNLINK RESOURCES TO TERMINAL
204 SEND FRAME
206 RECEIVE POWER ADJUST COMMAND AND MEASUREMENT REPORT FROM TERMINAL
208 ESTIMATE TRAFFIC TO TERMINAL IN NEXT FRAME
210 COMBINE POWER ADJUST REQUIREMENTS INDICATED BY POWER ADJUST COMMAND AND ESTIMATION
212 ADJUST POWERS IN NEXT FRAME FOR RESOURCES AND USERS AS REQUIRED
214 END

FIG. 2

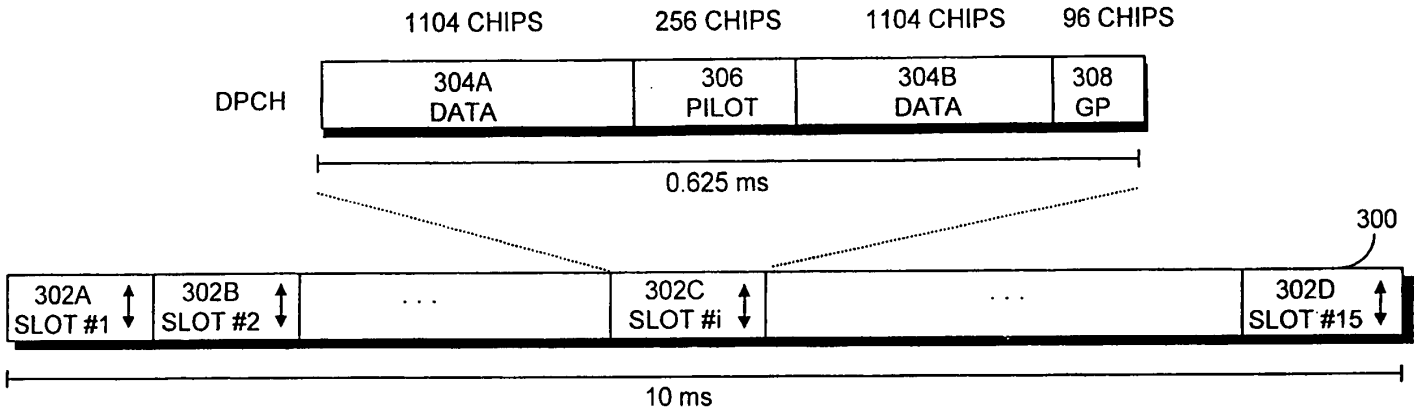

1104 CHIPS
256 CHIPS
1104 CHIPS
96 CHIPS
DPCH
304A DATA
306 PILOT
304B DATA
308 GP
0.625 ms
300
302A SLOT #1
302B SLOT #2
. . .
302C SLOT #i
. . .
302D SLOT #15
10 ms

FIG. 3

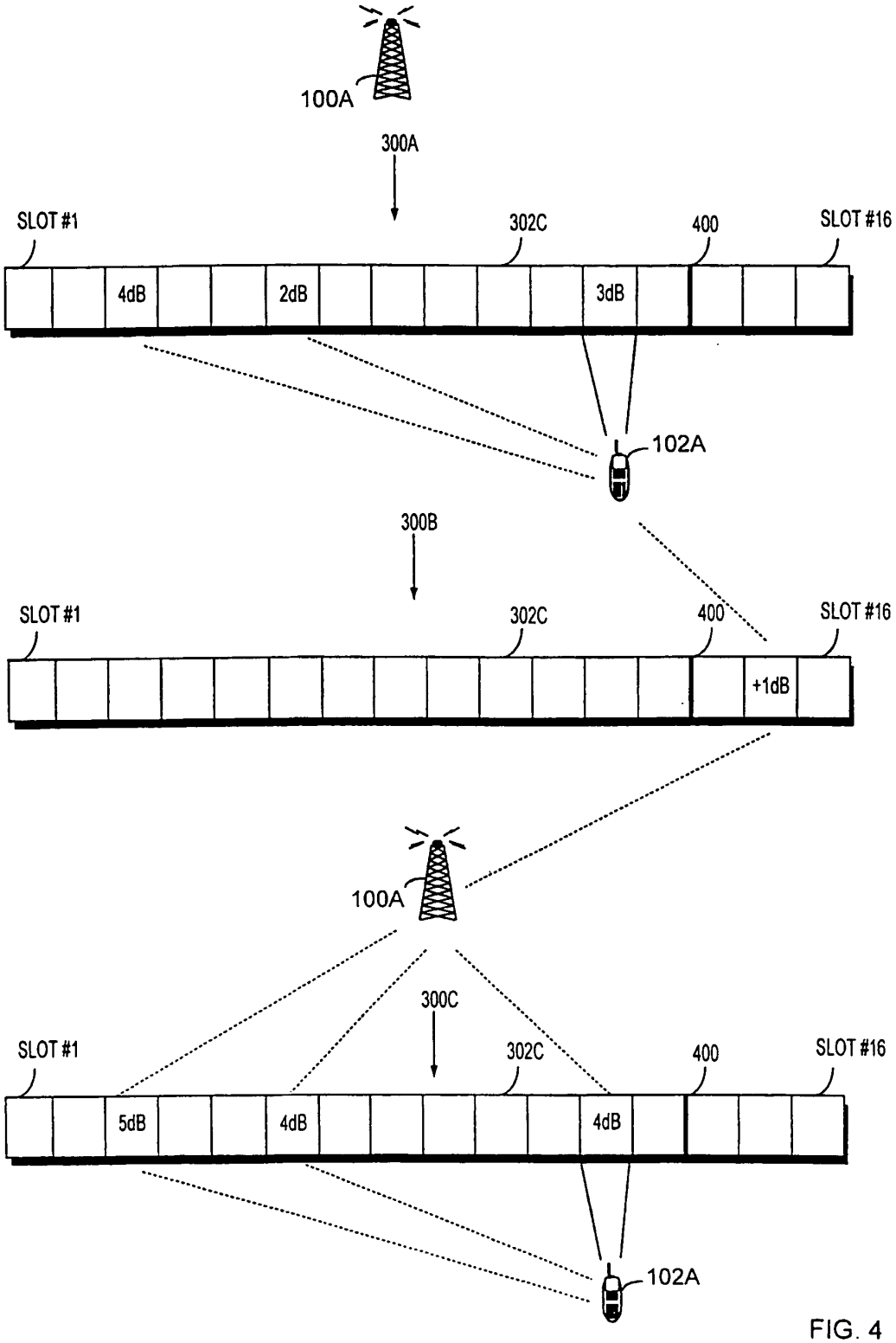

100A
300A
SLOT #1
302C
400
SLOT #16
4dB
2dB
3dB
102A
300B
SLOT #1
302C
400
SLOT #16
+1dB
100A
300C
SLOT #1
302C
400
SLOT #16
5dB
4dB
4dB
102A

FIG. 4

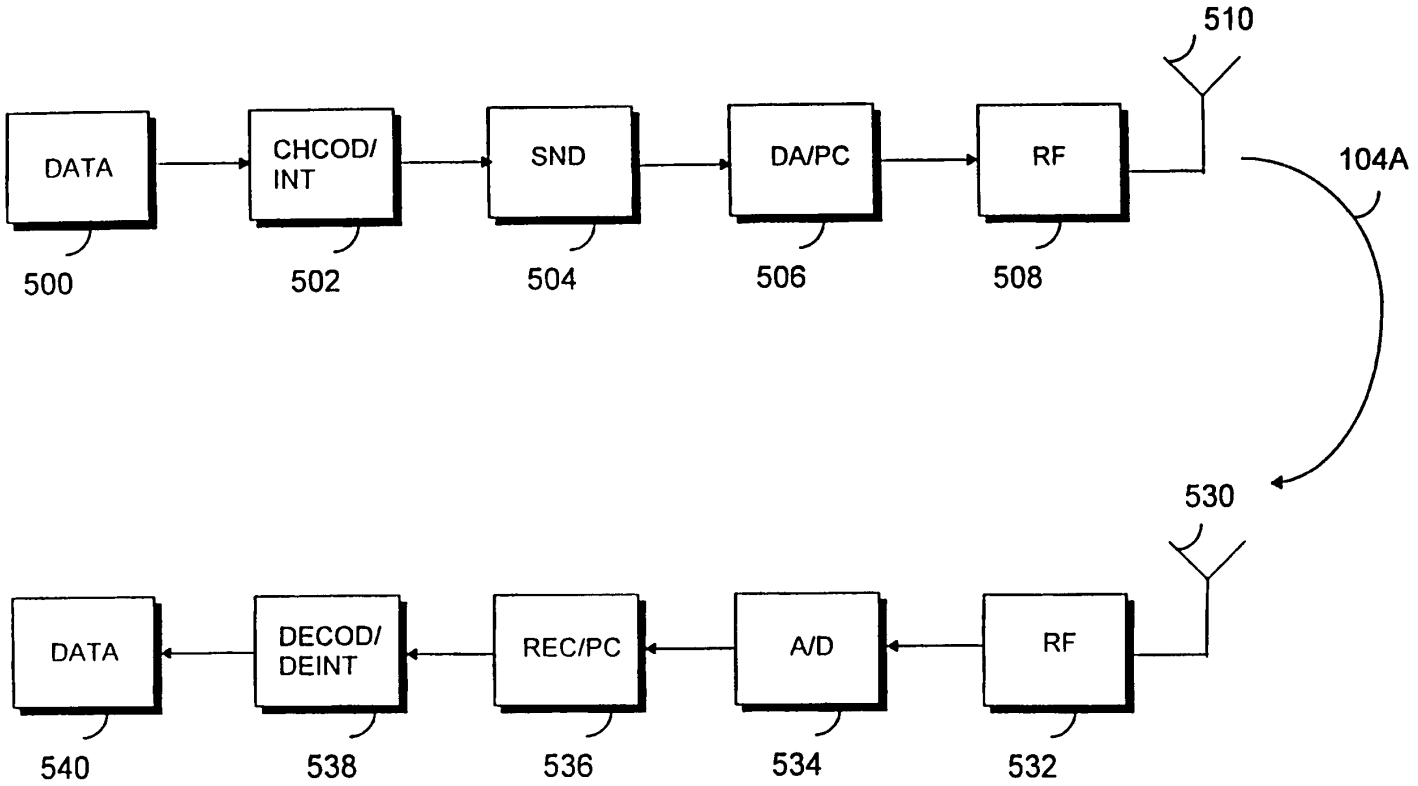

DATA
CHCOD/ INT
SND
DA/PC
RF
510
104A
530
DATA
DECOD/ DEINT
REC/PC
A/D
RF
500
502
504
506
508
540
538
536
534
532

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 01/00450

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04B 7/005, H04B 7/26
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)

IPC7: H04B, H04Q

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

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, INTERNET, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0923202 A2 (SONY CORPORATION), 16 June 1999 (16.06.99), column 9, line 45 - column 14, line 53 --	1-27
A	EP 0948221 A2 (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.), 6 October 1999 (06.10.99), abstract, claims --	1-27
A	US 607086 A (VASIC DOBRICA), 30 May 2000 (30.05.00), column 3, line 27 - column 4, line 47 -- --------	1-27

☐ 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	Date of mailing of the international search report
17 August 2001	23 -08- 2001
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer FREDRIK BLOMQVIST/EE Telephone No. +46 8 782 25 00

Form PCT/ISA.210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT
Information on patent family members

02/07/01

International application No.
PCT/FI 01/00450

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0923202 A2	16/06/99	JP 11178050 A	02/07/99
EP 0948221 A2	06/10/99	CN 1233117 A	27/10/99
		JP 11261544 A	24/09/99
US 607086 A	30/05/00	NONE	

Form PCT/ISA/210 (patent family annex) (July 1998)

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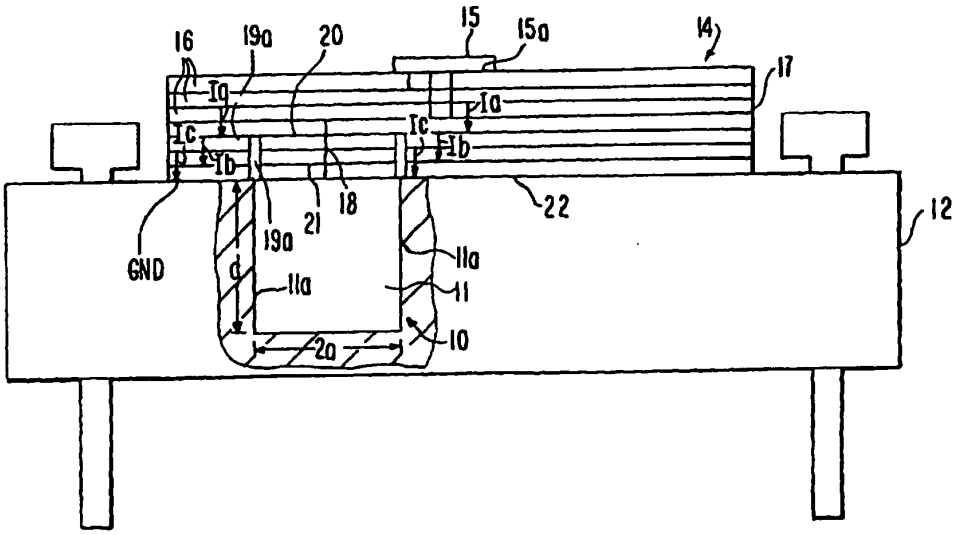
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Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: RESONATOR STRUCTURE EMBEDDED IN MECHANICAL STRUCTURE



(57) Abstract: An assembly for supporting a substrate of an integrated circuit and forming a cavity resonator with the substrate. The assembly includes a baseplate in which a cavity for the cavity resonator is integrally formed. A substrate is mounted over the cavity resonator in the baseplate and an excitation coupling extends into the cavity of the cavity resonator.

WO 01/50544 A1

Resonator Structure Embedded in Mechanical Structure

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a resonator incorporated in a baseplate of an integrated circuit module.

2. Description of the Related Art

Waveguide resonators are designed to operate at a resonant or natural frequency and store oscillating energy that is oscillating at or near the resonant frequency for time periods that are long relative to a period of the resonant frequency. Oscillating energy that is not oscillating at or near the resonant frequency is not stored for an appreciable amount of time. Resonators are described in terms of their quality factor Q which is dependent on a ratio of the maximum stored energy to the energy dissipated per cycle at a given frequency. Cavity resonators generally exhibit the highest Q values. However, the size of the cavity required to produce the desired resonant frequency makes it difficult to mount and connect to an integrated circuit module. For this reason, thin film resonators and dielectric resonators are used instead of cavity resonators because they are easier to attach to integrated circuit modules as discrete components. The use of thin film resonators or dielectric resonators instead of cavity resonators facilitates installation of the resonator on an integrated circuit module at the expense of having a lower Q value.

A prior art filter having cavity resonators is disclosed in U.S. Patent No. 5,799,247 for use with radio equipment in which cavity resonators are included

in the design of a shell for the body of the radio equipment. In this device, the shell is designed to include the required size of the cavity. To accommodate the depth of the cavity, which is larger than the thickness of the shell, the shell includes an expanded portion formed with a large enough depth to house the cavity. Accordingly, the shell must be specifically designed for the cavity for a specific circuit. If a resonator with different characteristics is to be used, i.e., for a different application, a new shell must be designed. Furthermore, the printed circuit board on which the circuit is arranged is connected to a different portion of the shell. Therefore, the resonator still requires external connections to both the input and output of the resonator.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a cavity resonator as an integral part of an electronic module.

The object of the present invention is achieved by an assembly for supporting a substrate of an integrated circuit that includes a baseplate for supporting the substrate and a cavity resonator having a cavity embedded in the baseplate. An excitation coupling of the cavity resonator is connectable to the integrated circuit of the substrate that is supportable on the baseplate. The substrate itself is mounted on the baseplate so that it covers the cavity and is therefore, an integral part of the cavity. The substrate may comprise a multi-layer substrate such as a laminate printed circuit board, a ceramic circuit board, or a thin film circuit board.

The baseplate comprises a material consisting of one of Kovar, CuW, and CuMo. The cavity of the cavity resonator may be circular or rectangular. However, a circular shape is preferred because it is easier to machine into the baseplate.

A tuner, such as a screw plunger, may be arranged in said baseplate for adjusting the resonant frequency of the cavity resonator.

The integrated circuit is mounted on the substrate and may be one of a flip chip, a bond chip, and a monolithic microwave integrated circuit.

The assembly of the present invention may further comprise a metal structure on which the baseplate is mounted. The metal structure may be a heat sink for the integrated circuit and substrate. Furthermore, the metal structure may include a waveguide for connecting the substrate to a further component, such as an antenna filter of a transmitter or receiver.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of the disclosure. For a better understanding of the invention, its operating advantages, and specific objects attained by its use, reference should be had to the drawing and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

Fig. 1 shows a multi-chip module mounted on a baseplate having an integrated cavity resonator according to an embodiment of the present invention;

Figs. 1a-1c show various layers of the multi-chip module of Fig. 1 above the cavity resonator; and

Fig. 2 shows a multi-chip module mounted on a baseplate and further connected to a further support according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

Fig. 1 shows an arrangement of a cavity 11 for a cavity resonator 10 integrated into a baseplate 12 on which a multi-chip module (MCM) 14 is mounted. The MCM 14 comprises an integrated circuit 15 mounted on a substrate 17. The integrated circuit 15 may comprise any type of circuit requiring a resonator such as, for example, a voltage controlled oscillator (VCO) or a filter. The integrated circuit 15 is connected to the cavity resonator 10 via an excitation coupling 18. The substrate 17 closes the cavity 11 and includes vias 19, i.e., passages through multiple layers of the substrate 17. The vias 19 are arranged so that the bottom of each of the vias is in communication with walls 11a of the cavity 11. The vias 19 may be, for example, 100-200 μm in diameter and may be arranged along the wall 11a of the cavity 11 at a pitch of, for example, 200-450 μm. The vias 19 each have a via wall 19a which extend the wall 11a of the cavity 11 inside the MCM 14. If the cavity 11 is circular, the vias 19 also form a circular frame in the MCM 14 (See Figs. 1a-1c). Accordingly, the substrate 17 forms a part of the cavity 11. In Fig. 1, the integrated circuit 15 is shown as a bonding or flip chip. However, the integrated circuit may comprise a Monolithic Microwave Integrated Circuit (MMIC) chip.

The MCM 14 includes a plurality of layers 16 between which the various conductors are arranged for interconnecting the various parts of the integrated circuit 15 to various signals including, but not limited to, external voltage sources, grounds, control signals, and the cavity resonator 10 input signal via a connection to the excitation coupling 18. As shown in Fig. 1a, the top of the vias 19 are connected by a grounded conductor 20 between two layers 16 which covers the area above the cavity 11 except for a void 20a around the excitation coupling 18. It should be noted that the excitation coupling 18 does not have to be centered with respect to the middle of the cavity 11. Referring to Fig. 1b, one or more of the vias 19 may be connected to the excitation coupling by a connector 21 running between two layers of the substrate 17 between the top and the bottom of the vias 19. Fig. 1c show that the bottom of the vias 19 are connected to a ground 22 arranged on the bottom of the substrate 17 and which surrounds the cavity 11. The integrated circuit 15 may, for example, be connected to the excitation coupling conductor via a ball connection. However, any other known connection for connection an integrated circuit to a substrate may also be used.

The cavity resonator 10 comprises a cavity 11 which may, for example, be a circular or rectangular in shape. However, a circular resonator is preferable because the circular shape is easier to machine into the baseplate 12. The baseplate 12 comprises a material that has a coefficient of thermal expansion value that is similar to the coefficient of thermal expansion value of the MCM 14. Therefore, when the MCM 14 comprises ceramic materials, the baseplate 12 may for example comprise Kovar, CuW, or CuMo. Of course, the baseplate

12 may comprise other materials having a coefficient of thermal expansion that is similar to the MCM 14, especially when the MCM 14 comprises materials other than ceramics such as a laminate or silicon. In the present invention, the multi-layer MCM 14 is an integral part of the resonator 10. Only one port of the cavity resonator 10 is connected to the integrated circuit 15 via the excitation coupling 18. The second port is connected to the substrate 17 of the MCM 14. The substrate 17 of the MCM 14 may comprise a laminate printed circuit board in which the layers 16 are glass fiber and epoxy, a ceramic circuit board in which the layers 16 comprise ceramic layers, and a thin film circuit board in which the layers 16 comprise thin films.

In the embodiment of the present invention shown in Fig. 2, a cavity 41 of a cavity resonator 40 is required to be deeper than the thickness of a baseplate 42. Therefore, the cavity resonator 40 may be arranged so that it extends through the baseplate 42 and into a support 50 on which the baseplate 42 is mounted. The structure including the baseplate 42 and the support 50 is used in transmitters and receivers located on point-to-point and point-to-multipoint radio links, i.e., base stations. The cavity 41 has walls 41a that are connected to an MCM 44 having layers 46 using vias 49. Furthermore, an excitation coupling 48 connects the cavity resonator 40 to an integrated circuit 45. The vias 49, MCM 44, excitation coupling 48 and integrated circuit 45 function the same as the vias 19, MCM 14, excitation coupling 18 and integrated circuit 15 described above with reference to Fig. 1.

Fig. 2 further shows that the support 50 to which the baseplate 42 is attached may be used for

supporting another function of the integrated circuit 45. For example, the structure 50 may comprise a metal heat sink and may also include a waveguide 52 to a further component such as an antenna filter for a transmitter or receiver.

Furthermore, the cavity resonator 40 may be tuned using a tuner such as a screw plunger 54 as shown in Fig. 2. The use of a screw plunger 54 as a cavity tuner may also be implemented in the Fig. 1 embodiment.

Referring to Figs. 1 and 2, a first specific example of a cavity resonator constructed in accordance with the present invention includes a TM010 circular-type resonator with dimensions a=10mm, d=10 mm and may be excited with either a loop or a sonde excitation loop. A second specific example of a resonator includes a TE111 circular-type resonator with dimensions a=25.5, d=16 mm which may be excited with a loop coupling. Instead of the couplings depicted, any other known excitation couplings may also be used. The examples mentioned may be implemented in the cavity resonator 10 in Fig. 1 or the cavity resonator 40 shown in Fig. 2.

Thus, while there have shown and described and pointed out fundamental novel features of the invention as applied to preferred embodiments thereof, it will be understood that various omissions and substitutions and changes in the form and details of the methods disclosed and devices illustrated, and in their operation, may be made by those skilled in the art without departing from the spirit of the invention. For example, it is expressly intended that all combinations of those elements which perform substantially the same function in substantially the same way to achieve the same results are within the scope of the invention. It is also to be understood that the drawings are not

necessarily drawn to scale but that they are merely conceptual in nature. Moreover, it should be recognized that structures and/or elements shown and/or described in connection with any disclosed form or embodiment of the invention may be incorporated in any other disclosed or described or suggested form or embodiment as a general matter of design choice. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto.

CLAIMS

1. An assembly for supporting a substrate of an integrated circuit so as to form a resonator cavity, comprising a baseplate having an upper surface onto which the substrate of the integrated circuit is mountable, a cavity being formed in said baseplate, the cavity having an open end in the upper surface of said baseplate, the substrate of the integrated circuit closing the open end of the cavity in said baseplate when the substrate is mounted on the upper surface of the baseplate so that the cavity is suitable for use as a cavity resonator.

2. The assembly of claim 1, wherein said baseplate comprises a material consisting of one of Kovar, CuW, and CuMo.

3. The assembly of claim 1, wherein said cavity comprises a shape consisting of one of a circle and rectangle.

4. The assembly of claim 1, further comprising a tuner arranged in said baseplate for adjusting a resonant frequency of said cavity resonator.

5. The assembly of claim 4, wherein said tuner comprises a screw plunger insertable into said cavity through said baseplate.

6. The assembly of claim 1, in combination with a substrate on which the integrated circuit is mountable, said substrate being mounted on said baseplate and covering said open end of said cavity so

that said substrate closes said open end and thereby forms a part of said cavity of said cavity resonator.

7. The assembly of claim 6, wherein said substrate comprises of plurality of layers and a plurality of vias extending upward from a bottom of said substrate, each said plural vias having an upper end, a bottom end, and via walls and being arranged such that a bottom of each of said plural via walls is in communication with said side wall of said cavity, said plural vias thereby extending said cavity into said substrate such that said substrate comprises a part of said cavity.

8. The assembly of claim 7, wherein each said plural vias comprises a diameter within the range including 100-200μm.

9. The assembly of claim 7, wherein said plural vias are arranged about an upper perimeter of said cavity at a pitch within the range including 200-450μm.

10. The assembly of claim 7, further comprising a connector arranged between two of said plural layers for connecting the upper ends of said plural vias.

11. The assembly of claim 10, wherein said plural vias are connected to an electrical ground in said substrate.

12. The assembly of claim 10, wherein said substrate further comprises an excitation coupling extending between said plural vias.

13. The assembly of claim 12, wherein said excitation coupling is connected to one of said plural vias by a conductor arranged between two of said plural layers.

14. The assembly of claim 7, in combination with an integrated circuit mounted on said substrate and connected to said cavity resonator via an excitation coupling, said integrated circuit comprising one of a flip chip, a bond chip, and a monolithic microwave integrated circuit.

15. The assembly of claim 14, wherein said integrated circuit comprises a voltage controlled oscillator.

16. The assembly of claim 6, further comprising a metal structure, wherein said baseplate is mounted on said metal structure and said cavity extends from said surface area through said baseplate and into said metal structure.

17. The assembly of claim 16, wherein said metal structure comprises a heat sink.

18. The assembly of claim 16, wherein said metal structure further comprises a waveguide for connection to a further component.

19. The assembly of claim 16, wherein said baseplate comprises a material consisting of one of Kovar, CuW, and CuMo.

20. The assembly of claim 16, wherein said cavity comprises a shape consisting of one of a circular and rectangular shape.

21. The assembly of claim 16, further comprising a tuner arranged in said baseplate for adjusting a resonant frequency of said cavity resonator.

22. The assembly of claim 21, wherein said tuner comprises a screw plunger insertable into said cavity through said baseplate.

23. The assembly of claim 16, wherein said substrate comprises of plurality of layers and a plurality of vias extending upward from a bottom of said substrate, each said plural vias having an upper end, a bottom end, and via walls and being arranged such that a bottom of each of said plural via walls is in communication with said side wall of said cavity, said plural vias thereby extending said cavity into said substrate such that said substrate comprises a part of said cavity.

24. The assembly of claim 23, wherein each said plural vias comprises a diameter within the range including 100-200μm.

25. The assembly of claim 23, wherein said plural vias are arranged about an upper perimeter of

said cavity at a pitch within the range including 200-450μm.

26. The assembly of claim 23, further comprising a connector arranged between two of said plural layers for connecting the upper ends of said plural vias.

27. The assembly of claim 26, wherein said plural vias are connected to an electrical ground in said substrate.

28. The assembly of claim 26, wherein said substrate further comprises an excitation coupling extending between said plural vias.

29. The assembly of claim 28, wherein said excitation coupling is connected to one of said plural vias by a conductor arranged between two of said plural layers.

30. The assembly of claim 16, in combination with an integrated circuit mounted on said substrate and connected to said cavity resonator via an excitation coupling, said integrated circuit comprising one of a flip chip, a bond chip, and a monolithic microwave integrated circuit.

31. The assembly of claim 30, wherein said integrated circuit comprises a voltage controlled oscillator.

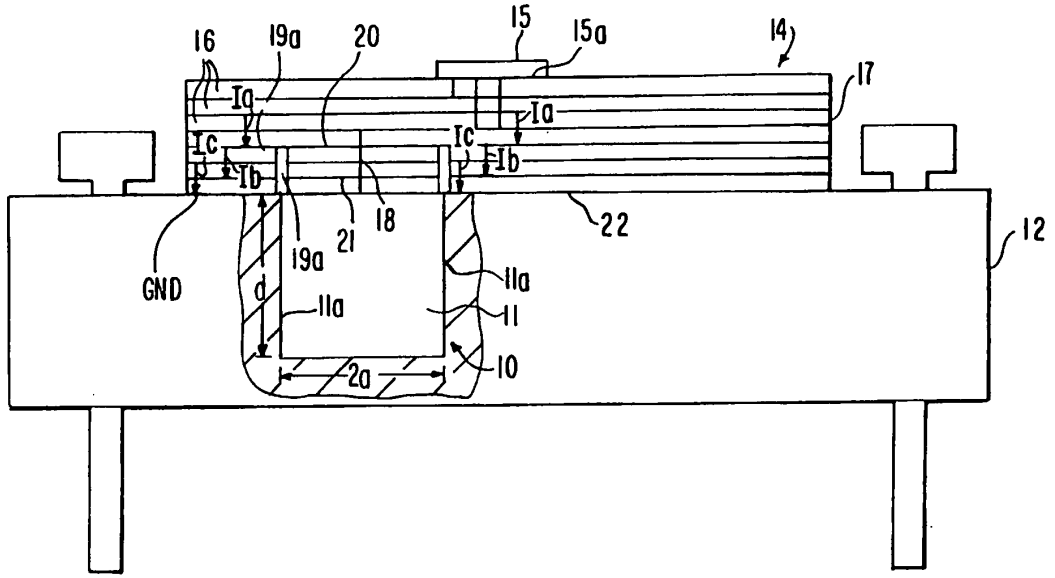


FIG.1

FIG. 1a

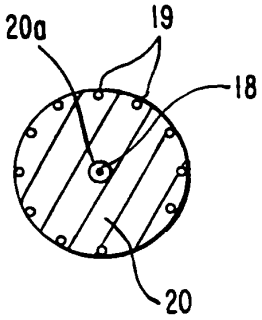


FIG. 1b

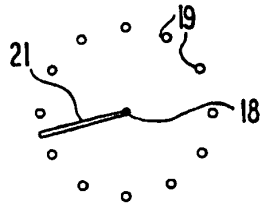


FIG. 1c

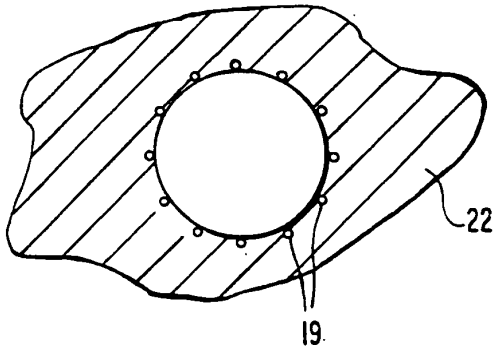
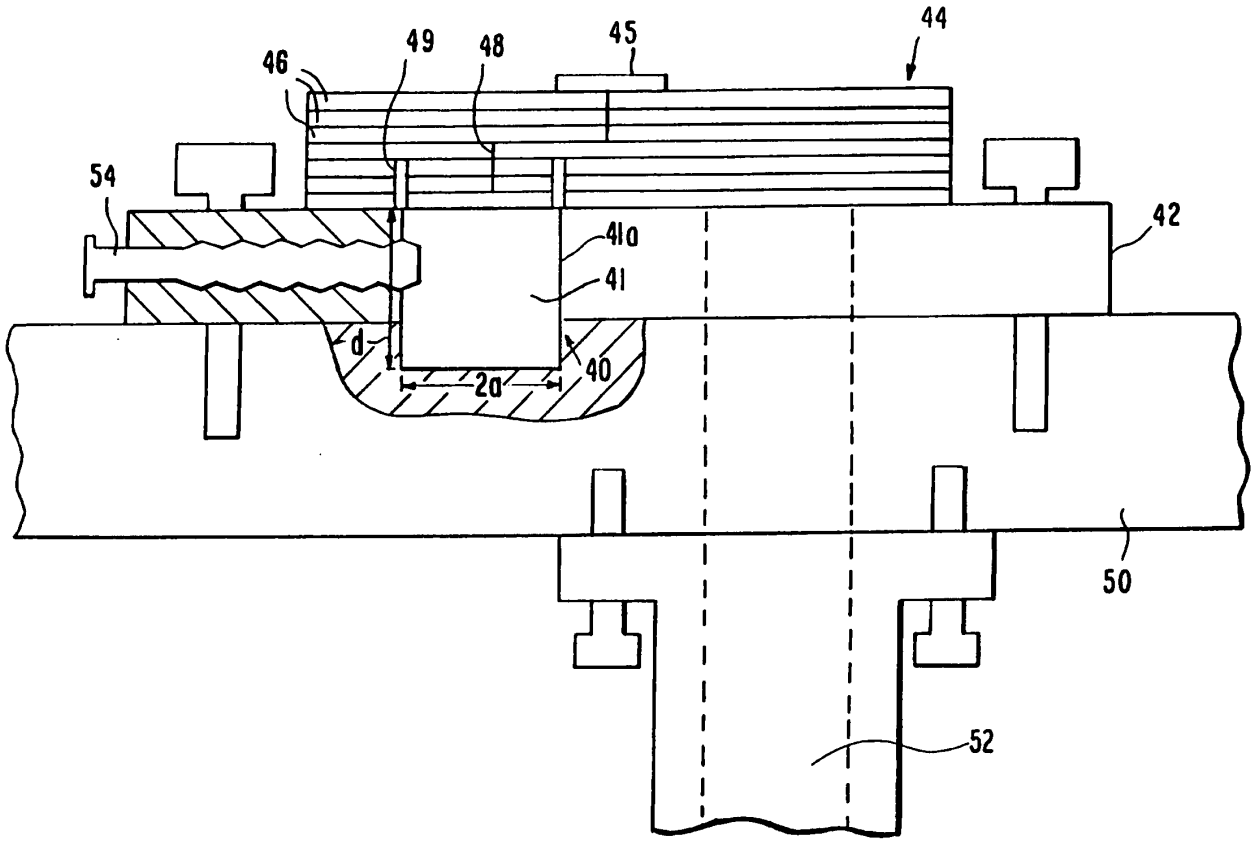


FIG. 2



INTERNATIONAL SEARCH REPORT

Intern ıal Application No
PCT/IB 00/01498

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01P7/06

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)
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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, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	I. SONG ET AL.: "PHASE NOISE ENHANCEMENT OF THE GAAS HIGH ELECTRON MOBILITY TRANSISTORS USING MICROMACHINED CAVITY RESONATORS AT KA-BAND" JAPANESE JOURNAL OF APPLIED PHYSICS (LETTERS), vol. 38, no. 6A/B, 15 June 1999 (1999-06-15), pages L601-L602, XP000902417 PUBLICATION OFFICE JAPANESE JOURNAL OF APPLIED PHYSICS. TOKYO., JP ISSN: 0021-4922 page L601, left-hand column, line 20 - line 42; figure 1 --- -/--	1,3

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

[X] Patent family members are listed in 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

"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	Date of mailing of the international search report
10 January 2001	19/01/2001

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

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INTERNATIONAL SEARCH REPORT

Intern ıal Application No
PCT/IB 00/01498

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4 758 922 A (ISHIGAKI ET AL.) 19 July 1988 (1988-07-19) column 3, line 4 -column 4, line 59; figures 1-3	1,3
A	US 5 821 836 A (KATEHI ET AL.) 13 October 1998 (1998-10-13) column 2, line 4 -column 5, line 67; figures 1-3	1,3
A	EP 0 963 001 A (MATSUSHITA ELECTRIC IND. CO. LTD.) 8 December 1999 (1999-12-08) column 3, line 32 -column 4, line 40; figures 1A,B	1

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

....ormation on patent family members

Interr ...al Application No
PCT/IB 00/01498

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4758922 A	19-07-1988	JP 63209305 A	30-08-1988
		JP 63237596 A	04-10-1988
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US 5821836 A	13-10-1998	NONE	
EP 0963001 A	08-12-1999	JP 11346103 A	14-12-1999

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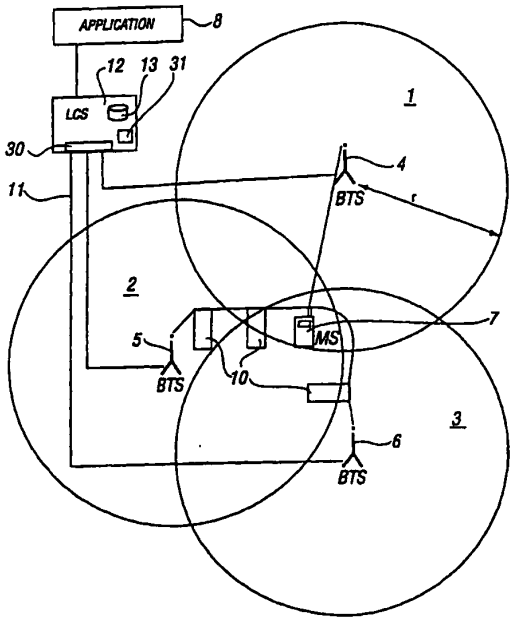
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[Continued on next page]

(54) Title: A TELECOMMUNICATIONS SYSTEM



(57) Abstract: A telecommunications system and a method for use in a telecommunications system is disclosed. The system comprises at least one station, means for determining the location of said station in said system, and means for providing information on said location of said station to a location service client. The system is also provided with means for defining in dependence on information relating to the client, the accuracy of the location information to be provided to the client. Different accuracy classes can be provided.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

A TELECOMMUNICATIONS SYSTEM

FIELD OF THE INVENTION

The present invention relates to telecommunications system and in particular but not exclusively to a wireless cellular telecommunications network.

BACKGROUND OF THE INVENTION

A cellular telecommunications system is based around cells or similar radio coverage areas. Examples of cellular telecommunications systems include standards such as the GSM (Global System for Mobile communications) or various GSM based systems (such as GPRS: General Packet Radio Service), AMPS (American Mobile Phone System) or DAMPS (Digital AMPS) or third generation standards based typically on the WCDMA (Wideband Code Division Multiple Access), such as the UMTS (Universal Mobile Telecommunications System) etc. In general, a cell coverage area or a base station coverage area of a cellular telecommunications system can be defined as a certain geographically limited area covered by one or several base transceiver stations (BTS) serving mobile stations (MS) via an air or radio interface and usually connected to a base station subsystem (BSS). Each of the coverage areas can be controlled by an appropriate controller apparatus. For example, in the WCDMA based systems each cell is controlled by at least one radio network controller (RNC) and in the GSM standard each cell is controlled by at least one mobile switching center (MSC). The controller is connected further to a gateway or linking apparatus, such as a serving GPRS support node (SGSN) or gateway mobile switching center (GSMC), linking the cell to the other parts of the communication system. Several cells cover a larger area, and form together the coverage area of a cellular telecommunications network.

The mobile station (MS) or similar user equipment (UE) within one of the cells of the telecommunications system is correspondingly controlled by the controller of the given cell. Even though the MS may be controlled by only one controller at time, it may also be connected simultaneously to several controllers, e.g. when the cells

overlap or in the so called soft handoff mode, where the MS may be in simultaneous communication with two base stations, and those base stations may be connected to different controllers. One of these controllers can be defined as the serving (main) controller whereas the others act as secondary controllers.

In the context of the location of a mobile station, and thus the user thereof, the use of cells or similar geographically limited radio coverage areas and associated controllers facilitates the cellular telecommunications system to produce at least a rough location information estimate concerning the current location of an individual mobile station. More particularly, the cellular telecommunications system is always aware of the current location of such mobile stations which are communicating with at least one of the base stations of the system and thus registered within at least one of the controllers of the system (i.e. are located within the area of one cell of the system). This information is available even when the mobile station is located within a coverage area of a visited or "foreign" network, as the visited network is capable of transmitting the location of the mobile station back to the home location register, e.g. for the purposes of routing and charging.

This location information could also be used for other purposes than solely for call processing (routing, charging, resource allocation etc.). There are several possible commercial and non-commercial applications which could use this location information if it were readily available. These possible applications include different local advertisement and information distribution schemes (e.g. transmission of information directed to those mobile users only who are currently within a certain area), area related WWW-pages (such as time tables, local restaurants, shop or hotel guides, maps local advertisements etc.) for the users of mobile data processing devices, location of those who have called to an emergency number and tracking of mobile users by anyone who wishes to receive this information and is legally entitled to obtain it. An application requiring precise and real-time location information of the movement of a mobile station is a mobile station movement prediction feature that could be utilized, for example, in dynamic network resource allocation. There are various other possible uses of the location information and applications, which could use the location information. All applications, which need location information relating

to the geographical location of the mobile station, could find the location information provided by means of a telecommunications system useful. The usability of this location information could even be substantially increased by improving the accuracy of the location information provided by the telecommunications system.

There is a proposal for a location service feature provided by means of a cellular telecommunications network which could provide the last known location of a mobile station together with a time-stamp. This feature can be provided by a separate network element or server which receives the information from the various controllers of the system. For example, in the GSM this information can be obtained from a Visitor Location Register (VLR) of the visited MSC or the Home location Register (HLR) of the home network. This proposal would give the location to an accuracy of one base station or cell, i.e. it would indicate that the mobile station is (or at least was) within the coverage area of a certain base station or cell. When the last coverage area within which the mobile station is positioned is known by the system, an appropriate processor facility may then define the rough geographical location of the mobile station on the basis of the radio coverage area information.

The accuracy of the location determination can be improved by utilizing results of measurements which define the travel time (or travel time differences) of the radio signal sent by the mobile station to the base station. The measurements are preferably accomplished by at least three different base stations covering the area in which the mobile station is currently located. The measurement by each of the three base stations gives the distance (range) between the base station and the mobile station or distance difference (range difference) between the mobile station and two base stations. Each of the range measurements generates a circle centered at the measuring base station. Each of the range difference measurement creates a hyperbola (not a circle as in the range measurements). Thus if range differences are used in the location calculation, the intersections of the hyperbolas are searched for. In an ideal case and in the absence of any measurement error, the intersection of the three circles by the three base stations or the hyperbolas would unambiguously determine the location of the mobile station.

SUMMARY OF THE INVENTION

According to one aspect of the present invention, there is provided a telecommunications system comprising at least one station; means for determining the location of said station; means for providing information on said location of said station to a location service client; and means for defining in dependence on information relating to the client, the accuracy of the location information to be provided to the client.

According to a second aspect of the present invention, there is provided a method for use in a telecommunications system comprising the steps of determining the location of a station in said system; providing information on said location of said station to a location service client; and defining the accuracy of the location information to be provided to the client in dependence on information relating to the client.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention and as to how the same can be carried into effect, reference will now be made by way of example to the accompanying drawings in which:

Figure 1 shows a schematic diagram of three radio coverage areas of a cellular telecommunications system in which the embodiments of the invention can be implemented;

Figure 2 shows two radio coverage areas provided by sector antennas;

Figure 3 illustrates one possible functional diagram for a location server; and

Figure 4 shows a partially sectioned view of a mobile station apparatus embodying the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will first be made to Figure 1 in which three base stations provide omnidirectional radio coverage areas 1, 2 and 3 of a telecommunications network. It

is noted that even though the exemplifying telecommunications network shown and described in more detail in the following uses the terminology of a GSM (Global System for Mobile communications) public land mobile network (PLMN), it should be appreciated that the proposed solution can be used in any system providing communications between a transmitting station and a receiving station. It should also be appreciated that even though Figure 1 shows three base station coverage areas, the invention can be implemented using one, two or more than three coverage areas. The coverage areas 1, 2 and 3 can also be, instead of base station coverage areas, three cell coverage areas of the mobile telecommunications network, wherein the coverage area of one cell can include more than one base station. It is also possible to group cells such that one coverage area comprises more than one cell (For example, an URA (UMTS Terrestrial Radio Access Network Registration Area) consists of a group of cells).

Figure 2 shows two radio coverage areas 16 and 17 which consist of sectors of base stations 14 and 15 provided with directional or sector antennas. The base stations may use e.g. three 120° directional antennas whereby three radio coverage areas are provided, or four 90° directional antennas providing four radio coverage areas and so on, or any combinations of different radio coverage beam widths.

In Figure 1 each radio coverage area 1, 2 and 3 is served by the respective base transceiver station (BTS) 4, 5 and 6. More particularly, each base transceiver station BTS is arranged to transmit signals to and receive signals from the mobile station (MS) 7. Likewise, the mobile station 7 is able to transmit signals to and receive signals from the respective base transceiver station. The mobile station 7 accomplishes this via wireless communication with the base stations. Typically a number of mobile stations will be in communication with each base station although only one mobile station is shown in Figure 1 for clarity. Each of the base stations is connected to a respective network controller (not shown), which in the exemplifying GSM system is a Mobile Services Switching Center (MSC). It is noted that more than one base station can be connected to each controller. Typically more than one controller is also provided in a network. The controller is connected to other elements of the network via a suitable linking or gateway apparatus (not shown), such as

Gateway Mobile Switching Center (GMSC) or a serving GPRS Support Node (SGSN).

The mobile station 7 is able to move from one coverage area to another coverage area. The location of the mobile station 7 may thus vary in time as the mobile station is free to move from one location (base station coverage area or cell coverage area) to another location (to another coverage area) and also within one coverage area.

Figure 1 also shows a Location Services (LCS) node 12 providing Location (LC) services for different applications or clients 8 who are entitled to receive at least some degree of information concerning the location (or location history) of a mobile station. Figure 3 illustrates in more detail one proposal according to ETSI (European telecommunications Standards Institute) technical specification "Location Services" (T1P1.5/99-048r4) for the functional diagram of the location server 12. In general terms, the LCS functionality can be defined as a feature capable of providing information concerning the location of the MS, and more particularly, the location defined on the basis of the position of the mobile station relative to the base station(s) of the mobile telecommunications network.

The location server node 12 is arranged to receive, by receiving means 30, predefined information concerning the location of the mobile station 7 and to process this information and/or some other predefined parameters and/or to compute by processor means 31 appropriate calculations for determining and outputting the geographical location of the given mobile station 7. The location server node 12 may also comprise a register or database 13 for storing radio coverage area specific data. This radio coverage area specific data can be alternatively stored in the base station itself or in the controller controlling the base station, from where it is transmitted to the location server node 12 for the calculations. The data is received from the telecommunications system by receiving means 30.

Even though not shown in detail, the location server node 12 can be connected by means of an appropriate interface to the network controllers (omitted from Figure 1 for clarity but previously discussed) controlling the base stations signalling with the MS 7.

It is also noted that even though the location server node 12 can be a separate node from a network controller, it could also be a part or an internal component or functionality of a controller, or gateway controller or any other element of the telecommunications system.

The determination of the location of a mobile station can be based on measurements of at least one feature of the received radio signal. A feature which can be used in this is the time of arrival of the radio signal sent by the mobile station 7 at the base stations 4, 5 and 6. The travel time of the received signal at any particular base station is related to the distance travelled given by formula:

$$R = cT, \qquad [1]$$

wherein

R = mobile to base station distance (range)

c = the speed of light, and

T = the travel time of the radio signal.

The location information can also be based on measurements made at the receiving station to determine the signal strength, signal to noise ratio or any other such feature of the received signal from which it is possible to determine the distance between the transmitting station and the receiving station. It is noted that the measurement of the feature of the radio signal can be accomplished in the uplink and/or in the downlink, i.e. at the base station end or at the mobile station end or both. In case the mobile station is used for the measurements of the signal, it can use the radio network for sending the measurement results to an appropriate network element. The necessary location calculations and determinations based on various collected/defined data can be accomplished at the station (base station or the mobile station) or at an appropriate network element having an access to all required data.

In the situation illustrated by the three circles in Figure 1 or two sectors 18 and 19 of a circle in Figure 2 each distance measurement would generate a circle or a sector of a circle, respectively, centred at the measuring base station and having a radius r equal to the transmitting mobile station to receiving base station distance. In the absence of

any measurement error, the intersection of the three circles of Figure 1 and the intersection of the two circles of Figure 2 would determine the accurate location of the mobile station 7.

Alternatively or additionally, the geographical location is obtained from a reliable external source, e.g. from the well known GPS (Global Positioning System). The GPS system is a satellite based system used in military and civil applications where accurate positioning is required, e.g. for the purposes of navigation. More accurate location information can be obtained through a differential GPS. In addition to the GPS, any other similar system capable of providing reliable location information to the can be used for this.

The mobile station or the like 20 comprises an antenna 24 for receiving the location signals from the GPS satellites or similar system. These signals are used by the mobile station 20 to determine the current position of the mobile station 20 in a known manner. This determination can be accomplished by a processor 23.

According to one alternative the user of the mobile station 20 inputs manually precise location coordinates (e.g. in altitudes and latitudes, or by using street names or similar established address information), e.g. by means of keys 26, a voice recognition device, or similar input interface.

The mobile station 20 of Figure 4 is provided with another antenna 22 for transmitting radio signals to and/or receiving radio signals from the base station BTS under examination. The mobile station can interface with the location server node 12 of figure 1 in several alternative manners. Since it is capable of establishing a radio communication with the base station, the mobile station may also use this radio interface for transmitting any messages and information to the location server or any other appropriate network element. The interface can also be a specific infrared or short range radio connection (such as a "bluetooth" connection) or a fixed connection using e.g. appropriate plugs and sockets or cabling between the mobile station 20 and the location server. The mobile station also comprises a display 28.

It should be appreciated that any other suitable technique for determining the position of the mobile station can be used as an alternative to the methods described previously. Method using Doppler shift techniques or time difference of arrival may be used. In some embodiments of the present invention, more than one method can be used. The location can be derived by the mobile station itself or by any of the network components. In either case, it should be ensured that the mobile station or the network element has the required information to determine the position of the mobile station. As will be discussed later, different techniques for calculating the position of the mobile station may be used at different times.

Figure 3 schematically shows the location service model in which a LCS client 8 is arranged to request location information for one or more certain target mobile stations 20 from the LCS server node 12. The LCS server node 12 obtains positioning information obtained using one or more of the techniques discussed previously or any other suitable technique. This information is provided to the LCS Client 8. The particular requirements and characteristics of a LCS Client 8 are known to the LCS server 12 by its LCS client subscription profile. The particular LCS-related restrictions associated with each target mobile station are detailed in the target mobile station subscription profile. The location service feature permits the location of a target mobile station to be determined at any time whilst the MS is attached.

The LCS client 8 is a logical functional entity that makes a request to the LCS server node 12 for the location information of one or more target mobile stations. The LCS client 8 may reside in any entity (including a mobile station) within the PLMN or in an entity external to the PLMN.

The LCS server node 12 consists of a number of location service components and bearers needed to serve the LCS clients 8. The LCS server node 12 provides a platform which will enable the support of location based services in parallel with other telecommunication services such as speech, data, messaging, other teleservices, user applications and supplementary services. The LCS server node 12 responds to a location request from a properly authorized LCS client with location information for the

target mobile stations specified by the LCS client 8 if considerations of target mobile station privacy are satisfied.

It shall be possible for the location determining process to make use of several sources of information in determining the location. Propagation and deployment conditions may limit the number or quality of measurements or additional measurements may be possible. Some mobile stations may also have additional (independent) sources of position information of the type discussed earlier. The LCS shall be capable of making use of the restricted or the extra information as appropriate for the service being requested.

The LCS Server 12 may provide the client 8, on request, the current or most recent geographic location (if available) of the target mobile station or, if the location fails, an error indication and optionally the reason for the failure.

The following are examples of possible clients. Clients broadcasting location related information to the mobile stations in a particular geographic area – e.g. on weather, traffic, hotels, restaurants; or the like. Clients recording anonymous location information (i.e. without any MS identifiers) – e.g. for traffic engineering and statistical purposes. Clients enhancing or supporting any supplementary service, IN (intelligent network) service, bearer service or teleservice subscribed to by the target MS subscriber. These are only examples and any other suitable clients may use the location service node. This service can of course be used to determine the location of a mobile station when it makes an emergency call.

The LCS Server 12 shall enable a network operator to charge LCS clients 8 for the LCS features that the network operator provides.

It may be possible for the LCS client 8 to specify or negotiate a (minimum) level of quality, such as accuracy, in a station location information request. Different applications demand different levels of positioning accuracy and other positioning performance parameters, so the levels of performance should be classified according to the type of applications. The quality of location information can involve parameters

like accuracy, update frequency, time stamp, time-to-first-fix, reliability, continuity, etc The quality of the generated location information can exceed the required level. In case location information is not available to the required quality level , the request can either be denied and the service execution terminated, or the user accepts the lower quality information. The quality level requirement of each service (application) could be set both by the subscriber and the service provider.

It may be possible to select the repetition rate of the location information update. The reports may be distributed to different clients at different rates. It may be possible to identify and report when the user's terminal enters or leaves a specified geographic area.

In one embodiment of the present invention, the classes are specified for the accuracy of the positioning information, with estimated probability of correctness. Every measurement will usually have a margin of error associated therewith. The classes should in preferred embodiments of the present invention take into account for what purpose the positioning information is required. The selection of the class can be determined by each client or by each mobile station. The class selected can also take into account the type of service to be provided by the client.

One benefit is for the user to define how accurate the location information is which is made available to different types of LCS clients 8. In one embodiment a logarithmic scale could be used, according to which the accuracy is for 90% of cases within.

(10cm-1m No accuracy class)
1m- 10m Accuracy class A
10m-100m Accuracy class B
100m - 1km Accuracy class C
1km-10km Accuracy class D
10km-100km Accuracy class E
"Not defined" - Accuracy class X

The US regulations require that when an emergency call is made that the location of the mobile station be known to an accuracy of 50 m. This would fall into class B. As an alternative class B can be split in two (or even more) classes: 10m-50m Accuracy class B1 and 50m-100m Accuracy class B2. Alternatively or additionally, any other class can be split into two or more subclasses.

Class B could be used to identify that the user is in a given building so a service application can inform the user about the companies situated in this building or e.g. commercial services available in this building or area close by. Class D could be used to identify users in a given town and class E to identify users in a given county or region.

Another way to define the accuracy classes may be (for 90% of the cases):

Class A: best achievable accuracy for the UE being positioned (whatever that may be)
Class B: small area, township, city block, around 1 km
Class C: somewhat bigger area, town, around 10km
Class D: big area, region, around 100 km
Class E: coverage area of the visited PLMN in question
Class F: no position information to be given
Class L: location area
Class R: routing area
Class O: cell coverage area
Class P: PLMN area
Class X: not defined

One main use of the accuracy classes is to enable the user to define wanted privacy levels. This means that the subscriber can indicate how accurate position information different LCS clients may receive.

Different LCS client types are defined, so that the user can then define his LCS privacy profile for example as follows:

"LCS Client of type Emergency center is allowed to get class A LCS information"
"LCS client of general Internet server type can get class B LCS information in general but class A only after asking me"
"LCS client type "family members" can get LCS information of class A"
"LCS client type "my company" can get LCS information of class ?"

Another possible use of the accuracy classes is to enable the operator to define location service tariffs for the client or the user: "Class A LCS accuracy will cost you x Euro every time when network is involved, Class B y Euro, class C is free of charge", etc.

In summary embodiments of the present invention make use of the feature that the geographical location of a station can be determined in a communications network with varying accuracy. The user of the station, or the network operator, will not automatically agree to communicate the best achievable accuracy of the station location to any client.

The user of the station is able to restrict the accuracy with which the location of the station is communicated to different clients. The user of the station is able to define this accuracy differently for different clients (types).

In embodiments of the invention the accuracy of the location information of a station is defined with different accuracy classes. Different types of clients are defined. It is possible to define what accuracy class is acceptable for the type of client. This combination of accuracy class per client type may be defined by the user or by the network operator in the target station subscription profile.

In preferred embodiments of the present invention, there is a plurality of different methods available for determining the position of the mobile station. The method for determining the position of the mobile station will be selected in accordance with the accuracy of the class of position information.

It should be appreciated that whilst embodiments of the present invention have been described in relation to mobile stations of a mobile telecommunications system,

embodiments of the present invention are applicable to any other suitable type of user equipment of other types of systems providing location functionality. These system include satellite based communication systems as well as satellite based location systems.

The data can be transmitted between the various network element in packet form. In alternative embodiments of the invention the data may be sent in any suitable format.

The embodiment of the present invention has been described in the context of a TDMA system. This invention is also applicable to any other access techniques including frequency division multiple access (FDMA) and code division multiple access (CDMA) as well as any hybrids thereof. It should also be appreciated that base stations can sometimes be referred to as node B.

Embodiments of the invention may be used with fixed wireline access network. Such networks can determine the approximate location of the terminal and hence its user by mapping the access point of the terminal to the network in geographical coordinates. In this way also the user of the fixed terminal can be offered services that are valid and relevant for the geographical location of the user terminal. Thus embodiments of the present invention may be used with other communication systems where the users are connected to the network over fixed wire lines, since the geographical location of the access point of the fixed station can be determined with varying degree of accuracy.

In additional, the embodiments may also be used with various satellite based telecommunication systems.

It is also noted herein that while the above describes one exemplifying embodiment of the invention, there are several variations and modifications which may be made to the disclosed solution without departing from the scope of the present invention as defined in the appended claims.

CLAIMS

1. A telecommunications system comprising:
at least one station;
means for determining the location of said station;
means for providing information on said location of said station to a location service client; and
means for defining in dependence on information relating to the client, the accuracy of the location information to be provided to the client.

2. A system as claimed in claim 1, wherein a plurality of different classes of location accuracy are provided.

3. A system as claimed in claim 2, wherein said classes are on a logarithmic scale.

4. A system as claimed in claim 3, wherein said scale is a log 10 scale.

5. A system as claimed in claim 4, wherein said classes includes at least one of the following classes:
1m- 10m
10m-100m
100m - 1km
1km-10km
10km-100km

6. A system as claimed in claim 5, where at least one class is divided into two or more subclasses.

7. A system as claimed in any preceding claim, wherein a user of the at least one station is arranged to define the accuracy with which the location information is provided to the client.

8. A system as claimed in any preceding claim, wherein a plurality of clients are present of at least two different types, the accuracy of the location information provided to the client being dependent on the type of the client.

9. A system as claimed in any preceding claim, wherein the accuracy with which the information is provided is dependent on the type of service provided by the client.

10. A system as claimed in claim 2 or any claim appended thereto, wherein one class defines that no information is to be provided.

11. A system as claimed in claim 2 or any claim appended thereto, wherein one class is provided for the case where no location information is available.

12. A system as claimed in any preceding claim, wherein the costs associated with a service or function of the client is dependent on the accuracy of the location information.

13. A system as claimed in claim 12, wherein the costs are associated with the station.

14. A system as claimed in claim 13, wherein the costs are associated with the user or subscriber of the station.

15. A system as claimed in claim 12, wherein the costs are associated with the client.

16. A system as claimed in any preceding claim, wherein one of a plurality of different location methods is selected to determine the location of the station in dependence of the accuracy required for the location information.

17. A system as claimed in any preceding claim, wherein said station is a mobile station.

18. A system as claimed in claims 1 to 16, wherein said station is a terminal of a fixed wireline communication systems.

19. A system as claimed in any of claims 1 to 16, wherein said station is a terminal of a satellite communication system.

20. A system as claimed in any preceding claim, wherein a location service node is provided along with at least one client, said location service node being arranged to provided location information with the required accuracy to the client.

21. A method for use in a telecommunications system comprising the steps of:
determining the location of a station in said system;
providing information on said location of said station to a location service client; and
defining the accuracy of the location information to be provided to the client in dependence on information relating to the client.

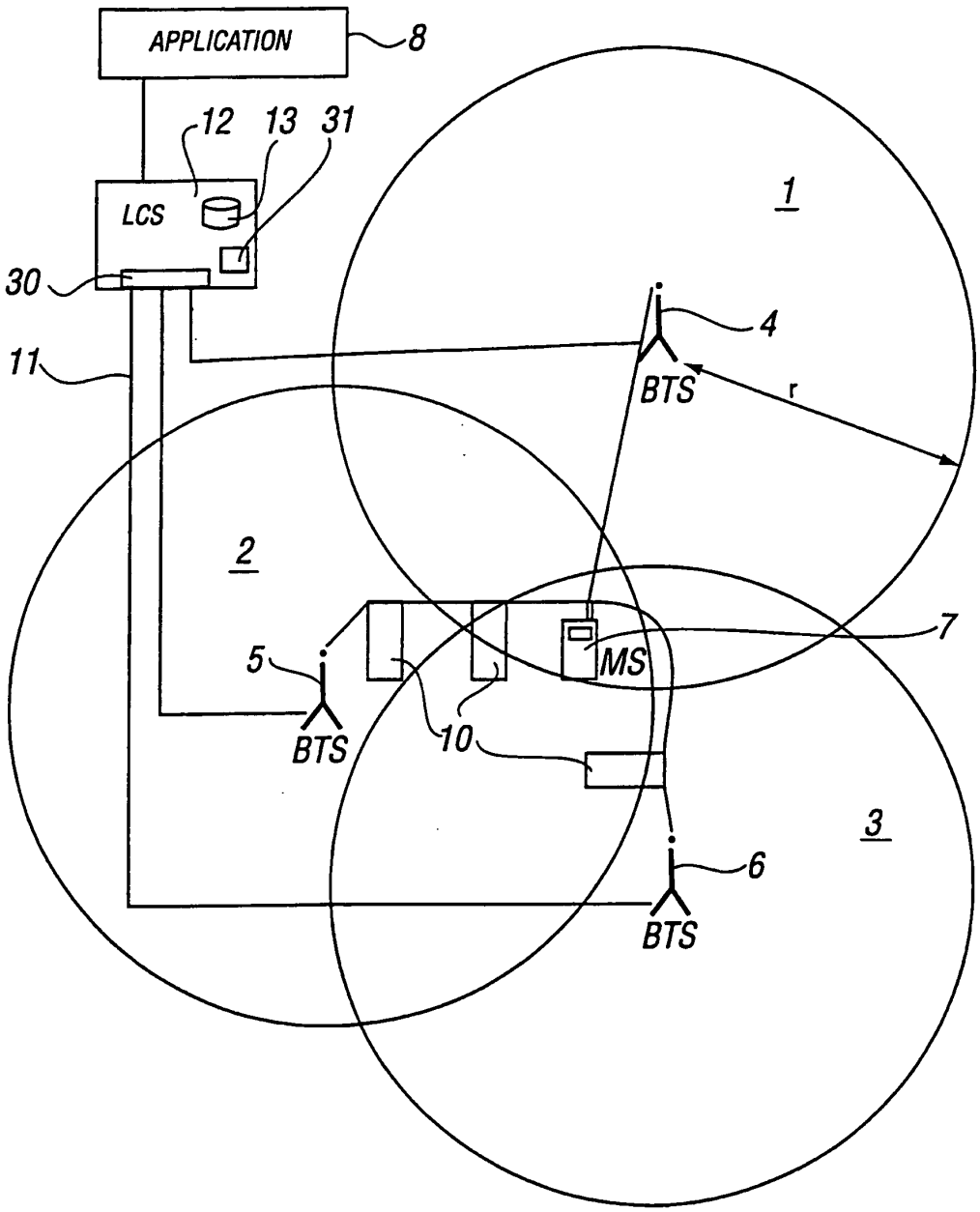


FIG. 1

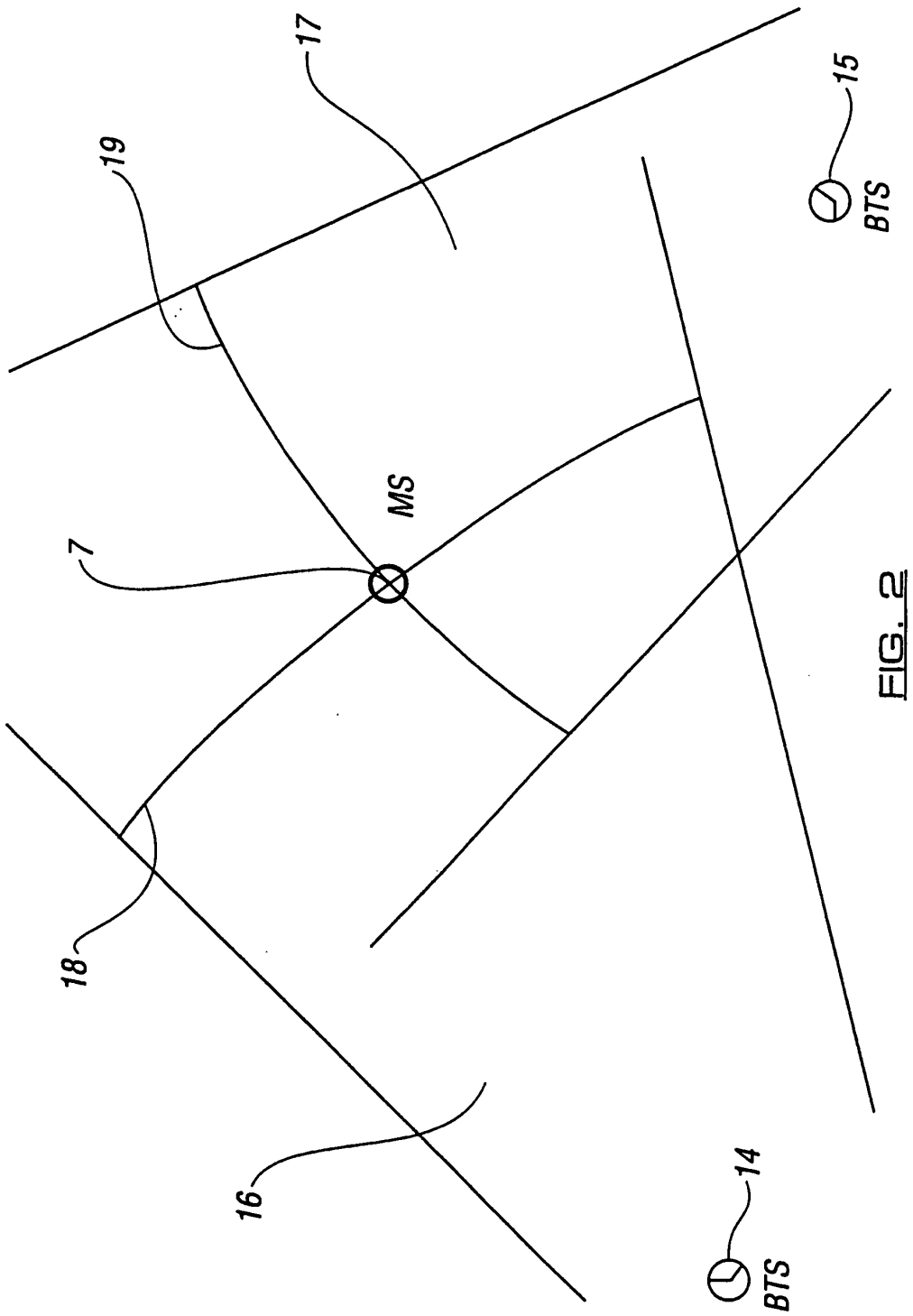


FIG. 2

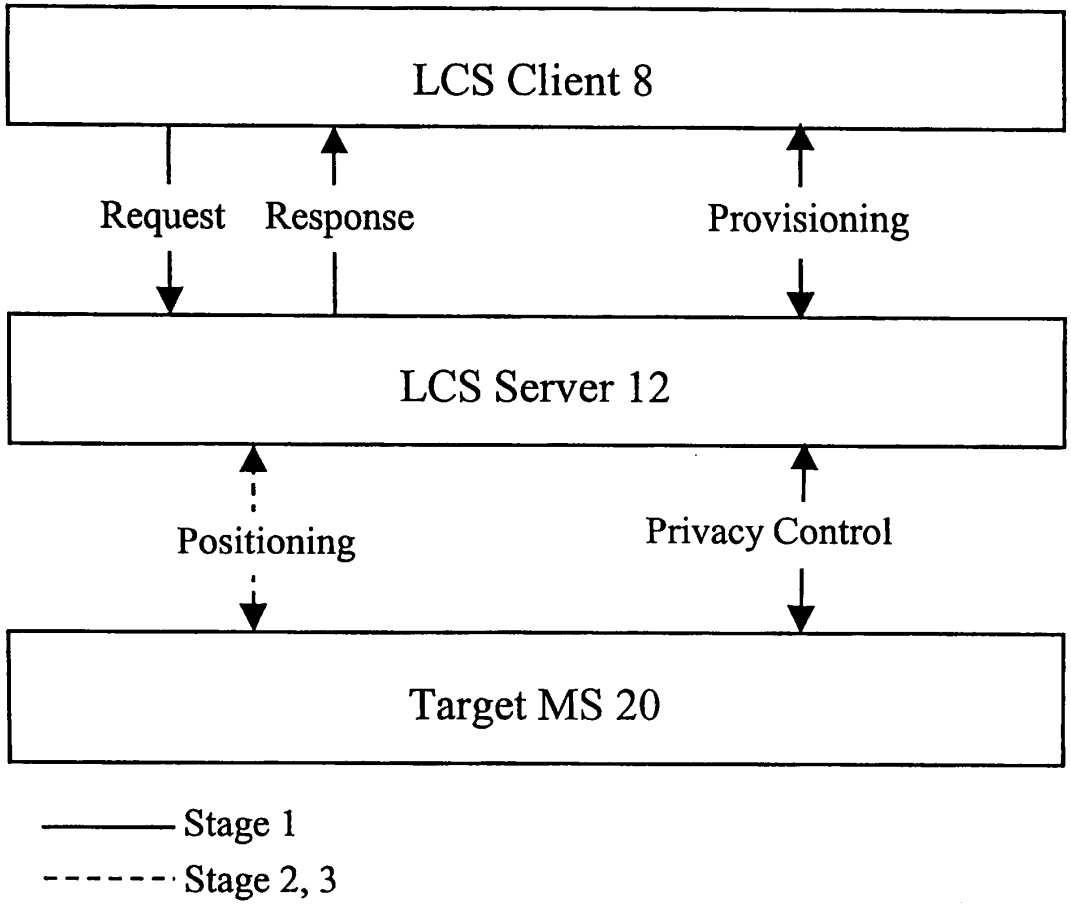

LCS Client 8
Request
Response
Provisioning
LCS Server 12
Positioning
Privacy Control
Target MS 20
Stage 1
Stage 2, 3

FIG. 3

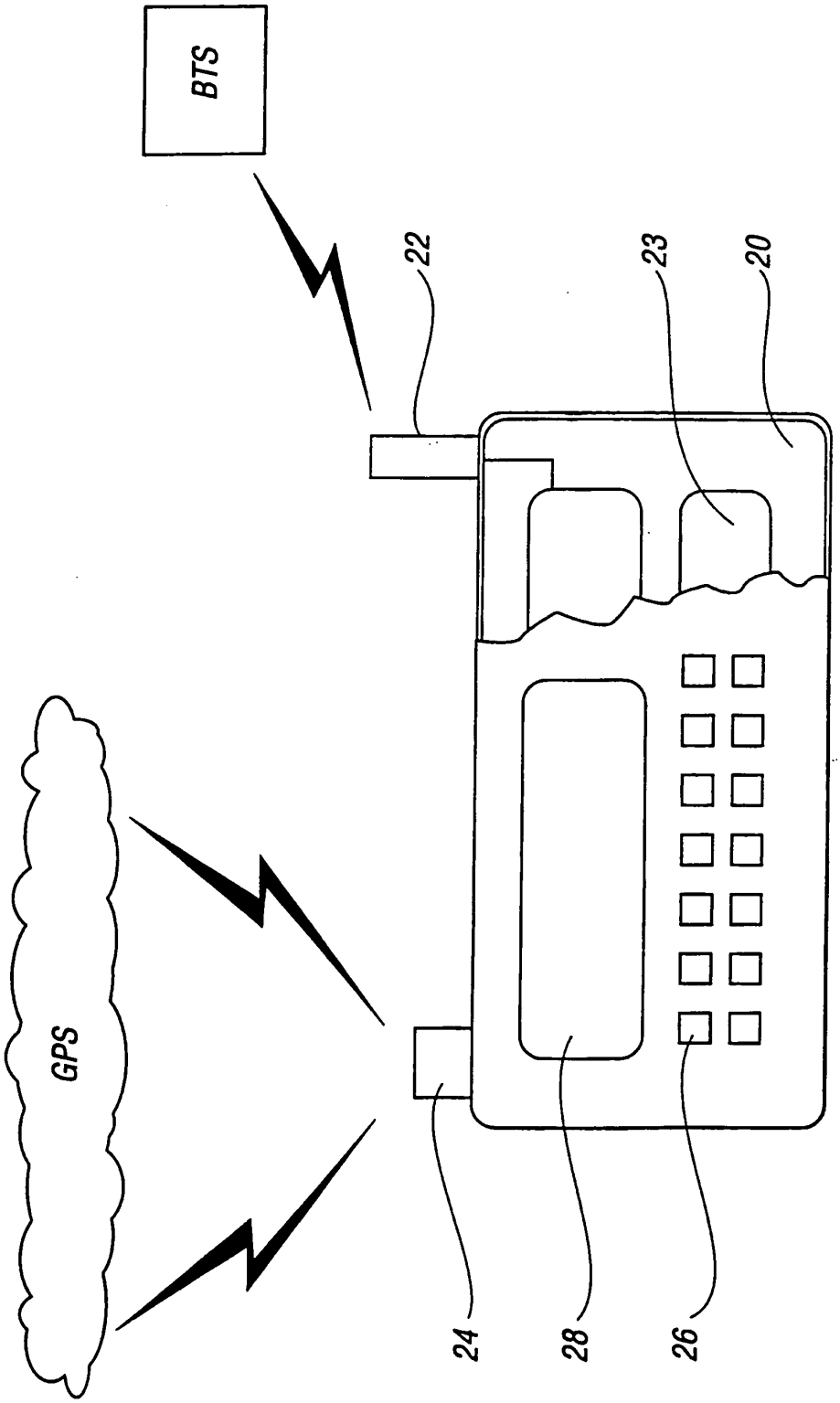


FIG. 4

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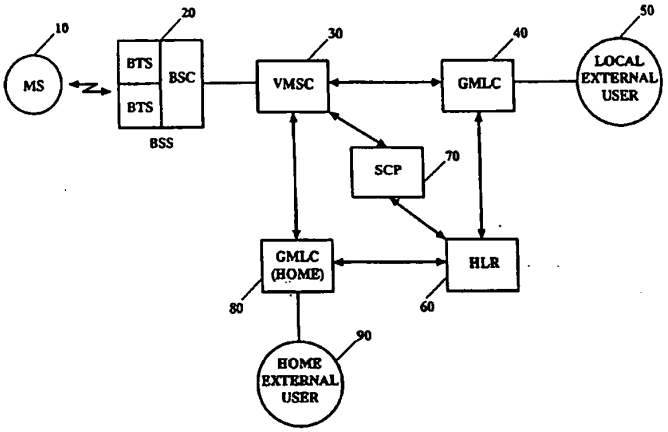
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[Continued on next page]

(54) Title: METHOD FOR ENABLING A USER TO BE NOTIFIED OF HIS/HER POSITIONING REQUESTS



(57) Abstract: The present invention proposes a method for processing an information request in a communication network, wherein a requesting side contacts a first element of said communication network and sends a request for specific information of a subscriber, said method comprising the steps of receiving a request for subscriber specific information, processing the request for said subscriber specific information, wherein in said processing a second network element is triggered, checking by said second network element, whether a permission for releasing said subscriber specific information to said requesting side is present, and, if a permission for releasing is present, forwarding said subscriber specific information to said requesting side, and if no permission for releasing is present, refusing the request for said subscriber specific information. The present invention also proposes a corresponding device and/or system. The present invention enables a consultation of the subscriber whether he/she permits a release of information concerning him/her, e.g. by using an intelligent network environment.

WO 01/39528 A1

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

METHOD FOR ENABLING A USER TO BE NOTIFIED OF HIS/HER POSITIONING REQUESTS

FIELD OF THE INVENTION

The present invention relates to a method for processing an information request in a communication network, and also relates to a corresponding device and/or a corresponding system. In particular, the present invention is directed to a method and corresponding device and corresponding system for managing subscriber location information in telecommunication networks.

BACKGROUND OF THE INVENTION

In the last years, telecommunication systems, in particular mobile telecommunication systems such as GSM (Global System for Mobile communication) and the like, became widely spread all over the world. Due to an increasing competition between network operators the offering of additional services besides the initial object of transmitting speech becomes more and more important.

Recently, a more flexible telecommunication network architecture has been developed, namely the intelligent network (IN). One example of such an intelligent network is CAMEL (Customized Applications for Mobile network Enhanced Logic) which is accommodated to the GSM system. The aim of such intelligent networks is for example to enable the creation of customized services that could be used by subscribers as well as by network operators. Furthermore, the introduction of new services in telecommunication networks shall be facilitated. The central authority in such an intelligent network is a so-called service control point (SCP) which controls distinct calls.

In mobile telecommunication systems, it is essential to know where a subscriber, i.e. a terminal equipment such as a mobile station MS, is located. That is, the location of the subscriber within the network, at least in which area or cell of the network, has to be detectable. There are several methods, as commonly known by persons skilled in the art, by which the location of the subscriber can be determined.

As one possibility, the location can be detected, for example, by accessing a Mobile Location Centre (MLC) for obtaining the latest position of the terminal. For external users, so-called Gateway Mobile Location Centres (GMLC) are provided, which can be directly connected to an external user. These Location Centres (MLC, GLMC) determine the Mobile services Switching Centres (MSC) or Visited Mobile services Switching Centres (VMSC) currently connected to the subscriber in question on the basis of a Home Location Register (HLR) inquiry. By this measure, the latest position can easily be obtained by referring to network elements already implemented in the network.

While it is commonly known that the location information is used for call routing services and the like, also other implementations for the location information are intended.

One example is to use the location information for forwarding specified information to the subscriber, depending on his/her position within the telecommunication network. That is, external users and/or the network operator send e.g. advertisements, tourist information or the like concerning the area in which the subscriber is located.

Therefore, it is necessary, that the sending side knows in which area the subscriber is located, or which subscribers are within a specified area. To obtain this location information, it is to be requested from the telecommunication network. A corresponding request is directed for example to the GMLC by the requesting external user or network operator, and, if the requesting side has access rights for the location information, the GMLC returns the respective location information of the subscriber in question.

However, there is a certain drawback in the above described location requesting method. Hitherto, the GMLC only contains access control records. The subscriber (or user), to whom the specified information is to be forwarded and whose location information is requested, is not directly involved in the decision process whether the request shall be fulfilled or not. Therefore, it is not possible for the user to control to which requesting part the location information is released, i.e. which information (advertisement and the like) he/she receives.

SUMMARY OF THE INVENTION

Therefore, it is an object of the present invention to provide a method for processing an information request in a telecommunication system and also a corresponding device and/or system, which provide an improved control for a subscriber to handle said information request.

According to the present invention, this object is achieved by a method for processing an information request in a communication network, wherein a requesting side contacts a first element of said communication network and sends a request for specific information of a subscriber, said method comprising the steps of receiving a request for

subscriber specific information, processing the request for said subscriber specific information, wherein in said processing a second network element is triggered, checking by said second network element, whether a permission for releasing said subscriber specific information to said requesting side is present, and, if a permission for releasing is present, forwarding said subscriber specific information to said requesting side, and if no permission for releasing is present, refusing the request for said subscriber specific information.

Furthermore, the present invention proposes a device for processing an information request in a communication network, wherein a requesting side contacts a first element of said communication network and sends a request for specific information of a subscriber, said device comprising receiving means for receiving a request for subscriber specific information means for processing the request for said subscriber specific information, wherein a second network element is triggered, and checking whether a permission for releasing said subscriber specific information to said requesting side is present, and means for forwarding said subscriber specific information to said requesting side, if a permission for releasing is present.

Moreover, according to the present invention, there is proposed a communication system, said system comprising at least a terminal device of a subscriber, a base station subsystem for connecting said terminal device, a serving center for controlling communication connections to and from said terminal device, a location center for detecting the location of said terminal device within said communication system, and a service control point for providing an operator tailored positioning policy service and triggered by said service center or said location center to perform said operator tailored positioning policy

service, wherein said operator tailored positioning policy service is used to involve said subscriber in a decision, whether a request for subscriber specific information made by a requesting side is to be fulfilled or not.

Advantageous further developments of the present invention are as set out in the respective dependent claims.

According to the present invention, the proposed method and/or device and/or system are very easy implemented since the usage of the Intelligent Network service environment, for example a CAMEL service environment CSE, for triggering an operator tailored positioning policy service provides a very good compatibility with other different network elements used for the location request. That is, it is e.g. possible to trigger said operator tailored positioning policy service when the location request (or another subscriber specific information request, respectively) is send to the VMSC connected to said subscriber, wherein said request is sent in the form of a mobile application part (MAP) location request, e.g. a MAP Provide Subscriber Location request. Alternatively, it is also possible to use the HLR for triggering, wherein the request is sent in the form of a MAP information request, e.g. a MAP Send Info for LCS request.

It is to be noted, that according to the invention the SCP can be triggered by various network elements, such as the GMLC, the VMSC, the HLR and the like, depending on the design of the network. Moreover, the present invention is also applicable in an packet switched network environment such as general packet radio services GPRS. That is, the SCP can also be triggered for example by a serving GPRS support node (SGSN).

As commonly known, the home location register (HLR) records contain several information about the subscriber. According to the present invention, there are also stored information that in case of a request for subscriber specific information such as location information the corresponding intelligent network element SCP (i.e. the operator tailored positioning policy service) is triggered. The network address of the SCP is also stored in the HLR.

Furthermore, the subscriber specific information can be requested by several different stations, for example by a service provider or by another subscriber located in the same or in a different area.

According to the present invention, it is further possible to define different decision modes. One is for example to directly contact the subscriber in question and to ask for the permission to fulfill the request for e.g. location information. Contacting the subscriber (i.e. the terminal device) can be performed for example by sending a short message (SMS), a unstructured supplementary service data (USSD) message, a wireless telephony application (WTA) indication by using a WTA service, and the like. This message may contain an identification of the requesting side.

The message can be delivered to the mobile station for example via a wireless application protocol (WAP) content push. The content of the message can include several forms. For example, it is possible that the content includes Java. Also other contents produced by the respective terminal (mobile station, SCP) are possible.

A message concerning a decision whether to fulfill the request or not can be sent back to the network via the same kind of message service, or also via another message

service different to that used before. The message types are definable for example by the network operator.

The identification of the requesting side can have various forms commonly known to persons skilled in the art. Most preferably, it should enable the subscriber to easy identify the requesting side, for example by a name or a logo or the like.

Also, an indication of the reason of the request, for example sending of tourist information, can be indicated. Therefore, it is also possible to filter location requests not only by checking the identification of the requesting side (i.e. who is requesting), but also by the reason why the location information (or other subscriber specific information) are requested. For example, when a requesting side is able to send advertisement as well as tourist information, but the subscriber wishes only to receive the latter, it is possible to refuse requests due to advertisements and fulfill requests due to tourist information.

Alternatively, as a further decision mode, it is possible to check whether the requesting side is authorized to request subscriber specific information. This may be especially the case for service providers. On the basis of a comparison of the identification of the requesting side with an table or the like, in which authorized identifications are stored, it is possible to decide whether to fulfill a location information request or not. The authorized identification can be input by the subscriber in advance and/or by the network operator.

It is also possible to define an automatic decision mode, in which it is preset by the subscriber, whether to fulfill requests of all requesting sides independent of which kind

they are, or to refuse all location requests of the kind described above. Furthermore, it is also possible for the subscriber to define a specified requesting side or group of requesting sides for which a request shall be fulfilled. This can be performed for example by forming a table or the like.

Moreover, according to the present invention, there is provided an ability for logging all requests for subscriber specific information, for example in a memory.

Preferred embodiments of the invention are described herein below in detail by way of example with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a block circuit diagram of a simplified structure of a telecommunication network.

FIG. 2 shows a flowchart of a first embodiment of the present invention.

FIG. 3 shows a flowchart of a second embodiment of the present invention.

FIG. 4 shows a flowchart of the second embodiment of the present invention.

FIG. 5 shows a flowchart of the second embodiment of the present invention.

FIG. 6 shows a flowchart of the second embodiment of the present invention.

FIG. 7 shows a message chart illustration a message flow for performing the present invention.

FIG. 8 shows a device arranged to perform the method according to the present invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

In FIG. 1, one simplified example of a telecommunication network such as a GSM network is shown. It is to be noted that the example shown in FIG. 1 illustrates a case in which a subscriber (mobile station MS) is located in a network different to his/her home network, i.e. he/she is located in a so-called visited network. However, it is obvious that the present invention, implemented in a network structure such as shown in FIG. 1 and described below, also works in the home network area.

Reference numeral 10 denotes a terminal device such as a mobile station MS of a subscriber. Reference numeral 20 denotes a base station subsystem BSS which comprises at least one base transceiver station BTS and a base station controller BSC. The base station subsystem is arranged to communicate with the mobile station 10.

Reference numeral 30 denotes a visited mobile service switching center VMSC. The mobile service switching center is arranged to control the communication to and from the mobile station. Here, the VMSC is located in a so-called visited area, i.e. a communication area within the communication network, which is not the home area. However, it is obvious that the MSC 30 could be also an MSC located in the home area of the subscriber.

Reference numerals 40 and 80 denote gateway mobile location centers GMLC, each of which is connectable to external

users 50 and 90. These external users, located for example either in the home area or in the visited area, may be other subscribers, service provider, network operator, and the like. The GMLC are connected to a home location register HLR in which data concerning the location, location changes and the like of the terminal device 10 (i.e. of the subscriber) are registered.

Reference numeral 70 denotes a service control point SCP, as a controlling part of a intelligent network IN, such as CAMEL, which is connected to other network elements, such as the HLR, VMSC or the like.

There may be the case that one of said external users 50, 90 intends to send, for example, advertisement or the like, which is directed to the area (cell area or the like) in which the subscriber is located. Thus the information of the subscribers which are located in the specific area are needed. Therefore, a request for location information of the subscriber is sent from the respective external user (i.e. from the requesting side) to a corresponding communication network element, i.e. to the corresponding GMLC 40, 80.

When, for example, a MAP location request is sent to the VMSC or the HLR, as described above, the service control point 70 is triggered to perform the operator tailored positioning policy service.

With reference to FIG. 2, now a first embodiment of the present invention for handling a request for subscriber specific information is described.

In the flowchart shown in FIG. 2, in step S110, the network receives, for example via the GMLC 40, 80, a request for location information of the subscriber 10 from an external

user 50, 90. Within said request an identification of the requesting side or the type of service requesting location information might be included. The request can be further processed by sending corresponding request messages to the VMSC 30 or the HLR 60, as described above.

When receiving such a request, the intelligent network element, i.e. the SCP 70, is triggered (step S120). Now, the operator tailored positioning policy service is performed. Therefor, in step S130, the subscriber (i.e. the user) is contacted by using a message service such as SMS, USSD, WTA service indication and the like. This message may also comprise the identification of the requesting side or the type of service requesting location information.

The subscriber is asked, on the basis of the identification indicated in the message, to decide whether said request is to be fulfilled or not, i.e. whether to release the location information to the requesting side or not. This decision can be done for example by a key input or the like. The result of the decision is then sent back to the network.

After receiving the result and determining the decision in step S140, the process proceeds to step S150. Here, when the decision of the subscriber is positive, i.e. the location information can be released to the requesting side, the operator tailored positioning policy service (i.e. the SCP) permits to fulfill the request (step S170) via the VMSC (or HLR) and the GMLC. Then, for example, the GMLC sends the requested location information (S180), which have been received from the HLR or the VMSC after the above mentioned inquiry.

In the case, that the decision of the subscriber is negative, the GMLC refuses (step S160) the request after

being informed, for example via the SCP and the VMSC. Therefor, a corresponding message can be sent to the requesting side.

Thereafter, the process is ended (step S190).

In the embodiment described with reference to FIG. 2, a case is described in which the subscriber is contacted directly after the network received a request for subscriber specific information. That is, the subscriber can decide for every request, for example via a key input.

With reference to FIGS. 3 to 8, a further embodiment is described in which several different decision condition modes are included.

In FIG. 3, steps S210 and S220 correspond to steps S110 and S120 of FIG. 2, and a description can be omitted.

In step S230, a check is performed which preset decision condition mode is present. The presetting of said mode can be performed for example in advance in the design phase of the network. Alternatively, the subscriber can set the mode, for example via his/her terminal device, and change it, if desired.

First, it is checked whether an authority decision mode is set (step S240). The authority decision mode enables to set a criteria in the operator tailored positioning policy service, by which certain requesting sides are recognized to be authorized to get subscriber specific information. This criteria may be a code or the like which is included in the request. Also, the identification of the requesting side itself can be used as indication for the authorization.

If the authority decision mode is not set, in step S250, a check is made whether the decision mode is an automatic decision mode. In the automatic decision mode, the subscriber or the network operator has set to handle the requests dependent who has made the request. For example, it is possible to set that all requests has to be fulfilled or refused. Another possibility is to set that only requests from specified requesting sides or groups of requesting sides (for example from all tourist information offices or the like) have to be fulfilled.

Alternatively, it is possible to filter location requests not only by checking the identification of the requesting side (i.e. who is requesting), but also by the reason why the location information (or other subscriber specific information) are requested. For example, if the subscriber wishes only to receive tourist information, it is possible to refuse requests due to advertisements and fulfill requests due to tourist information. This requires an information indicating the reason or the kind of information the requesting wishes to send.

If also the automatic decision mode is not set, the process proceeds to a step S270 in FIG. 6, i.e. it is adopted that the subscriber has to decide directly whether to fulfill the request or not. The steps S270 to S276 correspond to the steps S130 to S190 in FIG. 2, and a description thereof can be omitted.

If in step S240 of FIG. 3 the authority decision mode is set, the process proceeds to step S241 shown in FIG. 4. Here, the identification of the requesting side is determined. In step S242, the determined identification is compared as a decision criteria with a table containing authorized identifications. Said table is stored for example in a memory. Alternatively, instead of the

identification of the requesting side, a code indicating an authorization and sent with the request is determined in step S241 and checked in step S242. The way how to check the authorization can be set for example by the network operator.

Anyhow, in step S243, it is determined, on the basis of a result of the comparison in step S242, whether the requesting side is authorized. If NO, then the request is refused (step S244). If YES, in steps S245 and S246 the request is fulfilled. This corresponds to the steps S160 to S180 in FIG. 2. In step S247, the process is ended.

If in step S250 in FIG. 3 the automatic decision mode is set, the process proceeds to step S251 in FIG. 5. Here, a predetermined automatic decision condition is determined.

If a specified condition is set (step S252), the identification of the requesting side is compared with predetermined identifications of requesting sides for which a request is to be fulfilled (step S254). These predetermined identifications are stored for example in a memory and defined by the subscriber. In the following steps S254 and S255 the request of the requesting sides which are contained in said table of predetermined identifications is fulfilled, as already described above. Although not shown in FIG. 5, it is obvious that requests of requesting sides with identifications not included in said table are to be refused.

If in step S252 no specified condition is set, the process proceeds to step S257 in which it is checked if a general permission condition is set. If the general permission is set, i.e. all requests may be fulfilled, the location information is sent to the requesting side (steps S259, S260). On the other hand, if no general permission is set,

all requests are refused (step S258). In step S256, the process is ended.

It is to be noted, that the above described decision modes (automatic, authority) can also be used separately or in other combinations as described above. This can be defined by the corresponding network operator during the design phase of the network or changed later.

In FIG. 7, a message diagram is shown by which a message flow between network elements involved in a request handling according to the present invention is described.

After the GMLC has received a request for, e.g., location information of the subscriber from a requesting side, a MAP sending info for LCS request message M1 is sent to the home location register HLR. This is also described above. In the HLR, it is recognized that a request is handled whereby the service control point SCP is triggered by a corresponding signal M2 to perform the operator tailored positioning policy service.

In the SCP, a content presentation request is started by the policy service. Therefor, a corresponding content presentation request message M3 is sent to a so-called content server, which may be included for example in the SCP, or in a separate network element.

The content server is arranged to form a message by which the subscriber is informed about the request by a message containing the necessary information in a form usable for, e.g., a decision via a key input at the terminal device MS. The form of this message is for example a WAP page or the like which can be displayed or represented at the mobile station MS.

From the content server, the massage is delivered for example by a WAP content push (message M4) via a WAP gateway to the mobile station (i.e. to the subscriber) for transmitting the information indicating the request. The content may include Java or another content which is produced by the corresponding terminal.

The message is received at the mobile station MS and processed accordingly (i.e. displaying on a screen, receiving and processing input by the subscriber and the like). Next, from the mobile station MS, a message M5 indicating the response of the subscriber (determined by the key input or the like) is sent back via WAP gateway to the content server. Therefrom, it is forwarded to the service control point SCP (message M6). Here, the message is processed by the policy service. On the basis of said processing, it is decided whether to give a permission or a denial concerning the request. This is indicated to the HLR by a corresponding message M7. Then, depending on the decision, a positioning, i.e. a sending of location information, is performed, or the positioning is refused, as commonly known to persons skilled in the art.

FIG. 8 refers to a device according to the present invention. Reference numeral 100 denotes a transceiver means for communicating with the subscriber and the requesting side. There can be only one transceiver means for communicating with both sides or separated transceiver means each of which arranged to communicate with one counterpart. This may depend on the type of messages used for the communications, i.e. for the request, the message for asking a decision and the like.

Reference numeral 200 denotes a intelligent network means for processing and triggering the operator tailored positioning policy service, i.e. for deciding whether the

received request for subscriber specific information may be fulfilled for the respective requesting side or not. The way how the decision is made can be for example consulting the subscriber/user directly, using a predetermined decision condition (automatic, authority) or the like, as described above. The means 200 is arranged to form a message for the subscriber, to determine which decision is made, to handle the request dependent on this decision (refuse/fulfill). Furthermore, it is arranged to determine whether and which decision condition mode is set. Also a comparison between the identification of the requesting side and, e.g., stored identifications is performed by the intelligent network means 200.

Reference numeral 300 denotes a memory which may be used for storing different kinds of data. For example, identifications of requesting side which are authorized can be stored herein. Also one or more codes indicating an authorization of a requesting side can be stored. These data are then used by the intelligent network means 200 for a comparison with a received identification or code from a requesting side.

The memory 300 can also be used for storing identification data of requesting sides predetermined by the subscriber. Furthermore, it is possible to store information concerning a preset decision mode (automatic and the like).

As an alternative, received requests or at least an indication of received requests (counter) can be stored in said memory 300, for example for statistical purposes.

There can be used one single memory (RAM or the like), or different means used for separate storing functions (for example one for authorized identifications, one for logging, and the like).

It should be noted, that the means of the device in FIG. 8 can be included in one network element or in separate network elements. Moreover, the function of the corresponding means, in particular of means 200, can be distributed among different parts of the communication network.

The present invention proposes a method for processing an information request in a communication network, wherein a requesting side contacts a first element of said communication network and sends a request for specific information of a subscriber, said method comprising the steps of receiving a request for subscriber specific information, processing the request for said subscriber specific information, wherein in said processing a second network element is triggered, checking by said second network element, whether a permission for releasing said subscriber specific information to said requesting side is present, and, if a permission for releasing is present, forwarding said subscriber specific information to said requesting side, and if no permission for releasing is present, refusing the request for said subscriber specific information. The present invention also proposes a corresponding device and/or system. The present invention enables a consultation of the subscriber whether he/she permits a release of information concerning him/her, e.g. by using an intelligent network environment.

It should be understood that the above description and accompanying figures are merely intended to illustrate the present invention by way of example only. The preferred embodiments of the present invention may thus vary within the scope of the attached claims.

CLAIMS

1. A method for processing an information request in a communication network, wherein a requesting side (50, 90) contacts a first element (40, 80) of said communication network and sends a request for specific information of a subscriber (10), said method comprising the steps of:

receiving (S110; S210) a request for subscriber specific information;

processing (S120, S130; S220, S230, S240, S250; S241; S251, S252; S270) the request for said subscriber specific information, wherein in said processing a second network element is triggered;

checking (S140, S150; S242, S243; S253, S257; S271, S272) by said second network element, whether a permission for releasing said subscriber specific information to said requesting side is present; and,

if a permission for releasing is present, forwarding (S170, S180; S245, S246; S254, S255, S259, S260; S274, S275) said subscriber specific information to said requesting side, and if no permission for releasing is present, refusing (S160; S244; S258; S273) the request for said subscriber specific information.

2. A method according to claim 1, wherein said request comprises an identification of said requesting side.

3. A method according to claim 1, wherein said request comprises an information concerning a reason for the request by the requesting side.

4. A method according to claim 1, wherein said requesting side (50, 90) is a service provider.

5. A method according to claim 1, wherein said requesting side (50, 90) is another subscriber.

6. A method according to claim 1, wherein said specific subscriber information requested by said requesting side (50, 90) is a location information of said subscriber (10).

7. A method according to claim 6, wherein said requesting side (50, 90) contacts for receiving said subscriber specific information a visited mobile service switching center (30) which is connected to said subscriber (10), and said request is sent in the form of a MAP location request.

8. A method according to claim 6, wherein said requesting side (50, 90) contacts for receiving said subscriber specific information a home location register (60), and said request is sent in the form of a MAP information request.

9. A method according to claim 1, wherein said second network element (70) is a service control point of an intelligent network.

10. A method according to claim 9, wherein said service control point (70) provides an operator tailored positioning policy service.

11. A method according to claim 1, wherein said processing step comprises the further steps of

contacting (S130) said subscriber (10) and transmitting (S130) a message indicating said request of said requesting side (50, 90) for a decision of said subscriber on the basis of said transmitted message, whether to release said subscriber specific information or not;

receiving and determining (S140) said decision of said subscriber; and,

if the decision to release said subscriber specific information is positive, fulfilling (S170, S180) said request, or, if the decision is negative, refusing (S160) said request.

12. A method according to claim 11, wherein said message indicating said request of said requesting side is a short message and transmitted by using a short message service.

13. A method according to claim 11, wherein said message indicating said request of said requesting side is an unstructured supplementary service data message.

14. A method according to claim 11, wherein said message indicating said request of said requesting side is a wireless telephony application indication and transmitted by using a wireless telephony application service.

15. A method according to claim 11, wherein said message is delivered by using a wireless application protocol content push.

16. A method according to claim 1, wherein said processing step comprises the further step of checking (S230) a preset decision condition.

17. A method according to claim 16, comprising the further steps of:

if in said preset decision condition an authority mode is activated (S240), determining (S241) an identification of said requesting side;

comparing (S242), whether said identification is included in a table stored in a memory containing authorized identifications; and

if the requesting side is authorized (S243), fulfilling (S245, S246) said request, or, if the requesting side is not authorized, refusing (S244) said request.

18. A method according to claim 16, comprising the further steps of:

if in said preset decision condition an automatic mode is activated (S250), determining (S251) the kind of said automatic mode activated.

19. A method according to claim 18, comprising the further steps of:

if said automatic mode activated is a specified automatic mode (S252), comparing (S253), whether an identification of said requesting side is included in a table stored in a memory containing identifications stored by said subscriber in a memory; and

fulfilling (S254, S255) said request for a requesting side the identification of which is included in said table.

20. A method according to claim 16, comprising the further steps of:

if said automatic mode activated is a general permission automatic mode (S252, S257), determining, whether the request for said subscriber specific information is to be fulfilled for all requests or to be refused for all requests; and

if said request is to be fulfilled for all requests, sending (S259, S260) said subscriber specific information, or, if said request is to be refused for all requests, refusing (S258) said request.

21. A method according to claim 1, further comprising the step of logging said request for subscriber specific information in a memory.

22. A device for processing an information request in a communication network, wherein a requesting side (50, 90) contacts a first element (40, 80) of said communication network and sends a request for specific information of a subscriber (10), said device comprising:

receiving means (100) for receiving a request for subscriber specific information;

means (200) for processing the request for said subscriber specific information, wherein a second network element is triggered, and checking whether a permission for releasing said subscriber specific information to said requesting side is present, and

means (100) for forwarding said subscriber specific information to said requesting side, if a permission for releasing is present.

23. A device according to claim 22, wherein said request comprises an identification of said requesting side.

24. A device according to claim 22, wherein said request comprises an information concerning a reason for the request by the requesting side.

25. A device according to claim 22, wherein said requesting side is a service provider.

26. A device according to claim 22, wherein said requesting side is another subscriber.

27. A device according to claim 22, wherein said specific subscriber information requested by said requesting side is a location information of said subscriber.

28. A device according to claim 27, wherein said requesting side (50, 90) contacts for receiving said subscriber specific information a visited mobile service switching

center (30) which is connected to said subscriber (10), and said request is sent in the form of a MAP location request.

29. A device according to claim 27, wherein said requesting side (50, 90) contacts for receiving said subscriber specific information a home location register (60), and said request is sent in the form of a MAP information request.

30. A device according to claim 27, wherein said message is delivered by using a wireless application protocol content push.

31. A device according to claim 22, wherein said means (200) for processing and checking said request is implemented in a service control point (70) of an intelligent network.

32. A device according to claim 31, wherein said service control point is arranged to provide an operator tailored positioning policy service.

33. A device according to claim 22, wherein said means (200) for processing and checking said request is triggered by said first network element after receiving said request for subscriber specific information.

34. A device according to claim 33, wherein said means for processing and checking said request is arranged to send a message indicating said request of said requesting side to said subscriber.

35. A device according to claim 34, wherein said message indicating said request of said requesting side is a short message and transmitted by using a short message service.

36. A device according to claim 34, wherein said message indicating said request of said requesting side is an unstructured supplementary service data message.

37. A device according to claim 34, wherein said message indicating said request of said requesting side is a wireless telephony application indication and transmitted by using a wireless telephony application service.

38. A device according to claim 33, said device further comprises a memory (300), and said means (200) for processing and checking said request is arranged to compare an identification of said requesting side with identification data stored in said memory.

39. A device according to claim 38, wherein said request for subscriber specific information is logged in a memory.

40. A communication system, said system comprising at least

a terminal device (10) of a subscriber;

a base station subsystem (20) for connecting said terminal device;

a serving center (30) for controlling communication connections to and from said terminal device;

a location center (40, 80) for detecting the location of said terminal device (10) within said communication system; and

a service control point (70) for providing an operator tailored positioning policy service and triggered by said service center or said location center to perform said operator tailored positioning policy service, wherein said operator tailored positioning policy service is used to involve said subscriber in a decision, whether a request for subscriber specific information made by a requesting side (50, 90) is to be fulfilled or not.

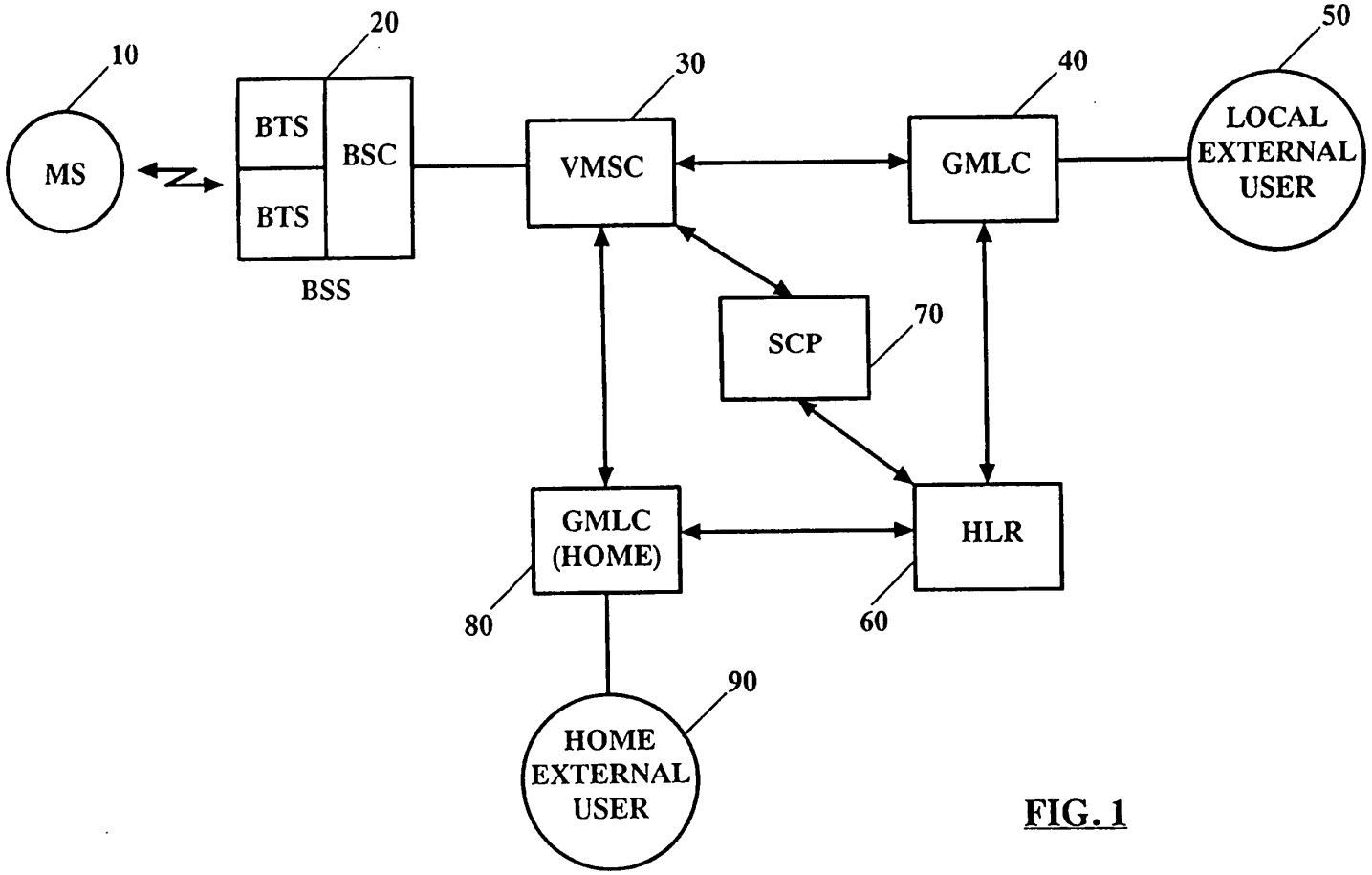

10
MS
20
BTS
BTS
BSC
BSS
30
VMSC
40
GMLC
50
LOCAL EXTERNAL USER
70
SCP
GMLC (HOME)
80
HLR
60
90
HOME EXTERNAL USER

FIG. 1

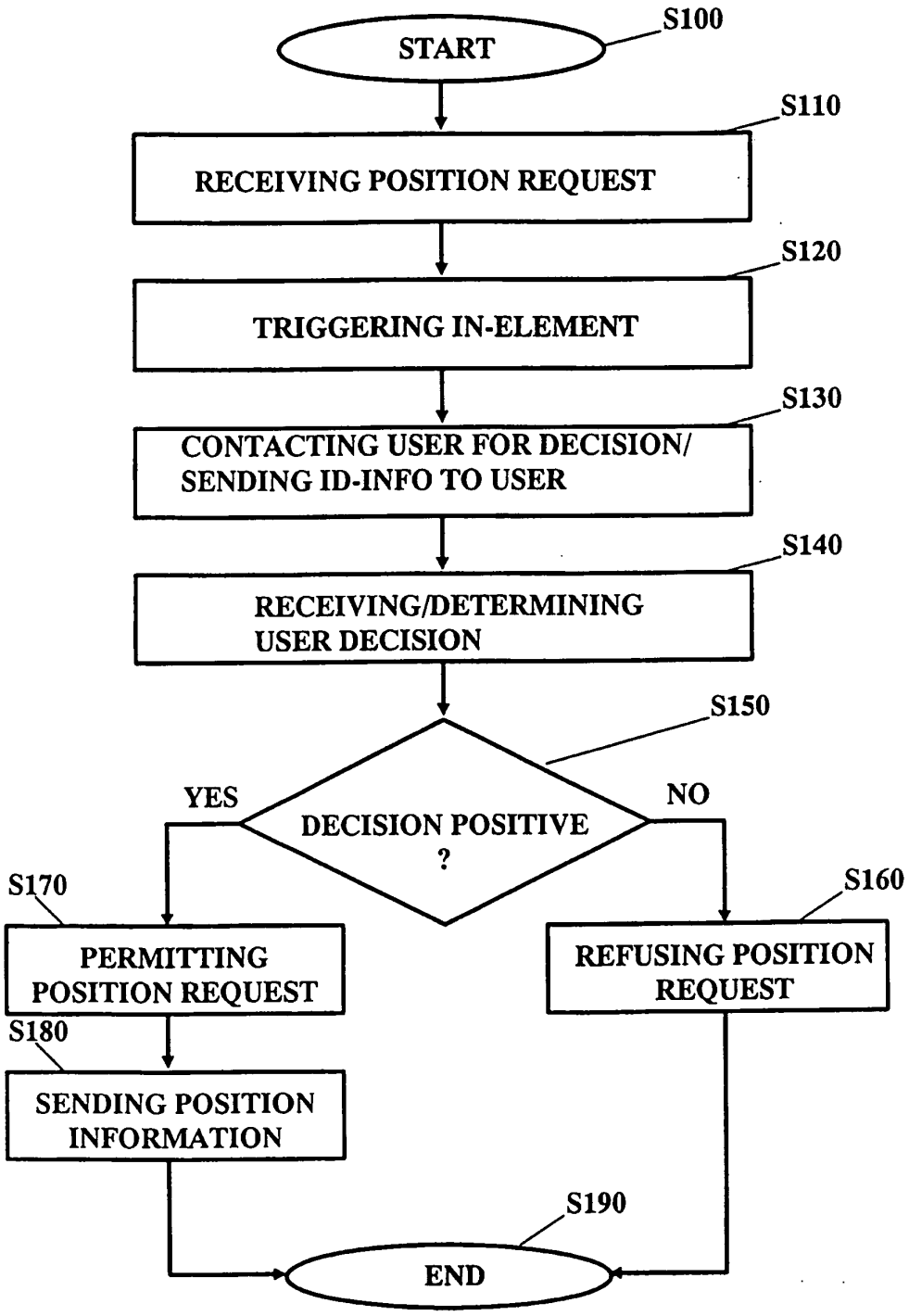

START
S100
RECEIVING POSITION REQUEST
S110
TRIGGERING IN-ELEMENT
S120
CONTACTING USER FOR DECISION/ SENDING ID-INFO TO USER
S130
RECEIVING/DETERMINING USER DECISION
S140
DECISION POSITIVE ?
S150
YES
NO
PERMITTING POSITION REQUEST
S170
REFUSING POSITION REQUEST
S160
SENDING POSITION INFORMATION
S180
END
S190

FIG. 2

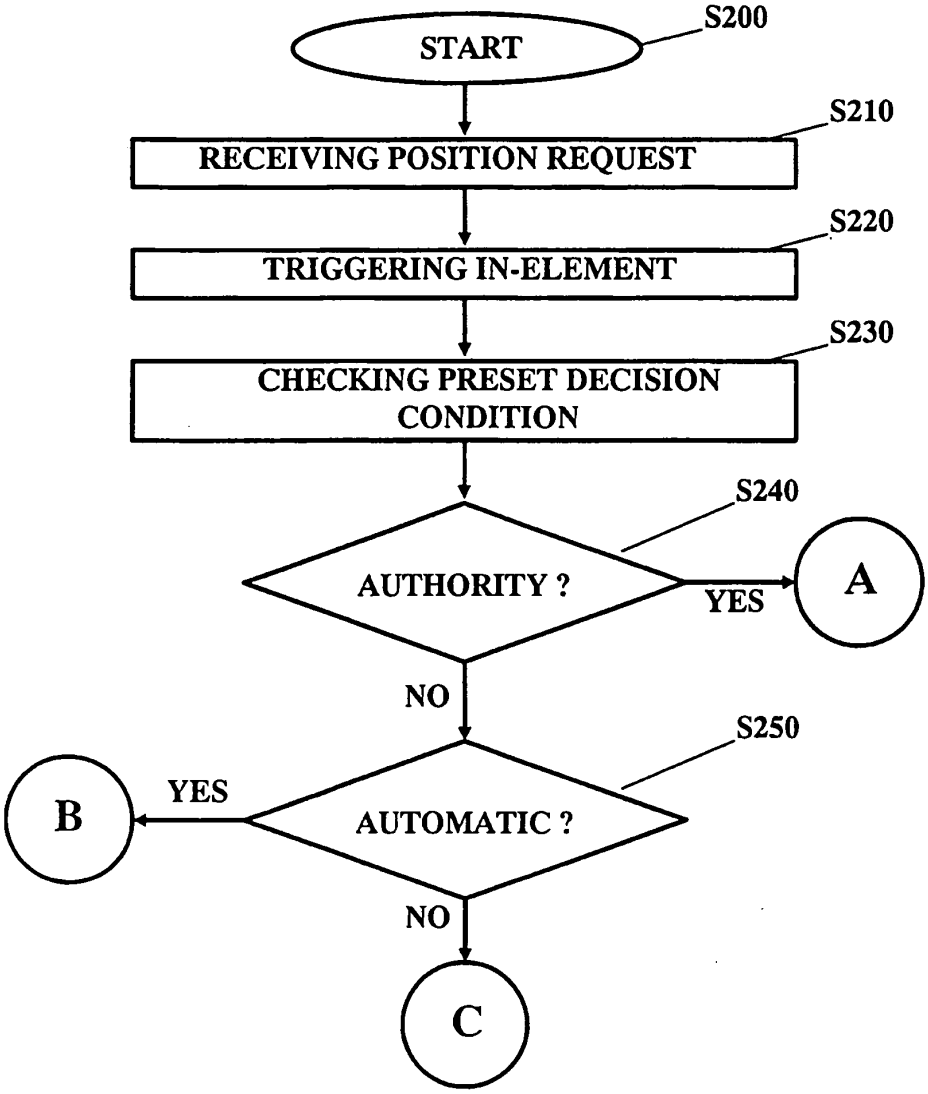

START
S200
RECEIVING POSITION REQUEST
S210
TRIGGERING IN-ELEMENT
S220
CHECKING PRESET DECISION CONDITION
S230
AUTHORITY ?
S240
YES
A
NO
AUTOMATIC ?
S250
YES
B
NO
C

FIG. 3

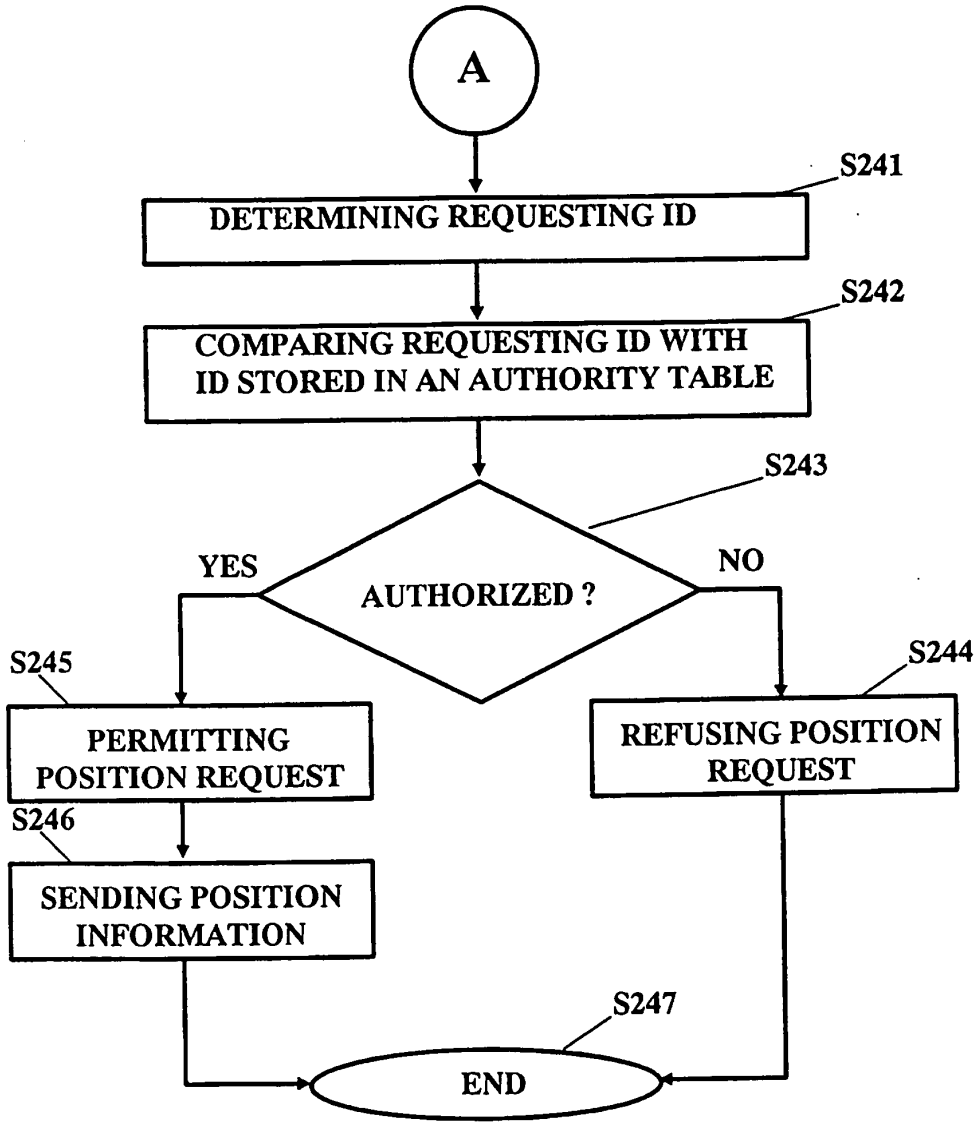

A
S241
DETERMINING REQUESTING ID
S242
COMPARING REQUESTING ID WITH ID STORED IN AN AUTHORITY TABLE
S243
AUTHORIZED ?
YES
NO
S245
PERMITTING POSITION REQUEST
S244
REFUSING POSITION REQUEST
S246
SENDING POSITION INFORMATION
S247
END

FIG. 4

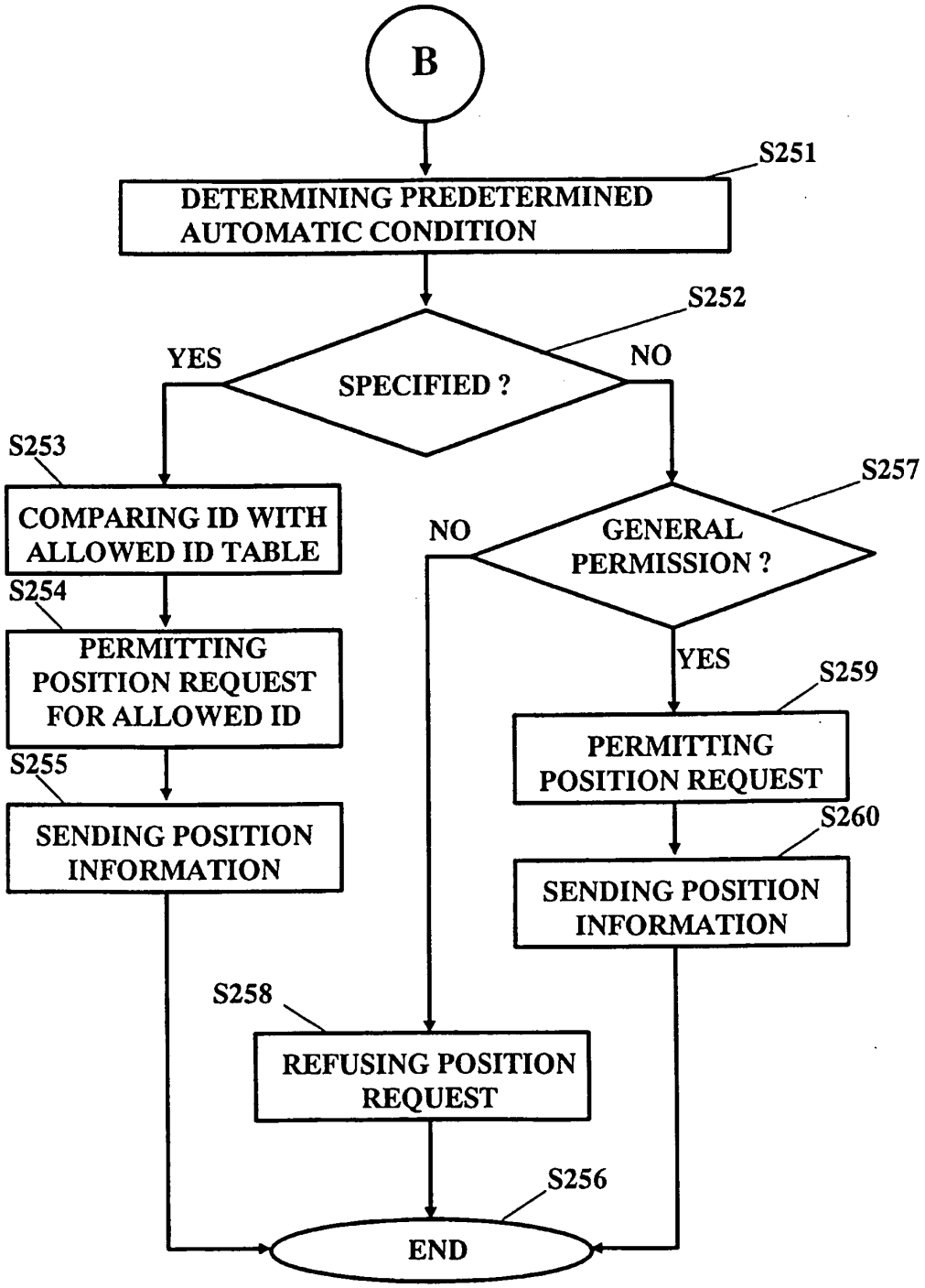

B
S251
DETERMINING PREDETERMINED AUTOMATIC CONDITION
S252
SPECIFIED ?
YES
NO
S253
COMPARING ID WITH ALLOWED ID TABLE
S254
PERMITTING POSITION REQUEST FOR ALLOWED ID
S255
SENDING POSITION INFORMATION
S257
GENERAL PERMISSION ?
NO
YES
S259
PERMITTING POSITION REQUEST
S260
SENDING POSITION INFORMATION
S258
REFUSING POSITION REQUEST
S256
END

FIG. 5

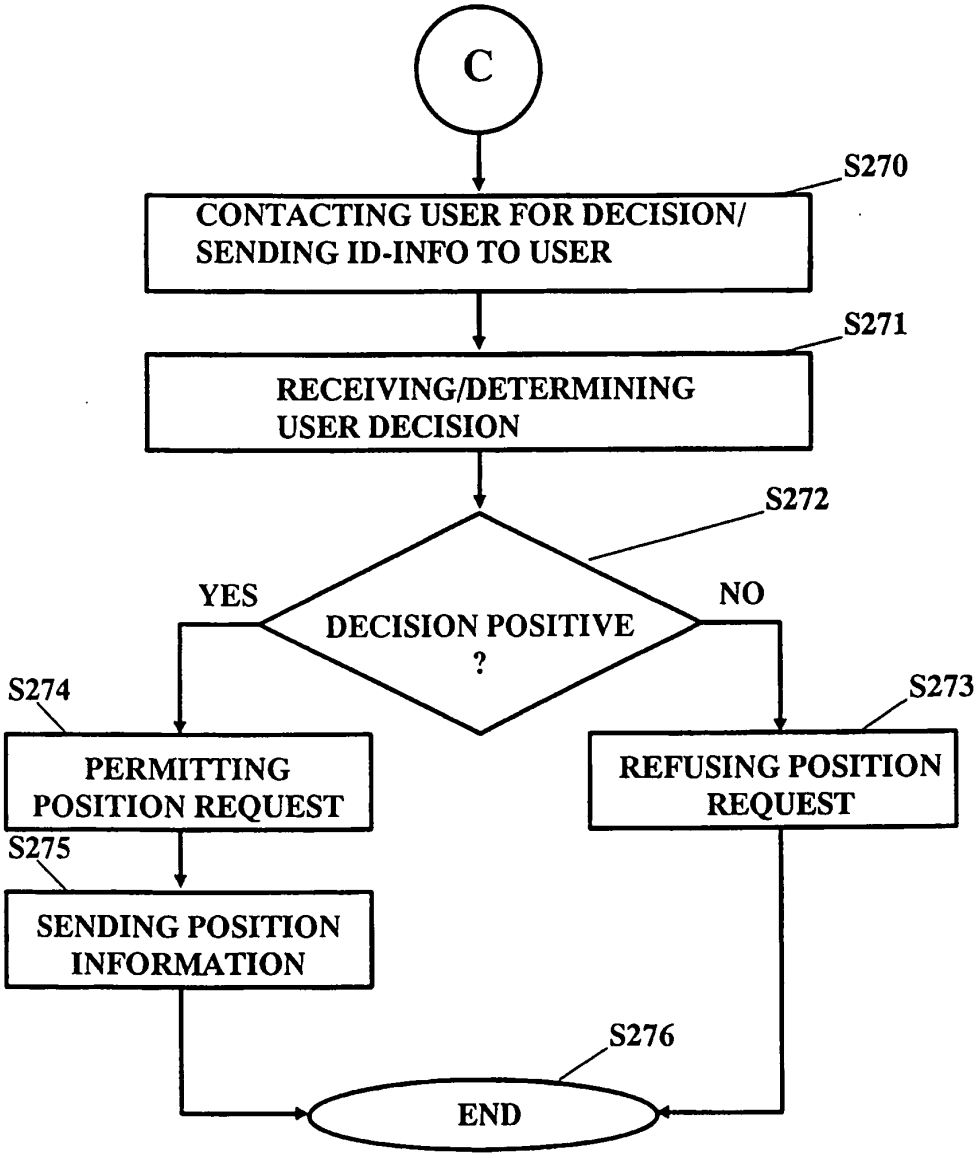

C
S270
CONTACTING USER FOR DECISION/ SENDING ID-INFO TO USER
S271
RECEIVING/DETERMINING USER DECISION
S272
DECISION POSITIVE ?
YES
NO
S274
PERMITTING POSITION REQUEST
S273
REFUSING POSITION REQUEST
S275
SENDING POSITION INFORMATION
S276
END

FIG. 6

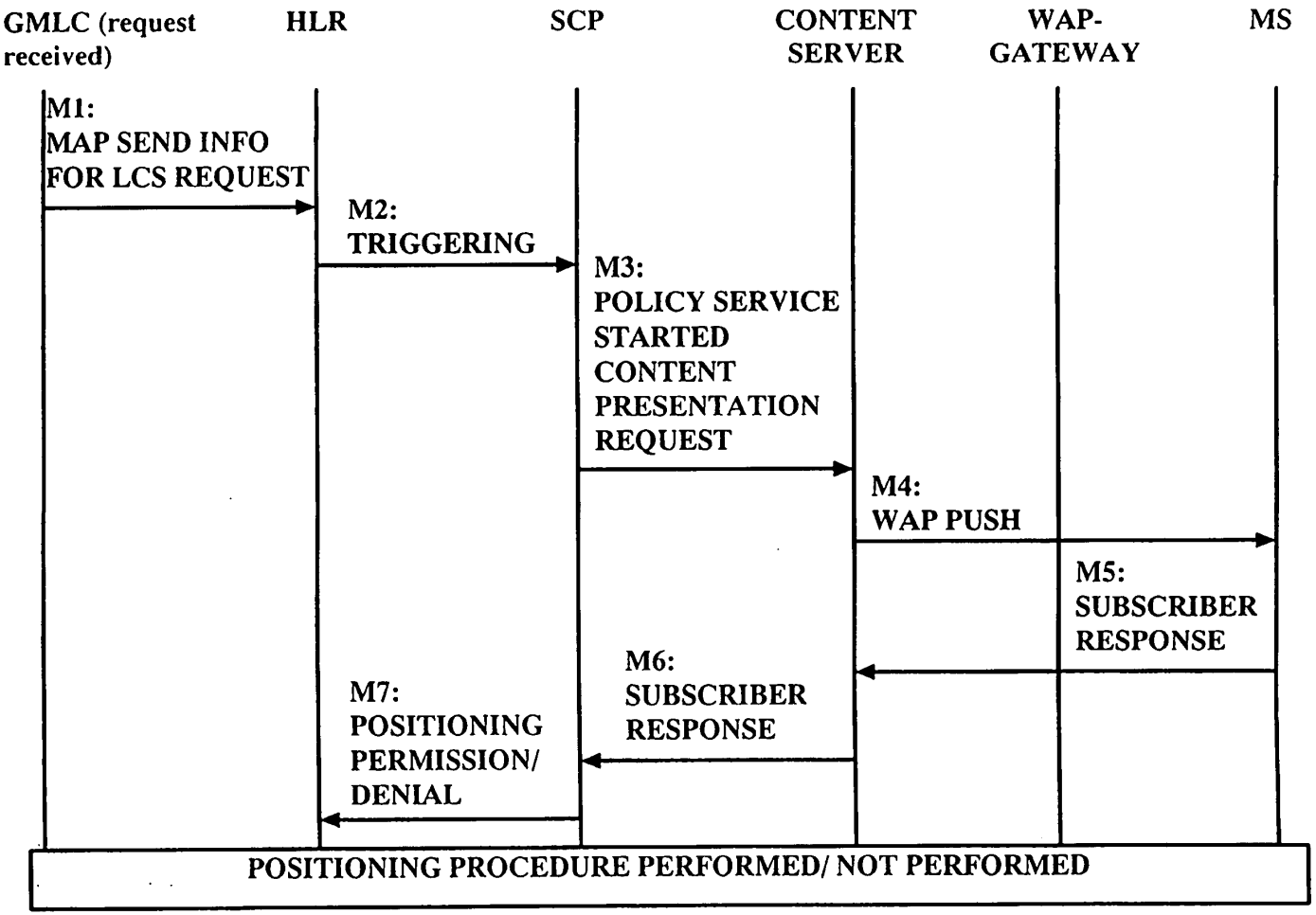

GMLC (request received)
HLR
SCP
CONTENT SERVER
WAP-GATEWAY
MS
M1: MAP SEND INFO FOR LCS REQUEST
M2: TRIGGERING
M3: POLICY SERVICE STARTED CONTENT PRESENTATION REQUEST
M4: WAP PUSH
M5: SUBSCRIBER RESPONSE
M6: SUBSCRIBER RESPONSE
M7: POSITIONING PERMISSION/ DENIAL
POSITIONING PROCEDURE PERFORMED/ NOT PERFORMED

FIG. 7

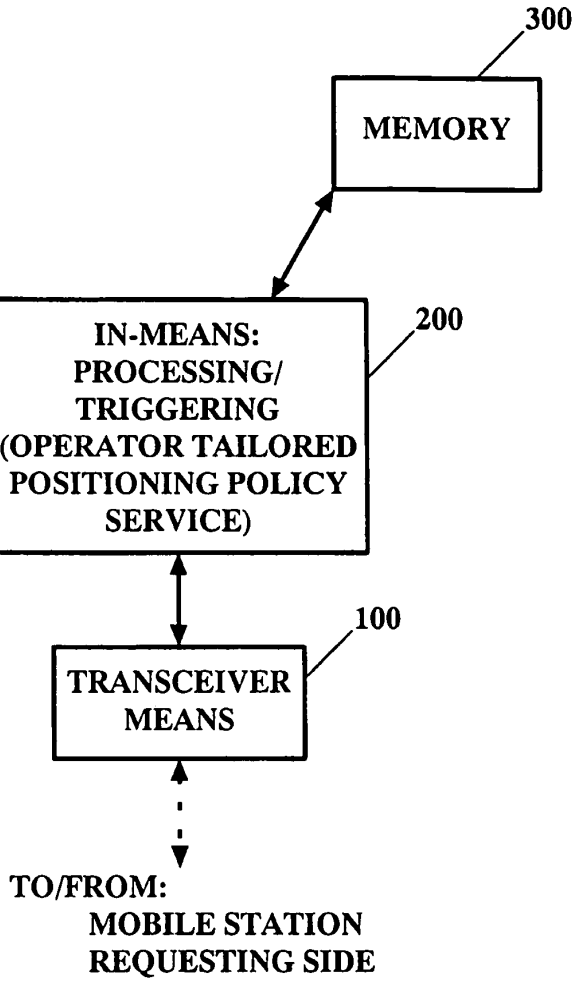

300
MEMORY
IN-MEANS:
PROCESSING/
TRIGGERING
(OPERATOR TAILORED
POSITIONING POLICY
SERVICE)
200
100
TRANSCEIVER
MEANS
TO/FROM:
MOBILE STATION
REQUESTING SIDE

FIG. 8

INTERNATIONAL SEARCH REPORT

Im ational Application No
PCT/EP 99/09043

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/22

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)
IPC 7 H04Q

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 950 137 A (KIM YOUNG-JE) 7 September 1999 (1999-09-07) column 3, line 51 -column 5, line 3	1,2,5,6, 11, 16-20, 22,23, 26-28, 33,40
X	WO 99 55115 A (ERICSSON INC) 28 October 1999 (1999-10-28) page 7, line 7 -page 11, line 8 -/--	1-3,6, 16-20, 22,23, 27,33, 34,40

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

[X] Patent family members are listed in annex.

* Special categories of cited documents :

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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

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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
20 July 2000	26/07/2000

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

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INTERNATIONAL SEARCH REPORT

Int. ational Application No
PCT/EP 99/09043

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 852 775 A (HIDARY MURRAY) 22 December 1998 (1998-12-22) column 2, line 63 -column 3, line 29 column 4, line 13 - line 36	1-3,11, 21-25, 33,34, 38,39

1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. ..tional Application No
PCT/EP 99/09043

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5950137 A	07-09-1999	GB 2317305 A	18-03-1998
WO 9955115 A	28-10-1999	AU 3751999 A	08-11-1999
US 5852775 A	22-12-1998	NONE	

Form PCT/ISA/210 (patent family annex) (July 1992)

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International Bureau

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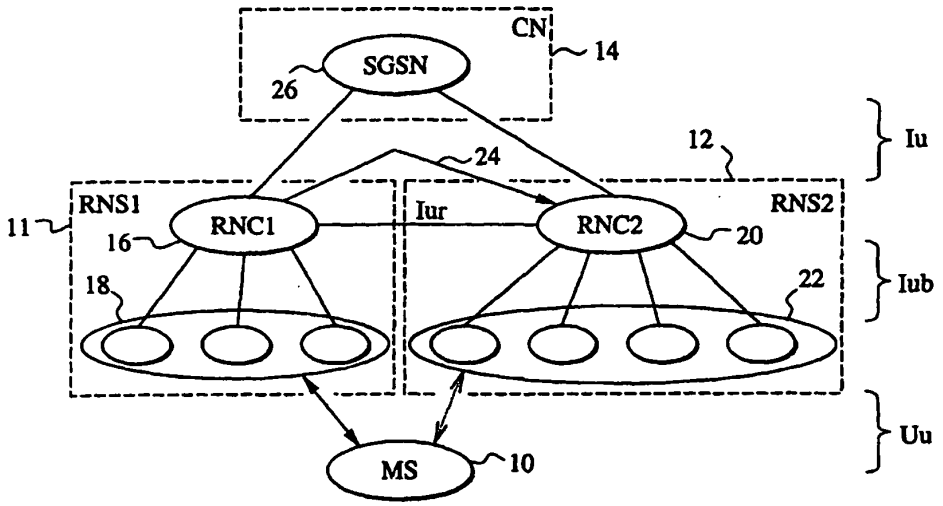
(74) Agent: MAGUIRE, Francis, J.; Ware, Fressola, Van Der Sluys & Adolphson LLP, 755 Main Street, P.O. Box 224, Monroe, CT 06468 (US).

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[Continued on next page]

(54) Title: TRANSFER OF OPTIMIZATION ALGORITHM PARAMETERS DURING HANDOVER OF A MOBILE STATION BETWEEN RADIO NETWORK SUBSYSTEMS



(57) Abstract: Instead of renegotiating parameters relating to an optimization algorithm previously negotiated between a mobile station and a target radio network subsystem during connection handover of the mobile station from a source radio network subsystem, prestored parameters are transferred instead between the source radio network subsystem and the target radio network subsystem either directly over an existing Iur interface or via a core network over an Iu interface.

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Published:
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

TRANSFER OF OPTIMIZATION ALGORITHM PARAMETERS DURING HANDOVER OF A MOBILE STATION BETWEEN RADIO NETWORK SUBSYSTEMS

TECHNICAL FIELD

2nd and 3rd generation cellular packet systems.

BACKGROUND OF THE INVENTION

In the Global System for Mobile Telecommunications/ General Packet Radio Service (GSM/GPRS) network architecture, as shown in Fig. 13, there are known data protocol stacks associated the various architectural elements, including the mobile station (MS), base station subsystem (BSS) including Base Transceiver Station (BTS) and Base Station Controller (BSC), serving GPRS support node (SGSN) and gateway GPRS support node (GGSN). The MS and the SGSN share peer logical link control (LLC) and subnetwork-dependent convergence protocol (SNDCP) layers in the user plane.

A typical GPRS negotiation that is required between peer entities in the mobile station and some of the fixed network devices is the exchange identification or XID negotiation, where so-called L3CE (layer 3 compatibility entity) parameters are agreed upon.

The UMTS packet network architecture is highly similar to GPRS. However, the naming of some elements and interfaces has been changed from GPRS. While Fig. 13 shows the GPRS network architecture, Fig. 14 shows the UMTS packet network architecture.

The UMTS packet network consists of the following network elements:

Node B: corresponds to Base Transceiver Station (BTS) in GSM.

RNC (Radio Network Controller): corresponds to Base Station Controller (BSC) in GSM.

3G-SGSN: the 3rd Generation version of the Serving GPRS Support Node (SGSN) of GSM/GPRS.

3G-GGSN: the 3rd Generation version of the Gateway GPRS Support Node (GGSN).

HLR: the GSM Home Location Register (HLR) with some updates.

As shown in Fig. 14, Node B and RNC comprise the RAN part of the UMTS network. RAN corresponds to GSM's BSS. The responsibility of RAN is the handling of all radio specific functions, e.g., radio channel ciphering, power control, radio bearer connection setup and release. The basic separation between elements is that Node B handles the physical layer functions and RNC handles the management functions. However, the separation might ultimately turn out to be slightly different than in GSM/GPRS.

The biggest architectural difference is the new interface, Iur, inside RAN. It is resident between RNCs. UMTS introduces a new concept called macrodiversity. In a macrodiversity situation, data is sent via multiple Node Bs. Because signals are transferred via multiple routes over the air interface and combined in the MS and the RNC, e.g., the fading effect is less harmful and thus lower power levels can be used. However, those Node Bs may belong to the area of two or more different RNCs, so the interface, i.e., Iur-interface between RNCs is required. In this situation, as shown on the right in Fig. 15, RNC can be in two logical roles. RNC can be logically either:

drift RNC (DRNC) or

serving RNC (SRNC).

The actual termination point of the Iu-interface is at the SRNC. The Iu-interface shown in Fig. 14 connects the Radio Access Network (RAN) and Core Network (CN) for

packet-switched or circuit switched services. The SRNC controls information transfer and requests radio resources from appropriate DRNCs. The DRNC only relays information between MS and SRNC.

The Core Network (CN) part of the packet-switched side consists of 3G-SGSN, 3G-GGSN and HLR elements, as shown in Fig. 14. The Packet Core Network (CN) also includes the IP-based backbone network. The backbone connects core network elements, e.g., 3G-SGSN and 3G-GGSN together.

3G-SGSN participates in routing of user packets as well as mobility and session management functions. The Mobility Management (MM) layer knows "who you are (security) and where you are (mobility)". The Session Management (SM) layer controls the user connections, i.e., sessions.

3G-GGSN maintains the location information of 3G-SGSN, which serves the mobile station to which a packet is targeted. The main function of 3G-GGSN is to perform interworking functions between the UMTS network and the external data network, e.g., the Internet. These interworking functions include, e.g., the mapping of the external QoS to a comparable UMTS QoS.

HLR stores the subscriber data and holds the information to which 3G-SGSN the user is connected. The subscriber data includes predefined QoS attributes for the user connections, among other things.

The UMTS packet data protocol stack has some major modifications compared to GPRS, partly due to the new radio interface technology (WCDMA) and partly due to much higher QoS requirements.

One of the most important changes is that Logical Link Control layer (LLC) of ESM/GPRS has been removed below the Layer 3 Compatibility Entity (L3CE). L3CE

corresponds to SubNetwork Dependent Convergence Protocol (SNDCP) protocol in GPRS. The main tasks of the LLC protocol have been:

flow control between MS and core network,
ciphering,
signaling message transfer,
multiplexing of different QoS and
retransmission between MS and the core network.

In UMTS, LLC is not needed due to the following reasons: 1) Ciphering has been decided to take place in lower layers, inside RAN. 2) Signaling message transfer does not use user plane protocols, because there are separate protocols for transferring signaling messages and thus the differentation between the user plane and the control plane is clearer than in GPRS.

In the UMTS radio interface, each radio bearer will have its own Radio Link Control (RLC) entity. By applying this approach the QoS provisioning is more efficient. The QoS related multiplexing will be a task for the Medium Access Control (MAC) layer and Layer 1 (L1) and thus LLC would not have any role in QoS multiplexing in UMTS. The retransmission between the MS and the core network cannot be easily justified. The main source of the errors is the radio interface, and RLC has the responsibility to correct those errors.

However, the removal of LLC will cause a lack of flow control between the MS and the core network. The flow control in the uplink is not a problem, because the radio interface will be the bottleneck and flow control of RLC takes care of it. In the downlink, RLC will handle the RNC - MS part. Between RNC and the core network, there is no flow control. But this is not a much worse situation than in GPRS, because GPRS does not have any flow control inside the core network (between

GGSN and SGSN).

Adequate data transfer between 3G-GGSN and RNC relies on large enough buffers, traffic policing in 3G-GGSN and end-to-end flow control, e.g., Transmission Control Protocol (TCP). In general, the removing of LLC streamlines the protocol stack and makes it easier to achieve higher data rates and reduces required processing power.

The location of the UMTS counterpart to L3CE (SNDCP in GPRS) called Packet Data Convergence Protocol (PDCP) is under consideration. Unlike in GPRS the PDCP layer is located in RNC instead of SGSN. The protocol *inter alia* takes care of optimization, e.g., by header compression, which is a form of optimization algorithm. Some header compression algorithms are based on the principle that disappearence of a few packets may cause undesirable additional packet loss due to the algorithm itself. This degrades packet transfer because more retransmissions are needed to be done. By locating it to the RNC, the retransmission time is short and the TCP level retransmission (due to TCP timers) can be avoided.

Network layer protocols are intended to be capable of operating over services derived from a wide variety of subnetworks and data links. The PDCP supports several network layer protocols providing protocol transparency for the users of the service. An introduction of new network layer protocols to be transferred over PDCP should be possible without any changes to other UMTS protocols. Therefore, all functions related to transferring of Network Layer Protocol Data Units (N-PDUs) are carried out in a transparent way by the network entities. Another requirement for PDCP is to provide functions that improve data and channel efficiency. This is done by different kind of optimization algorithms or

methods, e.g., the above-mentioned header compression.

UMTS (Universal Mobile Telecommunications System), as shown in Fig. 14, utilizes similar protocol structures and negotiation arrangements for communication between mobile stations, Radio Network Controllers (RNCs) and service nodes of packet-switched networks, with some modification. Exchange Identification (XID) negotiation is carried out by the PDCP but is called PDCP parameter negotiation and can be viewed generally as a transfer of optimization algorithm parameters.

In either case, the negotiated parameters will relate to such optimization algorithm parameters, for example, to the use of headers and data compression. The GSM/GPRS method for arranging an XID negotiation is to insert the proposed parameters into certain messages in an LLC protocol layer and to use corresponding LLC-level answering messages to either acknowledge or reject the proposed SNDCP parameters.

The XID negotiation is usually made when SNDCP and LLC in GPRS are initialized (values for XID parameters are no longer valid). This initialization is made, e.g., when the MS is powered on or the location of network side protocols changes in handover.

The main problem of the currently-proposed XID negotiation method for UMTS is that the location of PDCP is different from the location of SNDCP and LLC protocol. PDCP locates in the radio access network while comparable GPRS protocols locate in core networks. This means that the location of PDCP changes far more often than the locations of SNDCP and LLC. Because XID messages may be relatively large, this adds much more overhead to the air interface in UMTS than in GPRS.

Another problem is that UMTS has also real time packet connections. This means that negotiations such as

XID should be as fast as possible, because otherwise it may cause delays or at least more overhead in the air interface (header compression cannot be used after handover until XID negotiation is successfully made).

SUMMARY OF INVENTION

The object of the invention is to provide for improved UMTS as well as GSM/GPRS negotiation methods.

This invention improves any negotiation, such as optimization algorithm parameter negotiation, e.g., XID negotiation, by reducing the overhead over the air interface and making the negotiation procedure faster. The basic idea of the invention is that during handover, parameters such as XID, containing parameter information about optimization methods to be supported, are transferred from the old entity to the new entity on the network side. If the parameters were appropriate in the new entity, the actual negotiation between the MS and the network is not needed, thus saving resources on the air interface. This method is also considerably faster than, for instance, normal XID negotiation.

According to the present invention, a method of negotiating such as negotiating optimization algorithm parameters, for instance exchange identification (XID) parameters during connection handover of a mobile station between radio network subsystems, comprises the steps of signaling from a source radio network subsystem to a core network or to a target radio network subsystem that said handover is required, signaling from the core network or from the target radio network subsystem to the source radio network subsystem that said handover is to proceed, and transmitting said parameters from said source radio network subsystem to said target radio network subsystem directly or via the core network without any need for

renegotiating over an air interface between said mobile station and said target radio network subsystem.

In further accord with the present invention, wherein during initial establishment of said connection between the mobile station and the source radio network subsystem, the optimization algorithm paramaters such as exchange identification parameters may include various optional sets of parameters, only one of which is accepted by the source radio network subsystem, said method further comprising the step of storing all of said optional sets of parameters wherein said step of transmitting said parameter includes transmitting all of said optional sets of parameters.

From the foregoing, it will be realized that the present invention indeed saves resources for the air interface and makes any kind of negotiation, including negotiation of parameters relating to optimization methods such as XID faster, which is advantageous for real time connections.

These and other objects, features and advantages of the present invention will become more apparent in light of the detailed description of a best mode embodiment thereof, as illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

Fig. 1 shows a source radio network controller (RNC) moving already-negotiated XID parameters to a target RNC during handover, according to the present invention.

Fig. 2 shows a simplified procedure of SRNS relocation according to the present invention.

Fig. 3 shows an MSC connecting to the network.

Fig. 4 shows MSC initialization.

Fig. 5 shows MSC SRNS relocation.

Fig. 6 also shows MSC SRNS relocation.

Fig. 7 shows a situation before SRNS relocation and location registration.

Fig. 8 shows the situation after the SRNS relocation and location registration.

Fig. 9 shows how Figs. 9A and 9B fit together.

Figs. 9A and 9B together show the signaling sequence concerning interface information transfer for SRNS relocation update when changing SGSN area resulting in a change of register location and followed by location registration in a new location area.

Fig. 10 shows data paths before the SRNS relocation has been actually committed.

Fig. 11 shows data paths after the GGSN update.

Fig. 12 shows data paths after the resource release in the source RNC.

Fig. 13 shows the GPRS network architecture.

Fig. 14 shows the UMTS packet network architecture.

Fig. 15 shows two logical RNCs.

BEST MODE FOR CARRYING OUT THE INVENTION

The first XID negotiation after the MS is connected to the network is always a normal GPRS type of XID negotiation, as in the prior art. The GPRS XID parameter negotiation as part of the SNDCP protocol is defined in TS 101 297 v.6.4.0 (1999-08) (GSM 04.65 version 6.4.0 Release 1997 (chapter 6.8)).

Similarly, during inter RNC handover (SRNS relocation), according to the currently-proposed evolution of the GSM platform towards UMTS, the control point of data transfer moves from a source RNC (RNC 1) to a target RNC (RNC 2) and thus a new PDCP entity is established to the target RNC network element. However this new PDCP entity should negotiate XID parameters, before it starts data transfer towards the MS (PDCP can

transfer data before it knows negotiated XID parameters, but then it is allowed only use default values of XID parameters -> no optimization is allowed, e.g., header compression).

The prior art basic solution (as in GPRS) is still that the target RNC makes normal XID negotiation between itself and the MS and after that starts data transfer.

A more advantageous solution according to the present invention, and as illustrated in Fig. 1, is that the source RNC 16 (RNC 1) moves the already-negotiated XID parameters to the target RNC 20 (RNC 2) during handover, i.e., SRNS relocation directly or via SGSN 26 (see 3G TS 23.121 v3.0.0 - chapter 4.3.12.2.3).

Fig. 1 shows a pair of radio network subsystems 11, 12 connected to the core network 14 through an Iu interface. The radio network system 11 consists of a radio network controller 16 and one or more abstract entities 18, which may be called Node B, which corresponds to the Base Transceiver Subsystem of GSM. The entities of Node B are connected to the RNC through an Iub interface. A Node B can support FDD mode, TDD mode or dual-mode operation. The RNC is responsible for handover decisions that require signaling to the mobile station 10 over a Uu interface. The RNC comprises a combining/splitting function to support macrodiversity between different Node Bs. The Node B can comprise an optional combining/splitting function to support macrodiversity inside a Node B. The RNCs 16, 20 of the radio network subsystems 11, 12 can be interconnected together through an Iur interface, as already discussed previously in connection with Fig. 14.

Each RNC is responsible for the resources of its set of cells. For each connection between a user equipment, such as the mobile station MS 10 of Fig. 1, and the

illustrated access/core architecture, one RNC is the serving RNC. In Fig. 1, the RNC1 16 is initially the serving RNC. The RNC2 20 serves as a drift RNC (see also Fig. 15) and supports the serving RNC1 16 by providing radio resources for possible handover. Upon such a handover, as suggested above, during the inter-RNC handover, the control point of data transfer moves from RNC1 16 to RNC2 20 for establishing a new PDCP entity to the target RNC2 20. According to the prior art, this new PDCP entity should first negotiate PDCP parameters, before it starts data transfer to the MS, unless it wishes to only use the default values, i.e., without optimization.

According to the present invention, rather than renegotiating, such as renegotiating optimization algorithm parameters, for instance PDCP parameters all over again, the RNC1 16 transfers the already-negotiated PDCP parameters to RNC2 20, as indicated on a line 24, which transfer may take place over the Iur interface or through the core network 14, e.g., via a serving GPRS support node (SGSN) 26.

Fig. 2 shows an embodiment that represents a simplified procedure of SRNC relocation where two SGSNs are involved in the core network. One possible solution for PDCP parameter transfer is the use of SRNC relocation messages (e.g., SRNC_Relocation_Required 30, Forward_SRNC_Relocation 32 (e.g., if RNS1 and RNS2 are connected to different SGSNs, to possibly another SGSN 27 not shown in Fig. 1), SRNC_Relocation_Request 34 to the target SRNC 20, SRNC's Relocation_Proceeding 1 36, Forward_SRNC_Relocation Response 38, SRNC_Relocation_Proceed 2 40, SRNC_Relocation_Commit 42, RNC_Restart_44, Data_Transmission_Begin 46, PDCP_Parameter_Request (if needed) 48,

PDCP_Parameter_Response (if needed) 50). The format of PDCP parameters can be the same as in normal prior art XID negotiation. After the target RNC2 20 receives these PDCP parameters, it checks their validity. If they are valid, it can use the parameters immediately. Otherwise the target RNC makes a normal XID-type negotiation, as suggested in Fig. 2 at steps 48, 50. So PDCP negotiation between the MS and the target RNC is made only when PDCP parameters are not valid in the target RNC and therefore air resources are saved.

However, the MS requires information about the validity of the PDCP parameters before it can send data to the RNC (MS can't otherwise know whether PDCP parameters were alright in the RNC). There are two options:

Preferable solution: RNC informs the MS about validity of XID parameter during/before RLC restart within separate message, e.g., during step 44 of Fig. 2. If PDCP parameters were valid, both ends can use same negotiated PDCP parameters immediately. If PDCP parameters were not valid, PDCP negotiation is made after restart, as shown, e.g., in steps 48, 50. Until PDCP negotiation is completed, all data packets are sent in uncompressed mode, i.e., the default mode.

Another solution: It can be guaranteed, that PDCP parameter negotiation can be made before data transfer (preferably before RLC restart step 44), if it is needed. (This might cause delays to SRNC relocation, however.)

This retrieval of PDCP parameters from the source RNC, as described so far, has one disadvantage. The target RNC can't know if the MS can handle 'better' PDCP parameters, e.g., better compression methods than originally negotiated between the MS and the source RNC 16 (RNC 1).

Example:

- MS can handle header compression methods A and B
- RNC 1 can handle header compression method A
- RNC 2 can handle header compression methods A and B.

Because PDCP negotiation is made originally by RNC 1, only header compression A is negotiated for use. After SRNC relocation, RNC 2 checks the validity of the PDCP parameters. In the example they are valid, because RNC 2 can handle header compression A. The problem is that, in this situation, PDCP negotiation between MS is not made and header compression B is not taken up for use. If the header compression B is significantly better, it causes inefficiency. (Normal PDCP negotiation takes always the best XID parameters for use.)

This problem can be avoided, according further to the invention, with the following enhancements:

Firstly, the initial XID negotiation (first XID negotiation after MS is connected to the network) is always started from the MS side. (This is a normal situation in GPRS). The MS defines and puts suitable PDCP parameters into the PDCP message. Then the peer entity, i.e., RNC, negotiates, i.e., selects appropriate PDCP parameters and sets suitable values to them. After that the RNC returns negotiated XID parameters to the MS and the negotiated parameters are taken up for use.

However, if the RNC stores in addition to negotiated PDCP parameters also the 'not used' or discarded PDCP parameters (in the example, it stores information on header compression B), when SRNC relocation is made, the 'not used' PDCP parameters are retrieved from storage and are also transferred to the target RNC. (The same SRNC relocation messages are used then on transfer or negotiated PDCP parameters.) According to this information, the target RNC can decide if those 'not

used' XID parameters are 'better' (in the example, header compression B) than currently negotiated and make PDCP negotiation between MS to take up for use new and 'better' XID parameters.

A few examples of Negotiation of Header Compression (HC) parameters according to the invention will now be given.

Example 1:

An example of negotiation of header compression (HC) parameters is shown in Fig. 3. When Mobile Station connects to the network RRCs with a *UE CAPABILITY INFORMATION* message is used to inform the SRNC of the header compression (HC) methods that UE is able to use and the parameters thereof. This information is left to the network to be updated and taken care of.

After comparing the network's own and these received parameters, the network makes a decision of the HC-method to be used, also taking into consideration the QoS requirements. Thus it is possible to choose the most probable HC method (in other words, according to QoS requirements the first configured method can be chosen to be real-time traffic optimized method or not). After the network has made the decision it configures its own compressor, generates the OPT value table and commands using RRC messages *RADIO BEARER SETUP* (Fig. 4) or *RADIO BEARER RECONFIGURATION* (Fig. 5) the parameters relating to that algorithm with which the compressor in the UE end is configured. At the same time the OPT table is generated to match the table of the network's end. The VE_RRC responds with a RADIO_BEARER_SETUP_COMPLETE (Fig. 4) message to the SRNC_RRC or with a RADIO_BEARER_RECONFIGURATION_COMPLETE (Fig. 5) message in case of reconfiguration.

Because the network knows (Fig. 3) which algorithms the UE and the network itself are able to use, it is possible to configure a new compressor in case other kinds of packets (different from what is supported by current compressor) are recognized and the compression of these is supported by the network and the UE. In that case, new compressors will be configured at both ends immediately. If the notification is in the UE end, these are sent firstly to the RNC uncompressed and after the RNC notices the situation it configures the compressors at both ends. The new compressor at the UE end is configured using a *RADIO BEARER RECONFIGURATION* (Fig. 5) message containing the information, which is sent when the new method is being configured.

Because the network maintains the information of all possible methods for use at both the UE and the network and because only the most probable method is being configured, it is possible to leave the compressors of other methods to be configured later if needed.

In case of SRNS relocation, as detailed in Fig. 6, after the last *SRNC_relocation_Commit* message, a *new RNC RADIO BEARER RECONFIGURATION* (Fig. 5) message is sent, wherein new HC parameters are communicated if the method changes. In case the method doesn't change, only old parameters are communicated and information about the reset (yes/no) of the compressor is transmitted. If there is no resetting then the compression/decompression continues as it was in the old RNC.

Example 2:

Again, when the Mobile Station connects to the network RRCs with the *UE CAPABILITY INFORMATION* message of Fig. 3, the SRNC_RNC is informed of the desired header compression (HC) methods that the UE is able to use and

the related parameters. This information is left to the network to be updated and taken care of.

The network chooses the methods that can be supported based on its own supported methods as well as those of the UE. After this the network could send the parameters of all the supported methods at the same time with a message to the UE. This would mean that both the network and the UE would know which methods can be supported. In this case also the OPT table indicating different packet types of different methods is generated to be similar at both ends. This information transfer can be carried out by using RRC's *RADIO BEARER SETUP*, as shown in Fig. 4, or *RADIO BEARER RECONFIGURATION* messages, as shown in Fig. 5. At the same time the most probable method is informed and configured and the compressor is created.

In case the configured compressor is, e.g., TCP/IP but afterwards RTP/UDP/IP real-time packets are recognized, PDCP recognizes the situation and generates a new compressor for those. This new RTP/UDP/IP compressor is configured and inside the compressor the stream-based contexts are generated and stream-based Full Headers (FH) are sent to the other end. The link layer informs using the OPT-field about what compression method is in question and that it deals with that method's Full Header (FH). The other end notices the situation, configures the decompressor and generates (using FHs) the correct internal contexts for existing streams. In this situation no *RADIO BEARER RECONFIGURATION* messages need to be sent. After this the compressor is able to send compressed packets without further acts. This solution works independently of the transmission end (UE/network).

Another solution is that for all supported methods each end's own compressors are configured immediately in

the beginning, meaning that compressor configuration is done only once. In this case inside the compressor only the own specific stream-based contexts are generated and stream-based Full Headers (FH) are sent to the other end. Also if the same compressor supports two methods the configuration is not needed but only one's own stream-based compressor contexts are generated and FHs sent to the other end.

Again, in SRNS relocation after *SRNC_relocation_Commit* message, as shown in Fig. 6, a new *RNC RADIO BEARER RECONFIGURATION* message is being sent (Fig. 5), wherein the UE is informed if the method changes. In case the method doesn't change only information about the reset (yes/no) of the compressor is sent. If there is no resetting then the compression/decompression continues as it was in the old RNC.

Example 3:

It is also possible that network informs the UE about the methods it supports when connecting to the network and in case of SRNS relocation after *SRNC_relocation_Commit* message. In this case UE begins the transmission of compressor parameters using some *RADIO BEARER SETUP* (Fig. 4) and *RADIO BEARER RECONFIGURATION* (Fig. 5) based signaling and the compressor generating procedure according to example 1 or 2 with the difference that UE sends the configuration messages and network receives them.

The current (prior art) solution in GPRS is that XID negotiation is made again when the location of SGSN changes (inter SGSN handover). This negotiation is required, because the SNDCP and LLC protocols locate in SGSN and the old XID parameters are not known in the new

SGSN (and they may also be non-applicable). XID negotiation is made for certain (most, but not all) LLC and SNDCP parameters, e.g., header compression parameters.

However, this approach is not very suitable for UMTS.

- In UMTS, the PDCP is located in RNC, so negotiation will have to be made more often.
- UMTS has real time bearers also for packet data.
- Negotiation would be fast as possible.

Note: PDCP parameter negotiation is probably not to be named XID-negotiation, just PDCP parameter negotiation in UMTS.

Possible alternatives to make PDCP negotiation between UE and target RNC:

In the following, SRNS relocation is described in detail. All necessary information is transferred from the source RNC to the target RNC.

- negotiated PDCP parameters -> target RNC, whether they are OK or not for it. If they are, new negotiation is not needed and air resources and time are saved.
- UE capability information -> this includes UE's PDCP capability information among other capabilities. PDCP capability information may contain, e.g., the following information: PDCP version number and supported header compression methods and other parameters. This is not mandatory.

1) One solution is that network commands (RRC protocol in RNC), what parameters are used in the UE (in different radio layer protocols, L1, MAC; RLC, PDCP). This is not an actual two-way negotiation like XID negotiation. However the network shall know what

parameters the UE is able to support (because the network can't command what the UE can't support). This UE capability can be transferred from source SRNC (suggested) or requested from the UE by 'UE capability enquiry' (see RRC specification - TS 25.331 v1.5.0: Chapters 8.1.6 and 8.1.7). Now the target SRNC can negotiate (command) new parameters for the UE. The current (prior art) solution is that the parameters are transferred within 'Radio Bearer Setup/Reconfiguration' messages (see TS 25.332: Chapter 8.2). Actual PDCP parameters should probably be named as 'PDCP Info' like 'RLC info' (see table in chapter 10.1.5.4). Also other messages (new or existing ones) are possible.

In a case where the parameters were OK in the target SRNC:

- An indication is provided that previously negotiated parameters were OK. Both sides use old parameters. This indication can be one's own RRC level message or part of a 'Radio Bearer Setup/Reconfiguration'-message. This indication can be very short (1 bit), to indicate whether the negotiated parameters were OK or not.

In a case when parameters were not OK in the target SRNC:

- The target RNC commands new parameters taking into consideration the UE's capability. (Normal PDCP parameter negotiation).

In this solution, there is no time saving, because negotiation is one way.

2) In this solution, PDCP parameter negotiation is two-way between the network (RNC) and the UE. In this case, UE capability information is not mandatory (but such may help the target SRNC, when it negotiates new parameters). After SRNC receives the to be negotiated parameters, it checks the suitability of the parameters.

In a case where parameters are OK in target SRNC:
- An indication is provided that the previously negotiated parameters are OK. Both sides use the old parameters. This indication can be one's own RRC level message or part of a 'Radio Bearer Setup/Reconfiguration'-message. This indication can be very short (1 bit), to indicate whether negotiated parameters were OK or not.

In a case where parameters were not OK in target SRNC:
- The target RNC negotiates new parameters. (Two-way PDCP parameter negotiation). First direction message (request) may be same as in solution 1), i.e., 'Radio Bearer Setup/Reconfiguration', such as in Figs. 4 or 5, and second direction message (reply) could be 'Radio Bearer Setup/Reconfiguration Complete' (see chapter 10.1.5.5). Also new (own) messages for PDCP negotiation in RRC protocol may be possible.

In this solution, time is saved, because two-way negotiation needs to be made only when parameters weren't OK.

Note: In both solutions it is assumed that the RRC makes the PDCP negotiation and after negotiation (if needed) RRC informs new parameters to PDCP. An alternative solution is that PDCP makes the negotiation by itself. Then RRC messages are not used, but PDCP uses its own PDUs for negotiation. However the basic principles are the same also in this case.

A similar approach could be used also in future releases of GPRS.

SRNS relocation principles according to 3G TS 23.121 v 3.1.0 (1999-10) 3G PP Technical Specification Group

Services and Systems Aspects; Architectural Requirements for Release 1999 at Section 4.3.14.2, as modified according to the present invention:

According to Chapter 4.3.14.2.1 of 3G TS 23.121, to carry out SRNS relocation, the source SRNC must launch the SRNS relocation procedure, since it is not the target SRNC but the source SRNC that knows the current services of a user. This is done only when this procedure has the least adverse effect on user traffic. The SRNC relocation procedures must ensure that there is only one Serving RNC for a user even if this user has services through more than one (IP or ISDN) domain.

The SRNS relocation procedure is split in two phases. In the first phase resources are reserved on the new IU interfaces and (if needed) inside the CN. Only when this first phase has been successfully carried out for all domains on which the user currently has some services, can the source SRNC launch the second phase, i.e., handover of the role of SRNC to the target SRNC.

The signaling procedures shown below do not represent the complete set of possibilities, according to the TS 23.121 specification, nor do they mandate this kind of operation. It should be understood according to the standard, that a set of elementary procedures should be specified for each interface, which may be combined in different ways in an implementation. Therefore the illustrative sequences are merely examples of a typical implementation. In these examples from the 3G TS 23.121 standard, MSC stands for 3G_MSC/VLR and SGSN stands for 3G_SGSN.

SRNS relocation
(UE connected to a single CN node, 3G_SGSN)
followed by Location Registration in new Location Area as per Chapter 4.3.14.2.3 of 3G TS 23.121 as modified by the present invention

This example shows SRNS relocation when source RNC and target RNC are connected to different 3G_SGSNs. Fig. 7 and Fig. 8 respectively illustrate the situation before and after the SRNS relocation and location registration. Fig. 9 illustrates the signaling sequence where each step is explained below.

As shown in Fig. 7, before the SRNS relocation and location registration the UE is registered in SGSN1 and in MSC1. The UE is in state MM connected towards the SGSN1 and in state MM idle (see Chapter 4.3 UMTS Mobility Management (UMM) in 3G TS 23.121) towards the MSC1. The RNC1 is acting as SRNC and the RNC2 is acting as DRNC.

After the SRNS relocation and location registration as shown in Fig. 8, the UE is registered in MSC2 and in SGSN2. The UE is in state MM connected towards the SGSN2 and in state MM idle towards the MSC2. The RNC2 is acting as SRNC.

At SRNS relocation:

The source and target SGSN exchange CN level information (CN classmark, list of established PDP contexts)

The source and target SRNC exchange UTRAN level information (UTRAN classmark, ...) and information used to ensure that no user packet is lost nor duplicated during the SRNS relocation procedure. According to the teachings of the present invention, this UTRAN level information also includes negotiated PDCP (XID) parameters.

"Resource reservation" Phase

During this phase, according further to Chapter 4.3.14.2.3 of 3G TS 23.121 v 3.1.0 (1999-10), the transmission of packets between GGSN and UE through the source SRNC goes on. The following numbered paragraphs correspond to the numbered steps in Figs. 9A and 9B, which fit together as shown in Fig. 9.

1. UTRAN (source SRNC) makes the decision to perform the Serving RNC relocation procedure. This includes a decision on into which RNC (Target RNC) the Serving RNC functionality is to be relocated. The source SRNC sends SRNC Relocation Required messages to the SGSN1. This message includes parameters such as target RNC identifier and an information field that shall be passed transparently to the target RNC. According to the present invention, this may include negotiated PDCP (XID) parameters, UE capability (e.g., supported header compression methods by UE) and any other related parameters.

2. Upon reception of SRNC Relocation required message the SGSN1 determines from the received information that the SRNC relocation will (for instance, in this case) result in a change of SGSN.

The SGSN will then send a Forward SRNC relocation request to the applicable SGSN (e.g., SGSN2) including the information received from the Source SRNC (see above PDCP (XID) parameter information according to the invention) and necessary information for the change of SGSN (e.g., MM context, PDP context). The PDP context information contains the list of the PDP context (including PDP type, requested/negotiated QoS) currently established by the UE along with the address of the

associated GGSN. It does not contain any information linked with packet transmission (sequence numbers) because such information is under the responsibility of the UTRAN.

3. The SGSN2 sends a SRNC Relocation Request message to the target RNC. This message includes information for building up the SRNC context, transparently sent from Source SRNC (e.g., UE id., number of connected CN nodes, UE capability information (including the inventive information transfer relating to PDCP (XID) parameters described above), and directives for setting up Iu user plane transport bearers.

When the Iu user plane transport bearers have been established, and the target RNC completed its preparation phase, SRNC Relocation Proceeding 1 message is sent to the SGSN2, as shown in Figs. 9A and 9B. *The SRNC Relocation Proceeding 1 message* contains the IP address(es) (possibly one address per PDP context) on which the target RNC is willing to receive these packets.

4. When the traffic resources between target RNC and SGSN2 has been allocated and the SGSN2 is ready for the SRNC move, then the Forward SRNC Relocation Response is sent from SGSN2 to SGSN1. This message indicates that necessary resources have been allocated for the SRNC relocation: SGSN2/target RNC are ready to receive from source SRNC the downstream packets not yet acknowledged by UE. *The Forward SRNC Relocation Response message* contains the IP address(es) that were given in the SRNC Relocation Proceeding 1 message.

5. When the Forward SRNC Relocation Response has been received in the SGSN1, the SGSN1 indicates the completion of preparation phase at the CN PS domain side for the

SRNC relocation by sending the SRNC Relocation Proceeding 2 message to the Source RNC. This message contains the IP address(es) (possibly one address per PDP context) on which to send the downstream packets not yet acknowledged by UE.

"Actual hand-over of Serving RNC" Phase

6. When the source RNC has received the SRNC Relocation Proceeding 2 message, the source RNC sends a SRNC Relocation Commit message to the target RNC (list of (SNU, UP_RLC_Ack, SND)). SND is the GTP sequence number for the next downlink packet received from the GGSN. SNU is the GTP sequence number for the next uplink packet to be tunnelled to the GGSN. UP_RLC_Ack contains the acknowledgements for an upstream PDU received by the source SRNC on each RLC connection used by the UE (i.e., the Receive State Variable V(R) for all RLC SAPI in the acknowledged mode). The source SRNC starts a timer T3-TUNNEL, stops the exchange of the packets with the UE (point (a)), and starts tunnelling the buffered downstream packets towards the target SRNC. The target RNC executes a switch for all bearers at the earliest suitable time instance. In this phase, according to the present invention, new PDCP parameters are to be negotiated if needed. See the description above concerning possible alternatives for PDCP negotiation between the UE and the RNC.

7. The target RNC starts acting as SRNC and the remaining steps 7-14 of Chapter 4.3.14.2.3 of 3G TS 23.121 v 3.1.0 (1999-10) remain the same and are unaffected by the present invention. The target SRNC:

(a) Restarts the RLC connections. This includes the exchange between the target SRNC and the UE of the UP_RLC_Ack and DOWN_RLC_ACK. DOWN_RLC_ACK confirms all mobile-terminated packets successfully transferred before the start of the relocation procedure. If DOWN_RLC_ACK confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. UP_RLC_Ack confirms all mobile-originated packets successfully transferred before the start of the relocation procedure. From now on the exchange of the packets with the UE can restart (point (b)).

(b) Sends New MM System Information to the UE indicating, e.g., relevant Routing Area and Location Area. A new RAI triggers a routing area update procedure. Additional RRC information may then also be sent to the UE, e.g., new RNTI identity. This may trigger a location update procedure (see step 12 below).

8. Immediately after a successful switch at RNC, target RNC (=SRNC) sends SRNC Relocation Detect message to the SGSN2. After sending out the New MM System Information, the target RNC sends SRNC Relocation Complete message to the SGSN2.

9. The UE sends a Routing area update request (old RAI; old P-TMSI; old PTMSI signature, Update type) to SGSN2 when the New MM System Information included a new RAI.

10. Upon reception of RAU request, the SGSN2 updates the GGSN(s) with an Update PDP Context Request including the new SGSN address. The GGSN(s) then update the PDP context and return Update PDP Context Response. The SGSN

sends a Complete SRNC Relocation towards the SGSN1.

11. At reception of the Complete SRNC Relocation, SGSN1 will send a release indication towards the Source RNC. All resources allocated to this UE by the source RNC are released only when this message has been received and timer T3-TUNNEL has expired. Before timer T3-TUNNEL expires, all downstream packets received from the GGSN are sent towards the target SRNC.

12. The SGSN2 informs the HLR of the change of SGSN by sending Update GPRS location (IMSI, new SGSN address etc.) to the HLR. The HLR cancels the context in the old SGSN, SGSN1, by sending Cancel Location (IMSI). The SGSN1 removes the context and acknowledges with Cancel Location Ack. The HLR sends Insert subscriber data (IMSI, subscription data) to the SGSN2. The SGSN2 acknowledges with Insert Subscriber Data Ack. The HLR acknowledges the Update GPRS location by sending Update GPRS Location Ack to the SGSN2.

13. At reception of Insert subscriber data from HLR, the SGSN2 will initiate the update of MM information stored in the UE. This is done by sending Network Initiated Routing Area Update Command to the UE. This message will include new RAI, and possible also new P-TMSI. When the UE has made necessary updates it answers with Network Initiated Routing Area Update Complete.

14. When receiving new MM system information indicating a new Location Area, the UE will, in this case, initiate a Location Area update procedure towards the MSC2. This implies that the Location Area update will be performed in parallel to the above indicated activities related to the SGSN side of the Core Network.

UE-GGSN Communication path during the SRNS relocation procedure

Before point (a), in Fig. 9A, the connection is established between UE and GGSN via Source SRNC and SGSN1, as shown in Fig. 10 (Fig. 4-28 of 3G TS 23.121 v 3.1.0).

After transmission of the "SRNS relocation commit" to the target SRNC (after point (a) in Fig. 9A, the source RNC cannot exchange data with the UE because its RLC should be frozen after the transmission of the RLC sequence numbers to the target RNC. Before the restart of the RLC between target SRNC and UE (before point (b) in Fig. 9A), data transfer cannot go on. All downstream packets received by the target SRNC during this phase are buffered until restart of the RLC between target SRNC and UE.

After point (c), in Fig. 9A, the connection is established between UE and GGSN via Target RNC and SGSN2.

Before resource release in source RNC (before T3-TUNNEL expiry), target SRNC may receive downstream packet from two paths. Packets remaining on the backbone are sent on the "old path" (via SGSN1 and RNC1) and forwarded by source RNC1 to target SRNC2 while packets received by the GGSN on its Gi interface are sent on the new path (via SGSN2) to target SRNC2.

Fig. 11 shows data paths after the GGSN update (after point (c) in Fig. 9A).

Fig. 12 shows data paths after the resource release in source RNC (after the release response in Fig. 9A).

Although the invention has been shown and described with respect to a best mode embodiment thereof, it should be understood by those skilled in the art that the

foregoing and various other changes, omissions and additions in the form and detail thereof may be made therein without departing from the spirit and scope of the invention.

CLAIMS

1. Method of negotiating parameters of an optimization algorithm during connection handover of a mobile station between radio network subsystems, comprising the steps of:

signaling from a source radio network subsystem to a core network or to a target radio network subsystem that said handover is required;

signaling from the core network or from the target radio network subsystem to the source radio network subsystem that said handover is to proceed; and

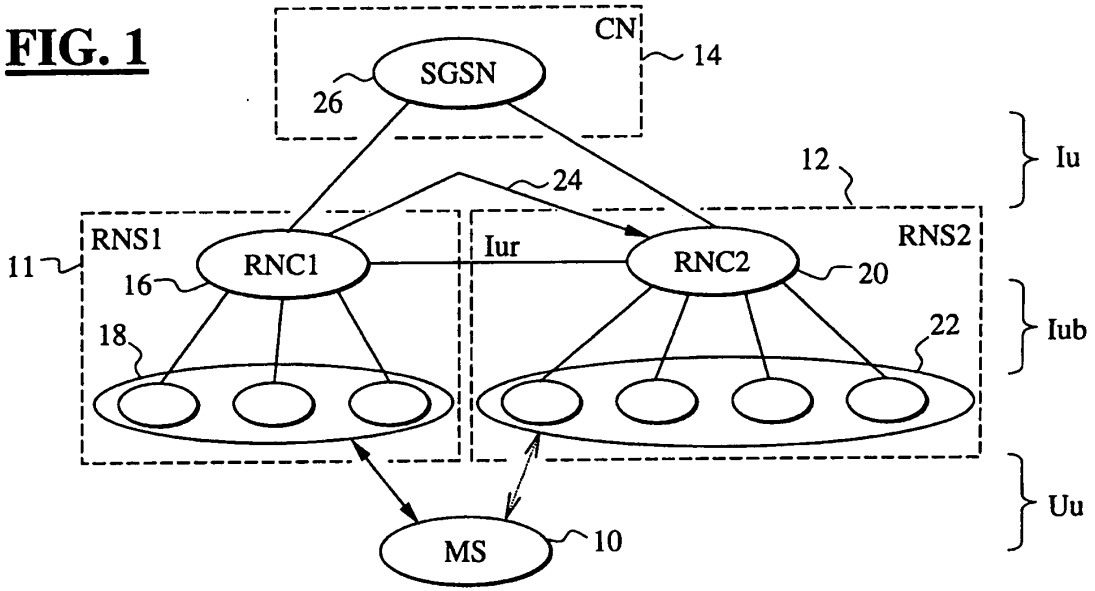
transmitting said parameters from said source radio network subsystem to said target radio network subsystem directly or via the core network without any need for renegotiating said parameters over an air interface between said mobile station and said target radio network subsystem.

2. The method of claim 1, wherein during initial establishment of said connection between the mobile station and the source radio network subsystem, the parameters may include various optional sets of parameters, only one of which is accepted by the source radio network subsystem, said method further comprising the step of storing all of said optional sets of parameters wherein said step of transmitting said parameter includes transmitting all of said optional sets of parameters.

3. Mobile telecommunications system including a core network (14) connected (Iu) to plural interconnected (Iur) radio network subsystems (11, 12) for communicating with a mobile station (10) over an air interface (Uu), wherein a first one of said radio network subsystems (11) includes a source radio network controller (16) for signaling to said core network or to a target radio network controller (20) in a second one of said radio network subsystems (12) that a handover is required wherein in response thereto said core network or said target radio network subsystem signals the source radio network controller that said handover is to proceed, and wherein parameters are then transmitted from said source radio network controller to said target radio network controller directly or via the core network without any need for renegotiating said parameters over said air interface between said mobile station and said target radio network controller.

4. The system of claim 3, wherein during an initial negotiation of said parameters between the mobile station and the source radio network controller, said parameters include various optional sets of parameters, only one of which is accepted by the source radio network controller, wherein said various optional sets of parameters are stored by said source radio network controller for transmittal to said target radio network controller after said source radio network controller signals said target radio network controller that said handover is to proceed.

FIG. 1


CN
14
SGSN
26
12
Iu
24
RNS1
11
RNC1
16
Iur
RNC2
20
RNS2
18
22
Iub
Uu
MS
10

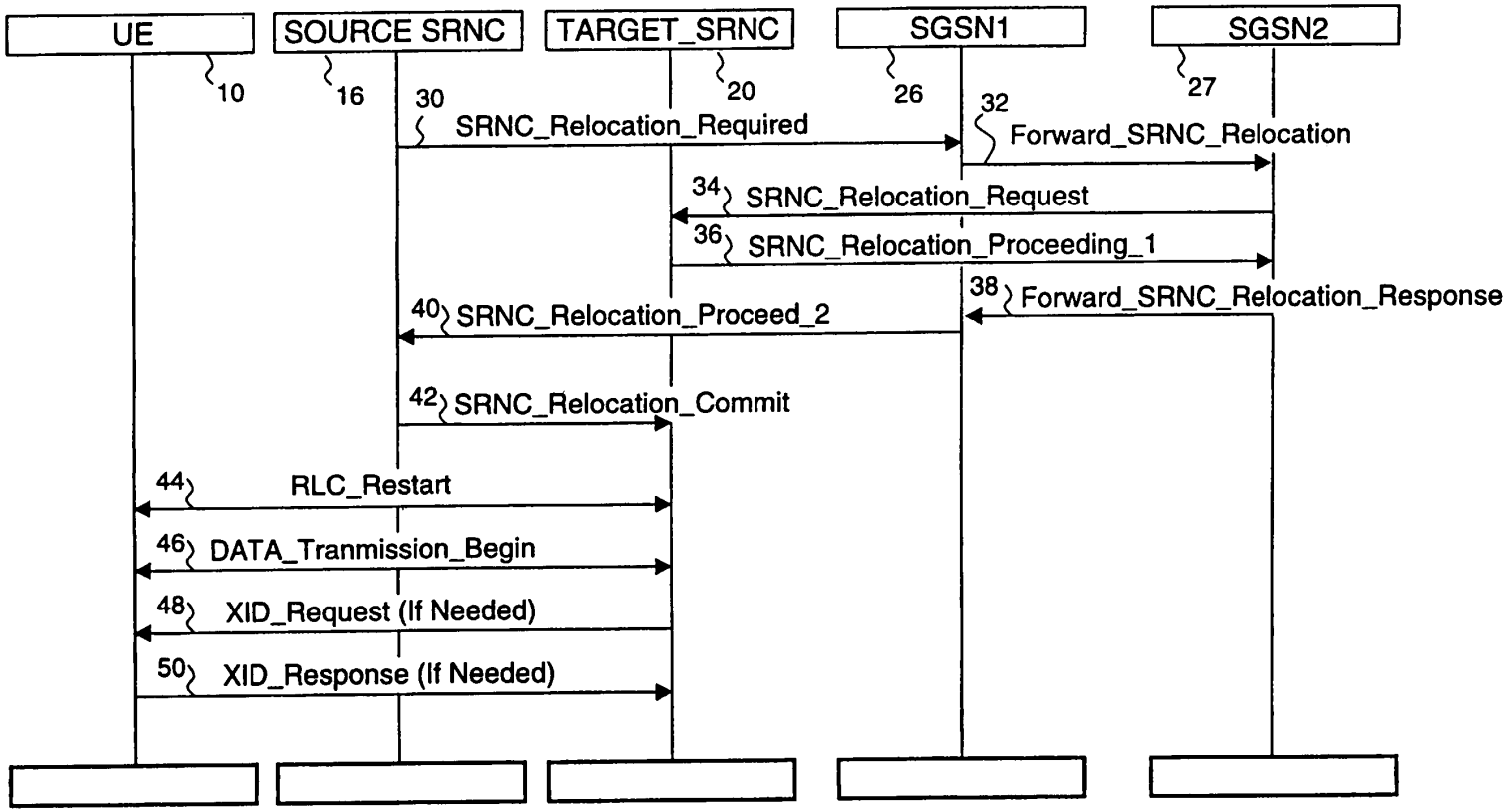
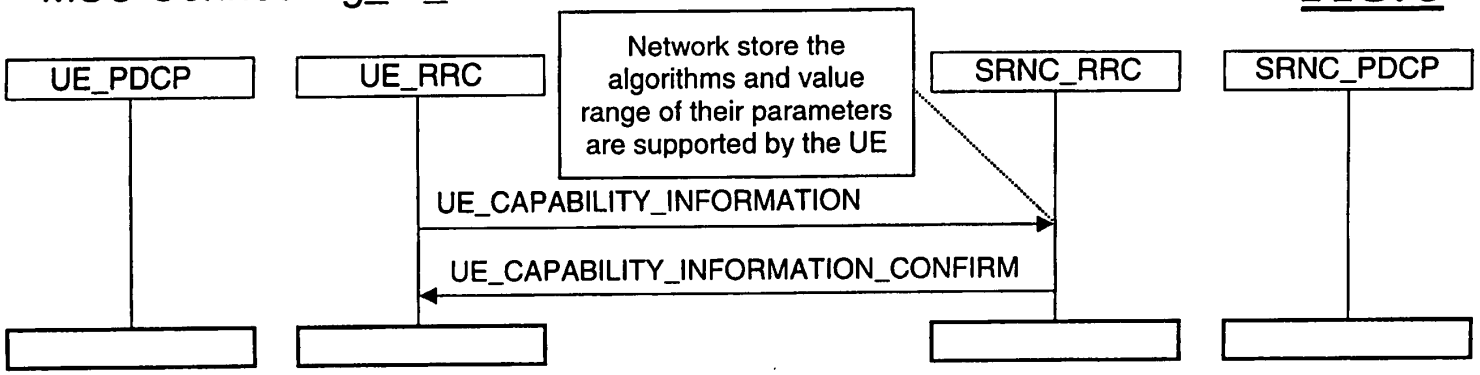

UE
SOURCE SRNC
TARGET_SRNC
SGSN1
SGSN2
10
16
20
26
27
30 SRNC_Relocation_Required
32 Forward_SRNC_Relocation
34 SRNC_Relocation_Request
36 SRNC_Relocation_Proceeding_1
38 Forward_SRNC_Relocation_Response
40 SRNC_Relocation_Proceed_2
42 SRNC_Relocation_Commit
44 RLC_Restart
46 DATA_Tranmission_Begin
48 XID_Request (If Needed)
50 XID_Response (If Needed)

FIG. 2

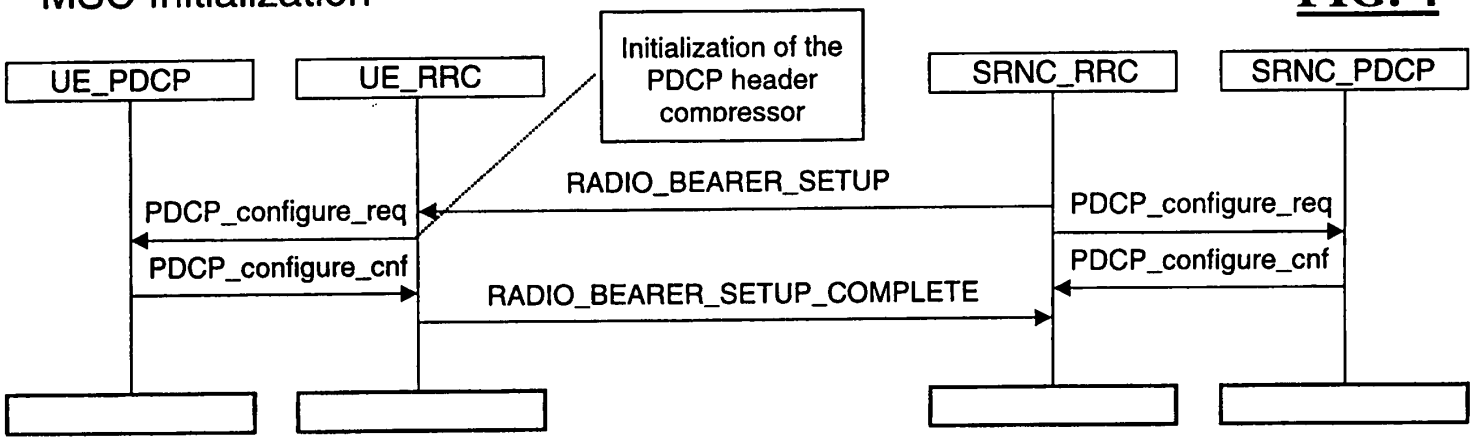
MSC Connecting_to_network

FIG. 3



MSC Initialization

FIG. 4



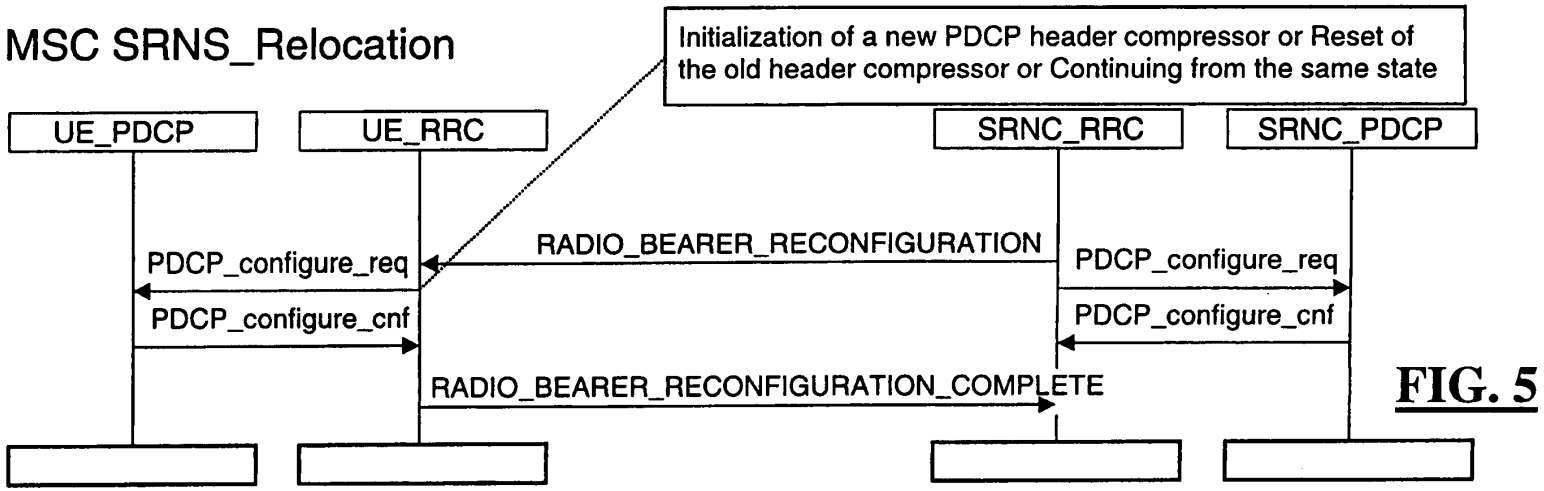

MSC SRNS_Relocation
Initialization of a new PDCP header compressor or Reset of the old header compressor or Continuing from the same state
UE_PDCP
UE_RRC
SRNC_RRC
SRNC_PDCP
RADIO_BEARER_RECONFIGURATION
PDCP_configure_req
PDCP_configure_req
PDCP_configure_cnf
PDCP_configure_cnf
RADIO_BEARER_RECONFIGURATION_COMPLETE

FIG. 5

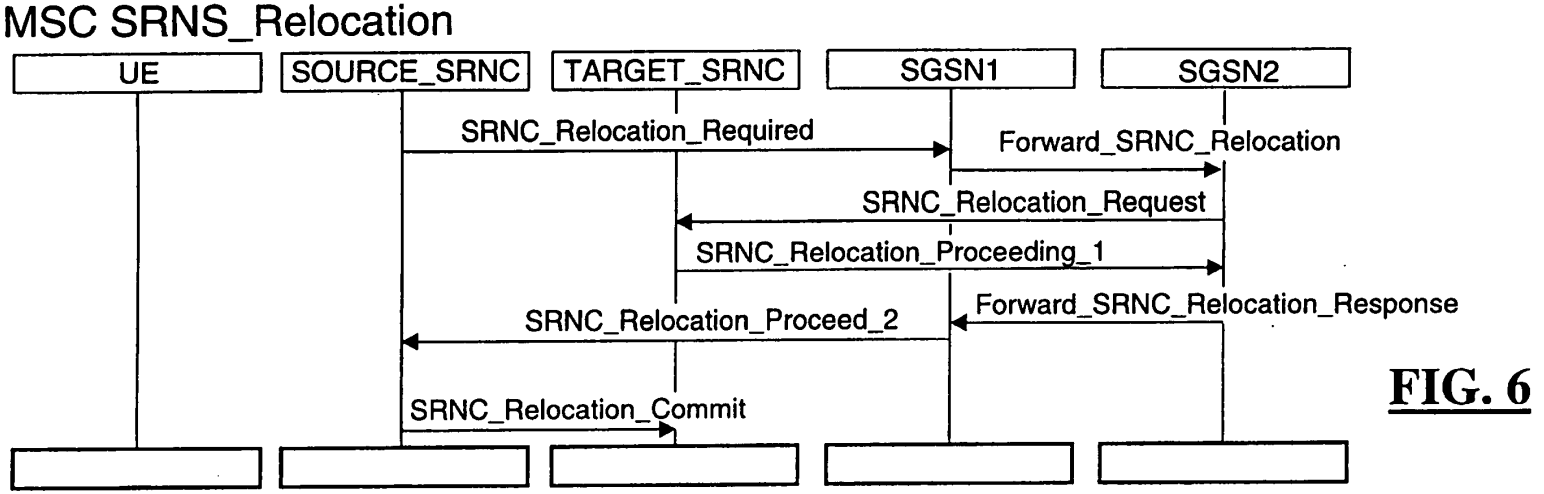

MSC SRNS_Relocation
UE
SOURCE_SRNC
TARGET_SRNC
SGSN1
SGSN2
SRNC_Relocation_Required
Forward_SRNC_Relocation
SRNC_Relocation_Request
SRNC_Relocation_Proceeding_1
Forward_SRNC_Relocation_Response
SRNC_Relocation_Proceed_2
SRNC_Relocation_Commit

FIG. 6

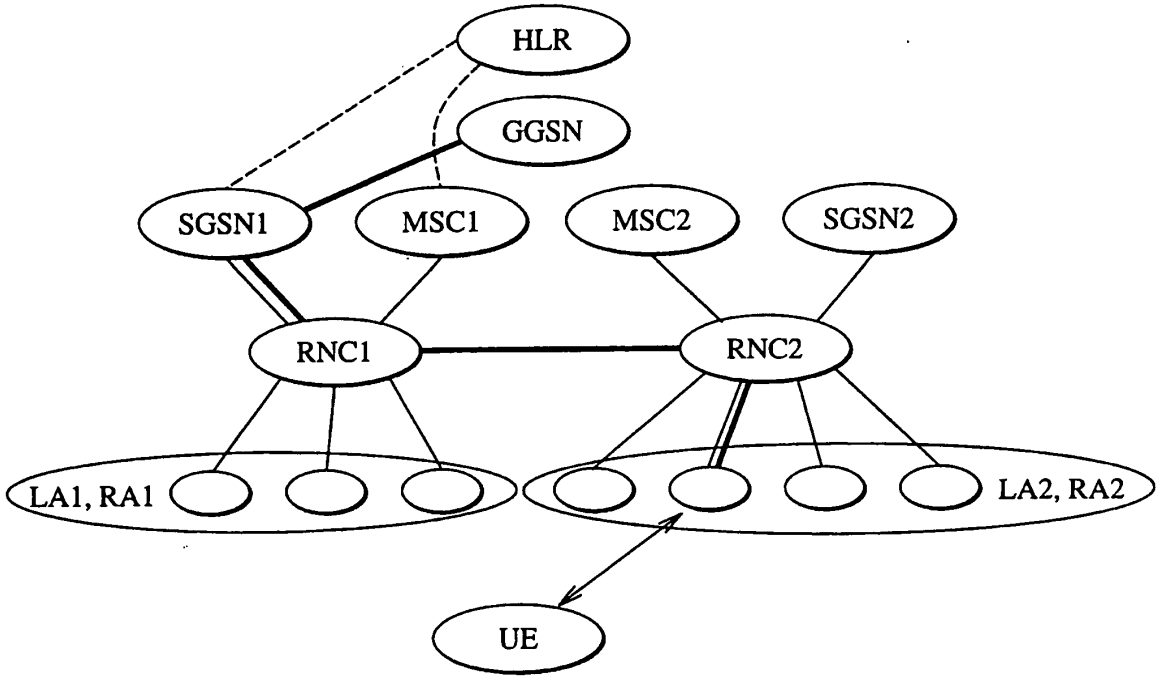


FIG. 7 (Before the SRNS relocation and location registration)

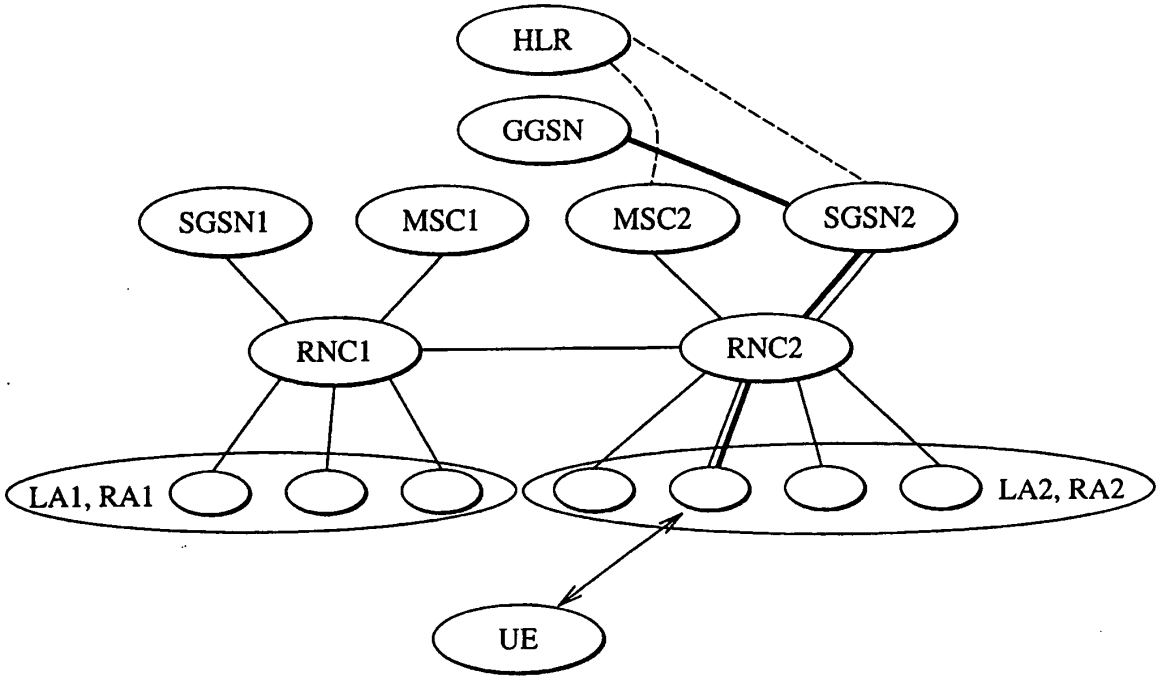


FIG. 8 (After the SRNS relocation and location registration)

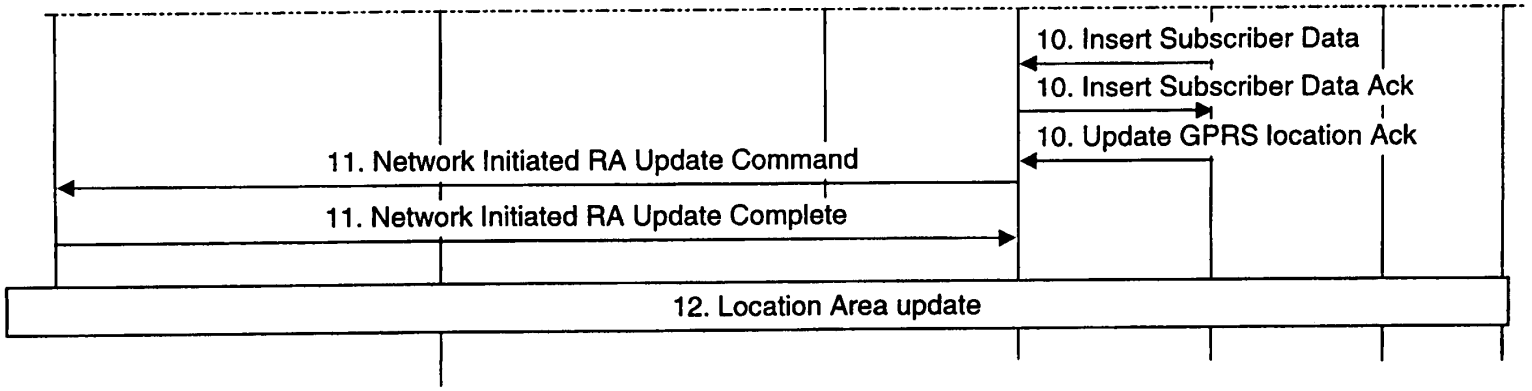


FIG. 9B (Interface information transfer for SRNS relocation update when changing SGSN area resulting in a change of registration location and followed by location registration in new Location Area)

FIG. 9A

FIG. 9B

FIG. 9

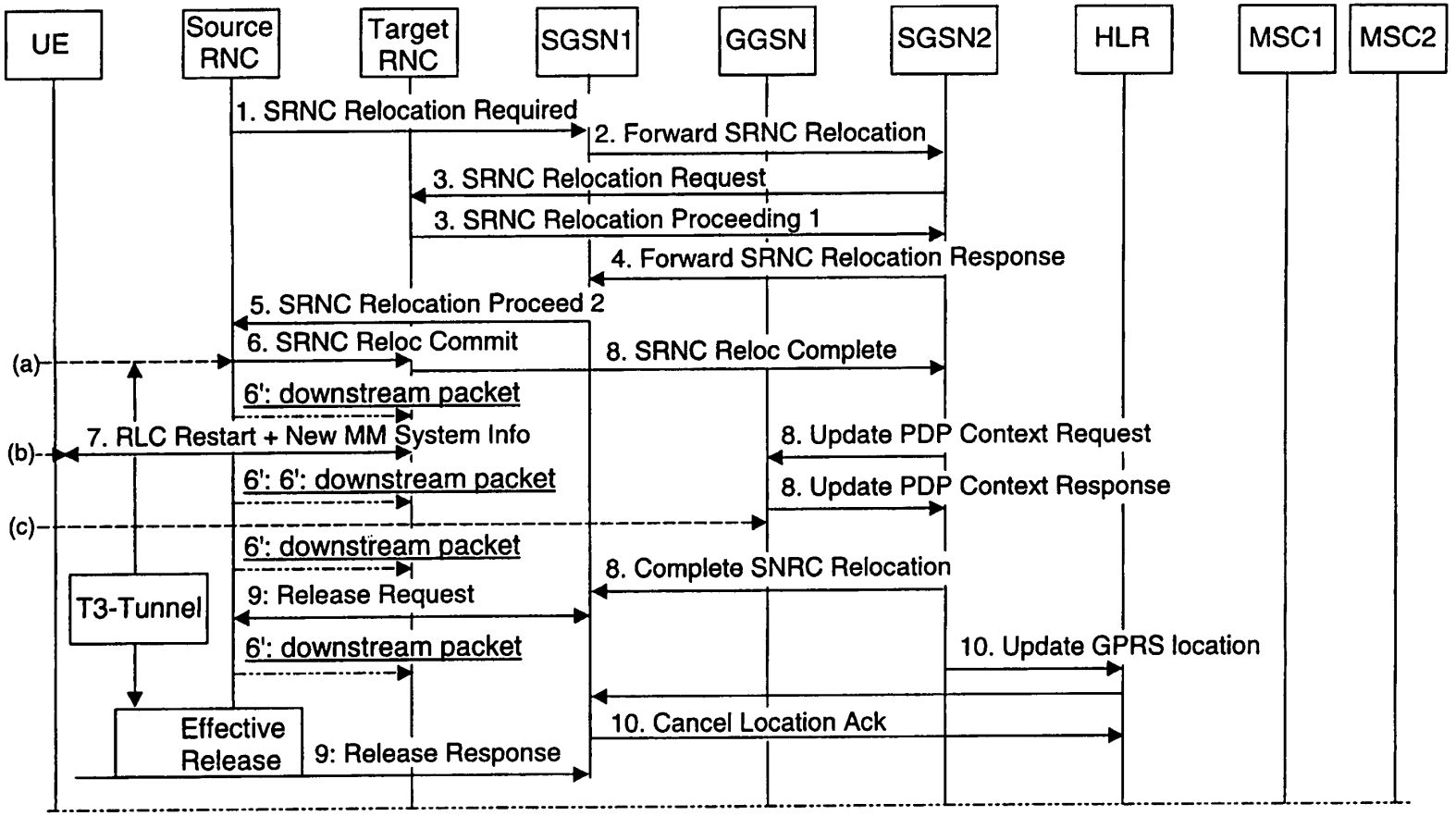

UE
Source RNC
Target RNC
SGSN1
GGSN
SGSN2
HLR
MSC1
MSC2
1. SRNC Relocation Required
2. Forward SRNC Relocation
3. SRNC Relocation Request
3. SRNC Relocation Proceeding 1
4. Forward SRNC Relocation Response
5. SRNC Relocation Proceed 2
6. SRNC Reloc Commit
8. SRNC Reloc Complete
(a)
6': downstream packet
7. RLC Restart + New MM System Info
(b)
8. Update PDP Context Request
6': 6': downstream packet
8. Update PDP Context Response
(c)
6': downstream packet
8. Complete SNRC Relocation
T3-Tunnel
9: Release Request
6': downstream packet
10. Update GPRS location
Effective Release
10. Cancel Location Ack
9: Release Response

FIG. 9A

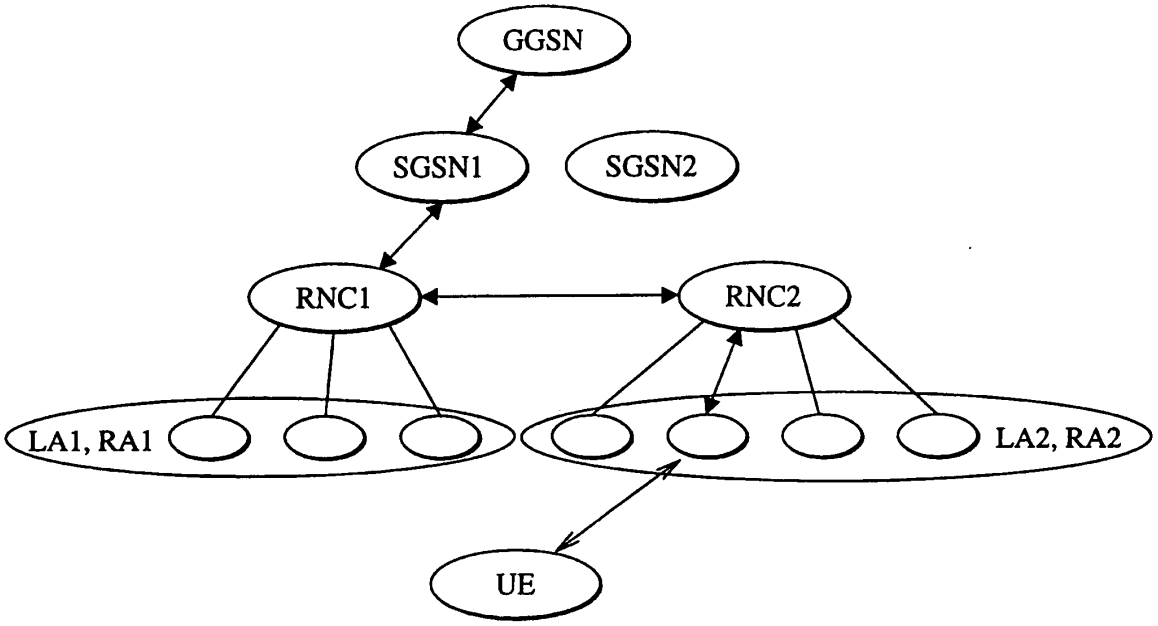


FIG. 10 (Data paths before the SRNS relocation has been actually committed (before point (a) in Figure 9))

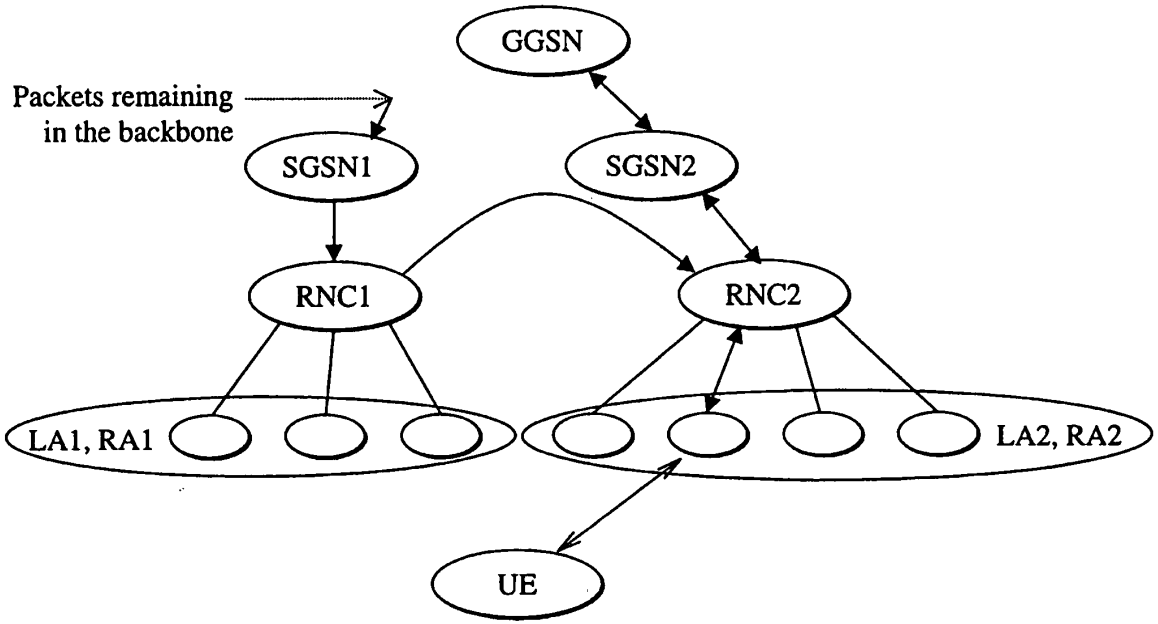


FIG. 11 Data paths after the GGSN update (after point (c) in Fig. 9)

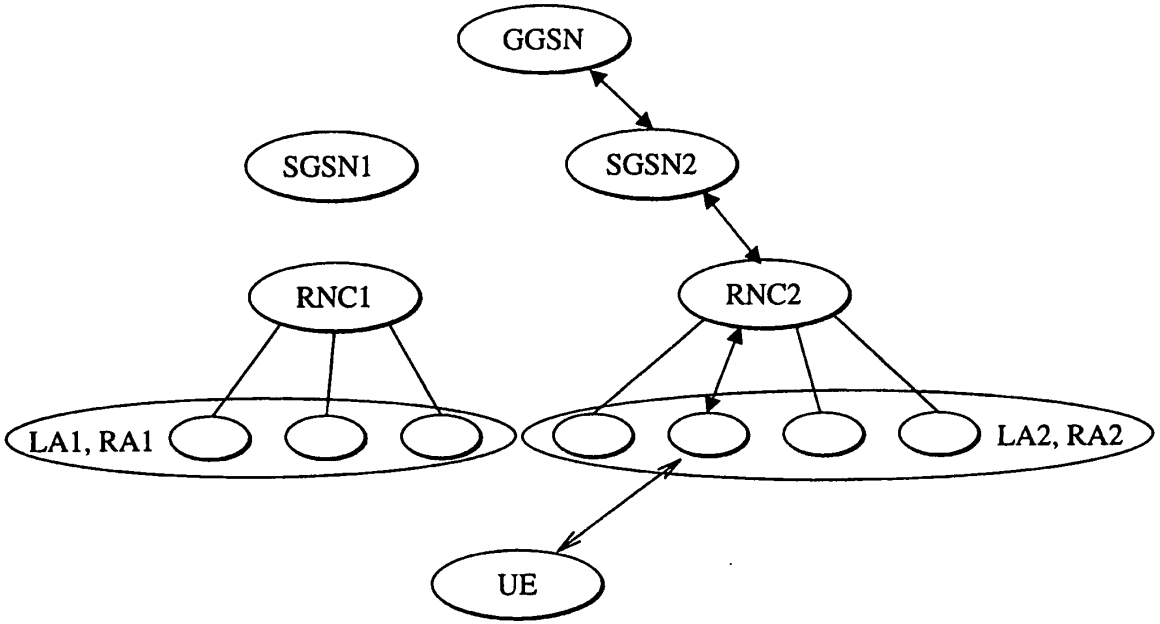


FIG. 12 Data paths after the resource release in source RNC (after point (d) in Figure 9))

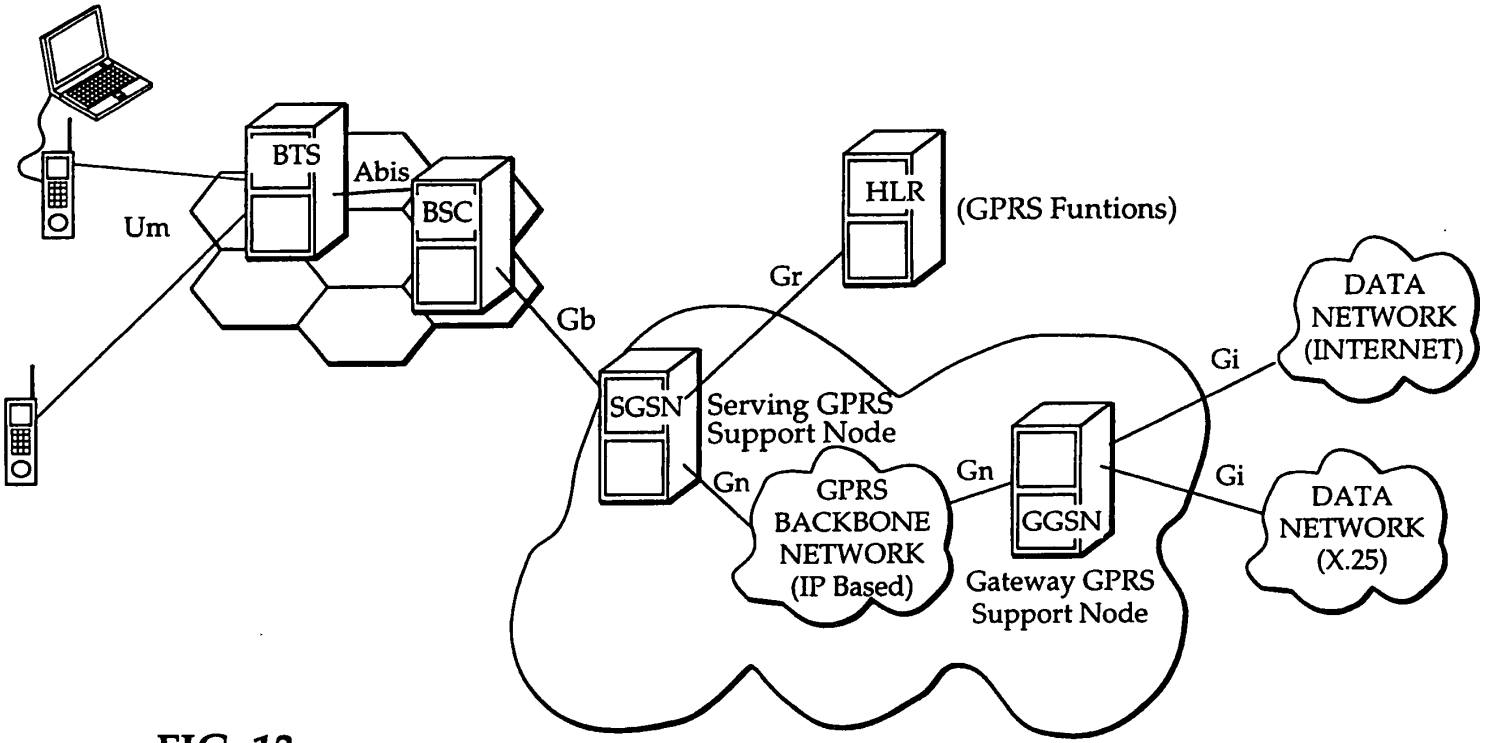


FIG. 13
(GPRS network architecture)

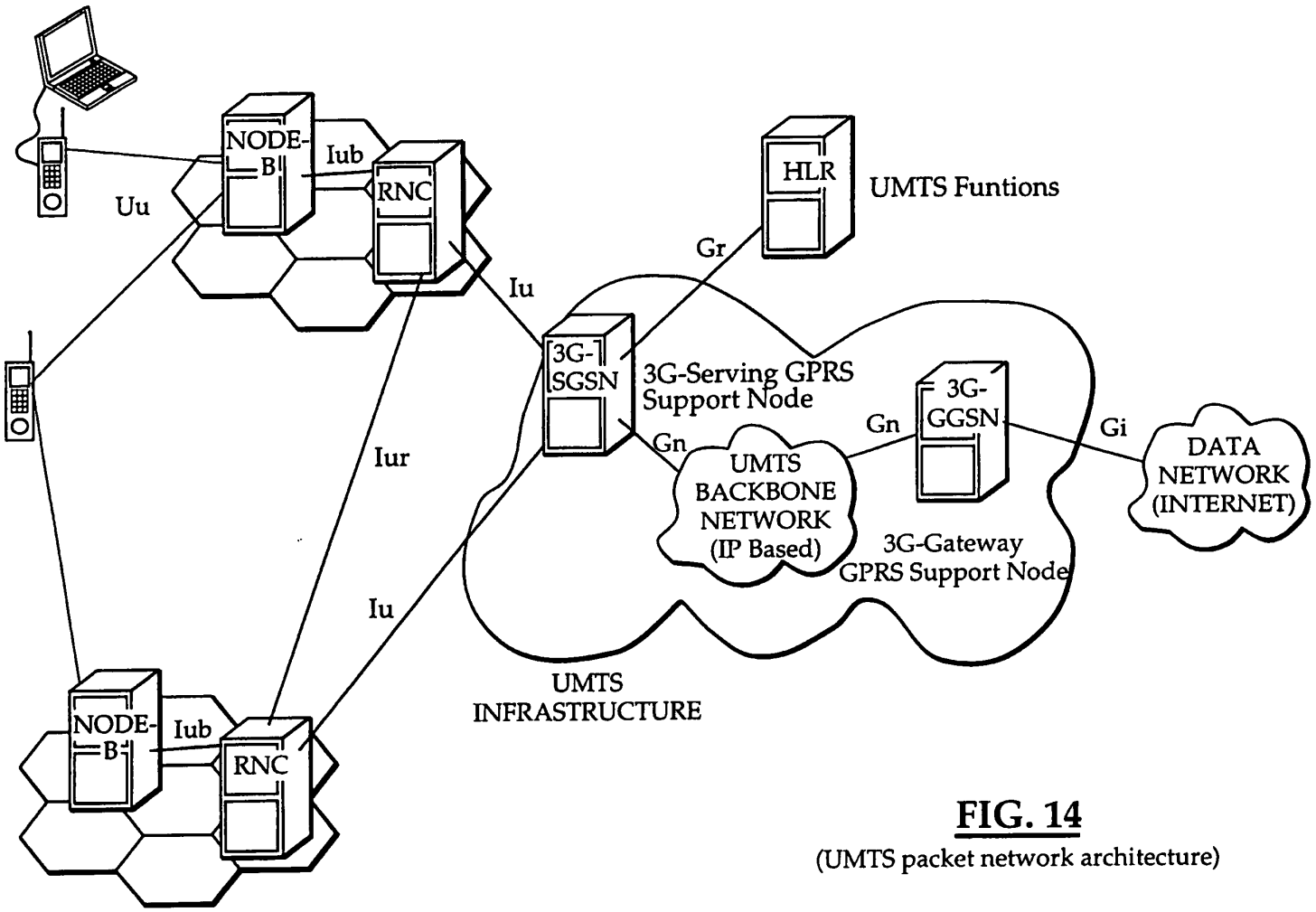
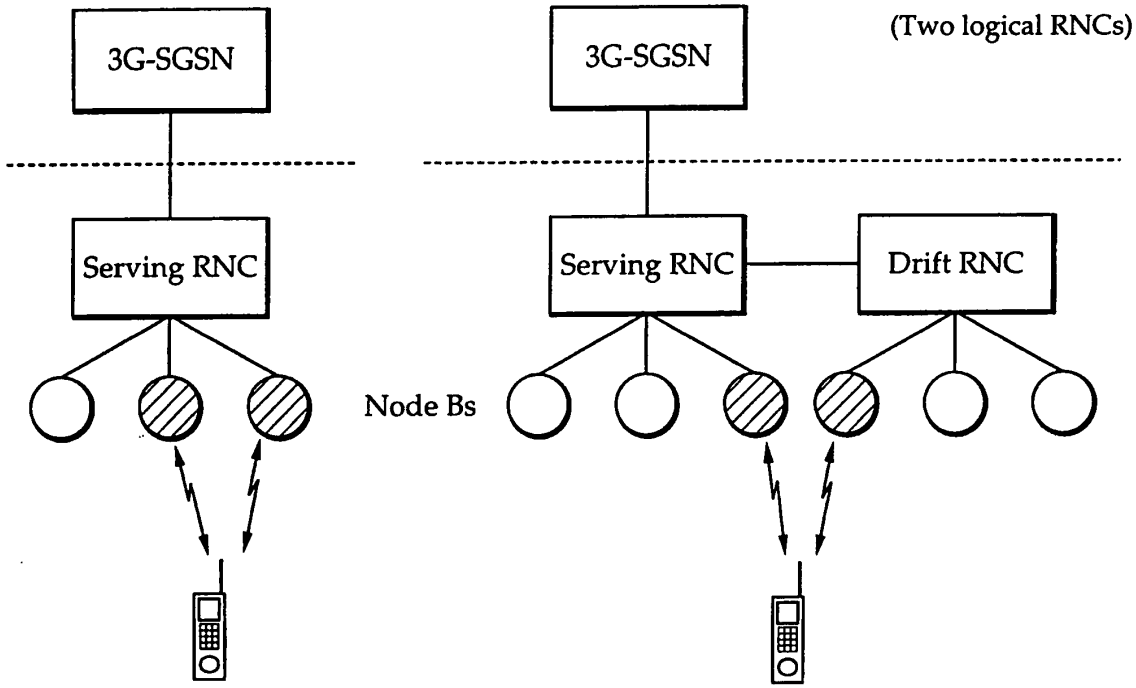


FIG. 14

(UMTS packet network architecture)

FIG. 15

(Two logical RNCs)



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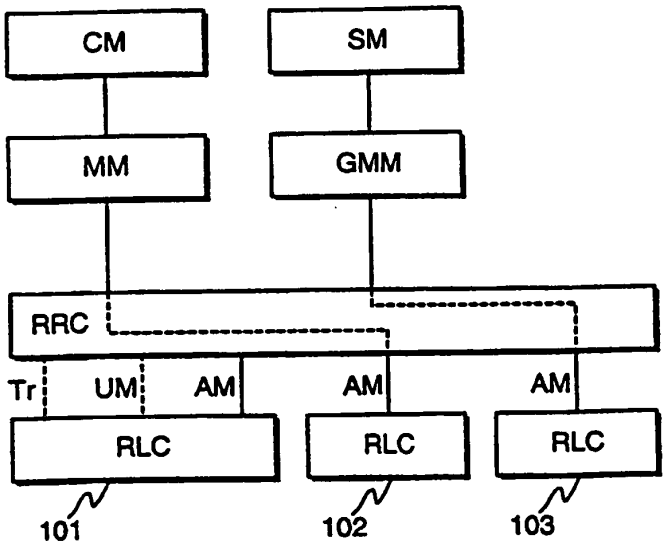
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(54) Title: A SIGNALLING METHOD



(57) Abstract: The invention relates to methods for transmission of signalling data in cellular telecommunication networks. According to the invention, multiple radio bearers can be allocated for transferring signalling traffic, but all higher layer signalling is in any case taken through the RRC protocol. In the inventive method, MM and higher layer messages are sent using RRC DIRECT TRANSFER messages, but a separate RLC entity is set up for RRC DIRECT TRANSFER messages. In various embodiments of the invention, separate radio bearers can be set up for individual CN domains and/or upper layer protocols and/or for a group of RRC messages.

WO 01/33885 A1

A signalling method

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to methods for transmission of signalling data in cellular telecommunication networks. Especially, the invention is related to such a method as specified in the preamble of the independent method claim.

2. Description of Related Art

The current concept of a signalling radio bearer in the UMTS system (universal mobile telecommunication system) defines that there is only one radio bearer for signalling traffic between the cellular network and a mobile communication means. Both the RRC (radio resource control) and higher protocol layers use the same radio bearer, i.e. the same RLC (radio link control) entity. In some implementations it is possible to have two RLC entities for signalling traffic, one entity for unacknowledged mode transfer and one entity for acknowledged mode transfer. However, there is currently no means to treat these entities separately for example for setup, reconfiguration or release. The signalling radio bearer, sometimes called the signalling link, is set up during the RRC connection establishment procedure. In some implementations, it is even possible that the radio bearer service is actually provided by the PDCP layer. In this case the PDCP will run in transparent mode for signalling traffic.

Higher layer messages, such as MM (mobility management) or CM (connection management) layer messages are carried between a mobile communication means and the network in a RRC DIRECT TRANSFER message payload. The protocol stack is illustrated in figure 1. Figure 1 shows an example of a partial protocol stack of a circuit switched core network (CN) domain, which protocol stack comprises connection management (CM) and mobility management (MM) protocol layers, and an example of a protocol stack of a packet switched core network domain, which protocol stack comprises session management (SM) and packet switched domain mobility management (PMM) protocol layers. Both of these protocol stacks communicate with the RRC (radio resource control) layer, which handles the transmission of the higher layer protocol messages in a RRC DIRECT TRANSFER MESSAGE payload. The radio link control protocol can be set up to provide

unacknowledged or acknowledged data transmission service. Each RLC instance is configured by RRC to operate in one of three modes: transparent mode (Tr), unacknowledged mode (UM) and acknowledged mode (AM). The transparent and unacknowledged mode are used by some of the RRC signalling procedures Majority of RRC signalling procedures including the Direct Transfer procedure utilize acknowledged mode transfer. The service that the RLC layer provides to upper layers is called radio bearer (RB). A radio bearer with the corresponding Iu bearer comprises a radio access bearer (RAB).

The problems with the prior art solution used at the time of writing this patent application are mainly related to priority control of signalling traffic. A problem can arise for example in a case, when a very long higher layer message is passed to RLC layer which buffers the message, and when a time critical RRC message also needs to be sent. In this situation, the RLC layer transmits the buffered messages first before transmitting more recent messages, which results in a delay of the time critical RRC message. Currently there are no mechanisms allowing priorization of more recent messages over those messages waiting in RLC transmission buffer. It is also possible that higher layer signalling such as MM and CM will need some prioritization means between the various higher layer protocols.

At the time of writing this patent application, a requirement has recently been identified which may finally require that several signalling radio bearers can be set up so that different QoS (quality of service) parameters can be used for different types of signalling. One solution for this requirement has been proposed. According to this solution, MM and higher layer signalling is carried over the air interface like any user traffic, in a separate radio bearer. This solution creates some problems related to integrity control function - which is defined as a RRC layer function - and to the existing procedures in Iu interface.

Figure 2 illustrates protocol stack configuration for signalling transfer according to a recently proposed solution. According to this solution, signalling traffic of MM and other higher layer protocols are transmitted directly using PDCP services. In this solution, only function that would be required from PDCP layer is the integrity protection. According to the solution, either one user plane radio bearer is used for all higher layer signalling protocols or a separate user plane radio bearer is allocated for each higher layer protocol stack. In the example of figure 2 each CN domain employs a different radio access bearer (RAB) for signalling between UE and each CN domain. According to this solution, priority control between MM and RRC

messages can be handled in RLC/MAC using normal radio bearer/logical channel priority control mechanisms.

This proposal has some disadvantages. For example, the proposed solution increases the complexity of the MM and PMM protocol implementations, since primitive interfaces are needed not only for the RRC protocol, but for the PDCP protocol as well. The proposed solution would also be an addition to current PDCP functions and change radically the basic function of PDCP as a packet service dependent sublayer. This would add complexity to the implementations of the PDCP protocol. Further, since PDCP is only intended for transmission of user plane traffic, in the proposed solution UE-CN signalling would be treated like user plane traffic, which implies that some modifications will most probably be needed also to the current Iu interface specifications. Further, in the proposed solution integrity protection needs to be implemented in two places: in PDCP layer for MM and higher layer signalling and in RRC layer for RRC signalling. As a consequence, the complexity of PDCP protocol increases and an additional header field is needed in PDCP data payload data units (PDU), since the integrity function requires a counter value to be transmitted with each piece of integrity protected data for use by the integrity protection algorithm.

SUMMARY OF THE INVENTION

An object of the invention is to realize a signalling method, which alleviates the aforementioned problems of prior art. A further object of the invention is to provide a method for transmission of control signalling, which allows determining of quality of service levels for different signalling traffic streams. A still further object of the invention is to provide the aforementioned objects of the invention, without adding complexity in the protocol layers above the RRC protocol layer.

The objects are reached by setting up at least two signalling radio bearers for transmission of signalling traffic, and specifying rules for routing of higher layer signalling to the signalling radio bearers.

The method according to the invention is characterized by that, which is specified in the characterizing part of the independent method claim. The network element according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a network element. The mobile communication means according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a

mobile communication means. The dependent claims describe further advantageous embodiments of the invention.

According to the invention, at least two signalling radio bearers are set up for transmission of signalling traffic and the cellular network configures how the signalling of higher layer protocols is mapped to said signalling radio bearers. Multiple radio bearers can be allocated for transferring signalling traffic, but all higher layer signalling is in any case taken through the RRC protocol.

In the inventive method, MM and higher layer messages are sent using RRC DIRECT TRANSFER messages, but separate RLC entities can be set up for RRC DIRECT TRANSFER messages. In various embodiments of the invention, separate radio bearers can be set up for individual CN domains and/or upper layer protocols and/or for a group of RRC messages.

Routing of messages to signalling bearers can advantageously be performed on the basis of CN domain identity information contained in every RRC DIRECT TRANSFER data unit. In embodiments, in which separate radio bearers are set up for different upper layer protocols or different groups of upper layer protocols, the routing of RRC DIRECT TRANSFER data units is advantageously performed on the basis of examination of the contents of data units and interpreting, with which protocol each data unit is associated.

The inventive method provides integrity protection of MM and higher layer messages as a consequence of the transmission of the messages in RRC DIRECT TRANSFER messages. The inventive method allows controlling of priority between MM and higher layer messages and RRC messages in the radio interface by adjusting the QoS parameters of bearers used to transfer the messages.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in more detail in the following with reference to the accompanying drawings, of which

Figure 1 illustrates protocol stack configuration for signalling transfer according to prior art,

Figure 2 illustrates protocol stack configuration for signalling transfer according to another solution of prior art,

Figure 3 illustrates protocol stack configuration for signalling transfer according to an advantageous embodiment of the invention,

Figure 4 illustrates RRC signalling related to radio bearers,

Figure 5 illustrates a method according to an advantageous embodiment of the invention,

Figure 6 illustrates an example of the structure of a radio network controller according to an advantageous embodiment of the invention, and

Figure 7 illustrates an example of the structure of a mobile communication means according to an advantageous embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A. A FIRST GROUP OF ADVANTAGEOUS EMBODIMENTS OF THE INVENTION

Figure 3 illustrates protocol stack configuration for signalling transfer according to an advantageous embodiment of the invention. This figure illustrates the example case that a separate radio bearer is reserved for each CN domain. In figure 3, each radio bearer is represented by a RLC entity corresponding to the radio bearer. Figure 3 illustrates, that signalling from the circuit switched CN domain (CM, MM) is transmitted via a second RLC entity 102, while signalling from the packet switched CN domain (SM, PMM) is transmitted via a third RLC entity 103, while a first RLC entity is used for transmission of the rest of RRC messages.

According to the invention, the RRC protocol can use one or more signalling radio bearers (SRB) i.e. RLC entities for transmission of signalling traffic between the network and the mobile communication means, i.e. UE (user equipment). In other words, the signalling link between a UE and a RNC (radio network controller) can comprise one or more signalling radio bearers.

The UE can be commanded to use only one signalling radio bearer for all signalling. An additional signalling radio bearer can be set up and the RRC layer and the UE can be configured to send all RRC DIRECT TRANSFER messages using this additional signalling radio bearer. Further, more than one signalling radio bearers can be set up by the network. Preferably, the network makes the decisions about the configuration of the signalling radio bearers. Different rules for using the more than one signalling radio bearers can be used in different embodiments of the invention.

For example, in an advantageous embodiment of the invention, separate signalling radio bearers are used for each CN domain protocol stack. Such an embodiment is illustrated in figure 3. In such an embodiment, the RRC layer can route the RRC DIRECT TRANSFER messages to correct radio bearer by checking the CN domain identification information in the data units comprising the messages.

As a second example, in an advantageous embodiment of the invention, separate signalling radio bearers are used for each higher layer protocol. In such an embodiment, the RRC layer can route the RRC DIRECT TRANSFER messages to correct radio bearer by checking the NAS (network access stratum) protocol discriminator information in the data units comprising the messages.

As a third example, in an advantageous embodiment of the invention, separate signalling radio bearers are used for various predefined groups of higher layer protocols. In such an embodiment, the RRC layer can route the RRC DIRECT TRANSFER messages to correct radio bearer by checking the NAS (network access stratum) protocol discriminator information in the data units comprising the messages. In such an embodiment, each signalling radio bearer carrying higher level protocol signalling has a corresponding predefined set of NAS protocol discriminators.

The invention is not limited to these rules for deciding about the usage of the signalling radio bearers, since other types of rules can as well be used. For example, the decision of which signalling radio bearer to use for any given message can in an embodiment of the invention based on the PDU size. In such an embodiment, the length of each message is checked, and the bearer to be used is selected at least partly on the basis of the result of this checking.

In a further advantageous embodiment of the invention, the routing is based on a Quality of Service parameter attached to the higher layer protocol data. In such an embodiment, higher layer protocols may add a QoS parameter to single messages, to plurality of messages, or for example to all messages in order to ensure, that the messages are routed via a signalling radio bearer fulfilling the desired QoS level. In such an embodiment, the RRC layer can route the RRC DIRECT TRANSFER messages to correct signalling radio bearer by checking the additional QoS class information from the data units comprising the messages. There can be for example a predefined set of QoS classes for higher layer signalling messages, for example two QoS classes, or the number of QoS classes can be decided by the network. Preferably, for each QoS class a separate radio bearer is set up. An example of this

QoS class separation could be the short message service (SMS) which could use lower priority than other signalling.

The functionality for performing the decisions about the number of signalling radio bearers and about the rules for dividing traffic to these signalling radio bearers can be implemented in many different network elements of a radio access network (RAN). Preferably, the network element performing the decisions about the number of signalling radio bearers and about the rules for dividing traffic to these signalling radio bearers is the radio network controller (RNC).

In a further embodiment of the invention, the rules to be used can be selected out of a predefined set of rules by using the number of signalling radio bearers. In this embodiment, each possible amount of signalling radio bearers is associated with a predefined set of rules.

In a further advantageous embodiment of the invention, one of the signalling radio bearers can be defined as a master signalling radio bearer. This radio bearer is set up only in the RRC connection establishment procedure and released only in the RRC connection release procedure. This master SRB would be used as the prior art signalling bearer. Such an embodiment ensures, that all signalling bearers are not released in error during the RRC connection, since the master SRB in this embodiment cannot be controlled by radio bearer control messages.

B. A SECOND GROUP OF ADVANTAGEOUS EMBODIMENTS OF THE INVENTION

In an advantageous embodiment of the invention, the messages used for controlling radio bearers are used for controlling the signalling radio bearers as well. The messages are the RRC CONNECTION SETUP, RADIO BEARER RECONFIGURATION, RADIO BEARER RELEASE, and RADIO BEARER SETUP messages. The usage of the messages is described in the following with reference to figure 4. In the prior art, these messages are only used to control the user-plane radio bearers, not signalling. More details of the prior art use of these messages and a description of the other messages of the RRC protocols can be found in the RRC protocol specifications of the UMTS system. Figure 4 illustrates four RRC layer procedures, namely RRC connection establishment, radio bearer setup, radio bearer reconfiguration, and radio bearer release procedures. The RRC connection establishment procedure initiates the RRC connection between the mobile communication means and the network, while the other three of these four

procedures listed here are used to control single radio bearers and may or may not occur during the lifetime of a RRC connection. Figure 4 shows signalling between a mobile communication means (UE, user equipment) and the radio access network (UTRAN, UMTS terrestrial radio access network).

The RRC connection establishment procedure is initiated by the UE, which sends 300 a RRC CONNECTION REQUEST message to the radio access network. The radio access network responds to the message by sending a RRC CONNECTION SETUP message, which comprises information about various parameters about the RRC connection to be established. The UE finishes the RRC connection establishment procedure by sending 310 a RRC CONNECTION SETUP COMPLETE message.

The radio bearer setup procedure is initiated by the network, which sends 320 a RADIO BEARER SETUP message to the UE. The message comprises information about various parameters of the radio bearer about to be established. The UE responds to the message by sending 325 a RADIO BEARER SETUP COMPLETE message.

The radio bearer reconfiguration procedure is initiated by the network, which sends 330 a RADIO BEARER RECONFIGURATION message to the UE. The message comprises information about new values of parameters for the radio bearer or bearers affected. The UE responds to the message by sending 335 a RADIO BEARER RECONFIGURATION COMPLETE message.

The radio bearer release procedure is initiated by the network, which sends 340 a RADIO BEARER RELEASE message to the UE. The message comprises information identifying the bearer to be released. The UE responds to the message by sending 335 a RADIO BEARER RELEASE COMPLETE message.

According to an advantageous embodiment of the invention, the setting up and configuration of all the signalling radio bearers is done during the RRC connection establishment procedure. This can advantageously be effected by adding information about the signalling radio bearers to be established to the RRC CONNECTION SETUP message. One advantageous example of the organization of such information is presented later in this application.

In one advantageous embodiment of the invention, only one signalling radio bearer is set up and configured during the RRC connection establishment procedure. In

such an embodiment, further signalling radio bearers can be set up and configured later during the RRC connection, if need for that arises.

In an advantageous embodiment of the invention, the radio access network can set up additional Signalling Radio Bearers during the RRC connection and configure how the higher layer signalling is mapped into the new and existing signalling radio bearers. This can advantageously be effected by adding information about the signalling bearers to be established to the RADIO BEARER SETUP message. One advantageous example of the organization of such information is presented later in this application.

In an advantageous embodiment of the invention, the radio access network can re-configure the mapping between higher layer signalling and any existing signalling radio bearer during the RRC connection. This can advantageously be effected by adding information about the signalling bearers to be reconfigured to the RADIO BEARER RECONFIGURATION message. One advantageous example of the organization of such information is presented later in this application.

In an advantageous embodiment of the invention, the radio access network can release any signalling radio bBearers during the RRC connection and reconfigure the mapping between higher layer signalling and any remaining signalling radio bearers. This can advantageously be effected by adding information about the signalling bearers to be released and the new reconfiguration information to the RADIO BEARER RELEASE message. One advantageous example of the organization of such information is presented later in this application.

The following paragraphs and tables show examples according to various advantageous embodiments of the invention about how information pertaining to signalling radio bearers can be presented in the referred messages.

In the RRC CONNECTION SETUP message, the information about signalling radio bearers can be presented among the radio bearer information elements as shown in the following table. Note that for clarity, the following table lists only radio bearer (RB) information elements of the message.

RB information elements Information Element	*Range*
Signalling Radio Bearer information	0 to <MaxSRBCount>
RB identity	
Signalling Radio Bearer type	
RB mapping info	
SRB mapping info	

The parameter "Signalling Radio Bearer information" indicates the number of signalling radio bearers. The other four parameters are then repeated the indicated number of times. The parameter "RB identity" identifies the radio bearer. The purpose of the "Signalling Radio Bearer Type" information element is to indicate the RLC parameters needed for the Signalling Radio Bearer. Advantageously, each possible value of "Signalling Radio Bearer Type" information element refers to a predefined set of parameters. The parameter "RB mapping info" indicates, as in prior art, details about multiplexing RLC frames to physical layer channels. The parameter "SRB mapping info" indicates how various protocol messages are mapped to the particular SRB. The parameter "MaxSRBCount" defines the maximum number of signalling radio bearers.

In the RADIO BEARER RECONFIGURATION message, the SRB information can be represented by a "SRB mapping info" parameter among the RB information elements. The parameter is optional, and only present if the particular radio bearer is a signalling radio bearer.

In the RADIO BEARER RELEASE message, the SRB information can be represented by a "SRB mapping info" parameter among the RB information elements. The parameter is optional, and only present if the particular radio bearer is a signalling radio bearer.

In the RADIO BEARER SETUP message, the SRB information can be represented by a "SRB mapping info" parameter among the new RB information elements, if the particular new RB is to be a SRB, and by a "SRB mapping info" parameter among information elements for other radio bearers affected by the message, if the

particular other RB is a SRB. These parameters are optional, and only present if the particular radio bearer is a signalling radio bearer.

In one advantageous embodiment of the invention, the allowed values of "SRB mapping info" parameter i.e. information element range from 0 to 7 with the following meanings:

0 all RRC signalling
1 all RRC signalling except RRC Direct Transfer messages
2 all RRC Direct Transfer messages
3 RRC Direct Transfer messages with specified CN Domain Identities
4 RRC Direct Transfer messages carrying NAS message with the specified PD
5 only the specified RRC messages
6-7 reserved for future use

If the value is 3, 4, or 5, then also information elements describing details of correspondingly CN domain identities, NAS PD information, and RRC message types are present.

C. A THIRD GROUP OF ADVANTAGEOUS EMBODIMENTS OF THE INVENTION

Figure 5 illustrates a method according to an advantageous embodiment of the invention. Figure 5 illustrates a method for transmission of signalling data in a cellular telecommunication system between the cellular network and a mobile communication means. According to the example of figure 5, the method comprises steps of setting up 200 of at least two signalling radio bearers for transmission of signalling traffic, and configuring 201 of how the signalling of higher layer protocols is mapped to said signalling radio bearers.

According to an advantageous embodiment of the invention, the method further comprises the step of routing 210 of signalling traffic data units via said at least two signalling radio bearers according to predefined rules.

In a further advantageous embodiment of the invention, said predefined rules are set by a network element of a radio access network of the cellular telecommunication system.

In a still further advantageous embodiment of the invention, said predefined rules are set by a radio network controller.

According to an advantageous embodiment of the invention, in said step of routing 210, signalling from different core network domains is routed 210a via separate signalling radio bearers.

According to a further advantageous embodiment of the invention, in said step of routing 210, signalling of a higher layer protocol is routed 210b via a signalling radio bearer specific to said higher layer protocol.

According to a still further advantageous embodiment of the invention, in said step of routing 210, signalling traffic of a predefined group of higher layer protocols is routed 210c via a signalling radio bearer corresponding to said predefined group.

According to a still further advantageous embodiment of the invention, in said step of routing, signalling traffic of higher layer protocols is routed via a signalling radio bearer based on a Quality of Service parameter attached to the higher layer protocol data.

In a further advantageous embodiment of the invention, said setting up and configuration of said signalling radio bearers is performed during the RRC connection establishment procedure.

In an even further advantageous embodiment of the invention, the method comprises steps of setting up of a further signalling radio bearer during the RRC connection, and configuring the mapping of higher layer signalling to said further signalling radio bearer and previously existing signalling radio bearers.

In an even further advantageous embodiment of the invention, the method comprises the step of reconfiguring the mapping of higher layer signalling to said signalling radio bearers.

In an even further advantageous embodiment of the invention, the method comprises the step of releasing a signalling radio bearer.

D. A FOURTH GROUP OF ADVANTAGEOUS EMBODIMENTS OF THE INVENTION

Figure 6 illustrates the functional structure of a typical radio network controller 400 of a cellular telecommunications network using as an example the structure of a

RNC of a UMTS radio network utilizing WCDMA (wideband code division multiple access) transmission method. The invention is not limited to the UMTS system, but can be used in other similar systems as well.

The radio network controller 400 comprises a switching fabric unit (SFU) 450 to which several control processor units can be connected. Multiplexing units (MXU) 440 can be used between a number of processor units and the SFU to map the low bit rate data flows from the processor units into the high bit rate data flows of the SFU input ports. The network interface units (NIU) 410 handle the physical layer connections to different interfaces, such as Iub interface toward Node B elements, Iur interface towards other RNCs, and the Iu interface towards core network nodes. The operations and maintenance unit (OMU) 430 contains the RNC configuration and fault information and can be accessed from external operations and maintenance center. The signalling units (SU) 420 implement all the control and user plane protocols required in the RNC. Accordingly, the invention can be implemented in a RNC in the signalling units 420. The invention can be implemented using means 460 comprising software executed in the processors of the signalling units, which software causes the signalling units to perform according to the invention.

In an advantageous embodiment of the invention, a network element of a radio access network of a cellular telecommunication system is provided. According to the embodiment, the network element is arranged to set up at least two signalling radio bearers for transmission of signalling traffic and to configure how the signalling of higher layer protocols is mapped to said signalling radio bearers.

In a further advantageous embodiment of the invention, the network element is a radio network controller.

Figure 7 illustrates roughly the functional structure of a typical mobile communication means (UE) 500. The UE comprises a user interface (UI) 550, a control unit 540, a DSP unit 530, an RF unit 520, and an antenna 510. The RF unit handles the radio frequency processing of received and transmitted signals and converts the received signals to digital form. The DSP unit handles physical layer processing such as interleaving, channel coding, multiplexing, and segmentation. The DSP unit 530 can also implement a part of or all of layer 2 radio protocols such as the MAC, RLC, and PDCP protocols. Layer 3 protocols such as the RRC, MM, and CM protocols and typically also a part of layer 2 protocols are implemented in the control unit 540. Accordingly, the invention can be implemented in a UE in the control unit 540. The invention can be implemented using means 560

comprising software executed in the processor of the control unit, which software causes the control unit to perform according to the invention.

According to a further advantageous embodiment of the invention, a mobile communication means for a cellular telecommunication system is provided According to the embodiment, the mobile communication means is arranged to route radio resource control protocol messages to at least two signalling radio bearers as instructed by the cellular telecommunication system.

E. FURTHER CONSIDERATIONS

The present invention has several advantages. For example, the inventive solution retains the beneficial aspects of the prior art solutions described previously, while retaining the present specifications as unmodified as possible. Further, the inventive approach allows keeping of integrity protection in one protocol layer only, i.e. in RRC. The inventive method avoids the prior art problem of increasing the complexity of the PDCP protocol.

The inventive method is at the time of writing this patent application fully compatible with the present solutions regarding CND domain concepts and routing of higher layer signalling messages from or to CN domains based on CN domain identification information. The inventive method also requires no changes to Iu interface specifications.

The inventive method also allows prioritization between different types of signalling, such as between RRC signalling and higher layer signalling. The inventive method further allows the use of different QoS parameters for different types of signalling. Further, the inventive solution will also allow usage of different integrity algorithm for NAS (network access stratum) and AS (access stratum) signalling, if that would be later required. This can be effected by allocating separate bearers for these signalling flows, and applying a bearer specific integrity algorithm for the bearers.

In the present application the term signalling is intended to cover transmission of messages of various protocols controlling various aspects of the functioning of the cellular telecommunication systems, i.e. other transmissions than payload data transmissions.

The term higher layer protocol is in this application and particularly in the accompanying claims intended to cover the Radio Resource Control protocol and

any other layer 3 protocol acting between the mobile station and the radio access network and all layer 3 or higher layer signalling protocols between the mobile station and core network, such as for example the Mobility Management, Call Control, and Session Management protocols.

The invention is applicable in so called third generation mobile cellular systems, such as the UMTS system (universal mobile telecommunication system) and corresponding systems. The various message names such as the RRC DIRECT TRANSFER message name are intended to be examples only, and the invention is not limited to using the message names recited in this specification.

In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention. While a preferred embodiment of the invention has been described in detail, it should be apparent that many modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention.

Claims

1. Method for transmission of signalling data in a cellular telecommunication system between the cellular network and a mobile communication means, **characterized** in that in the method, at least two signalling radio bearers are set up for transmission of signalling traffic and the cellular network configures how the signalling of higher layer protocols is mapped to said signalling radio bearers.

2. A method according to claim 1, **characterized** in that the method comprises the step of

- routing of signalling traffic data units via said at least two signalling radio bearers according to predefined rules.

3. A method according to claim 2, **characterized** in that

said predefined rules are set by a network element of a radio access network of the cellular telecommunication system.

4. A method according to claim 3, **characterized** in that

said predefined rules are set by a radio network controller.

5. A method according to claim 1, **characterized** in that

said setting up and configuration of said signalling radio bearers is performed during the RRC connection establishment procedure.

6. A method according to claim 1, **characterized** in that

the method comprises steps of

- setting up of a further signalling radio bearer during the RRC connection, and

- configuring the mapping of higher layer signalling to said further signalling radio bearer and previously existing signalling radio bearers.

7. A method according to claim 1, **characterized** in that

the method comprises the step of reconfiguring the mapping of higher layer signalling to said signalling radio bearers.

8. A method according to claim 1, **characterized** in that

the method comprises the step of releasing a signalling radio bearer.

9. A method according to claim 2, **characterized** in that

in said step of routing, signalling from different core network domains is routed via separate signalling radio bearers.

10. A method according to claim 2, **characterized** in that

in said step of routing, signalling of a higher layer protocol is routed via a signalling radio bearer specific to said higher layer protocol.

11. A method according to claim 2, **characterized** in that

in said step of routing, signalling traffic of a predefined group of higher layer protocols is routed via a signalling radio bearer corresponding to said predefined group.

12. A method according to claim 2, **characterized** in that

in said step of routing, signalling traffic of higher layer protocols is routed via a signalling radio bearer based on a Quality of Service parameter attached to the higher layer protocol data.

13. A network element of a radio access network of a cellular telecommunication system, **characterized** in that

the network element is arranged to set up at least two signalling radio bearers for transmission of signalling traffic and to configure how the signalling of higher layer protocols is mapped to said signalling radio bearers.

14. A network element according to claim 13, **characterized** in that the network element is a radio network controller.

15. A mobile communication means for a cellular telecommunication system **characterized** in that

it is arranged to route radio resource control protocol messages to at least two signalling radio bearers as instructed by the cellular telecommunication system.

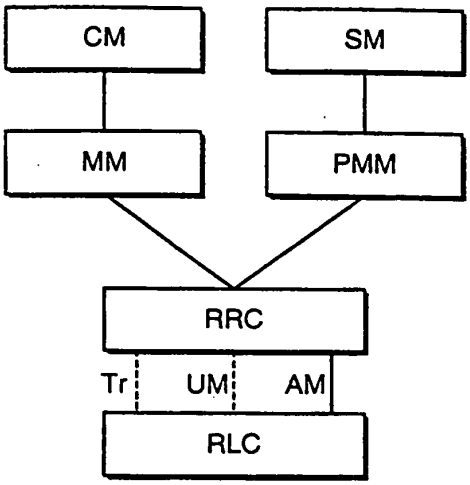


Fig. 1
PRIOR ART

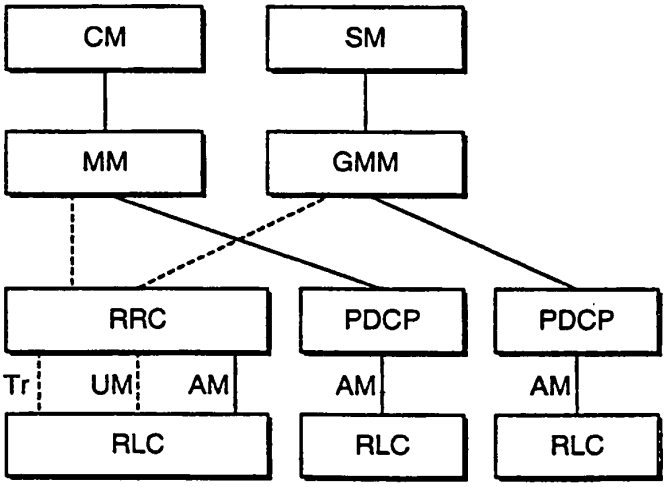


Fig. 2
PRIOR ART

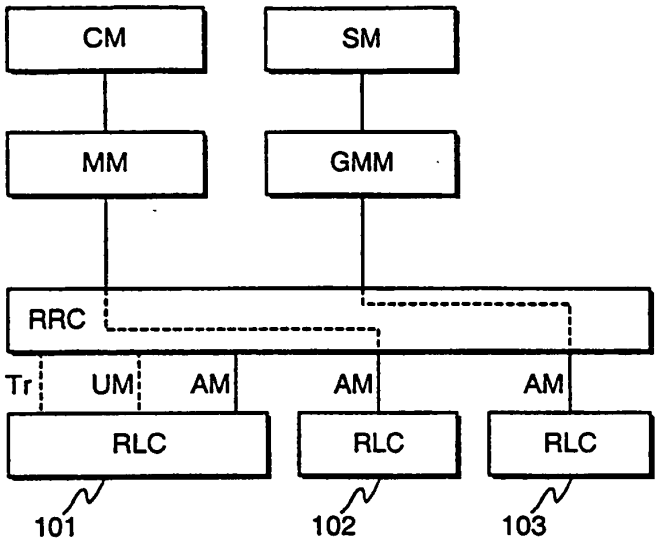


Fig. 3

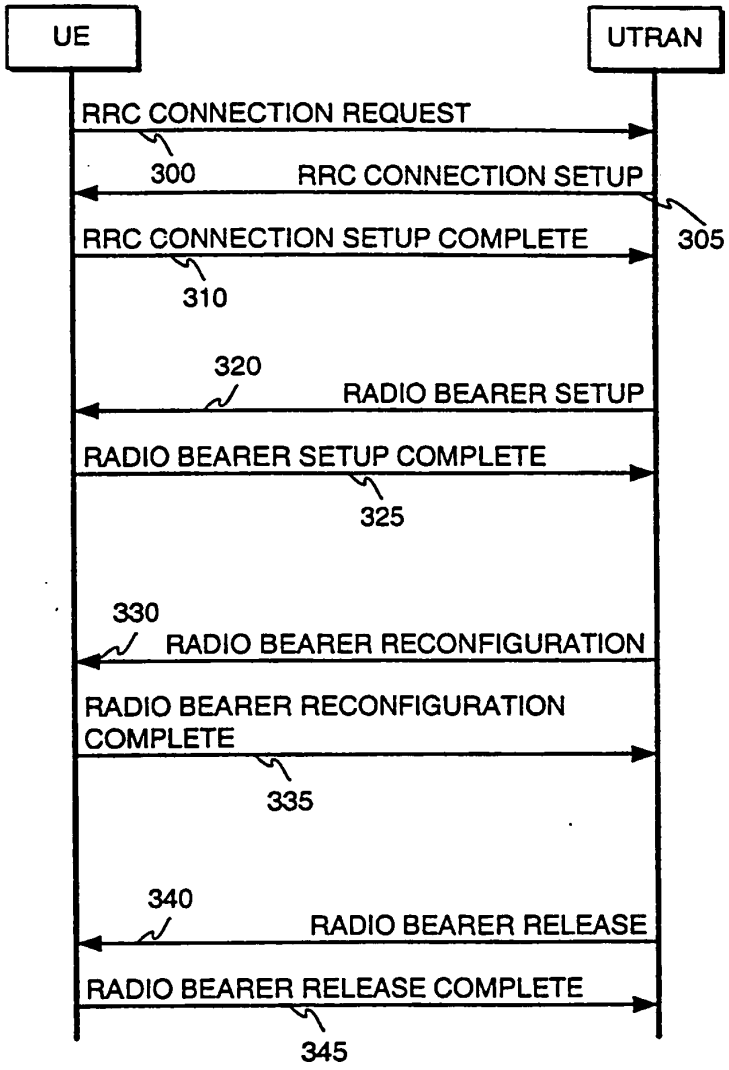

UE
UTRAN
RRC CONNECTION REQUEST
300
RRC CONNECTION SETUP
305
RRC CONNECTION SETUP COMPLETE
310
320
RADIO BEARER SETUP
RADIO BEARER SETUP COMPLETE
325
330
RADIO BEARER RECONFIGURATION
RADIO BEARER RECONFIGURATION COMPLETE
335
340
RADIO BEARER RELEASE
RADIO BEARER RELEASE COMPLETE
345

Fig. 4

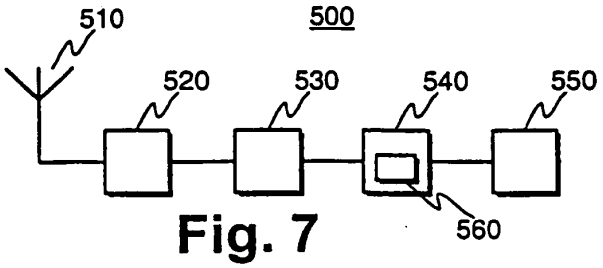

510
500
520
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540
550
560

Fig. 7

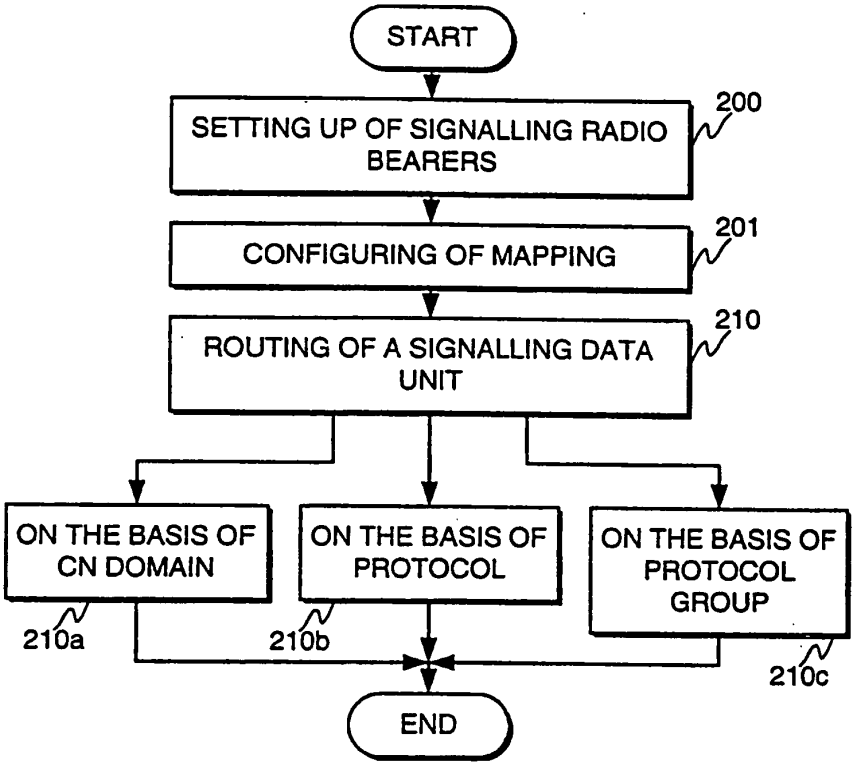

START
SETTING UP OF SIGNALLING RADIO BEARERS
200
CONFIGURING OF MAPPING
201
ROUTING OF A SIGNALLING DATA UNIT
210
ON THE BASIS OF CN DOMAIN
ON THE BASIS OF PROTOCOL
ON THE BASIS OF PROTOCOL GROUP
210a
210b
210c
END

Fig. 5

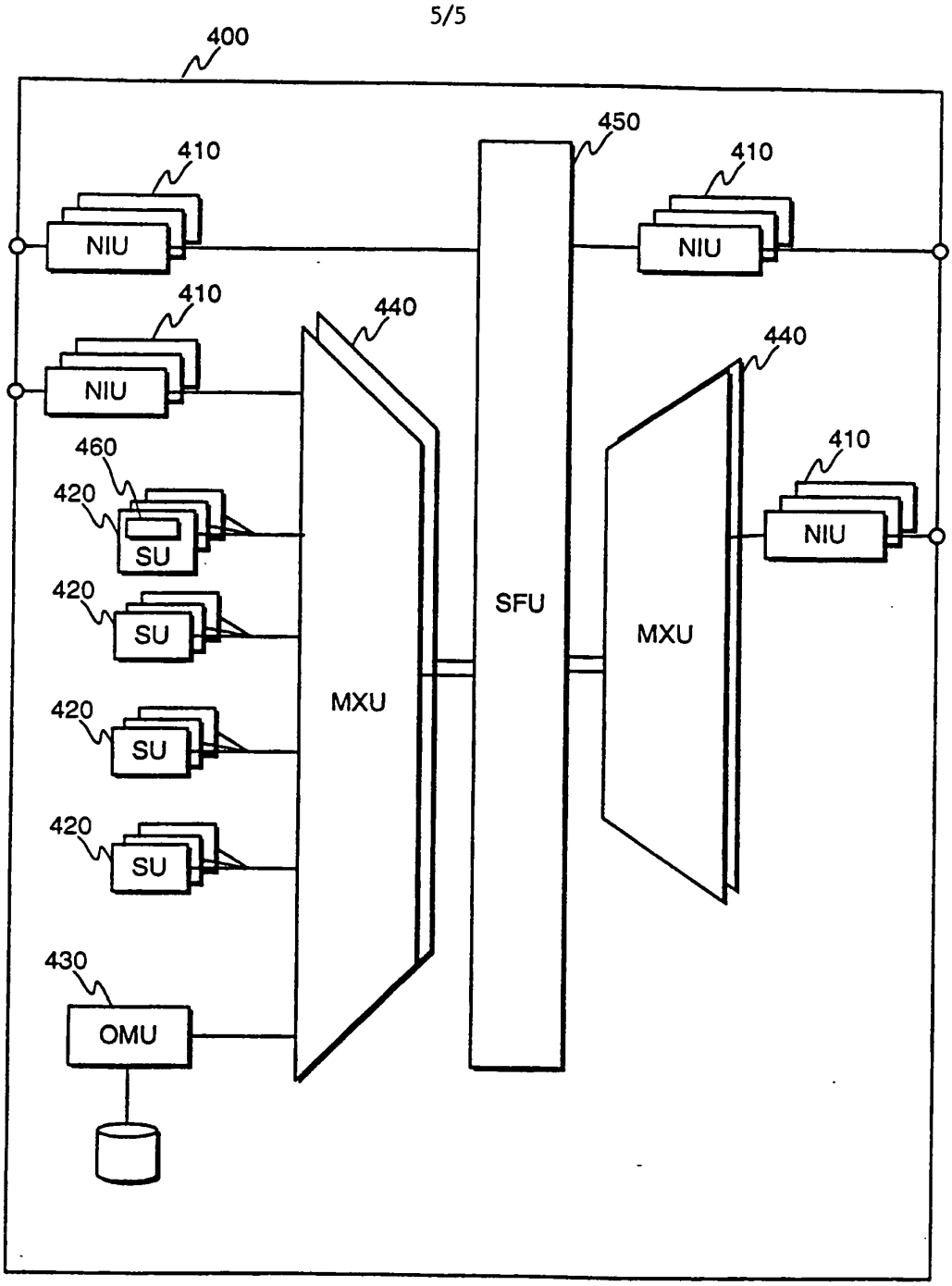

400
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NIU
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460
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MXU
SFU
MXU
430
OMU

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00955

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/38
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)

IPC7: H04Q

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

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9939528 A1 (NOKIA TELECOMMUNICATIONS OY), 5 August 1999 (05.08.99), abstract --	1-15
A	GB 2312810 A (GPT LIMITED), 6 November 1997 (06.11.97), page 2, line 5 - page 3, line 23 --	1-15
A	WO 9315583 A1 (GPT LIMITED), 5 August 1993 (05.08.93), abstract -- --------	1-15

☐ 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
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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
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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	Date of mailing of the international search report
15 February 2001	16 -02- 2001
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Stefan Hansson/JAn Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

Information on patent family members

27/12/00

International application No.
PCT/FI 00/00955

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		GB 9201540 D	00/00/00
		JP 6510238 T	17/11/94
		US 5469617 A	28/11/95

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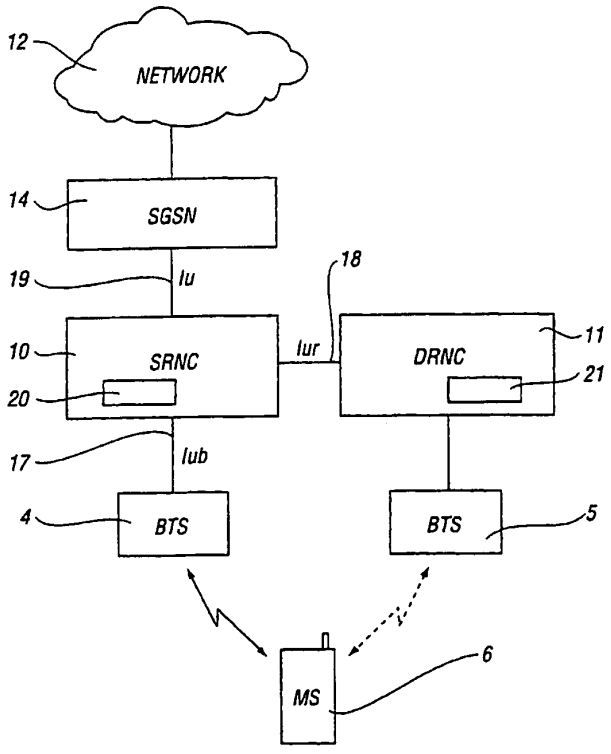
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[Continued on next page]

(54) Title: RELOCATION IN A COMMUNICATION SYSTEM



(57) Abstract: The present invnetion relates to relocation of a protocol termination point in a communication system comprising a first protocol termination point, a second protocol termination point and control means for relocating a first protocol from the first protocol termination point to the second protocol termination point. A protocol initialization unit that contains predefined information of the first termination point is defined by means of the first protocol. The protocol initialization unit is subsequently transferred from the first termination point to the second termination point by means of a second protocol. The second termination point is initialized based on the received protocol initialization unit.

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Relocation in a communication system

Field of the Invention

The present invention relates to relocation in a communication system and in particular, but not exclusively, to relocation of a protocol termination point.

Background of the Invention

Communication networks typically operate in accordance with a given standard which sets out what the elements of the network are permitted to do and how that should be achieved. The communication in the networks follows predefined rules which are referred to in the following as protocols. The protocols to be used are defined in the associated standard. The protocols can be used for controlling various events and functionalities in a connection provided through the communications network. Several protocols may be simultaneously in an active state for providing control of a connection. During an ongoing i.e. active connection a protocol is having a termination point in the network element controlling the connection. For example, a protocol may have termination points in a telephone terminal and in a network controller controlling the connection.

A communication network is a cellular radio network consisting of cells. In most cases the cell can be defined as a certain area covered by one or several base transceiver stations (BTS) serving mobile stations (MS) via a radio interface and connected to a base station subsystem (BSS). Several cells cover a larger area, and form the coverage area of a cellular

radio network. The cell (or group of cells) and thus the mobile station (MS) or similar user equipment (UE) within one of the cells of the system can be controlled by a node providing controller functionality, for example by a radio network controller (RNC) or a mobile switching center (MSC). The controller can be connected further to a gateway or linking node, for example a gateway GPRS support node (GGSN) or gateway mobile switching center (GSMC), linking the cell to the other parts of the communication system and/or other communication networks, such as to a PSTN (Public Switched Telecommunications Network) or to a data network, such as to a X.25 based network or to a TCP/IP (Transmission Control Protocol/Internet Protocol) based network.

The mobile station MS may be controlled by only one controller at time. However, the MS may also be simultaneously controlled by several controller nodes. This may occur e.g. when the cells overlap or in so called soft handoff mode, where the MS may be in communication with two base stations and those base stations may be connected to different controllers, or when one controller is controlling another controller controlling the MS. One controller of the plurality of controllers in the system can be defined as a serving (main) controller whereas the others may act as secondary controllers. The responsibility of controlling a connection between the mobile station and the network may change during an ongoing connection. It is therefore necessary to relocate at least part of functionalities associated with the connection such that the connection will not become disconnected and/or that the quality of the connection remains in an acceptable level. It is to be appreciated that in addition or as an alternative to relocating functionalities of the controller node, the

functionality to be relocated may also be located in any other of the network elements, for example in the base station, base station subsystem, in the gateway and so on.

When relocation is decided to be performed, the serving controller or another node of the communication system may initiate the necessary proceeding for replacing one or several of the network nodes with a new corresponding node or nodes.

In case of an active i.e. ongoing connection, one of the features that should to be relocated is the state of a protocol termination point. Although it is not always necessary, in a usual case the status of the protocol termination point at the new "replacing" network element or node should be such that it may take over the functions of the old "replaced" network node. At the present the parameters which need to be transferred have to be defined also in the protocols which are used to convey the information from the old termination point to the new termination point. For example, if parameters of a Radio Resource Control (RRC) or Medium Access Control (MAC) or Radio Link Control (RLC) protocols are to be relocated in a system that would use radio network subsystem application part (RNSAP) for communication between the network controller nodes, this would mean that a lot of "external" parameters would have to be defined for the RNSAP. This would increase the complexity of the RNSAP. In addition, if several additional parameters of a protocol are to be defined for the another protocol, it makes these two different protocols very dependent on each other. The independent evolution of them would thus become more difficult to manage.

Summary of the Invention

It is an aim of the embodiments of the present invention to address one or several of the above problems.

According to one aspect of the present invention, there is provided a method in a communication system for relocating a protocol termination point, comprising:

defining a protocol initialization unit containing predefined information of a first termination point of a first protocol by the first protocol;

transferring the protocol initialization unit from the first termination point to a second termination point by a second protocol; and

initializing the second termination point based on the protocol initialization unit.

According to another aspect of the present invention there is provided a communication system, comprising:

a first protocol termination point;

a second protocol termination point;

control means for relocating a first protocol from the first protocol termination point to the second protocol termination point, said control means being arranged to form a protocol initialization unit containing predefined information of the first protocol at the first protocol termination point;

communication path based on a second protocol between the first and the second termination points for transferring the protocol initialization unit; and

control means for initializing the second protocol termination point based on the protocol initialization unit.

According to a still another aspect of the present invention there is provided a network element for use in a communication network, comprising:

a protocol termination point;

control means for relocating a first protocol from the protocol termination point to another protocol termination point, said control means being arranged to form a protocol initialization unit containing predefined information of the first protocol at the protocol termination point; and

interface to said other protocol termination point based on a second protocol for transferring the protocol initialization unit from the first termination point by means of the second protocol.

According to a still another aspect of the present invention there is provided a network element for use in a communication network, comprising:

a protocol termination point of a first protocol;

interface to another protocol termination point for receiving a protocol initialization unit containing predefined information of the first protocol at said other termination point, wherein the interface is based on a second protocol; and

control means for initializing the protocol termination point based on the received protocol initialization unit.

According to a more specific embodiment, the protocol initialization unit may contain state information of the first protocol termination point.

The first termination point may also be located at a first network element of the communication system and the second

termination point may be located at a second network element of the communication system. The second network element may, upon receiving the protocol information unit, generate and transmit a response to the first network element by means of the second protocol.

The protocol initialization unit may be encapsulated in a message transmitted between the first termination point and the second termination point. The protocol initialization unit may also be transparent for the second protocol.

The protocol initialization unit may be transmitted via a network element of a core network of the communication system. This may be accomplished by means of a radio access network application part (RANAP) protocol. According to an embodiment, the protocol initialization unit may be transmitted directly between the termination points. This may be accomplished by means of a radio network subsystem application part (RNSAP) protocol.

The protocol initialization unit may contain information of at least one further protocol. According to an embodiment at least one further protocol initialization unit may be defined containing predefined information of a further protocol by the further protocol, whereafter the further protocol initialization unit is transferred from the first termination point to the second termination point. The further protocol initialization unit may be transferred between the termination points by a protocol that is different to the second protocol.

The parameters of the second termination point may be set into a state that is relatively similar to the state of parameters

of the first termination point before or at the time the relocation procedure was initiated during the initialization procedure.

The embodiments of the invention provide several advantages. One of the benefits is that a need for defining a great number of parameters of one protocol in another protocol is avoided. This provides clear benefits in updating and maintenance of the protocols.

Brief Description of Drawings

For better understanding of the present invention, reference will now be made by way of example to the accompanying drawings in which:

Figure 1 shows a schematic diagram of a cellular radio network system in which embodiments of the invention can be implemented;

Figure 2 shows the hierarchy of various elements of the network of Figure 1;

Figure 3 shows two possible interfaces between network nodes; and

Figure 4 is a flow chart for operation in accordance with one embodiment.

Description of Preferred Embodiments of the Invention

Reference will be first made to Figure 1 in which three cells 1,2,3 of a cellular telecommunications network are shown. Each cell 1,2,3 is served by a respective base transceiver station (BTS) 4',4,5. Each base transceiver station (BTS) is arranged to transmit signals to and receive signals from the mobile

stations (MS) 6 located in the cell associated with the given base transceiver station. Likewise, each mobile station 6 is able to transmit signals to and receive signals from the respective base transceiver station 4',4,5, and also able to move from the coverage area of one cell to the coverage area of another cell, e.g. from cell 2 to cell 3.

The exemplifying cellular telecommunications network will be described in more detail in the following by using the terminology of a proposed Universal Mobile Telecommunications System (UMTS) standard. However, it is to be appreciated that the invention is not restricted to UMTS but can be implemented in any standard. Examples of these include, without any intention to restrict the possible communication systems to these, any of the code division multiple access (CDMA) based systems or any of the time division multiple access (TDMA) based systems or any of the frequency division multiple access (FDMA) based systems or any hybrids thereof.

Reference is now made to Figure 2 which shows the hierarchy of a cellular communication system. As can be seen, the mobile station 6 is in wireless communication with one of the base stations. Typically a number of mobile stations will be in communication with each base station although only one mobile station is shown in Figure 2 for clarity. A first base station 4 is connected to a first network controller, which in Figure 2 is a serving radio network controller SRNC 10. Again, more than one base station is usually connected to each controller 10 although only one is shown for clarity. Typically more than one controller is also provided in a network. The SRNC 10 is connected to other elements of the network 12 via a suitable

linking or gateway apparatus, such as a serving GPRS (General Packet radio Service) Support Node (SGSN) 14.

The SRNC 10 is arranged to control the base station, either directly or through an intermediate node (not shown). The controller 10 passes on data to be transmitted to the mobile station by the base station. The controller 10 will also receive from the base station data which the base station has received from the mobile station. The implementation of the communication between the base station, the mobile station and the controller is known, and will thus not be discussed in detail herein. It is sufficient to note that the interface may comprise channels in both uplink and downlink directions. The data may be sent between the mobile station and the controller in any suitable format. The messages sent from the mobile stations may include information identifying the mobile station (for instance, MS ID and/or IMSI (Mobile Station Identity and/or International Mobile Subscriber Identity, respectively)).

In addition to the serving controller (RNC 10), the cellular telecommunications system of Figure 2 includes another controller RNC 11 controlling the base station 5 of cell 3 of Figure 2. It is, again, noted that the second controller may also control more than one base station. The second controller may also sometimes be referred to as a drift controller (DRNC). The SNRC 10 and DRNC 11 may communicate with each other over an open Iur interface 18 established between them.

Figure 2 illustrates one possible relocation situation wherein the mobile station MS 6 or similar user equipment communicates firstly via the BTS 4 over a radio interface designated by a

solid line and then switches to communicate via a new BTS 5, as designated by the dashed radio interface. According to one possibility the change from one base station to another may occur after the mobile station 6 has moved into the service or illumination area of the second base station 5. However, it is to be appreciated that in addition to the movement of the mobile station, there are also other possible reasons for triggering the relocation of the connection to another base station or to another network element, such as network optimization, load balancing, hardware congestion, connection quality improvement, fault in the system or base station and so on.

In order to ensure a proper operation of the system and to avoid disconnecting a possibly ongoing call, at least some of the functionalities of the network elements have to be relocated for the connection. For example, when a SRNC functionality is to be located from a first RNC to a second RNC some protocol termination points of an ongoing connection (such as RRC, RCL and/or MAC protocols) need to be changed from the first RNC to the second RNC.

Before explaining an embodiment for the relocation in more detail, a brief explanation will given of the protocol termination point with reference to Figure 3 showing a block diagram of the source RNC 10 and the target RNC 11. The exemplifying protocol termination point is illustrated to comprise a radio resource control (RRC) protocol. However, it is to be appreciated that the described RRC protocol is only an example, and that the embodiments can be implemented for any other protocol used for a connection in a communication system as well. These other protocols include, without any

restriction to these, medium access control (MAC) protocol, radio link control (RLC) protocol and packet data convergence protocol (PDCP).

The SRNC 10 and DRNC 11 each are provided with a Radio Resource Controller functionality RRC 24 and 26, respectively. When the MS 6 is communication with the controller 10, the RRC protocol has its other termination point correspondingly at the controller 10, while the other termination point is at the mobile station. However, should the controller change, the termination point of the RRC protocol should also be changed correspondingly. More precisely, the new controller 11 should be provided with a similar termination point functionality using similar parameters as the previous controller had. These functionalities will be controlled by a control unit 20 at the source controller 10 and by a control unit 21 at the target controller 11.

Figure 3 shows further an Iur interface 18 between the DRNC 10 and the SRNC 11. For example, a RNSAP (Radio Network Subsystem Application Part) protocol can be used for the direct signalling between the two RNCs. A RANAP (Radio Access Network Application Part; in the control plane) protocol can used for L3 (Layer 3) signalling over the Iu interface between the RNCs and an appropriate element 14 of the core network 14. The core network element 14 can be e.g. a mobile switching center or a serving GPRS support node.

A reference will now be made to the flow chart of Figure 4 showing in more detail an embodiment for moving the required state information of a protocol termination point from one termination point at a first network element (NE) to another

termination point in a second network element. As illustrated by step 30, the protocol termination point is to be moved between the termination points during an active state of the protocol between the servicing network controller and the mobile station. After the relocation procedures are initiated at step 32, the "old" protocol termination point in the source network element produces at step 34 a special protocol data unit (PDU) containing predefined necessary protocol parameters for initialization of the second termination point before relocation of the connection. The PDU is passed at step 36 to the new termination point with help of a second protocol. The second protocol is used for signaling between the different network elements or nodes. The passed information can be transparent to the second protocol used for the transmission of the PDU. Examples of the protocols which may be used for the transmission of the PDU will be discussed in more detail later in this specification. The new termination point receives the PDU and it is initialized at step 38 based on the information received from the old termination point. After the initialization procedure the termination point will be relocated at step 40 to the new network element and the operation of the system continues as before except that the protocol termination point of the active protocol is now situated in the new network element.

In other words, an explicit protocol message will be passed between the old termination point and the new termination point of a protocol in case of relocation of the protocol termination point. The specified PDU (or message) is used within a protocol peer between the old and the new termination point of the protocol. In a preferred embodiment a single protocol defines the information to be transferred between the

protocol peers and the information to be transmitted within one peer. By means of this it is possible to avoid a need for defining a great number of parameters of one protocol in another protocol. For example, by the embodiment described in the following about 100 RRC parameters in the RANAP protocol are avoided.

Referring again to Figure 3, a more detailed example of the relocation procedure will now be given in context of relocating a radio interface L3 protocol (i.e. a radio resource control; RRC) protocol from a first or source controller (e.g. RNC 10 of Figure 3) to a second or target controller (e.g. RNC 11 of Figure 3). The exemplifying RRC protocol is known, and is not described in more detail. It is sufficient to note that the RRC provides common controlling and signaling over the air interface between the serving RNC and the mobile station and that the RRC can be shared with circuit switched traffic and packet switched traffic.

The control unit 20 of the first (source) RNC 10 produces the special protocol initialization unit which in this instance will be referred to as a RRC PDU. The RRC PDU contains all such predefined RRC parameters that have to be known by the new termination point in order to receive and continue the connection. These parameters may include information concerning e.g. one or several of the following: radio bearer(s), transport channel(s), radio link(s) and their physical channels, capability information as well as user equipment capabilities and measurements being reported by the user equipment and so on. According to a preferred embodiment the RRC PDU contains all such RRC parameters that are required by the termination point at the target RNC to start the RRC

protocol in a relatively similar state and conditions that existed in the old termination point.

According to an embodiment the generated RRC PDU can be transferred from the first RNC to the second RNC by means of a RNSAP (Radio Network Subsystem Application Part) over an open interface Iur 18 provided between the first controller 10 and the second controller 11. The termination point at the second RNC receives the RRC PDU and subsequently decodes the received RRC PDU. The termination point 26 is initialized based on the received and decoded information. The initialization procedure can be controlled by the control unit 21.

According to another embodiment the PDU is firstly moved from the source RNC 10 to the core network (CN) 14 over an Iu interface 19 by a RANAP (Radio Access Network Application Part) message 'RELOCATION REQUIRED' and subsequently from the core network to the target RNC 11 by an Iu RANAP message 'RELOCATION REQUEST'.

The RRC PDU can be encapsulated within a message in the second protocol as there is no need for the contents of the RRC PDU to be visible for the functionality of the second protocol, such as to the RANAP or the RNSAP. The encapsulation of protocol messages transparently to a message of another protocol is a known technique and will thus not be discussed in more detail herein

It should be appreciated that the status of any other protocol, such as the MAC protocol or RLC protocol referred to above, could also be conveyed by the RRC protocol. In more general terms, a protocol may "collect" required information

for several protocols and generate a PDU containing required information for all or at least more than one of the protocols to be relocated. According to an embodiment a separate or further protocol initialization unit PDU is used for each of the protocols to be relocated or at least some of the protocols to be relocated. The different protocol initialization units can be transferred between the termination point by protocols that are different to each other.

It should also be appreciated that some embodiments do not require an identical or relatively similar protocol termination point at the old and the new network element. However, it is preferred that the information included in the protocol initialization unit is such that that the functionalities of the communication system may continue without disconnecting the user equipment from the communication system.

According to one possibility the termination point is not relocated from a network element or node to another node but within the node.

It is noted that in some embodiments of the invention, the relocation of some or all functionalities may also be triggered even in such conditions where the communication could continue without any relocation proceedings, e.g. in order to optimize the operation of the system or balance the load distribution in the system. In addition, the mobile station 6 of Figure 2 may be in communication with both controllers 10 and 11. Furthermore, it may not be necessary to relocate the entire protocol or all protocols used for a

connection, but instead only a part of the information concerning the protocols is transmitted between the network elements. For example, a user plane communication may be enabled via the Iur interface 18 of Figure 2, whereby the mobile station 6 within the service area of the controller 11 could still be controlled by the old servicing controller 10 via the controller 11.

According to a further embodiment the initialization is a bi-directional process. In other words, instead of only transmitting information from the first network element (node) to the second element, the new network element may send a respond to the first element or accomplish a transmission to a further network element. The respond may include a message such as "unable to initialize", "overload", "all parameters not received" and so on. Upon receiving the response, the first network element may modify its state and/or take some other actions towards the new termination point. For example, transmit modified parameter or parameters, or use different transmission route, or try to relocate the connection to another network element.

It should also be appreciated that whilst embodiments of the present invention have been described in relation to a connection between the network nodes and a mobile station, embodiments of the present invention are applicable to any other suitable type of connections terminating to one node. It should also be appreciated that base stations can sometimes be referred to as node B.

There are also other possible reasons for initiating the relocation procedure that movement of the mobile station into a new service area. For example, the network element in

question may become overloaded or a failure in the system of the network element itself may force the system to relocate at least a part of the functionalities, network optimization, load balancing and so on.

The exemplifying embodiments of the invention have discussed protocols terminated to a network controller. Embodiments of the present invention can be applicable to other network elements as well where applicable.

It is also noted herein that while the above describes one exemplifying embodiment of the invention, there are several variations and modifications which may be made to the disclosed solution without departing from the scope of the present invention as defined in the appended claims.

Claims

1. A method in a communication system for relocating a protocol termination point, comprising:

defining a protocol initialization unit containing predefined information of a first termination point of a first protocol by the first protocol;

transferring the protocol initialization unit from the first termination point to a second termination point by a second protocol; and

initializing the second termination point based on the protocol initialization unit.

2. A method according to claim 1, wherein the protocol initialization unit contains state information of the first protocol termination point.

3. A method according to claim 1 or 2, wherein the first termination point is located at a first network element of the communication system and the second termination point is located at a second network element of the communication system.

4. A method according to claim 3, wherein the second network element, upon receiving the protocol information unit, generates and transmits a response to the first network element by means of the second protocol.

5. A method according to any of the preceding claims, wherein the protocol initialization unit is encapsulated in a message transmitted between the first termination point and the second termination point by the second protocol.

6. A method according to any of the preceding claims, wherein the protocol initialization unit is transparent for the second protocol.

7. A method according to any of the preceding claims, wherein the protocol initialization unit is transmitted via a third network element between the termination points.

8. A method according to claim 7, wherein the transmission is based on a radio access network application part (RANAP) protocol.

9. A method according to any of claims 1 to 6, wherein the protocol initialization unit is transmitted by a direct connection between the termination points.

10. A method according to claim 9, wherein the transmission is based on a radio network subsystem application part (RNSAP) protocol.

11. A method according to any of the preceding claims, wherein the predefined information of the first protocol comprise one or several parameters of a radio resource control protocol (RRC), medium access control protocol (MAC), radio link control protocol (RLC), and/or packet data convergence protocol (PDCP).

12. A method according to any of the preceding claims, wherein the protocol initialization unit contains information of at least one further protocol.

13. A method according to any of the preceding claims, comprising steps of:

defining at least one further protocol initialization unit containing predefined information of a further protocol by the further protocol; and

transferring the further protocol initialization unit from the first termination point to the second termination point.

14. A method according to claim 13, wherein the further protocol initialization unit is transferred between the termination points by a protocol that is different to the second protocol.

15. A method according to any of the preceding claims, wherein at least one of the termination points is located at one of the following: a base station controller, a radio network controller, a base station, a gateway.

16. A method according to any of the preceding claims, wherein the step of initializing the second termination point comprises setting the parameters of the second termination point into a state that is similar to the parameters of the first termination point before or at the time the relocation procedure was initiated.

17. A communication system, comprising:

a first protocol termination point;

a second protocol termination point;

control means for relocating a first protocol from the first protocol termination point to the second protocol termination point, said control means being arranged to form a

protocol initialization unit containing predefined information of the first protocol at the first protocol termination point;

communication path based on a second protocol between the first and the second termination points for transferring the protocol initialization unit; and

control means for initializing the second protocol termination point based on the protocol initialization unit.

18. A communication system according to claim 17, wherein the protocol initialization unit contains state information of the first protocol termination point.

19. A communication system according to claim 17 or 18, wherein the control means for relocating are arranged to encapsulate the protocol initialization unit into a message to be transmitted from the first termination point to the second termination point.

20. A communication system according to any of claims 17 to 19, wherein the first termination point is located at a first network element of the communication system and the control means for relocating are arranged in connection with the first network element.

21. A communication system according to any of claims 17 to 20, wherein the second termination point is located at a second network element of the communication system and the control means for initializing are arranged in connection with the second network element.

22. A communication system according to any of the claims 17 to 21, wherein the protocol initialization unit contains information of at least one further protocol.

23. A network element for use in a communication network, comprising:

a protocol termination point;

control means for relocating a first protocol from the protocol termination point to another protocol termination point, said control means being arranged to form a protocol initialization unit containing predefined information of the first protocol at the protocol termination point; and

interface to said other protocol termination point based on a second protocol for transferring the protocol initialization unit from the first termination point by means of the second protocol.

24. A network element according to claim 23, wherein the network element comprises a controller of a cellular communication network.

25. A network element according to claim 23 or 24, wherein the control means for relocating are arranged to encapsulate the protocol initialization unit into a message to be transmitted from the first termination point by means of the second protocol.

26. A network element according to any of claims 23 to 25, wherein the protocol initialization unit contains information of at least one further protocol.

27. A network element for use in a communication network, comprising:

a protocol termination point of a first protocol;

interface to another protocol termination point for receiving a protocol initialization unit containing predefined information of the first protocol at said other termination point, wherein the interface is based on a second protocol; and

control means for initializing the protocol termination point based on the received protocol initialization unit.

28. A network element according to claim 27, wherein the network element comprises a controller of a cellular communication network.

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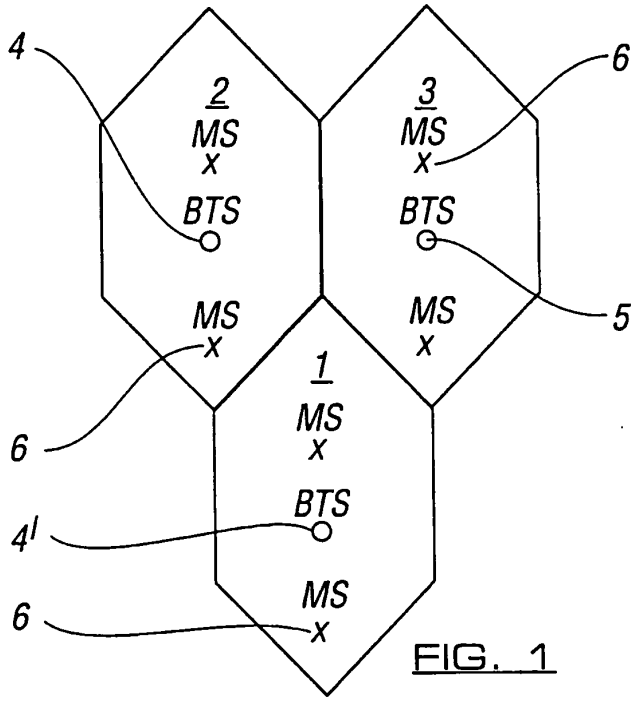

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x
BTS
MS
x
6
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FIG. 1

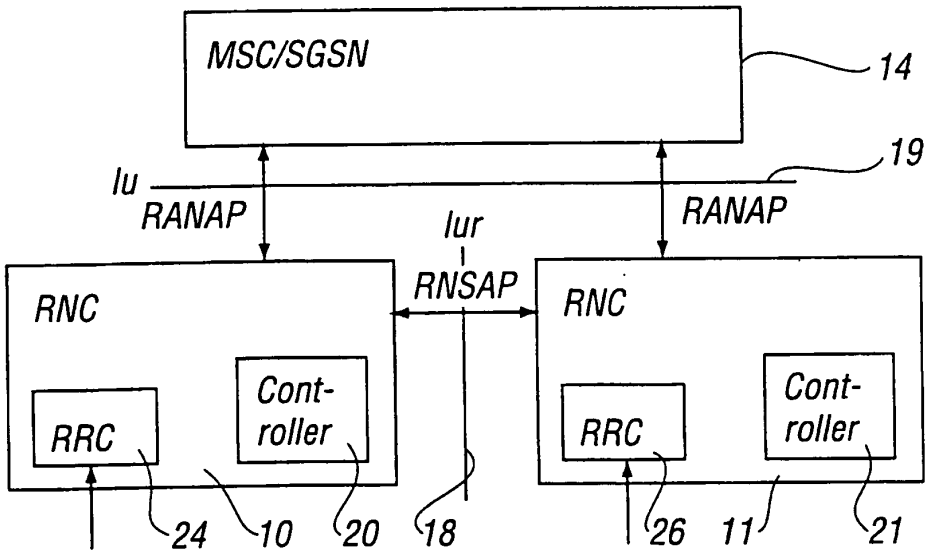

MSC/SGSN
14
19
Iu
RANAP
RANAP
Iur
RNSAP
RNC
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Cont-
roller
RRC
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roller
24
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20
18
26
11
21

FIG. 3

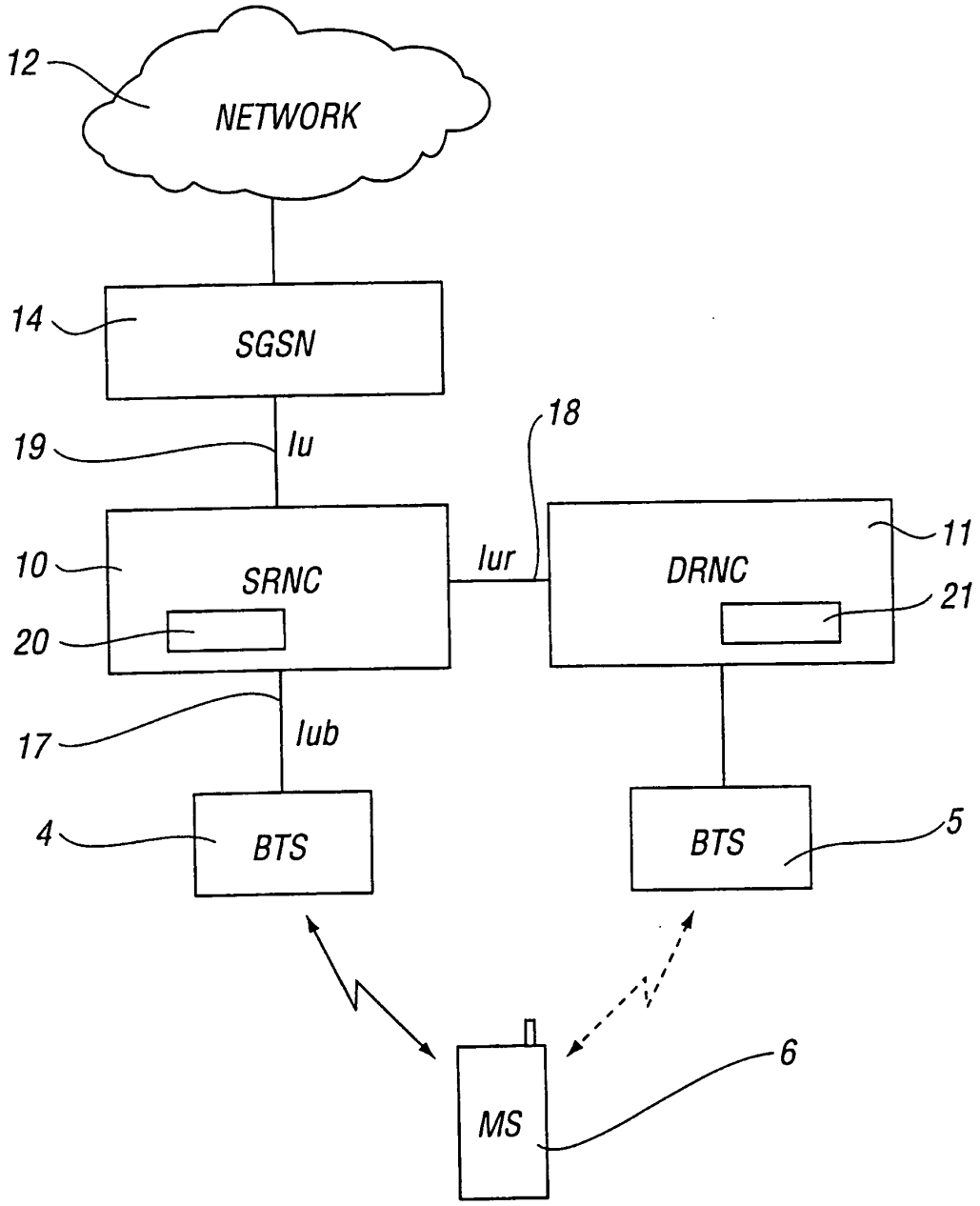

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MS

FIG. 2

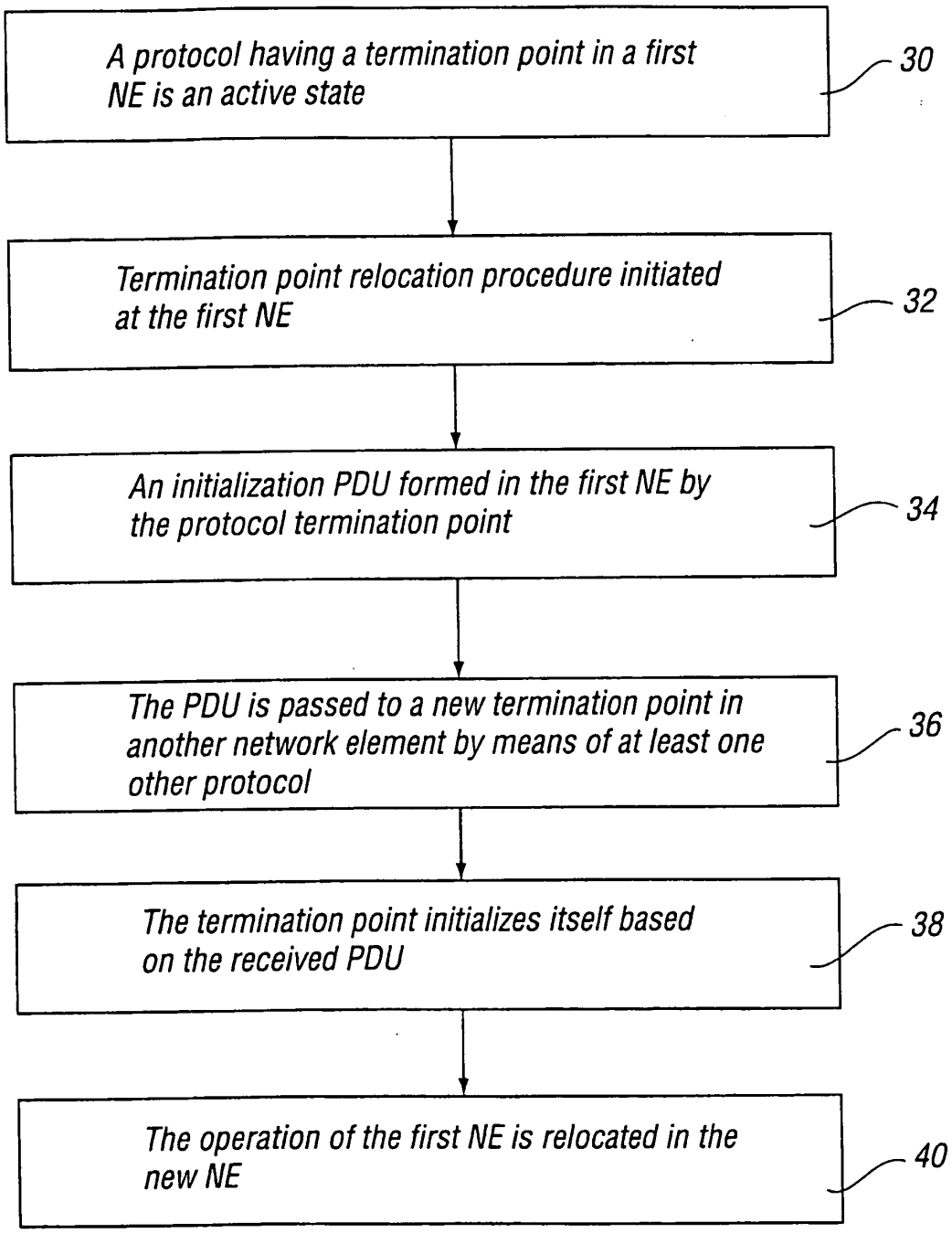

A protocol having a termination point in a first NE is an active state
30
Termination point relocation procedure initiated at the first NE
32
An initialization PDU formed in the first NE by the protocol termination point
34
The PDU is passed to a new termination point in another network element by means of at least one other protocol
36
The termination point initializes itself based on the received PDU
38
The operation of the first NE is relocated in the new NE
40

FIG. 4