network element, and the transmission of the caller picture from the network element to the terminal of the called party are performed in response to a subscriber information indicating a subscription of a supplementary service for providing the caller picture. Thus, the user may subscribe a supplementary service if he wishes to provide or receive a caller picture. The subscriber information may either indicate a caller picture presentation or a caller picture presentation restriction.

Preferably, the caller picture is taken by the camera function at the beginning of the call. Additionally, the caller picture may selectively be stored in a memory of the terminal of the calling party, and may be transmitted from the memory to the telecommunication network at the beginning of the call. In this case, the selective storing operation of the caller picture in the memory of the terminal of the calling party may be performed in accordance with a selection input operation at the terminal of the called party. Thereby, the calling person may store any picture taken in advance, wherein the stored picture may then be transmitted via the network element to the called party at the beginning of the call.

Preferably, the network element comprises a control means for checking a subscriber information of the called party stored in a subscriber data base, and for controlling the storing means based on the subscriber information. In particular, the data base may be a location register of a mobile network. The telecommunication network may be a GSM or a UMTS network. The network element may be a switching means such as a mobile switching center or a serving GPRS support node (SGSN).

The terminal of the calling party may comprise a switching means for selectively connecting a transmitting means to a camera means or to a memory means in accordance with a selection operation of a selection means for selecting a direct transmission operation in which the caller picture is generated and transmitted at the beginning of the call, or a memory operation in which the caller picture is generated and stored in the memory means from which it can be transmitted later. Thereby, a flexible generation timing of the caller picture can be provided.

The subscriber terminal may be a mobile terminal of a mobile communication network. Furthermore, the terminal of the called party as well as a terminal of a calling party may both be mobile terminals.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the present invention will be described in greater detail on the basis of a preferred embodiment with reference to the accompanying drawings, in which:

Fig. 1 shows a principle block diagram of a mobile telecommunication network in which the method and system according to the present invention is implemented;

Fig. 2 shows a principle block diagram of a mobile terminal according to the preferred embodiment of the present invention;

Fig. 3 shows a principle block diagram of a mobile switching center according to the preferred embodiment of the present invention; and

Fig. 4 shows a flow diagram of an operation of the mobile switching center according to the preferred embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the following, the preferred embodiment of the method and system according to the present invention will be described on the basis of a mobile telecommunication network such as a GSM or UMTS network.

Fig. 1 shows a principle block diagram of a mobile communication network comprising a mobile terminal or mobile station (MS) 2 having an integrated or separate camera 1 and an integrated or separate display 7 for displaying a picture taken at a terminal of a calling party. In the following, this picture is referred to as caller picture.

The MS 2 is radio-connected to a Base Station Subsystem (BSS) 3 which is connected to a Mobile Switching Center (MSC) 4 arranged to provide a switching function for switching or routing received calls according to the location of the called party. Furthermore, subscriber data bases such as a Visitor Location Register (VRL) 81 and a Home Location Register (HLR) 82 are connected to the MSC 4 so as to provide a file system for storing subscriber information such as a location information of mobile terminals, an information about supplementary (operator) services subscribed by individual subscribers, and the like.

The MSC 4 is connected via an interworking function to a fixed network 5 such as a Public Switched Telephone Network (PSTN) or an IN network. Thereby, a connection can be established between a multi-media end terminal (TE) 6 of the fixed network 5 and the MS 2. The TE 6 also comprises an external or internal camera 1 and an external or internal display 7.

According to the communication system shown in Fig. 1, a caller picture can be supplied to a called mobile station of the mobile telecommunication network or to the end terminal TE 6 of the fixed network 5. In particular, a caller picture taken by the camera 1 is transferred via the MSC 4 to the display 7 at the terminal of the called party at the beginning of the call. The calling party may selectively store the picture into a memory provided in the calling terminal, such as the MS 2 or the TE 6. Alternatively, the caller may take a picture just at the beginning of the call and may directly transmit the generated caller picture to the terminal of the called party. There are no limitations for the coding system of the picture, as long as the terminal of the called party is able to decode and display the image information received from the terminal of the calling party.

Furthermore, a supplementary service can be applied both to telephone calls and video calls. The supplementary service may be arranged to define a Caller Picture Presentation / Caller Picture Presentation Restriction (CPP/CPPR), wherein the subscriber defines by a corresponding service subscription whether a CPP or a CPPR is to be established for desired connections. The subscriber information defining the CPP/CPPR can be stored in the HLR 82 or the VLR 81, depending on the location of the MS 2.

Alternatively, a separate storing means may be provided in the MSC 4 for storing the above subscriber information. In the fixed network 5, the subscriber information may be stored in a corresponding data base of a switching means of the fixed network 5.

Thus, according to the preferred embodiment, both caller picture presentation and caller picture presentation restriction are defined as a supplementary service that can be applied to a telephone call (teleservice) or video call. These services can be subscribed to e.g. in GSM, UMTS or any other telecommunication system.

Fig. 2 shows a principle block diagram of the MS 2. It is to be noted that the same components are also included in the end terminal TE 6 of the fixed network 5. Therefore, the description of the present invention is restricted to the block diagram of the MS 2.

According to Fig. 2, the camera 1 which may be a separate or an integrated camera is connected via an I/O interface 26 to a signal processing unit 21 arranged for performing e.g. an encoding, encryption and/or compressing operation required for transmitting the generated caller picture via the communication network. The signal processing unit 21 is connected via a switch 23 either to a transceiver (TRX) 24 or to a volatile or non-volatile memory 22. Thus, a picture taken by the camera 1 may selectively be stored in the memory 22 or directly transmitted via the TRX 24 to the MSC 4.

The switch 23 is controlled by a control unit 27 connected to the TRX 24 and the I/O interface 26. The I/O interface 26 is further connected to the display 7 which may be an

LCD or the like, and to an operating unit such as a key pad 25. In particular, the key pad 25 and the display 7 may correspond to the conventional input/output units of a multi-media end terminal.

In the block diagram shown in Fig. 2, a memory storing operation for storing a picture received from the camera 1 in the memory 22, a direct transmission operation for directly transmitting the picture received from the camera 1 to a called party, or a memory transmission operation for transmitting a caller picture stored in the memory 22 may be selected by a corresponding input operation at the key pad 25. Based on this input operation, the control unit 27 controls the switch 23 so as to selectively store the picture received from the camera 1 in the memory 22 or transmit an actual or stored picture via the TRX 24 to the called party. Furthermore, the control unit 27 may receive a subscriber information via the TRX 24 from the telecommunication network, wherein the subscriber information indicates a restriction of the supplementary CPP service. Based on this subscriber information, the control unit 27 may control the switch 23 so as to switch a picture taken by the camera 1 to the memory 22 irrespective of an input operation at the key pad 25. In this case, a corresponding error message indicating that the CPP service is not subscribed to can be displayed on the display 7.

Thus, at the beginning of a call, e.g. before or after the dialing operation, a calling person performs the above selection by a corresponding input operation at the key pad 25. The input operation may be controlled by the control unit 27 on the basis of a control menue displayed at the display 7. Additionally, a default operation may be provided, if a selection is not performed. The

corresponding control program may be stored in a non-volatile program memory (not shown) provided in the control unit 27.

Fig. 3 shows a principle block diagram of the MSC 4. According to Fig. 3, the MSC 4 comprises a transceiver (TRX) 41 connected to the BSS 3. The TRX 41 is connected to a switch 42 arranged to perform switching according to the location of the desired called party. Furthermore, the switch 42 is connected to the VLR 81 and the HLR 82, such that the MSC 4 may refer to the subscriber information of a calling party or a called party.

Furthermore, the MSC 4 comprises a control unit 43 arranged for controlling a storing function of a caller picture received from a calling party in a corresponding memory 44. Thus, in case a call is received by the MSC 4, it refers to the VLR 81 or HLR 82 in order to retrieve the corresponding subscriber information of the called party and/or the calling party. In case the subscriber information of the called party indicates that the CPPR has been activated, i.e. the caller picture presentation is restricted, the control unit 43 inhibits the storing of the received caller picture in the memory 44. Furthermore, a function may be provided according to which the MSC 4 transmits a subscriber information to the calling party so as to indicate that the caller picture presentation is restricted at the called terminal. Based on this subscriber information, the terminal of the calling party may inhibit the transmission of the caller picture. The same operations indicated above may be performed if the MSC 4 determines based on the retrieved subscriber information that the calling party has restricted the caller picture presentation.

In case the subscriber information retrieved from the VLR 81 or the HLR 82 indicates that the caller picture presentation is subscribed or activated by the called party, the control unit 43 controls the memory 44 so as to store the received caller picture. After the connection has been established between the calling party and the called party, the stored caller picture is transmitted from the MSC 4 to the called party, so as to be displayed at the terminal of the called party. Based on the displayed caller picture, the called party may decide whether to respond to the call or not.

Fig. 4 shows a principle block diagram of a processing performed by the control unit 43 of the MSC 4.

Initially, it is determined in step S100 whether a call has been received. If not, the control unit waits in step S100 until a call has been received from the mobile network. If a call has been received, the control unit 43 initiates a checking operation so as to refer to the subscriber data base, e.g. the VLR 81 or the HLR 82 (S101). In case the checking step indicates that the CPPR is activated for the called party, the flow branches to an optional step S105 where a corresponding CPPR information is transmitted to the calling party so as to indicate the restricted caller picture presentation. In case the CPP is activated, i.e. the called party has subscribed to the caller picture presentation, the image data of the caller picture are received and stored in the memory 44 (step S102). Thereafter, the connection between the called party and the calling party is established in step S103, and the stored image data of the caller picture are transmitted in step S104 to the called party.

Then, the control unit 43 waits in step S106 for a signaling indicating the end of the call. If such a signaling has been received, the connection is released in step S107 and the flow returns to step S100 in order to wait for the receipt of a new call.

As already mentioned, the checking operation in step S101 may also be performed for the calling party, wherein the storing and transmission of the caller picture at the MSC 4 is only performed if both parties have not restricted the caller picture presentation service.

It is to be pointed out that the caller picture may be stored in any network element having a switching or routing function. In particular, the control operation according to Fig. 4 may be performed in a Service GPRS Support Node (SGSN) of a General Packet Radio System (GPRS), or in any switching means of the fixed network 5. Furthermore, the present invention may be applied to any telecommunication network to which multi-media communication apparatuses can be connected. The subscriber terminal may be a terminal or device connected to a fixed lines telecommunications network, such as a PSTN, ISDN or a local area (data) network.

As an alternative, the caller picture may be transferred between two mobile terminals, wherein a service is provided for transmitting the caller picture via the MSC 4 to a called mobile terminal at the beginning of a mobile connection.

The above description of the preferred embodiment and the accompanying drawings are only intended to illustrate the

present invention. The preferred embodiment of the invention may thus vary within the scope of the attached claims.

In summary, the present invention relates to a method and system for providing a caller picture via a telecommunication network to a called party. When the calling party makes a call, the caller picture is transferred to the network and further to the terminal of the called party. The caller picture is generated and transmitted to an network element at the beginning of the call. Then, the network element stores the caller picture. Thereby, it is possible to achieve a better quality and to generate any caller picture at the terminal of the calling party in real-time, so as to provide an up-to-date picture. Alternatively, the caller picture can be stored in advance, such that the user may edit the caller picture before it is sent to the network. Furthermore, the caller picture presentation can be defined as a supplementary service which subscribers can subscribe to. (Fig. 1)

Claims

1. A method for providing a caller picture via a telecommunication network to a called party, comprising the steps of:

a) generating said caller picture at a terminal of a calling party;

b) transmitting said caller picture to said telecommunication network at the beginning of a call;

c) storing said caller picture at a network element of said telecommunication network; and

d) transmitting said caller picture from said network element to a terminal of said called party.

2. A method according to claim 1, wherein steps b) to d) are performed in response to a subscriber information indicating a subscription of a supplementary service for providing said caller picture.

3. A method according to claim 2, wherein said subscriber information indicates a caller picture presentation or a caller picture presentation restriction.

4. A method according to any one of the preceding claims, wherein said caller picture is taken by a camera function at the beginning of the call.

5. A method according to anyone of claims 1 to 4, wherein said caller picture is selectively stored in a memory of said terminal of said calling party, and transmitted from said memory to said telecommunication network at the beginning of the call.

6. A method according to claim 5, wherein said selective storing operation of said caller picture in said memory of said terminal of said calling party is performed in accordance with a selection input operation at said terminal of said calling party.

7. A system for providing a caller picture to a called party via a telecommunication network having a plurality of terminals **(2, 6)** and at least one network element **(4)** for routing calls,

a) wherein each of said plurality of terminal **(2, 6)** comprises camera means **(1)** for generating said caller picture, display means **(7)** for displaying said caller picture, and transmitting means **(24)** for transmitting said caller picture to said at least one network element **(4)** at the beginning of a call; and

b) wherein said network element **(4)** comprises receiving means **(41)** for receiving said caller picture, storing means **(44)** for storing said caller picture, and transmitting means **(42)** for transmitting said caller picture to a terminal of said called party.

8. A system according to claim 7, wherein each of said plurality of terminals **(2, 6)** comprises memory means **(22)** for storing said caller picture; and selecting means **(25)** for selecting a direct transmission operation in which said caller picture is generated and transmitted at the beginning of the call, or a memory operation in which said caller picture is generated and stored in said memory means **(22)**.

9. A system according to claim 7 or 8, wherein said network element **(4)** comprises control means **(43)** for checking a subscriber information of said called party, stored in a

subscriber data base **(81, 82)**, and for controlling said storing means **(44)** based on said subscriber information.

10. A system according to claim 9, wherein said subscriber information indicates a subscription of a caller picture presentation service.

11. A system according to claim 9 or 10, wherein said data base is a location register **(81, 82)**.

12. A system according to any one of claims 7 to 11, wherein said network element **(4)** is a switching means of said telecommunication network.

13. A system according to claim 12, wherein said switching means is a mobile switching center **(4)** or an SGSM.

14. A system according to any one of claims 7 to 13, wherein said telecommunication network is a GSM or a UMTS network.

15. A system according to claim 14, wherein said terminal of said called party and a terminal of a calling party are both mobile terminals.

16. A network element for a telecommunication network, comprising:

a) receiving means **(41)** for receiving a caller picture from a terminal **(2)** of a calling party at the beginning of a call;
b) storing means **(44)** for storing said caller picture; and
c) transmitting means **(42)** for transmitting said caller picture to a terminal **(6)** of a called party.

17. A network element according to claim 16, further comprising control means **(43)** for checking a subscriber information of said called party, stored in a subscriber data base **(81, 82)** and for controlling said storing means **(44)** so as to perform the storing operation based on said subscriber information.

18. A network element according to claim 17, wherein said control means **(43)** is arranged to transmit a restriction information to said calling party, if said subscriber information indicates that the called party is not subscribed to a caller picture presentation service.

19. A network element according to any one of claims 16 to 18, wherein said network element is a switching means **(4)** of said telecommunication network.

20. A subscriber terminal of a telecommunication network having at least one network element for routing calls, said subscriber terminal **(2, 6)** comprising:

a) camera means **(1)** for generating a caller picture;
b) display means **(7)** for displaying a received caller picture; and
c) transmitting means **(24)** for transmitting said generated caller picture to said at least one network element **(4)** at the beginning of a call.

21. A subscriber terminal according to claim 20, further comprising memory means **(22)** for storing said generated caller picture; and selecting means **(25)** for selecting a direct transmission operation in which said caller picture is generated and transmitted at the beginning of the call, or a memory operation in which said caller picture is generated and stored in said memory means **(22)**.

22. A subscriber terminal according to claim 21, further comprising switching means **(23)** for selectively connecting said transmitting means **(24)** to said camera means **(1)** or to said memory means **(22)** in accordance with a selection operation at said selection means **(25)**.

23. A subscriber terminal according to any one of claims 20 to 22, wherein said subscriber terminal is a mobile terminal **(2)**.

24. A subscriber terminal according to any one of claims 20 to 22, wherein said subscriber terminal is a terminal or device connected to a fixed lines telecommunications network.

25. A subscriber terminal according to claim 24, wherein said fixed lines telecommunications network is a PSTN, ISDN or a local area network.

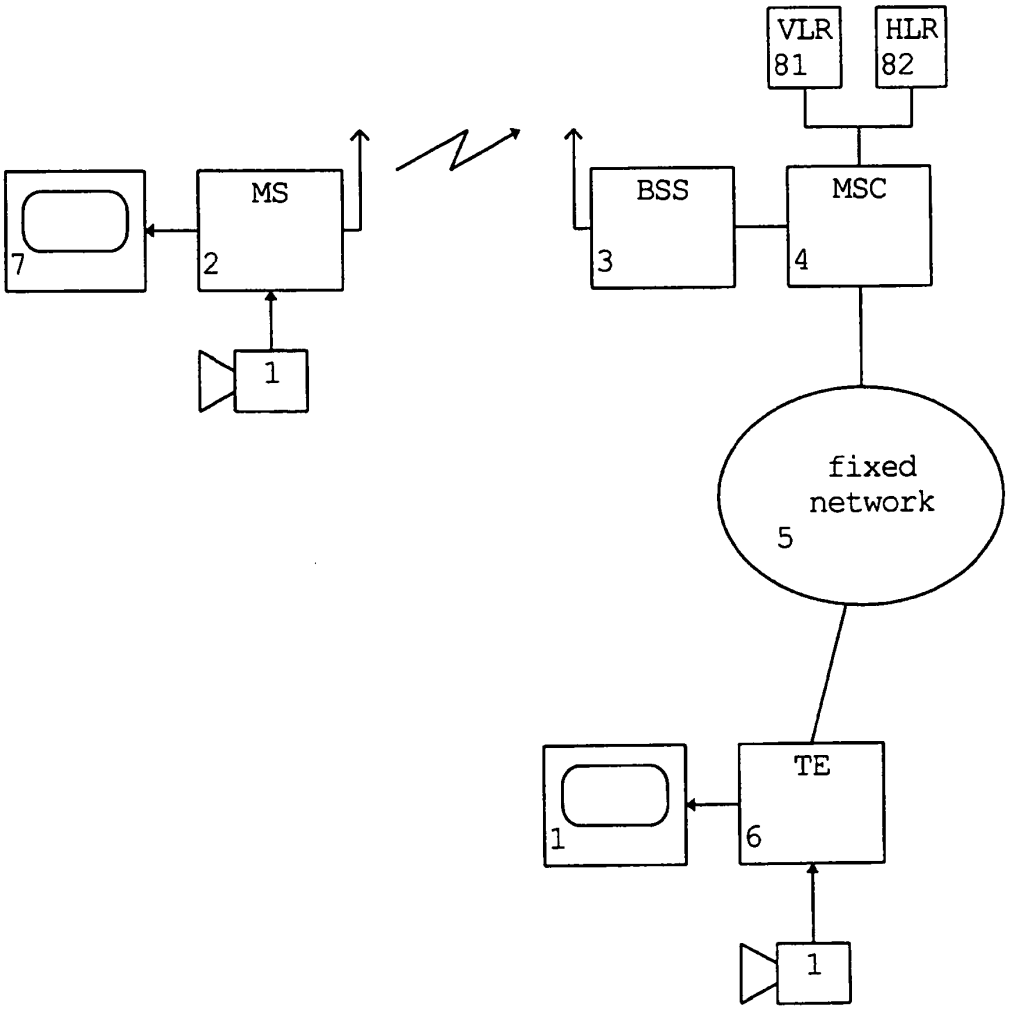


Fig. 1

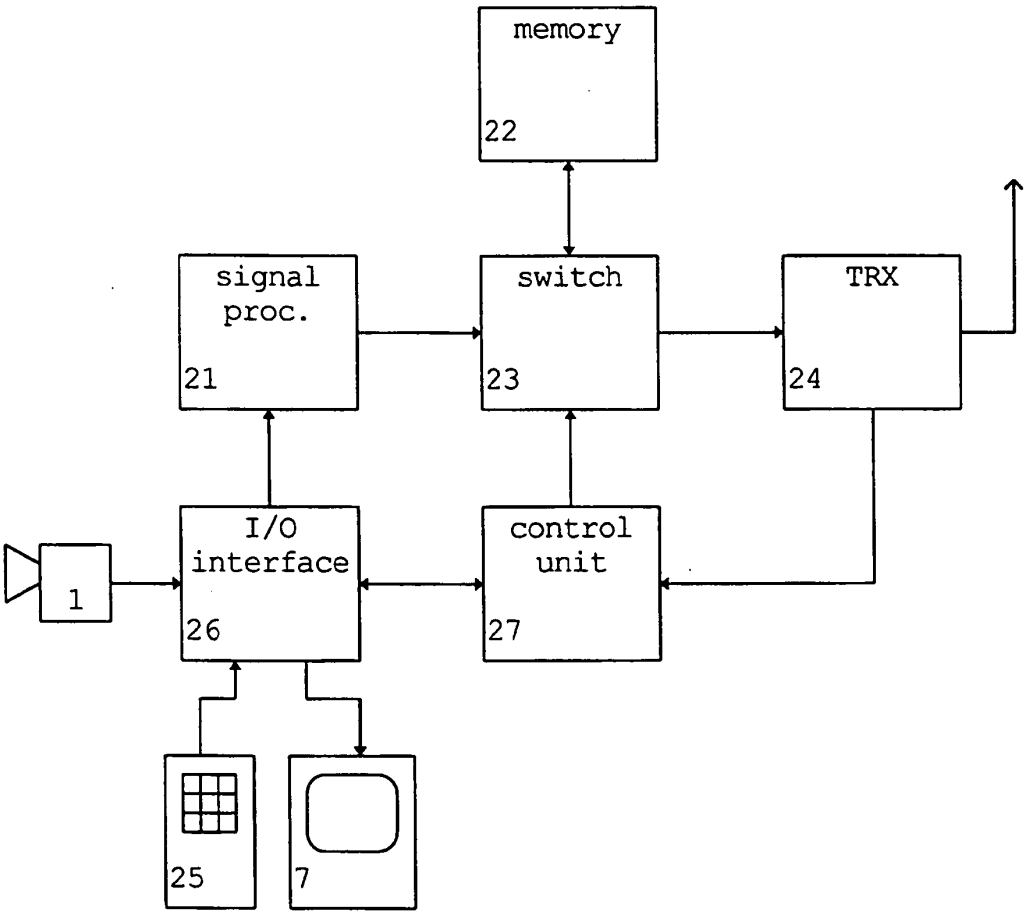

memory
22
signal proc.
21
switch
23
TRX
24
I/O interface
26
control unit
27
1
25
7

Fig. 2

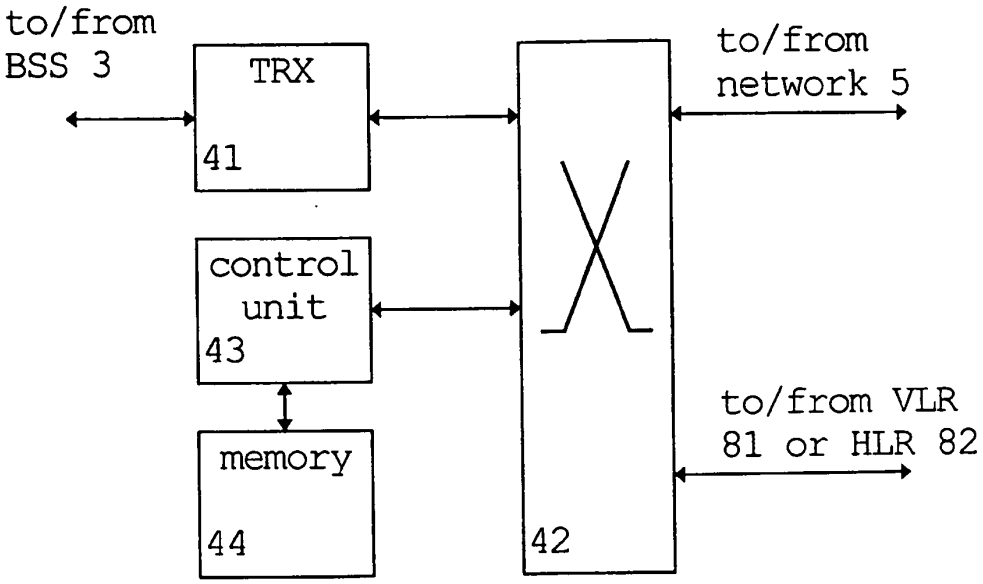

to/from
BSS 3
TRX
41
control
unit
43
memory
44
42
to/from
network 5
to/from VLR
81 or HLR 82

Fig. 3

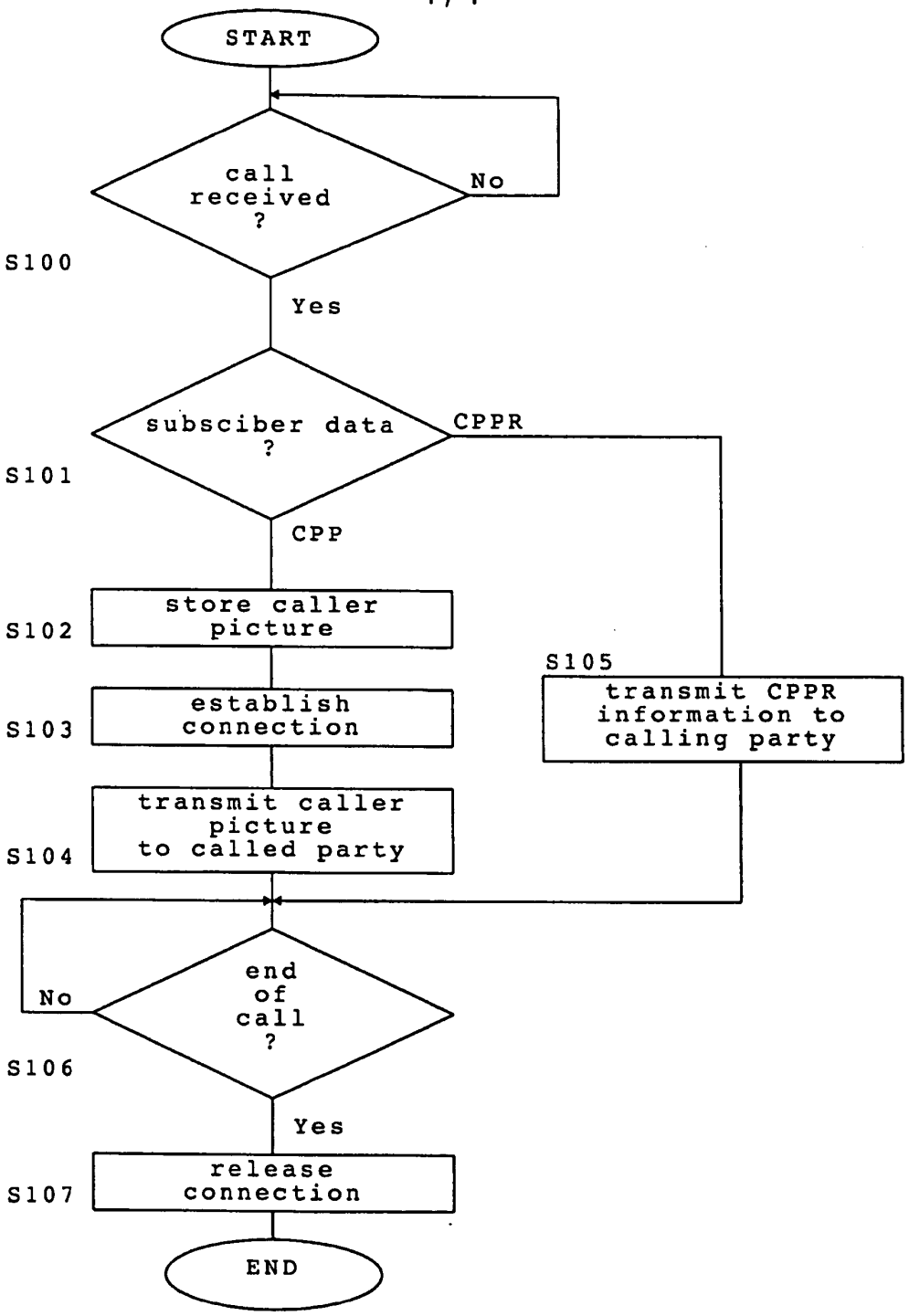

START
call received ?
No
S100
Yes
subsciber data ?
CPPR
S101
CPP
store caller picture
S102
S105
transmit CPPR information to calling party
establish connection
S103
transmit caller picture to called party
S104
end of call ?
No
S106
Yes
release connection
S107
END

Fig. 4

INTERNATIONAL SEARCH REPORT

Inter ...nal Application No
PCT/EP 99/04519

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04M1/57

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 H04M

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 741 484 A (AT & T CORP) 6 November 1996 (1996-11-06) column 1, line 3 -column 3, line 43 column 5, line 10 - line 19	1,4-7, 12,16, 19-22, 24,25
X	EP 0 436 345 A (CANON KK) 10 July 1991 (1991-07-10) column 2, line 14 - line 49 column 4, line 7 - line 43	1,4-7, 12,16, 19-22, 24,25

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 March 2000	31/03/2000

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	Vaucois, X

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INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/EP 99/04519

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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A	EP 0 474 555 A (CANON KK) 11 March 1992 (1992-03-11) column 3, line 28 -column 4, line 47 column 8, line 34 -column 10, line 51	1-25

Form PCT/ISA/210 (continuation ° >econd sheet) (July 1992)

EX1002 - Page 638

INTERNATIONAL SEARCH REPORT

information on patent family members

Inter anal Application No
PCT/EP 99/04519

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		EP 0809411 A	26-11-1997
		US 5309434 A	03-05-1994

Form PCT/ISA/210 (patent family annex) (July 1992)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 January 2001 (11.01.2001)

PCT

(10) International Publication Number
WO 01/03454 A1

(51) International Patent Classification[7]: H04Q 7/24

(21) International Application Number: PCT/IB00/00989

(22) International Filing Date: 30 June 2000 (30.06.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
9915301.7 30 June 1999 (30.06.1999) GB

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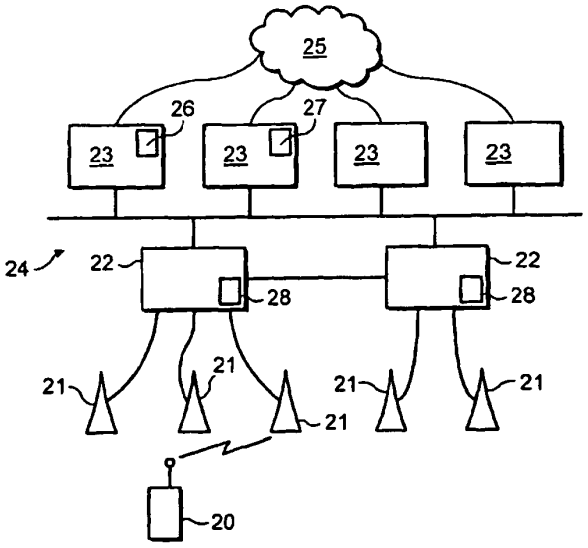
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian 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), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

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: SERVICE MANAGEMENT



(57) Abstract: A method of establishing a connection in a telecommunications system in which an intermediate network provides for communications between a user terminal and one or more of a plurality of serving network entities each capable of providing communications services to the user terminal by means of at least one telecommunications protocol, the method comprising the step of the intermediate network transmitting to the user terminal an indication of the serving network entities and the communications services provided by each one.

WO 01/03454 A1

SERVICE MANAGEMENT

This invention relates to managing services and overseeing mobility of a user in a telecommunication network. The invention is especially, but not exclusively, suitable for implementation in the proposed UMTS (Universal Mobile Telecommunications System) architecture.

Figure 1 shows generally the architecture proposed for UMTS. A mobile station (MS) 1 can communicate by radio with one or more base stations (BS) 2. Each base station is linked by an Iub interface 3 to a single radio network controller (RNC) 4. Each RNC can be linked to one or more BSs. An RNC can be linked to another RNC by an Iur interface 5. Each RNC is linked by an Iu interface 6 to a core network (CN) 7. The CN includes one or more serving nodes that can provide communication services to a connected mobile station, for example a mobile switching centre (MSC) or a serving GPRS (general packet radio service) support node (SGSN) 8. These units are connected by the Iu interface to the RNCs. The CN is also connected to other telecommunications networks 9 such as fixed line networks or other mobile networks to allow onward connection of communications outside the UMTS network. The CN also includes other units such as a home location register (HLR) 10 and a visitor location register (VLR) 11 which help to control access to the network. The BSs and the RNCs and their interconnections constitute a UMTS terrestrial radio access network (UTRAN).

A mobile station can communicate with a core network via an RNC and a base station connected to that RNC. In soft handover (macrodiversity), the mobile station can send traffic communications via more than one base station. Those base stations may be connected to the same RNC or to different RNCs. If the base stations are connected to different RNCs then those RNCs communicate directly with each other via the Iur interface to co-ordinate their actions and to combine signals received from the mobile station. One of those RNCs is designated as the serving

RNC and the others as drift RNCs. Communications between the user and the core network go via the serving RNC only. Thus, whether the mobile station is in soft handover or not its connection to the CN is through a single RNC. It can also arise in other circumstances than macrodiversity that a BS is controlled by a drift RNC, with communications going via serving a serving RNC to the core network.

In the core network each serving node such as an MSC or SGSN can provide a set of services to the mobile station. For example:

- An MSC can provide circuit switched (CS) communications, for example for speech, fax or non-transparent data services, and therefore has a link to other entities in the circuit switched domain such as other CS mobile networks such as GSM (Global System for Mobile Communications) and CS fixed wire networks such as conventional voice telephony networks.
- An SGSN can provide packet switched (PS) communications, for example for packet data protocol (PDP) contexts for internet protocol (IP) data transmission, and therefore has a link to other entities in the packet switched domain such as GPRS-equipped GSM networks and the internet.

The division of services between serving nodes is specified in the system specification and is strictly tied to the assumed network architecture. There may be other nodes than the MSC or SGSN providing overlapping or additional services.

It can be envisaged that in the future some services may be provided differently from the current arrangement. For example, speech services seem likely to migrate from the CS to the PS domain. In order to implement these changes to the network in the form described above is likely to cause substantial disruption. For example, to shift the provision of a fundamental service such as voice traffic to the PS domain may require routing hardware and software, as well as software in each mobile station, to be updated. This would cause great expense and inconvenience to network operators.

It would be desirable for there to be a way in which an operator can move a service previously executed by one type of network node to another type of network node with less disruption, or to introduce a new service via a new or an existing core network .

According to one aspect of the present invention there is provided a method of establishing a connection in a telecommunications system in which an intermediate network provides for communications between a user terminal and one or more of a plurality of serving network entities each capable of providing communications services to the user terminal by means of at least one telecommunications protocol, the method comprising the step of the intermediate network transmitting to the user terminal an indication of the serving network entities and the communications services provided by each one.

According to a second aspect of the present invention there is provided a telecommunications system comprising: a user terminal; a plurality of serving network entities each capable of providing communications services to the user terminal by means of at least one respective telecommunications protocol; an intermediate network providing for communications between a user terminal and one or more of the serving network entities, and being capable of transmitting to the user terminal an indication of the serving network entities and the communications services provided by each one.

Suitably, the user terminal selects the set of serving network entities which together support the set of services the user terminal wishes to use, and attaches to the serving network entities of the set.

Suitably the said indication is generated by the intermediate network. For this purpose the intermediate network may suitably store information defining the

available serving network entities and the service(s) capable of being provided by each one, preferably together with an identifier for each network entity.

The said indication may be transmitted to the user terminal during and/or after establishment by the user terminal of a connection with the intermediate network. In the latter case, the indication may suitably be transmitted in response to a mobility event of the mobile terminal, for example during or generally in consequence of a procedure of the intermediate network consequent on reallocation of equipment in the intermediate network serving the connection with the user terminal. That event may be a serving radio network controller relocation in, for example, a UMTS system or the like.

The intermediate network is suitably capable of adjusting the number of paging areas according to the number of serving network entities, for example with one paging area for each serving network entity. Alternatively, all, or at least more than one, of the serving network entities may use a common paging area.

The intermediate network is suitably capable of constituting a communication path between the user terminal and one or more of the network entities. The user terminal and one or more of the network entities are preferably capable of communicating via the intermediate network.

There may be a plurality of mobile stations, which are preferably operable in similar manner, whereby each mobile station can individually establish or register for communications with one or more serving network entities.

Suitably, for the user terminal an instance of a management process is established for each serving network entity with which that terminal is registered for informing the respective serving network of changes in the connection path to the respective terminal through the intermediate network. The said instance may be run on

processing apparatus local to the user terminal. On a change in the connection path to the mobile station through the intermediate network, each serving network entity may be informed of the change by means of the respective instance.

Suitably the intermediate network is capable of transmitting to a mobile station an indication of one or a plurality of serving network entities and the communications services provided by each one. Preferably, in order to receive a desired service a mobile station is capable of determining one of the serving network entities indicated as providing that service and attempting to establish a connection with that serving network entity via the intermediate network. Preferably, in consequence of the said indication of serving network entities and the communications services provided by each one, the system (most preferably the terminal) is capable of establishing a further instance of the management process for informing a respective serving network entity of changes in the connection path to a the said mobile station through the intermediate network. Alternatively, when a list of services is communicated to a terminal the terminal may already know which services are related to which serving nodes and consecutive to which management process. In that case if later the terminal needs to initialise a communication for a specific service then it may already be aware of which serving node it should contact, and thus suitably of which management process a request for such initialisation may be related to. In consequence of the said indication of serving network entities and the communications services provided by each one the system may suitably be capable of terminating an instance of the management process for informing a respective serving network entity of changes in the connection path to the said mobile station through the intermediate network.

The management process may be a mobility management process, suitably operable in accordance with a mobility management protocol, suitably a mobility management protocol of or for the Universal Mobile Telecommunications System or a derivative thereof.

The service(s) related to such management processes may, for example, be call control entities, session management entities, PDP (packet data protocol) entities, SMS (short message service) handling entities, voice-over-IP (internet protocol) entities, H.323 or H.324 entities, or supplementary service instances.

Some preferred features of all aspects of the invention will now be set out.

Suitably the user terminal is capable of communicating by radio and/or another medium with the intermediate network. The user terminal may be a unit that can be termed a mobile station, whether it is in fact mobile or immobile. The user terminal may be a mobile telephone.

The intermediate network is suitably operable according to the Universal Mobile Telecommunications System or a derivative thereof.

The intermediate network may be a radio access network, and is preferably a Universal Mobile Telecommunications System radio access network. The intermediate network is suitably capable of routing signals between the user terminal and one of the serving network entities, for example on the basis of (or in dependence on) a core network domain indicator. The intermediate network may include a Universal Mobile Telecommunications System radio network controller capable of performing the said routing.

Suitably at least one of the serving network entities is capable of providing for communications between the intermediate network and another telecommunications network. Each serving network entity may be a core network. Each serving network entity may include a home location register and/or a visitor location register. Suitably one or more of the serving network entities is capable of providing for circuit switched communications between the intermediate network and another telecommunications network. Suitably one or more of the serving network entities is capable of providing

for packet switched communications between the intermediate network and another telecommunications network.

The or each serving network entity may suitably but not necessarily be a serving network domain or serving network element.

The present invention will now be described by way of example with reference to the accompanying drawings, in which:

figure 1 is a schematic diagram of the currently-proposed architecture for a UMTS telecommunications system;

figure 2 is a schematic diagram of a modified architecture for a UMTS telecommunications system; and

figure 3 is a flow diagram illustrating the operation of a method in the system of figure 2.

The network shown in figure 2 is arranged so that instead of services being offered to a mobile station by a set of rigidly configured core network nodes, services can be offered to the user by a set of logical CN nodes. The services offered by each logical CN node can be reconfigured in a relatively straightforward manner. Furthermore, it is relatively easy to add additional CN nodes to introduce new services.

The network of figure 2 includes a mobile station 20, base stations 21 and RNCs 22. The interconnection of these units and the general aspects of their operation are suitably as for the UMTS system of figure 1.

The network of figure 2 also includes a plurality of core network entities 23 any of which may communicate with any of the RNCs 22 via a distributed communication arrangement 24. The core networks 23 can communicate with external telecommunications networks 25 such as other mobile networks, the internet and fixed line networks, depending on the capabilities of the respective core network. For

example, a core network may include a mobile switching centre (MSC) 26 for communications via voice or fax protocols or a serving GPRS (general packet radio service) support node (SGSN) 27 for data protocol communications. In a large network not all of the core networks 25 may be able to communicate with all of the RNCs 22, for geographical network configuration reasons.

The RNCs 22 include processing apparatus 28 for processing communications through the RNCs, handling control of the base stations 21 (e.g. controlling handovers), managing access of mobile stations into the system, managing mobility (e.g. location management or radio resource management) of mobile stations in the system between base stations, and other functions.

When a mobile station makes contact with the network it makes radio communication with a base station and thereby establishes an RRC (radio resource control) connection with the RNC to which that base station is connected. In the course of setting up that connection the UTRAN indicates to the mobile station the available CN nodes (domains) offering services within the service area controlled by the respective RNC. For each domain the UTRAN indicates to the MS the service(s) offered by that domain, together with an identifier for the domain, suitably a logical identifier such as a core network access number that may be used by the mobile station or other network entities to identify that core network in communications and allow routing to that network.

The MS is aware of which services it supports and for which of those services it requires a connection to the network. The MS can therefore select one or more appropriate CN domains for providing the required service(s). The MS attempts to connect to each selected domain so that it can be provided with a desired service from that domain.

For example, if the MS connects to the network requiring a circuit switched fax connection and a packet switched voice connection, the MS receives from the UTRAN a message indicating the available domains and the services offered/supported by each. The MS then selects one CN domain that is offering a fax service and one CN domain that is offering a packet switched service capable of carrying voice traffic. The MS then attempts to make a connection to each one of those domains. The domains may be the same or different.

The process is illustrated generally in figure 3.

The said core network access number can simply be an identifier that is generated by the RNC for use in its communications with the MS. The MS can use the core network access number to indicate to the RNC which core network it wishes to access but the subsequent forwarding of an access request message on to the relevant core network may be done by the RNC using a different, true identifier that is unknown to the MS. Thus, from the point of view of the MS the RNC transparently passes its communications on to the relevant core network. Once a core network accepts and establishes an attachment to an MS the MS can be informed of a true identifier for the core network to allow it to direct communications to the core network via another RNC if necessary. The RNC preferably has logic to allow it to direct communications to a suitable CN serving entity of the desired domain – for example randomly, on the basis of information determined by the RNC, on the basis of information given to the RNC by one or more of the serving node (e.g. their loads) or on the basis of information given to the RNC by the user equipment (UE) (e.g. the identity of the entity that previously handled the UE's communications and therefore may have some information on the UE). When such an entity has been selected the RNC may address that entity by the identifier of a specific entity given to the user equipment by the entity itself.

As the mobile station moves within the network the base station(s) and the RNC(s) serving it may change, as may the serving nodes in the core network. To cope with this the UMTS system provides for mobility management (MM) protocol instances which handle location updates within the network in idle mode. In connected mode (i.e. when an RRC connection exists between the mobile station and an RNC) handover procedures are used, in which a connection is switched from a former node to a new node; the same principle is used whether the changing node is the BS, RNC or serving CN. In the system of figure 2, on attaching to a domain a mobile station initiates a UMTS mobility management instance especially for that domain. Therefore, associated with each MS there is a MM instance for each CN domain to which that MS is attached. In principle each MM instance operates independently of the others, following the UTRAN paging area indication and making appropriate location updates to its respective CN domain. (In practice the MM instances may be somewhat linked by, for example, a common paging area). By this means, each CN domain to which the MS is attached can be kept independently updated of the mobile station's location so that it can route communications to the mobile station accordingly.

As the operator updates the network and offers different services through different CN domains this is handled automatically through by the connection arrangement described above. When the MS accesses the network, if the operator now offers a service through a different CN node than before the MS simply attaches to the new CN node that is indicated to the mobile as being capable of providing the desired service. Thus the above arrangement copes automatically with the addition of new CN domains to provide services and with adjustment of the functional split of services between CN domains.

The system is preferably also capable of accommodating changes in the attachment pattern of the MS even whilst it is connected to the network. If the mobile receives from the UTRAN a message indicating a change in the split of services between CN

nodes that affects the services for which the mobile station is attached then it suitably changes its pattern of attachment to meet with the new split of services. To meet the new split of service any of the following changes may be made, as appropriate:

1. Changing the arrangement for provision of a service from one CN domain to which the MS is already attached to another CN domain to which the MS is already attached. In this case the existing MM instance for that CN domain can also be updated to reflect the change in services being accessed through the respective CN domain.
2. Dropping the attachment for provision of a service from one CN domain and establishing an attachment for provision of that service from another CN domain to which the MS was not previously attached. In this case the existing MM instance for the dropped CN domain can be terminated and a new MM instance established for the newly attached CN domain.

This capability offers great flexibility to operators in the provision of new services or the reconfiguration of a network to provide existing services through new nodes. In particular, as services migrate from the CS domain to the PS domain the above arrangement provides the capacity for relatively straightforward reconfiguration of MS to CN connections from nodes that formerly provided a service in the CS domain to nodes that provide an equivalent service in the PS domain.

If the mobile station is informed of the availability of a service that is unknown to the mobile station then it can suitably ignore the availability of that service. By this means the system described above may be used to assist in version management – that is to assist compatibility between older and newer equipment in the system. Thus older mobile stations that are not compatible with newer services can cope with indications of the availability of services with which they are not compatible.

The applicant draws attention to the fact that the present invention may include any feature or combination of features disclosed herein either implicitly or explicitly or any generalisation thereof, without limitation to the scope of any of the present claims. 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.

CLAIMS

1. A method of establishing a connection in a telecommunications system in which an intermediate network provides for communications between a user terminal and one or more of a plurality of serving network entities each capable of providing communications services to the user terminal by means of at least one telecommunications protocol, the method comprising the step of the intermediate network transmitting to the user terminal an indication of the serving network entities and the communications services provided by each one.

2. A method as claimed in claim 1, wherein in order to receive a desired set of services the mobile station determines a set of the serving network entities indicated as together providing that set of services and attempts to establish a connection with the serving network entities in the set via the intermediate network.

3. A method as claimed in claim 2, wherein the said indication is generated by the intermediate network.

4. A method as claimed in any preceding claim wherein the user terminal is capable of communicating by radio with the intermediate network.

5. A method as claimed in any preceding claim wherein the intermediate network is operable according to the Universal Mobile Telecommunications System or a derivative thereof.

6. A method as claimed in claim 5, wherein the serving network entities are core networks.

7. A method as claimed in any preceding claim, wherein the intermediate network is a radio access network.

8. A method as claimed in claim 7, wherein the intermediate network is a Universal Mobile Telecommunications System radio access network.

9. A method as claimed in any preceding claim, wherein the said indication is transmitted to the user terminal during the establishment of a connection between the user terminal and the intermediate network.

10. A method as claimed in any preceding claim, wherein the said indication is transmitted to the user terminal during establishment of a radio resource control connection between the user terminal and the intermediate network.

11. A method as claimed in any of claims 1 to 8, wherein said indication is transmitted to the user after establishment by the of a connection between the user terminal and the intermediate network.

12. A method as claimed in any of claims 1 to 8 or 11, wherein the said indication is transmitted to the user terminal during a procedure of the intermediate network consequent on reallocation of equipment in the intermediate network serving the connection with the user terminal.

13. A method as claimed in claim 11 as dependant directly or indirectly on claim 5, wherein the said indication is transmitted to the user terminal in consequence of a serving radio network controller relocation.

14. A method as claimed in any preceding claim, wherein the said indication is transmitted to the user terminal in consequence of a change in serving network entity.

15. A method as claimed in any preceding claim, wherein the intermediate network is capable of adjusting the number of paging areas according to the number of serving network entities.

16. A method as claimed in any preceding claim, wherein at least one of the serving network entities is capable of providing for communications between the terminal and another telecommunications network.

17. A method as claimed in any preceding claim, wherein at least one of the serving network entities is capable of providing for circuit switched communications between the terminal and another telecommunications network.

18. A method as claimed in any preceding claim, wherein at least one of the serving network entities is capable of providing for packet switched communications between the terminal and another telecommunications network.

19. A method as claimed in any preceding claim, wherein the intermediate network is capable of routing signals between the user terminal and one of the serving network entities.

20. A method as claimed in claim 19, wherein the intermediate network is capable of routing signals from the mobile station to a selected one of the serving network entities on the basis of a core network domain indicator.

21. A method as claimed in claim 19 or 20, wherein the intermediate network includes a Universal Mobile Telecommunications System radio network controller capable of performing the said routing.

22. A method as claimed in any preceding claim, comprising establishing for each user terminal for each serving network entity with which that terminal is registered an

instance of a management process for informing the respective serving network of changes in the connection path to the respective mobile station through the intermediate network, whereby on a change in the connection path to the mobile station through the intermediate network, each serving network entity may be informed of the change by means of the respective instance.

23. A method as claimed in claim 22, comprising the step of, in consequence of the said indication of serving network entities and the communications services provided by each one, establishing a further instance of the management process for informing a respective serving network entity of changes in the connection path to the mobile station through the intermediate network.

24. A method as claimed in claim 22, comprising the step of, in consequence of the said indication of serving network entities and the communications services provided by each one, terminating an instance of the management process for informing a respective serving network entity of changes in the connection path to the said mobile station through the intermediate network.

25. A method as claimed in claim 23 or 24, comprising the step of, in consequence of the said indication of serving network entities and the communications services provided by each one, modifying an instance of the management process for informing a respective serving network entity of changes in the connection path to a the said mobile station through the intermediate network.

26. A method as claimed in any of claims 22 to 25, wherein the management process is a mobility management process.

27. A method as claimed in claim 26, wherein the management process is operable in accordance with a mobility management protocol.

28. A telecommunications system comprising:

a user terminal;

one or more serving network entities each capable of providing communications services to the user terminal by means of at least one respective telecommunications protocol;

an intermediate network providing for communications between a user terminal and one or more of the serving network entities, and being capable of transmitting to the user terminal an indication of the serving network entities and the communications services provided by each one.

29. A telecommunications system as claimed in claim 28, comprising processing apparatus capable of for each user terminal establishing for each serving network entity with which that terminal is registered an instance of a management process for informing the respective serving network of changes in the connection path to the respective user terminal through the intermediate network, whereby on a change in the connection path to the user terminal through the intermediate network, each serving network entity may be informed of the change by means of the respective instance.

30. A method for establishing a connection substantially as herein described with reference to figures 2 and 3 of the accompanying drawings.

31. A method for managing communications substantially as herein described with reference to figures 2 and 3 of the accompanying drawings.

32. A telecommunications system substantially as herein described with reference to figures 2 and 3 of the accompanying drawings.

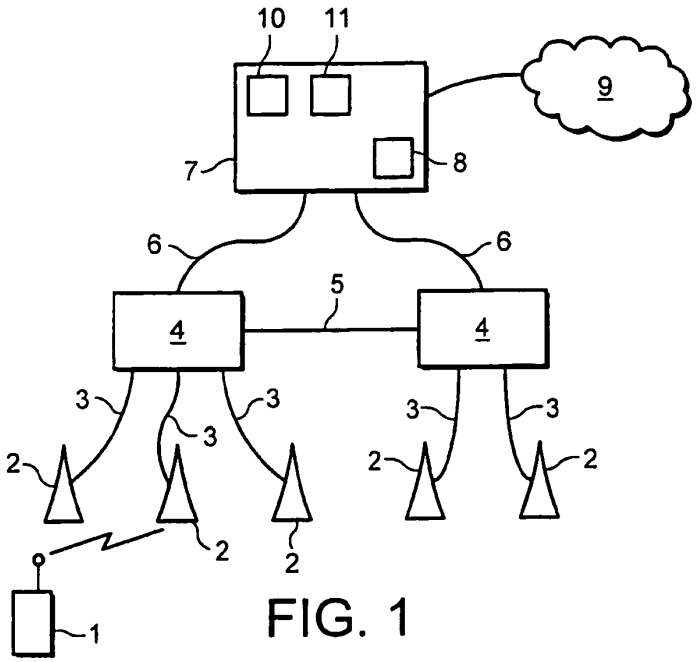

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FIG. 1

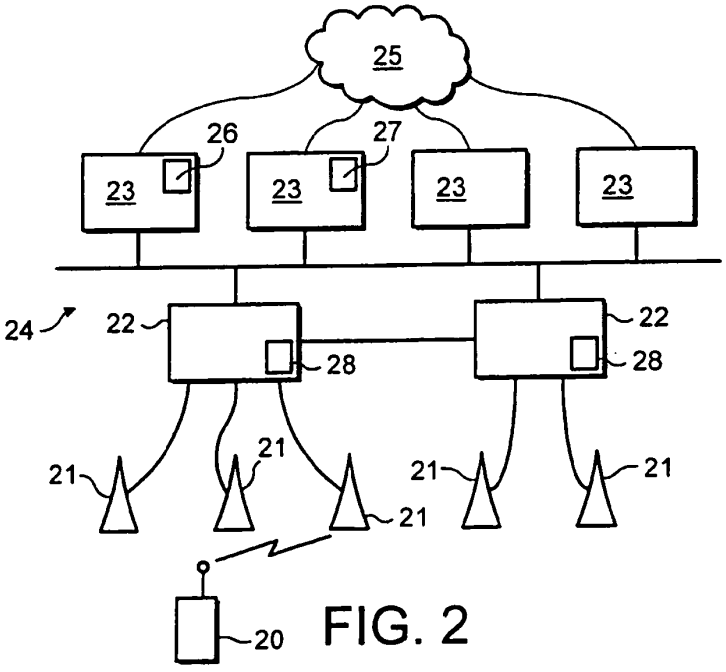

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FIG. 2

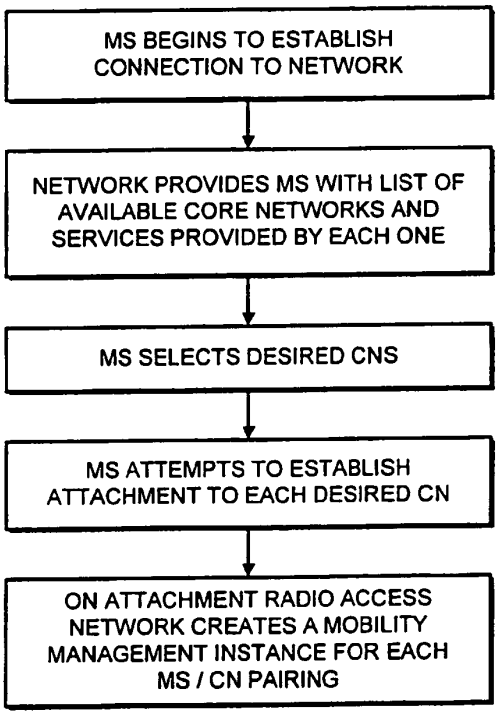

MS BEGINS TO ESTABLISH CONNECTION TO NETWORK
NETWORK PROVIDES MS WITH LIST OF AVAILABLE CORE NETWORKS AND SERVICES PROVIDED BY EACH ONE
MS SELECTS DESIRED CNS
MS ATTEMPTS TO ESTABLISH ATTACHMENT TO EACH DESIRED CN
ON ATTACHMENT RADIO ACCESS NETWORK CREATES A MOBILITY MANAGEMENT INSTANCE FOR EACH MS / CN PAIRING

FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB 00/00989

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/24

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, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 294 844 A (MOTOROLA INC) 8 May 1996 (1996-05-08) page 3, line 22 -page 4, line 25 claims 1,2	1,4,6,9, 17,28
A	BERRUTO E ET AL: "ARCHITECTURAL ASPECTS FOR THE EVOLUTION OF MOBILE COMMUNICATIONS TOWARD UMTS" IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS,US,IEEE INC. NEW YORK, vol. 15, no. 8, October 1997 (1997-10), page 1477-1486 XP000721279 ISSN: 0733-8716 the whole document	1-29

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[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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"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

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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
29 August 2000	04/09/2000

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	Pecci, R

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB 00/00989

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	SCHIEDER A ET AL: "GRAN - A NEW CONCEPT FOR WIRELESS ACCESS IN UMTS" ISS. WORLD TELECOMMUNICATIONS CONGRESS. (INTERNATIONAL SWITCHING SYMPOSIUM),CA,TORONTO, PINNACLE GROUP, 21 September 1997 (1997-09-21), page 339-345 XP000704485 the whole document -----	1-29

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

I ational Application No
PCT/IB 00/00989

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2294844 A	08-05-1996	AU 700136 B	24-12-1998
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		DE 19581443 T	27-02-1997
		WO 9614719 A	17-05-1996
		FI 962789 A	03-09-1996
		JP 9507986 T	12-08-1997

Form PCT/ISA/210 (patent family annex) (July 1992)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 January 2001 (11.01.2001)

PCT

(10) International Publication Number
WO 01/03461 A1

(51) International Patent Classification[7]: H04Q 7/38

(21) International Application Number: PCT/EP99/04518

(22) International Filing Date: 30 June 1999 (30.06.1999)

(25) Filing Language: English

(26) Publication Language: English

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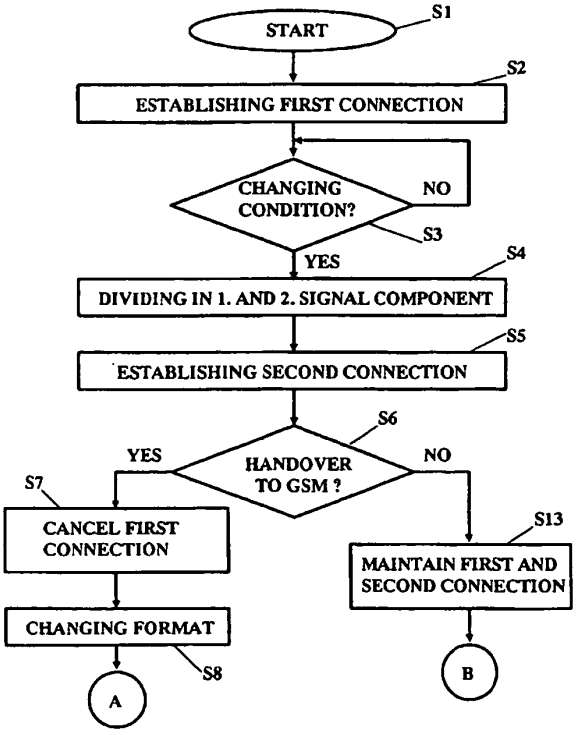
(74) Agents: **TRÖSCH, Hans-Ludwig** et al.; Tiedtke-Bühling-Kinne et al., Bavariaring 4, D-80336 München (DE).

(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian 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,

[Continued on next page]

(54) Title: METHOD AND DEVICE FOR HANDLING A MULTIMEDIA CALL



(57) Abstract: The present invention proposes a method for performing a communication between two terminal equipments (TE1, TE2) via at least one communication network (NW1, NW2), said method comprising the steps of establishing (S2) a first connection for a communication signal (V/S) between the two terminal equipments, detecting (S3) a connection changing condition, and, if said connection changing condition is detected, dividing (S4) said communication signal at least into a first signal component (V) and a second signal component (S) and establishing (S5) at least one second connection, said first signal component being transmitted via the first connection and said second signal component being transmitted via the second connection. The present invention proposes also a corresponding device (100) and a corresponding system.

WO 01/03461 A1

NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

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.

METHOD AND DEVICE FOR HANDLING A MULTIMEDIA CALL

FIELD OF THE INVENTION

The present invention relates to a method for performing a communication between two terminal equipments via at least one communication network and also relates to a corresponding device and a corresponding system. In particular, the present invention is directed to a method and a corresponding device and a corresponding system for handling a multimedia call in different communication networks.

BACKGROUND OF THE INVENTION

In recent and future communication systems the ability to perform a multimedia call becomes more and more important. An example of such a multimedia call is a videotelephony call. Such kind of communication requires e.g. high data transfer rates and a high quality of service (QoS) level. Therefore, specific services and equipment are to be defined.

Telecommunication systems and networks being adapted to perform a videotelephony call are for example the Integrated Services Digital Network (ISDN), General Packet Radio Service (GPRS) in the Global System for Mobile communication (GSM) or the Universal Mobile Telecommunications System (UMTS). Furthermore, in combination with a respective system, it is possible to use a circuit switched communication or a packet data communication.

For defining a multimedia communication several recommendations for example by the International Telecommunications Union (ITU) have been made, e.g. the

H.245, the H.324 and the like, which describe services, protocols, terminals etc. to be used for a multimedia call such as a videocall.

In the case of the above mentioned videocall, it is possible to transfer data between two terminals (mobile or fixed) via a communication network of one of the above mentioned types. The terminals or terminal equipments (such as mobile stations or videotelephones) can be in the same communication network or in different communication networks. The videocall is performed via a bi-directional connection between the two terminal equipments. Said connection initiated by one of said terminal equipments is for example an end-to-end H.324 connection which is carried for example on a UMTS data bearer.

In view of the high amount of data, the used network has to provide a corresponding high data transfer rate. Said data rate is also to be ensured for a data exchange between two different networks when the two terminal equipments are within respective different networks (for example UMTS -> ISDN, UMTS A -> UMTS B and the like).

However, there are some drawbacks. During a normal connection (e.g. packet data communication or circuit switched communication) between the two terminal equipments being in the same network such as a UMTS network, the quality of service (i.e. of the connection) can get worse and a good or even adequate communication can not be guaranteed. Moreover, when a handover is to be made for at least one of the terminal equipments from a network adapted to perform a videocall such as a UMTS network to a network with lower capacity (and therefore for example not able to perform a videocall) where such high data rates used for a multimedia call are not supported, the connection is interrupted. In the case that the lower capacity network

handed over to is able to perform a videocall, at least the quality of service is getting worse.

SUMMARY OF THE INVENTION

Therefore, it is an object of the present invention to provide a method and a corresponding device for handling a multimedia call such as a videocall in different communication networks, which are free from the above mentioned drawbacks. Furthermore, a corresponding device is to be provided.

According to the present invention, this object is achieved by a method for performing a communication between two terminal equipments via at least one communication network, said method comprising the steps of establishing a first connection for a communication signal between the two terminal equipments, detecting a connection changing condition, and, if said connection changing condition is detected, dividing said communication signal at least into a first signal component and a second signal component and establishing at least one second, said first signal component being transmitted via the first connection and said second signal component being transmitted via the second connection.

Furthermore, the present invention proposes a device for performing a communication between two terminal equipments via at least one communication network, said device comprising first establishing means for establishing a first connection for a communication signal between the two terminal equipments, detecting means for detecting a connection changing condition, dividing means for dividing said communication signal at least into a first signal component and a second signal component, if said detecting means detects said connection changing condition, and

second establishing means for establishing at least one second connection, said first signal component being transmitted via the first connection and said second signal component being transmitted via the second connection.

Moreover, the present invention proposes a system in which a communication between two terminal equipments is performed via at least one communication network, said system is adapted to establish a first connection for a communication signal between the two terminal equipments, detect a connection changing condition, and, if said connection changing condition is detected, divide said communication signal at least into a first signal component and a second signal component and establish at least one second connection, said first signal component being transmitted via the first connection and said second signal component being transmitted via the second connection.

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 allow to establish at least one second connection between the two terminal equipments or between a respective terminal equipment and a respective network, respectively. By using said second connection parallel to the first one, it is possible to transmit one component (for example a video component) of the original communication signal via the first connection and another component (for example a speech component) of the original communication signal via the second connection. Advantageously, the video component can use the complete capacity of the first connection which improves the quality and robustness according for example H.324. On the other hand, the speech component transmitted via the second connection is not affected by the video component which

also improves quality. Said second connection can be a connection similar to the first one (e.g. a UMTS multimedia call connection) or just a (lower capacity) speech call connection. It is also possible to use both connection as a data bearer and split and combine the data as it seems fit between the two connections.

Additionally, in case of a handover, in particular in a handover to a network with lower capacity or which is unable to perform a videocall (for example some GSM networks), by dropping the video component (i.e. the corresponding connection), the multimedia call or at least the speech call can be maintained. In case of a connection between e.g. a UMTS network and a GSM network each using different protocol types, the speech component can be easily transcoded by a corresponding element. At a handover back to the UMTS network, the multimedia call can be reestablished in the original way.

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

FIGS. 1A, 1B and 1C show connection states between two terminals.

FIGS. 2A, 2B show connection paths with elements used in a communication according to the invention.

FIG. 3 is a flowchart illustrating a method for handling a communication according to the invention.

FIG. 4 is a flowchart illustrating a method for handling a communication according to the invention.

FIG. 5 is a flowchart illustrating a method for handling a communication according to the invention.

FIG. 6 is a block circuit diagram for illustrating a device for handling a communication according to the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

In FIG. 1A a connection state for a multimedia call in a most general case is shown. A first terminal equipment TE 1 is connected to a second terminal equipment TE 2 via a communication network NW 1. Said network is for example an UMTS network adapted to perform a multimedia communication. Through the connection a multimedia signal V/S (e.g. a videotelephony call) is transmitted between said terminal equipments.

FIG. 1B illustrates one implementation of the present invention. In this case, for example the quality of the communication connection within the network NW 1 is getting worse. Therefore the original multimedia signal V/S is divided into at least two components V and S each of which transmitted via a separate connection. The at least one new connection is established similar to the original connection. It is either of the same type (for example an UMTS multimedia call connection) or of a different type (for example a normal speech call connection). The selection of the connection type used for the second connection can be made subscriber specific, dependant on network resources available or fixed (i.e. always the same type such as the above mentioned UMTS connection).

The two signal components V and S can be of the same type (split and combine the data stream of the original signal V/S in accordance with network requirements), i.e. the

connections are used as similar data bearers. On the other hand, there can be formed different component types such as video and speech component.

Optionally, the first connection transmitting for example the video signal component V from the network NW 1 to the second terminal equipment TE 2 can be canceled depending on network resources.

The above described case is also possible when the two terminal equipments are within different networks both of them adapted to perform a multimedia call on the same level. It is obvious, that corresponding connections are to be established between the networks in such a case.

It is to be noted, that for deciding whether a second connection (or even more connections) is to be established e.g. because of a deterioration of quality the connection is to be monitored. This monitoring can be done either by the network (e.g. by a mobile switching center MSC) and/or by the terminal equipment. Also the decision of the establishment of said second connection can be made by either the network or the terminal equipment.

In FIG. 1C another implementation of the present invention is shown. Here, a case of a handover to a second network NW 2, i.e. the second terminal equipment TE 2 is moved into a coverage area of said second network, is described. The second network NW 2 is for example a GSM network which has not adequate resources for transmitting such a high amount of data as used in a multimedia call. Therefore, when recognizing this circumstances, after establishing the second connection and dividing the original multimedia signal V/S into the two components V and S, the first connection and hence the first (video) component is dropped. Only the second component S, for example the

speech component, is forwarded (or handed over) by the first network to the second user equipment. Here, in particular in a circuit switched type connection, when one component is dropped (e.g. the video component V), it can be necessary to notify this change in communication to the terminal equipments TE1, TE2 to guarantee an uninterrupted communication.

In this case, it is also possible that the format of the multimedia signal, i.e. the format of the second signal component S, is to be changed in accordance with the respective second network NW 2 such as a GSM network. For example, when the first network NW 1 uses H.324, the corresponding signal component S is to be transcoded for the second network NW 2.

In the above described cases (FIG. 1B, 1C), when the reason for the establishment of the second connection and the division of the multimedia signal V/S (i.e. a changing condition) is not present anymore, for example due to a back-handover from a GSM network to a UMTS network, the original connection state (one connection, one signal V/S) can be reestablished. However, it is also possible to maintain the two connections.

It should be noted, that it is also possible, e.g. in the case of a packet data transfer, that only a part of the data packets with corresponding contents will be transferred via the communication connection according to the present invention.

In the following, with reference to FIG. 2A and 2B, connection paths and specific network elements used therein in case of the above described handover are illustrated. It is to be noted, that here the paths are shown in the direction from the lower capacity network to the higher

capacity network. However, it is easy to understand that the same procedure is executed in the opposite direction.

In FIG. 2A one example of a connection according to the present invention is shown, in particular in case of a handover to a lower capacity network. This type of handover requires a videocodec/speech codec (encoder/decoder) adapter in the connection path. The situation before said handover is as shown in FIG. 1A. After the handover, as illustrated in FIG 2A, the connection is as follows. The signals are forwarded from a terminal equipment TE 1 via an advanced multirate speech coder AMR to a transcoder. The AMR is a new type of speech coder used for GSM systems, which is adapted to vary its coding rate in accordance with the data (speech) to be transmitted. The transcoder is adapted to encode and decode for example the speech signal into corresponding data formats. The data is then transmitted to a network element of the (second) network NW 2, for example to a mobile switching center MSC. Here, a pulse code modulation PCM is used as a coding method for transmitting data such as speech via the networks. One method used for coding is for example A-law. Then, the data is forwarded to another network NW 1 via a gateway 1. Said gateway is also a transcoder used for changing the format of the data from the PCM A-law format into another format, for example a H.324 format. Optionally, a further advanced multirate speech coder can be introduced. Via the network NW 2 (for example a network applicable according to H.324) data is transmitted to the called terminal equipment TE 2.

FIG. 2B shows a similar case to FIG. 2A. Here, a tandemfree operation is supported, i.e. the transcoder is within the network itself. In contrast to the above described case with reference to FIG. 2A, the gateway 2 simply adepts the AMR speech signal format to a H.324 format, which can be also correspond to an AMR.

As mentioned above, it is also possible to use the present invention in case of a deterioration of quality or to guarantee service continuity. For this application, it is for example requested to switch off the video connection or video channel V, i.e. the corresponding data bearer. The speech component S (AMR speech) is for example encapsulated in a H.223 multiplexing protocol data stream. In this case, it is possible to reach a lower bit error rate and a higher quality. Furthermore, also a dedicated speech service with AMR speech coding and the like can be requested.

With reference to FIG. 3, a method for performing a communication between the two terminal equipments TE1, TE2 according to the invention is described. When the procedure is started (step S1), first the first connection for the multimedia signal V/S between the two terminal equipments TE1, TE2 via the first communication network is established in step S2. When in step S3 a connection changing condition (e.g. because of a deterioration of quality or due to a handover, as described above) is detected, the process proceeds to step S4, otherwise said step S3 is repeated.

In step S4, after detection of said connection changing condition, the multimedia signal V/S is divided at least into a first signal component V and a second signal component S, which are in the case of a videotelephony call a video component and a speech component, respectively. Also, in step S5, at least one second connection is established, either on request by a respective terminal equipment TE 1, TE 2 or by the network itself. Now the first signal component V may be transmitted via the first connection and the second signal component S may be transmitted via the second connection.

In a step S6, it is decided, whether the changing condition detected in said detecting step S3 is a handover to a lower capacity network. If YES, in step S7 the first connection including the transmitted first signal component V (for example the video component as the component requiring the most resources) is canceled. Furthermore, in step S8, the format of the still transmitted signal component S may be changed or transcoded, if required.

With reference to FIG. 4, in the following the case is described where the changing condition concerning a handover is canceled. When detecting in step S9 that e.g. the handover to a lower capacity network is finished and a handover to a higher capacity network (at least at an adequate capacity level to perform a multimedia call) is performed, in step S10 the first connection canceled in said canceling step S7 is reestablished. This reestablishment can be initiated by a terminal equipment TE 1, TE 2 or by the network (for example by the mobile switching center MSC). Now, the multimedia communication can be performed via the first connection transmitting the first signal component V and the second connection transmitting the second signal component S, as described above. However, it is also possible to recombine both components V and S to the original multimedia signal V/S (step S11). Then the second connection can be canceled or still used to transmit one part of said multimedia signal V/S split thereof.

With reference to FIGS. 3 and 5, now the case is described where no handover is to be performed but the changing condition detected in said detecting step S3 is for example a lack of quality.

In the above mentioned case, in step S13, the multimedia communication is performed by maintaining the first and the

second connection transmitting the first and the second signal component V, S. Similar to the above described handover, when the canceling of the changing condition is detected in step S14 in FIG. 4 (i.e. the quality can be guaranteed again or because of a user request), in step S15 the original multimedia signal V/S is rebuilt from the first signal component V and the second signal component S. The second connection is canceled in step S16 the rebuilt multimedia signal V/S is again transmitted via the first connection. Optionally, the second connection can be maintained, as described above, for transmitting one signal part.

In FIG. 6, a device 100 (V/S call device) adapted to perform a handling of a multimedia call in accordance with the present invention is shown. For said multimedia call, the first connection for a multimedia signal V/S between the two terminal equipments TE1, TE2 via the network is established by a connection establishing means 110. When a detecting means 120 detects a connection changing condition such as a handover to a lower capacity network or a deterioration of quality, a dividing means 130 divides said multimedia signal V/S at least into a first signal component V (for example a video component) and a second signal component S (for example a speech component). The establishing means 110 establishes at least one second connection, wherein said first signal component V may be transmitted via the first connection and said second signal component S may be transmitted via the second connection.

Additionally, a canceling means 140 is adapted to cancel the first connection transmitting the first signal component V, for example in the case of a handover to a lower capacity network NW2 as described above. Then the communication is performed only via the second connection transmitting the second signal component S.

A reestablishing means 150 is adapted to reestablish the first connection canceled by said canceling means 140, when said changing condition is dropped (detected for example by said detecting means 120). Now the communication may be performed via the first connection transmitting the first signal component V and the second connection transmitting the second signal component S. It is also possible, that the original multimedia signal V/S is rebuilt by a rebuilding means 160 from the first and the second signal component V and S. In this case, said communication may be performed via the first and second connection both transmitting one part of the multimedia signal V/S (for example split). Another solution is to cancel the second connection by said canceling means 140. Then the multimedia call is only performed via the first connection transmitting the rebuilt multimedia signal V/S.

In the case of a handover, when the lower capacity network uses for example a different protocol type, a changing means 170 is used for changing or transcoding the respective communication signal (for example the speech component S) from one format into the respective other format used in the respective networks NW 1, NW 2.

It should be noted, that the device 100 can be part of the corresponding networks and or of the terminal equipments.

As mentioned above, it is possible to maintain both parallel connections even if the changing condition is dropped. However, it should be mentioned, that this solution increases costs as more resources are required. Therefore, in general the second connection is only activated if required (low quality, preparation of handover or the like) and canceled when not needed anymore.

A user performing a call using the present invention will be charged according to the number (and/or capacity) of the currently established connections. However, when a connection or connections are for example handed over from one network (e.g. NW1) to another network (e.g. NW2), it is obvious that charging will be stopped in the first network and started in the second network handed over to. Conditions for the charge can be subscriber specific or according to usual network negotiations.

It may be possible to enhance current in-band negotiation protocols to handle the above described parallel call feature according to the present invention. The data bearer should be able to carry H.245 signaling.

The parallel (speech call) connection can be established for example before, during or after a handover, e.g. to a lower capacity network. Furthermore, the present invention can be used in a handover within for example one UMTS network (intra-UMTS handover), in a user initiated handover or in a user initiated change of connection type (bearer re-negotiation).

In particular, when the present invention is used in a packet data multimedia communication for example in a H.323 system, it is very easy to implement. Since in a H.323 system each multimedia signal component (e.g. speech and video) has own separate bearers (in uplink and downlink direction), a diversion of the components or even a switch off of one component (i.e. of the corresponding bearers) is easy to perform. This allows an improvement of quality or a continuation of the multimedia call, for example only by speech, when a lack of capacity of the used network as a changing condition occurs (e.g. due to a handover or other reasons, as described above). When the changing condition is dropped (e.g. handover back to the higher capacity

network or the like), it is also easy to reestablish the original communication paths only by switching on the previously cancelled bearers.

The present invention proposes a method for performing a communication between two terminal equipments TE1, TE2 via at least one communication network NW1, NW2, said method comprising the steps of establishing S2 a first connection for a communication signal V/S between the two terminal equipments, detecting S3 a connection changing condition, and, if said connection changing condition is detected, dividing S4 said communication signal at least into a first signal component V and a second signal component S and establishing S5 at least one second, said first signal component being transmitted via the first connection and said second signal component being transmitted via the second connection. The present invention proposes also a corresponding device 100 and a corresponding system.

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 performing a communication between two terminal equipments (TE1, TE2) via at least one communication network (NW1, NW2),

said method comprising the steps of:

establishing (S2) a first connection for a communication signal (V/S) between the two terminal equipments (TE1, TE2),

detecting (S3) a connection changing condition, and,

if said connection changing condition is detected, dividing (S4) said communication signal (V/S) at least into a first signal component (V) and a second signal component (S) and

establishing (S5) at least one second connection, said first signal component (V) being transmitted via the first connection and said second signal component (S) being transmitted via the second connection.

2. A method according to claim 1, wherein said changing condition is a reduction of quality of said first connection.

3. A method according to claim 1, wherein said changing condition is a handover.

4. A method according to claim 1, further comprising the steps of:

canceling (S7) the first connection transmitting the first signal component (V), and

maintaining the communication via the second connection transmitting the second signal component (S).

5. A method according to claim 4, further comprising the steps of:

reestablishing (S10) the first connection canceled in said canceling step (S7), when said changing condition is dropped (S9), and

performing the communication via the first connection transmitting the first signal component (V) and the second connection transmitting the second signal component (S).

6. A method according to claim 4, further comprising the steps of:

reestablishing (S10) the first connection canceled in said canceling step (S7), when said changing condition is dropped (S9),

rebuilding (S11) the communication signal (V/S) from the first signal component (V) and the second signal component (S), and

performing the communication via the first connection transmitting the communication signal (V/S) rebuilt in said rebuilding step (S11).

7. A method according to claim 1, further comprising the steps of:

maintaining (S13) the communication via the first and the second connection transmitting the first and the second signal component (V, S),

rebuilding (S15) the communication signal (V/S) from the first signal component (V) and the second signal component (S),

canceling (S16) the second connection, and

transmitting the rebuilt communication signal (V/S) via the first connection.

8. A method according to claim 1, wherein said communication signal (V/S) is a videotelephony signal.

9. A method according to claim 8, wherein said first signal component (V) is a video signal component and said second signal component (S) is a speech component.

10. A method according to claim 3, wherein said handover is performed when at least one of said terminal equipments (TE1, TE2) leaves a communication area of a first communication network (NW1) and enters a communication area of a second communication network (NW2).

11. A method according to claim 10, wherein communication signals of a first format are used in said first communication area (NW1) and communication signals of a second format are used in said second communication area (NW2),

said method further comprising the step of

changing (S8) the communication signal (V/S) or the first signal component (V) or the second signal component (S) from one of said first or second format into the respective other of the first or second format.

12. A method for performing a packet data multimedia communication between two terminal equipments (TE1, TE2) via at least one communication network (NW1, NW2),

said method comprising the steps of:

establishing at least a first connection and a second connection for communication signal components (V, S) between the two terminal equipments (TE1, TE2),

detecting a connection changing condition, and,

if said connection changing condition is detected, canceling one of said at least first and the second connections transmitting one communication signal component (V).

13. A method according to claim 12, wherein said changing condition is a reduction of quality of said first connection.

14. A method according to claim 12, wherein said changing condition is a handover.

15. A method according to claim 14, further comprising the steps of:

reestablishing the connection canceled in said canceling step, when said changing condition is dropped, and

performing the communication via the at least first and second connections transmitting the communication signal components (V, S).

16. A device for performing a communication between two terminal equipments (TE1, TE2) via at least one communication network (NW1, NW2),

said device (100) comprising:

first establishing means (110) for establishing a first connection for a communication signal (V/S) between the two terminal equipments (TE1, TE2),

detecting means (120) for detecting a connection changing condition,

dividing means (130) for dividing said communication signal (V/S) at least into a first signal component (V) and a second signal component (S), if said detecting means (120) detects said connection changing condition, and

second establishing means (110) for establishing at least one second connection, said first signal component (V) being transmitted via the first connection and said second signal component (S) being transmitted via the second connection.

17. A device (100) according to claim 16, wherein said changing condition is a reduction of quality of said first connection.

18. A device (100) according to claim 16, wherein said changing condition is a handover.

19. A device (100) according to claim 16, comprising canceling means (140) for canceling the first connection transmitting the first signal component (V), said communication being maintained via the second connection transmitting the second signal component (S).

20. A device according to claim 19, comprising reestablishing means (150) for reestablishing the first connection canceled by said canceling means (140), when said changing condition is dropped, said communication being performed via the first connection transmitting the first signal component (V) and the second connection transmitting the second signal component (S).

21. A device (100) according to claim 19, comprising reestablishing means (150) for reestablishing the first connection canceled by said canceling means (140), when said changing condition is dropped, and rebuilding means (160) for rebuilding the communication signal (V/S) from the first and the second signal component (V, S), said communication being performed via the first connection transmitting the communication signal (V/S) rebuilt by said rebuilding means (160).

22. A device according to claim 16, wherein the communication is maintained via the first and the second connection transmitting the first and the second signal component (V, S),
said device (100) comprising

rebuilding means (160) for rebuilding the communication signal (V/S) from the first and the second signal component (V, S),

canceling means (140) for canceling the second connection, said communication being performed via the first connection transmitting the communication signal (V/S) rebuilt by said rebuilding means (160).

23. A device according to claim 16, wherein said communication signal (V/S) is a videotelephony signal.

24. A device according to claim 23, wherein said first signal component (V) is a video signal component and said second signal component (S) is a speech component.

25. A device according to claim 18, wherein said handover is performed when at least one of said terminal equipments (TE1, TE2) leaves a communication area of a first communication network (NW1) and enters a communication area of a second communication network (NW2).

26. A device according to claim 25, wherein communication signals of a first format are used in said first communication area (NW1) and communication signals of a second format are used in said second communication area (NW2),

said device (100) comprising

changing means (170) for changing the communication signal (V/S) or the first signal component (V) or the second signal component (S) from one of said first or second format into the respective other of the first or second format.

27. A device for performing a packet data multimedia communication between two terminal equipments (TE1, TE2) via at least one communication network (NW1, NW2),

said device comprising:

establishing means for establishing at least a first connection and a second connection for communication signal components (V, S) between the two terminal equipments (TE1, TE2),

detecting means for detecting a connection changing condition, and

canceling means for canceling one of said at least first and the second connections transmitting one communication signal component (V).

28. A device according to claim 27, wherein said changing condition is a reduction of quality of said first connection.

29. A device according to claim 27, wherein said changing condition is a handover.

30. A device according to claim 27, further comprising:

reestablishing means for reestablishing the connection canceled by said canceling means, when said changing condition is dropped, said packet data communication being performed via the at least first and second connections transmitting the communication signal components (V, S).

31. A system in which a communication between two terminal equipments (TE1, TE2) is performed via at least one communication network (NW1, NW2),

said system is adapted to:

establish (S2) a first connection for a communication signal (V/S) between the two terminal equipments (TE1, TE2),

detect (S3) a connection changing condition, and,

if said connection changing condition is detected, divide (S4) said communication signal (V/S) at least into a

first signal component (V) and a second signal component (S) and

establish (S5) at least one second connection, said first signal component (V) being transmitted via the first connection and said second signal component (S) being transmitted via the second connection.

32. A system according to claim 31, wherein said changing condition is a reduction of quality of said first connection.

33. A system according to claim 31, wherein said changing condition is a handover.

34. A system according to claim 31, further adapted to:

cancel (S7) the first connection transmitting the first signal component (V), and

maintain the communication via the second connection transmitting the second signal component (S).

35. A system according to claim 34, further adapted to:

reestablish (S10) the canceled first connection, when said changing condition is dropped (S9), and

perform the communication via the first connection transmitting the first signal component (V) and the second connection transmitting the second signal component (S).

36. A system according to claim 34, further adapted to:

reestablish (S10) the first connection canceled in said canceling step (S7), when said changing condition is dropped (S9),

rebuild (S11) the communication signal (V/S) from the first signal component (V) and the second signal component (S), and

perform the communication via the first connection transmitting the communication signal (V/S) rebuilt in said rebuilding step (S11).

37. A system according to claim 31, further adapted to:

maintain (S13) the communication via the first and the second connection transmitting the first and the second signal component (V, S),

rebuild (S15) the communication signal (V/S) from the first signal component (V) and the second signal component (S),

cancel (S16) the second connection, and

transmit the rebuilt communication signal (V/S) via the first connection.

38. A system according to claim 31, wherein said communication signal (V/S) is a videotelephony signal.

39. A system according to claim 38, wherein said first signal component (V) is a video signal component and said second signal component (S) is a speech component.

40. A method according to claim 33, wherein said handover is performed when at least one of said terminal equipments (TE1, TE2) leaves a communication area of a first communication network (NW1) and enters a communication area of a second communication network (NW2).

41. A method according to claim 40, wherein communication signals of a first format are used in said first communication area (NW1) and communication signals of a second format are used in said second communication area (NW2),

said system is adapted to

change (S8) the communication signal (V/S) or the first signal component (V) or the second signal component

(S) from one of said first or second format into the respective other of the first or second format.

42. A system for performing a packet data multimedia communication between two terminal equipments (TE1, TE2) via at least one communication network (NW1, NW2),

said system being adapted to:

establish at least a first connection and a second connection for communication signal components (V, S) between the two terminal equipments (TE1, TE2),

detect a connection changing condition, and,

if said connection changing condition is detected, cancel one of said at least first and the second connections transmitting one communication signal component (V).

43. A system according to claim 42, wherein said changing condition is a reduction of quality of said first connection.

44. A system according to claim 42, wherein said changing condition is a handover.

45. A system according to claim 44, further adapted to:

reestablish the connection canceled in said canceling step, when said changing condition is dropped, and

perform the communication via the at least first and second connections transmitting the communication signal components (V, S).



FIG. 1A



FIG. 1B

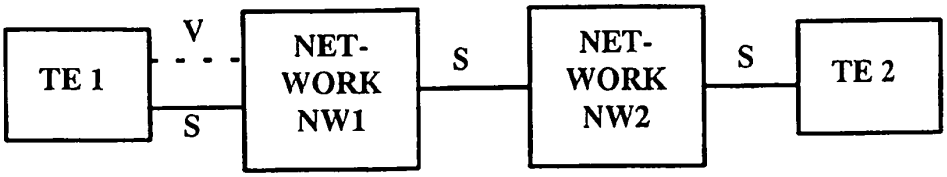


FIG. 1C

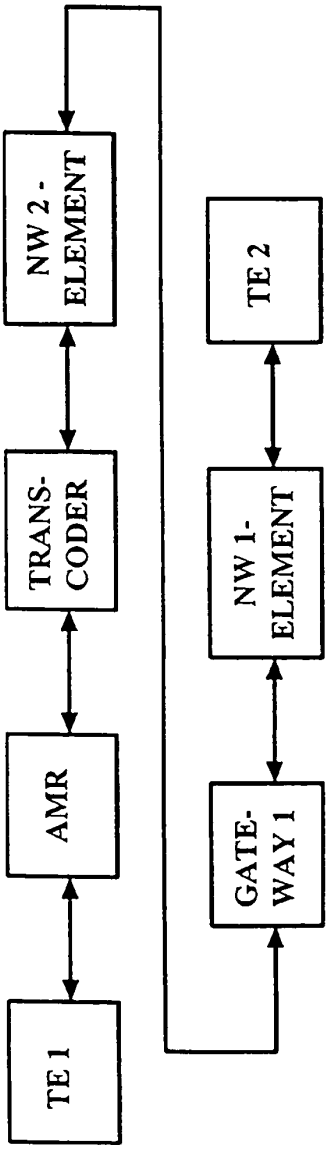

TE 1
AMR
TRANS-CODER
NW 2 - ELEMENT
GATE-WAY 1
NW 1-ELEMENT
TE 2

FIG. 2A

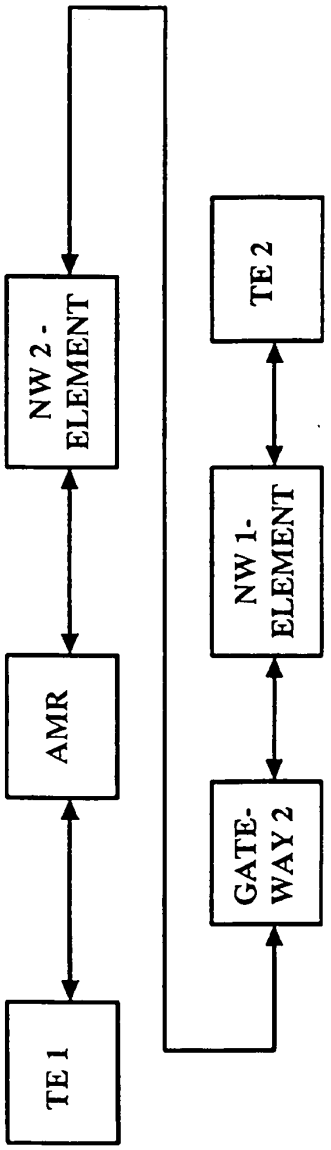

TE 1
AMR
NW 2 - ELEMENT
GATE-WAY 2
NW 1-ELEMENT
TE 2

FIG. 2B

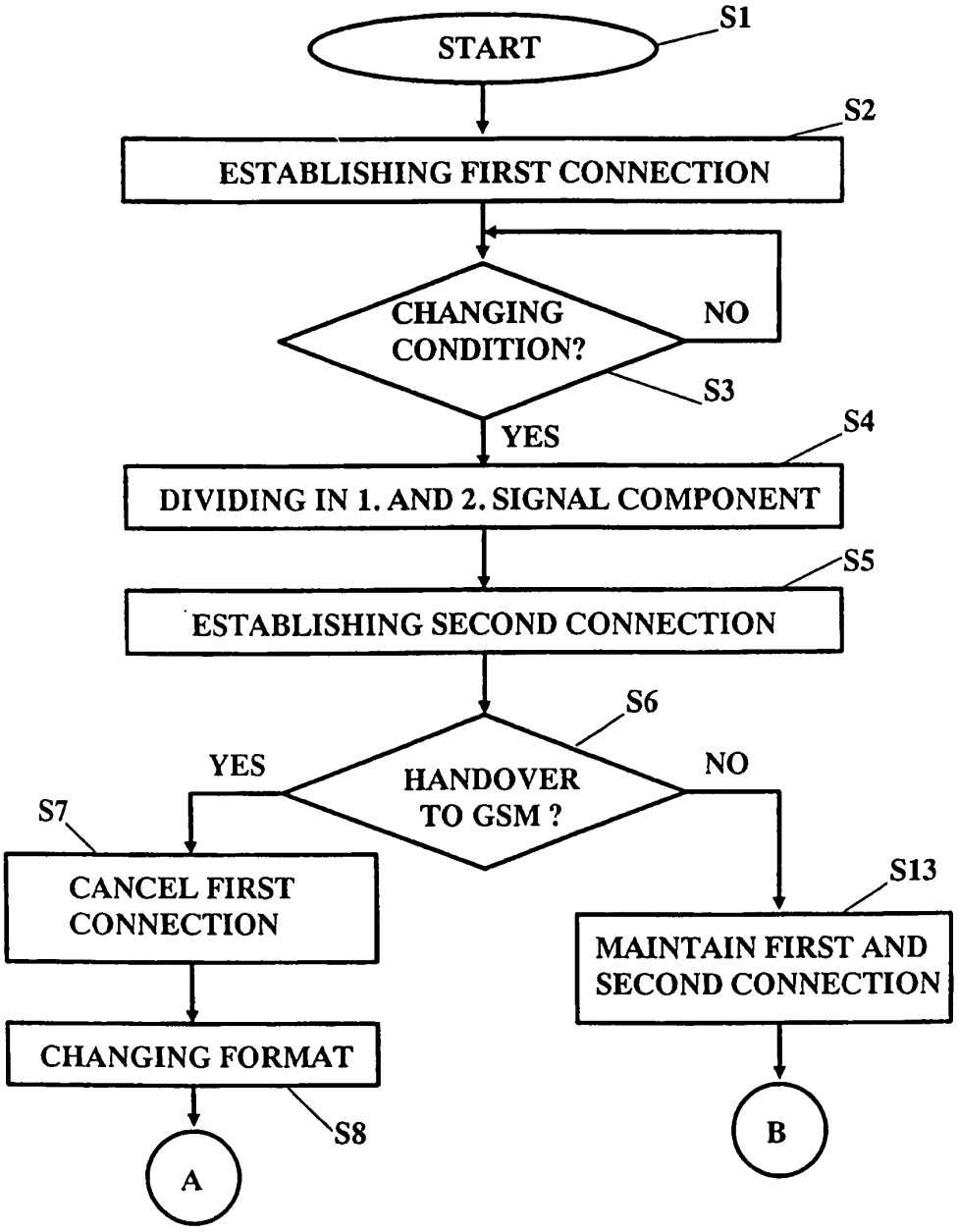

START
S1
ESTABLISHING FIRST CONNECTION
S2
CHANGING CONDITION?
NO
S3
YES
S4
DIVIDING IN 1. AND 2. SIGNAL COMPONENT
ESTABLISHING SECOND CONNECTION
S5
S6
HANDOVER TO GSM ?
YES
NO
S7
CANCEL FIRST CONNECTION
CHANGING FORMAT
S8
A
S13
MAINTAIN FIRST AND SECOND CONNECTION
B

FIG.3

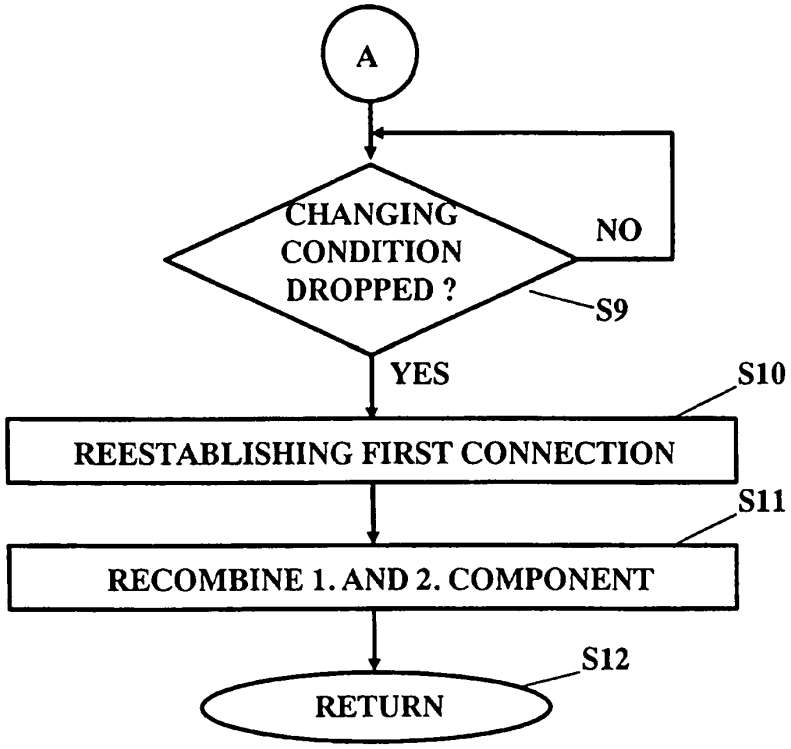

A
CHANGING CONDITION DROPPED ?
NO
S9
YES
S10
REESTABLISHING FIRST CONNECTION
S11
RECOMBINE 1. AND 2. COMPONENT
S12
RETURN

FIG.4

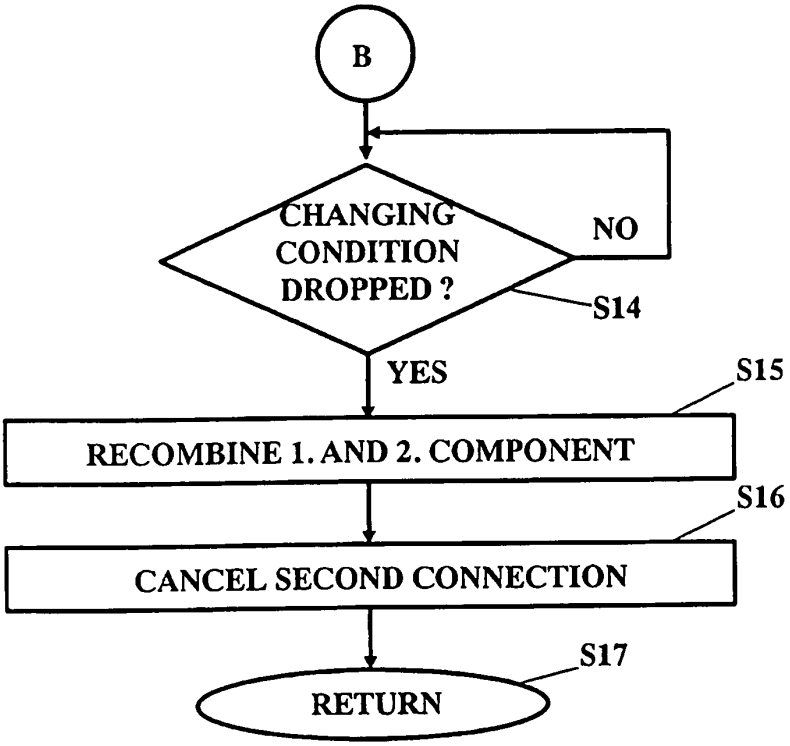

B
CHANGING CONDITION DROPPED ?
NO
S14
YES
S15
RECOMBINE 1. AND 2. COMPONENT
S16
CANCEL SECOND CONNECTION
S17
RETURN

FIG.5

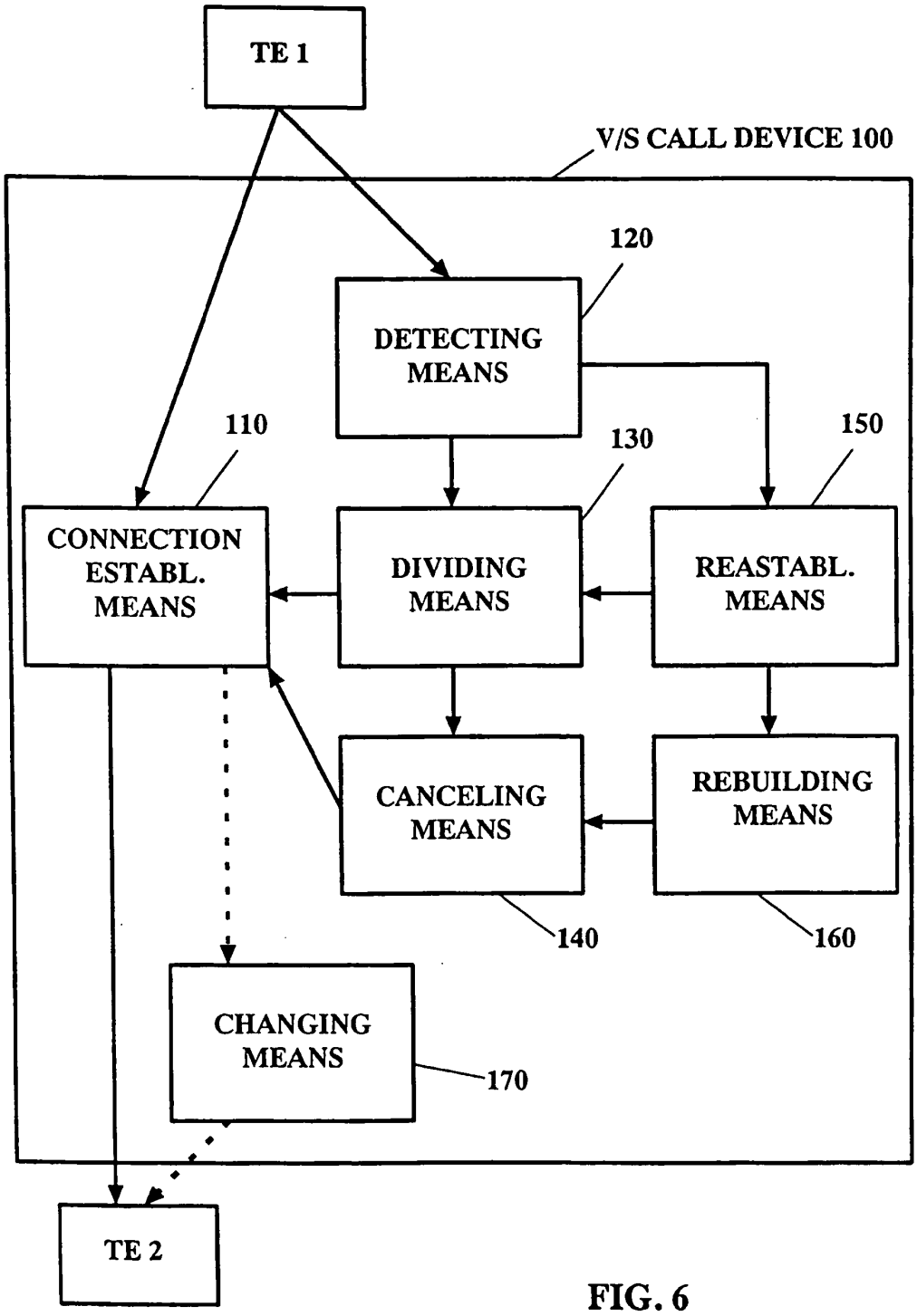

TE 1
V/S CALL DEVICE 100
120
DETECTING MEANS
110
130
150
CONNECTION ESTABL. MEANS
DIVIDING MEANS
REASTABL. MEANS
CANCELING MEANS
REBUILDING MEANS
140
160
CHANGING MEANS
170
TE 2

FIG. 6

INTERNATIONAL SEARCH REPORT

Inter. nal Application No
PCT/EP 99/04518

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 841 763 A (NOKIA MOBILE PHONES LTD) 13 May 1998 (1998-05-13) column 11, line 47 -column 12, line 5 column 13, line 6 - line 22 column 14, line 24 - line 32 column 14, line 48 - line 51 column 15, line 1 - line 17 column 21, line 34 - line 36; claim 42 — -/—	1,8,9, 12,16, 19,23, 24,27, 31,34, 38,39,42

[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

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Date of the actual completion of the international search	Date of mailing of the international search report
18 February 2000	28/02/2000

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	Rothlübbers, C

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INTERNATIONAL SEARCH REPORT

Intern nal Application No
PCT/EP 99/04518

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97 09810 A (MOTOROLA INC) 13 March 1997 (1997-03-13) page 3, line 9 - line 17 page 4, line 21 - line 31 page 5, line 16 - line 27 page 7, line 17 - line 21	1,2,12, 13,16, 17,27, 28,31, 32,42,43
E	WO 99 52307 A (ERICSSON TELEFON AB L M) 14 October 1999 (1999-10-14) page 4, line 17 - line 19 page 6, line 5 - line 17 page 7, line 9 - line 12 page 29, line 15 - line 23	1,2,8,9, 12,13, 27,28, 42,43

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INTERNATIONAL SEARCH REPORT

...formation on patent family members

Intern... ...al Application No
PCT/EP 99/04518

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		BR 9705138 A	18-05-1999
		JP 10190621 A	21-07-1998
WO 9709810 A	13-03-1997	US 5974106 A	26-10-1999
		EP 0847641 A	17-06-1998
WO 9952307 A	14-10-1999	AU 3857199 A	25-10-1999

Form PCT/ISA/210 (patent family annex) (July 1992)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
22 March 2001 (22.03.2001)

PCT

(10) International Publication Number
WO 01/20938 A1

(51) International Patent Classification[7]: H04Q 7/38

(21) International Application Number: PCT/EP00/09100

(22) International Filing Date:
13 September 2000 (13.09.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
9921706.9 14 September 1999 (14.09.1999) GB

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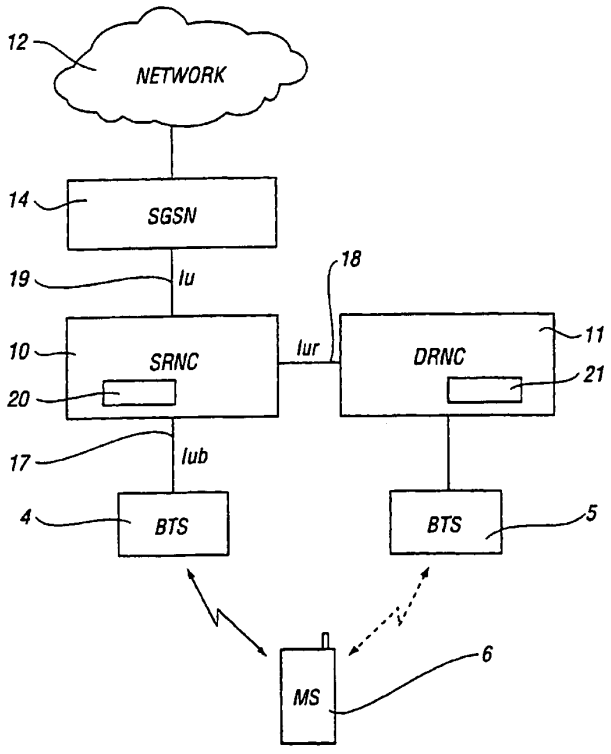
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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European

[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.

WO 01/20938 A1



patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

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Published:

— *With international search report.*

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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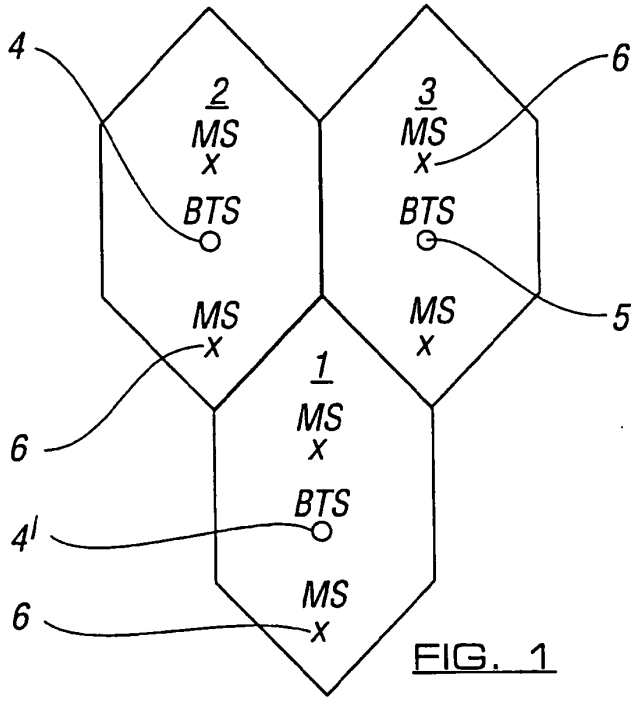

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FIG. 1

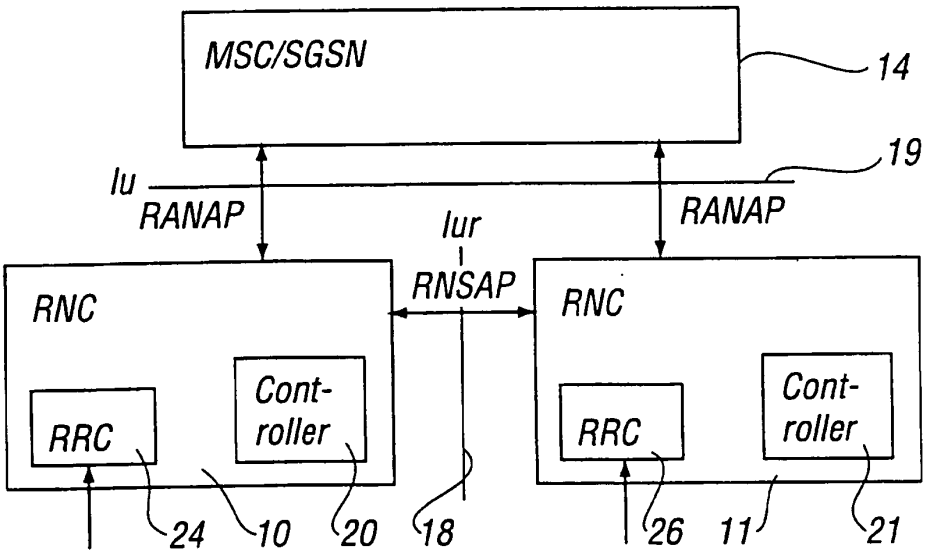

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FIG. 3

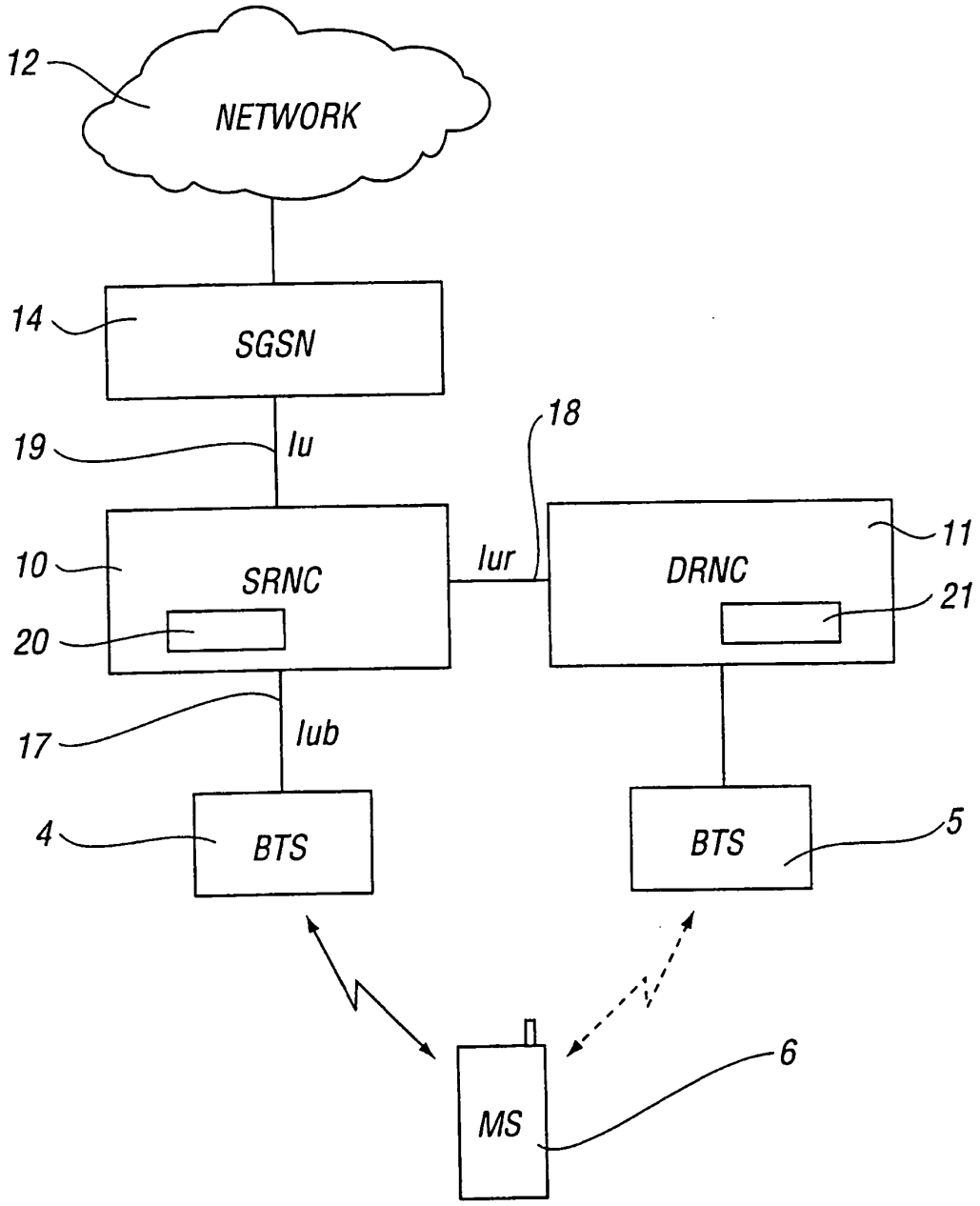

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FIG. 2

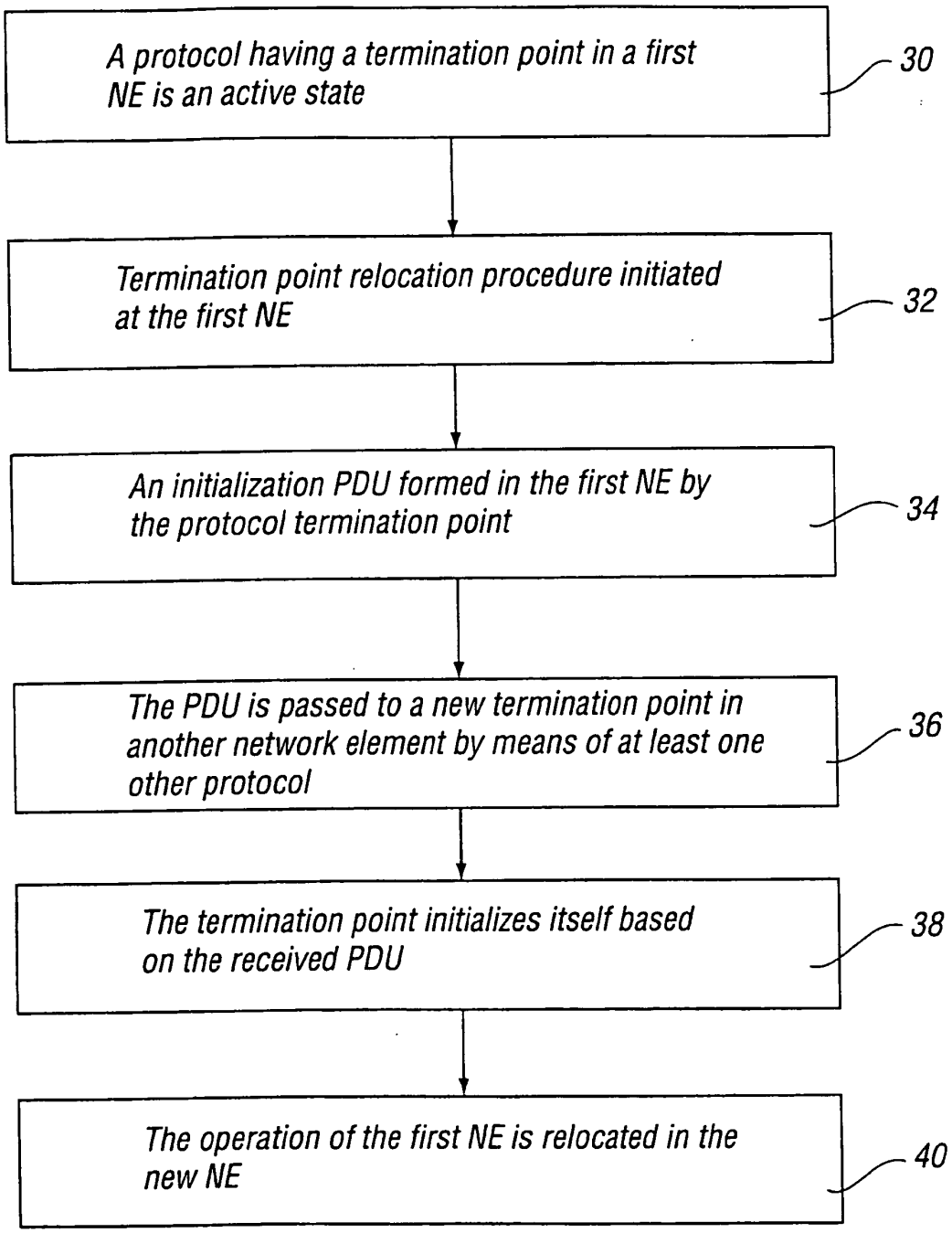

A protocol having a termination point in a first NE is an active state
30
Termination point relocation procedure initiated at the first NE
32
An initialization PDU formed in the first NE by the protocol termination point
34
The PDU is passed to a new termination point in another network element by means 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

INTERNATIONAL SEARCH REPORT

Interna al Application No
PCT/EP 00/09100

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, WPI Data, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 898 438 A (NOKIA MOBILE PHONES LTD) 24 February 1999 (1999-02-24) column 4, line 18 -column 5, line 22 column 8, line 1 - line 8 column 10, line 7 -column 11, line 49 figure 7 ---	1-3,5,7, 9,15-21, 23-25, 27,28
A	CH 682 867 A (ASCOM TECH AG) 30 November 1993 (1993-11-30) column 7, line 19 -column 10, line 20 --- -/--	1,3,15, 17,20, 21,23, 24,27,28

[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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"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
6 December 2000	12/12/2000

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Intern: al Application No
PCT/EP 00/09100

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Interna al Application No
PCT/EP 00/09100

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		AU 7045198 A	08-03-1999
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		AU 3149699 A	18-10-1999
		BR 9909307 A	21-11-2000

Form PCT/ISA/210 (patent family annex) (July 1992)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
10 May 2001 (10.05.2001)

PCT

(10) International Publication Number
WO 01/33885 A1

(51) International Patent Classification[7]: H04Q 7/38

(21) International Application Number: PCT/FI00/00955

(22) International Filing Date:
2 November 2000 (02.11.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
19992369 2 November 1999 (02.11.1999) FI

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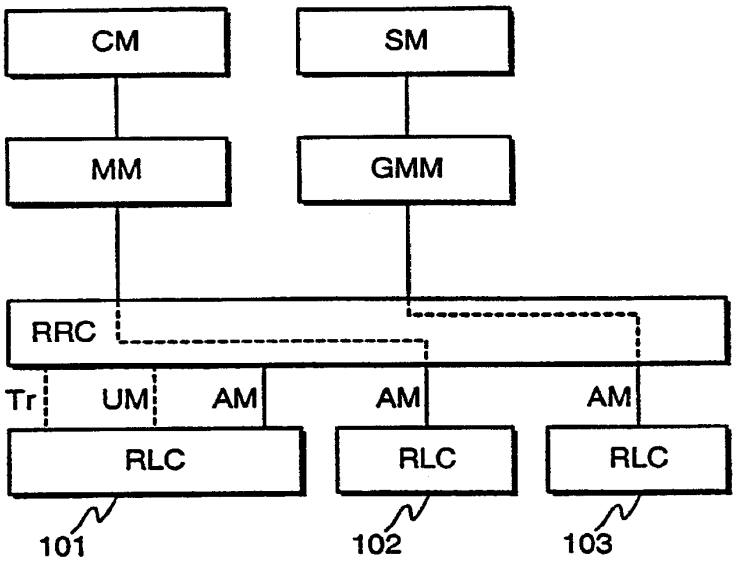
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian 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).

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: 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.

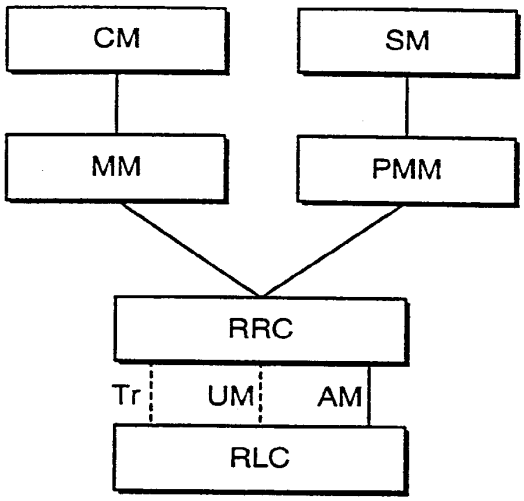


Fig. 1
PRIOR ART

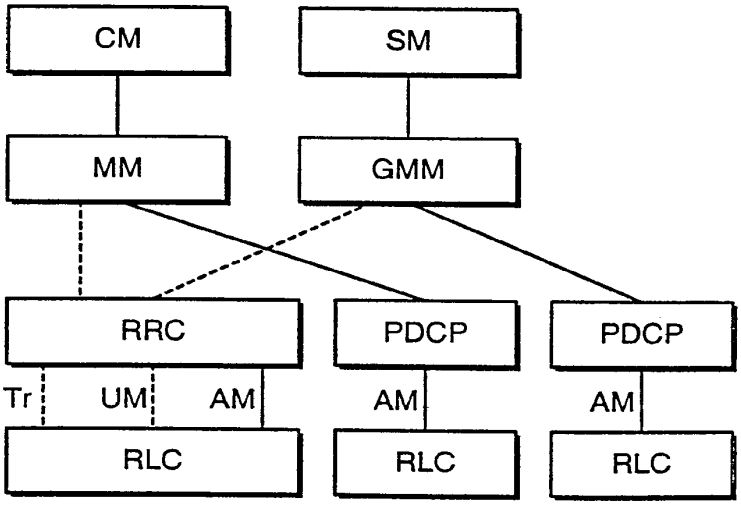


Fig. 2
PRIOR ART

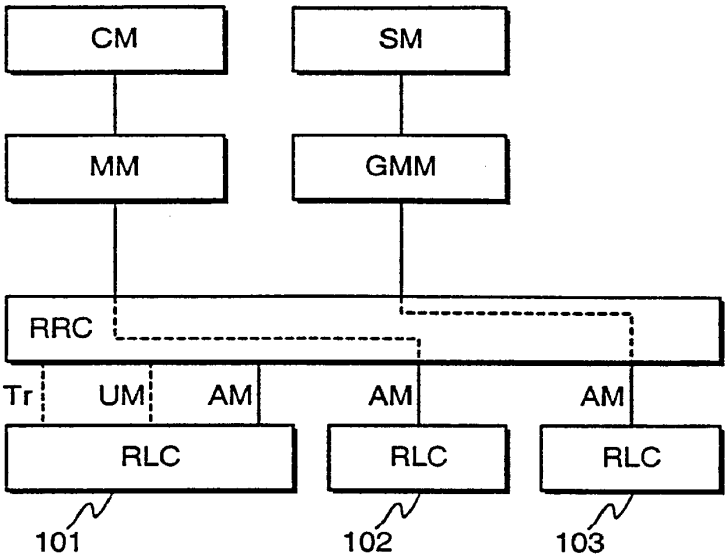


Fig. 3

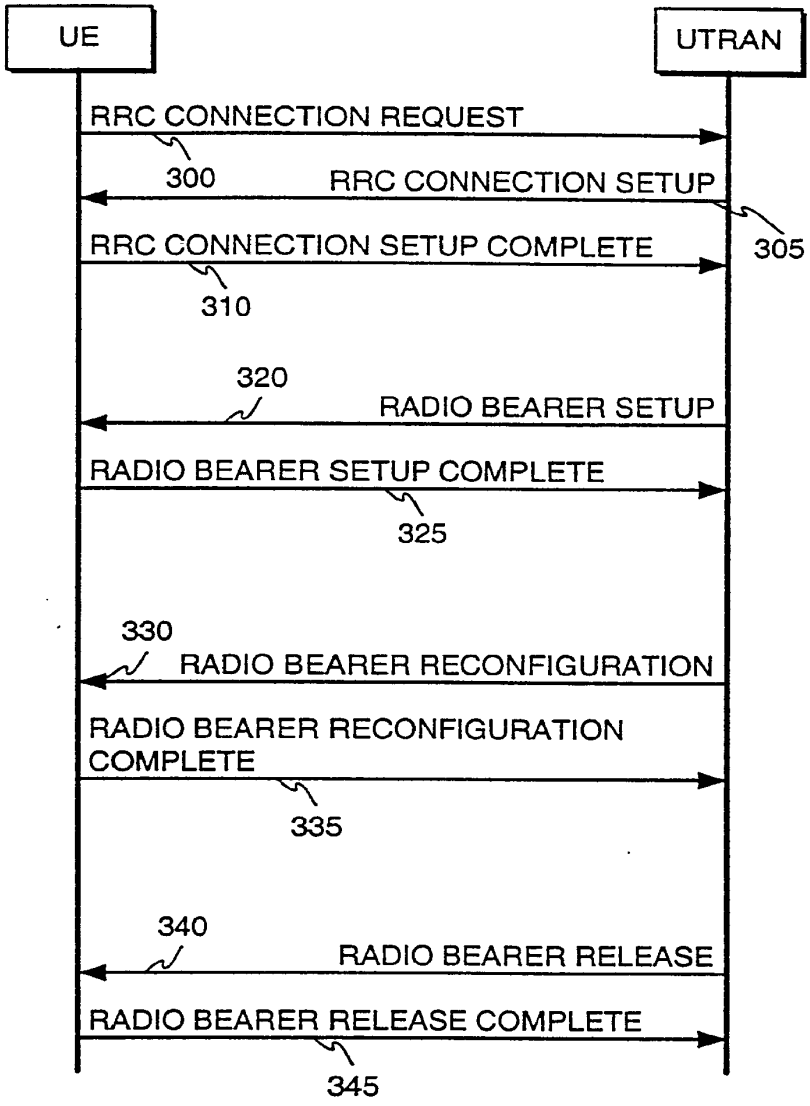

UE
UTRAN
RRC CONNECTION REQUEST
300
RRC CONNECTION SETUP
305
RRC CONNECTION SETUP COMPLETE
310
320
RADIO BEARER SETUP
RADIO BEARER SETUP COMPLETE
325
330
RADIO BEARER RECONFIGURATION
RADIO BEARER RECONFIGURATION COMPLETE
335
340
RADIO BEARER RELEASE
RADIO BEARER RELEASE COMPLETE
345

Fig. 4

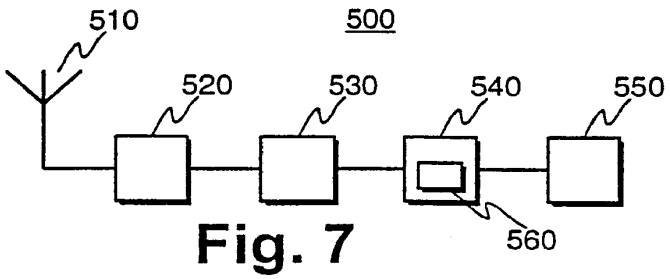

510
500
520
530
540
550
560

Fig. 7

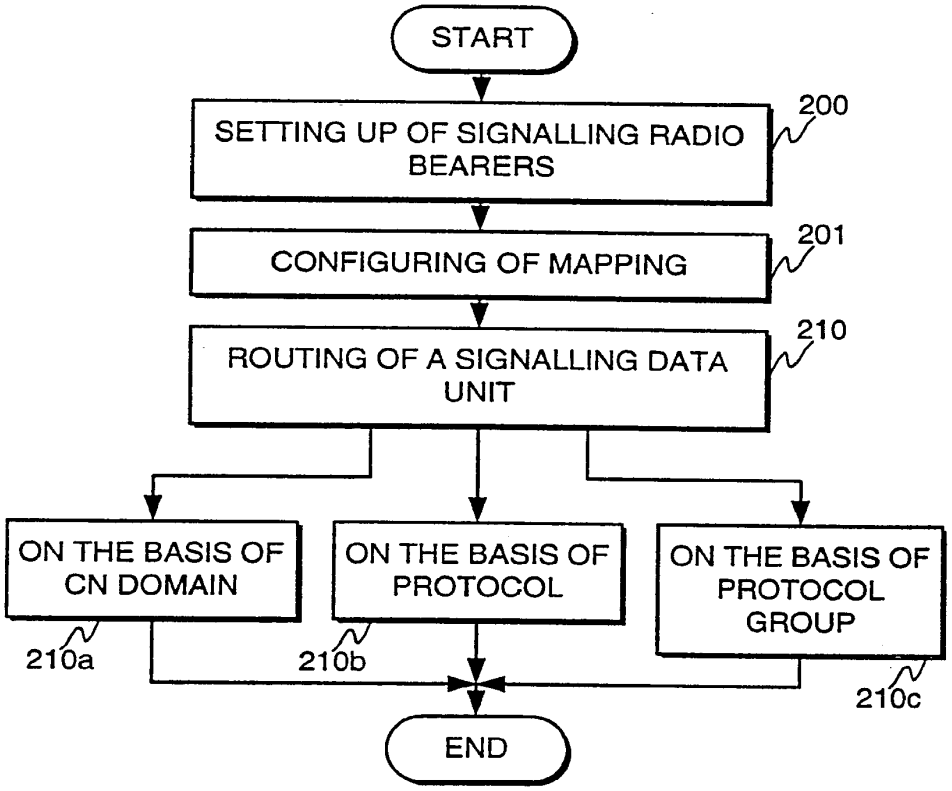

START
SETTING UP OF SIGNALLING RADIO BEARERS
200
CONFIGURING OF MAPPING
201
ROUTING OF A SIGNALLING DATA UNIT
210
ON THE BASIS OF CN DOMAIN
ON THE BASIS OF PROTOCOL
ON THE BASIS OF PROTOCOL GROUP
210a
210b
210c
END

Fig. 5

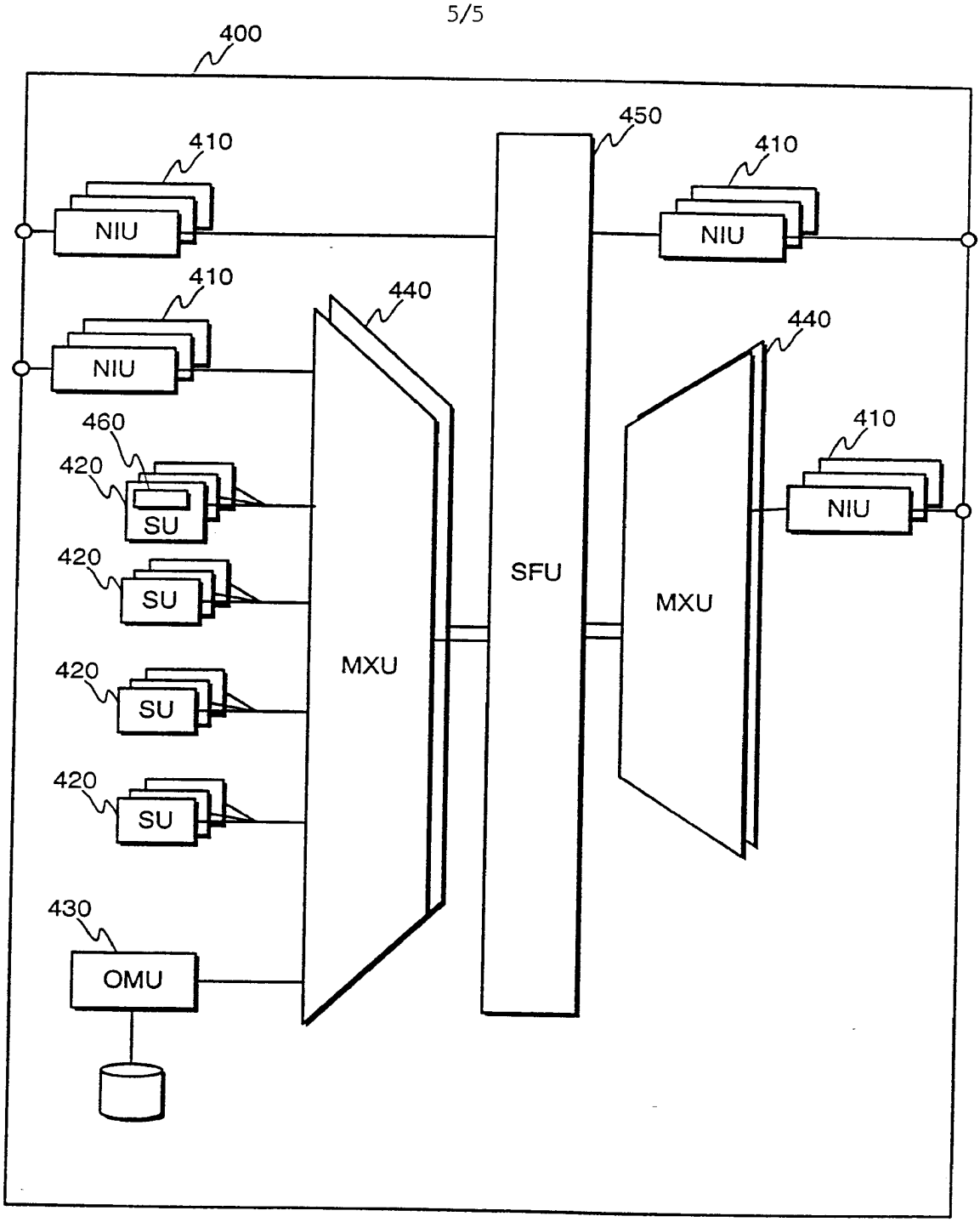

400
410
NIU
450
410
NIU
410
NIU
440
440
460
420
SU
420
SU
420
SU
420
SU
MXU
SFU
MXU
410
NIU
430
OMU

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
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"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
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

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		SE 0602072 T3	
		GB 9201540 D	00/00/00
		JP 6510238 T	17/11/94
		US 5469617 A	28/11/95

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
31 May 2001 (31.05.2001)

PCT

(10) International Publication Number
WO 01/39525 A2

(51) International Patent Classification[7]: H04Q 7/00

(21) International Application Number: PCT/IB00/01709

(22) International Filing Date:
20 November 2000 (20.11.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/167,924 29 November 1999 (29.11.1999) US

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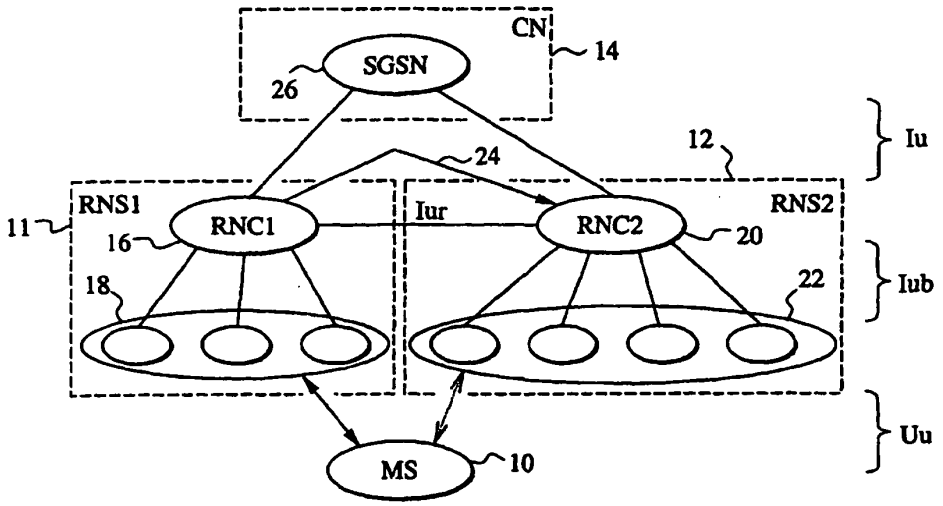
(74) Agent: MAGUIRE, Francis, J.; Ware, Fressola, Van Der Sluys & Adolphson LLP, 755 Main Street, P.O. Box 224, Monroe, CT 06468 (US).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian 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).

[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.

WO 01/39525 A2

Published:
— *Without international search report and to be republished upon receipt of that 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.

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.

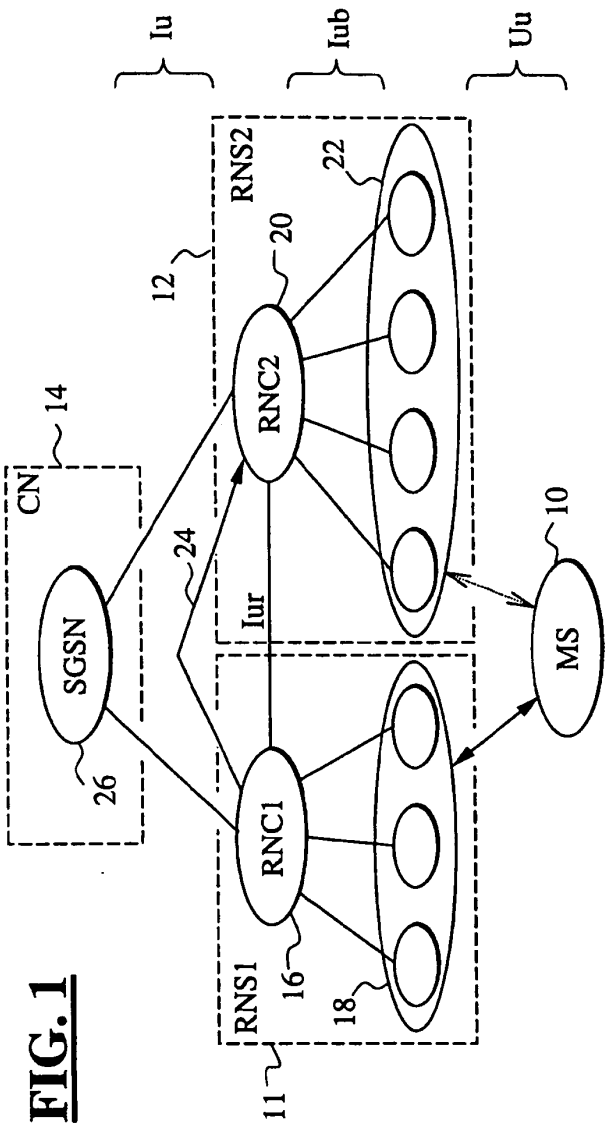

Iu
Iub
Uu
RNS2
22
20
12
RNC2
14
CN
24
10
Iur
SGSN
MS
26
RNC1
RNS1
16
18
11

FIG. 1

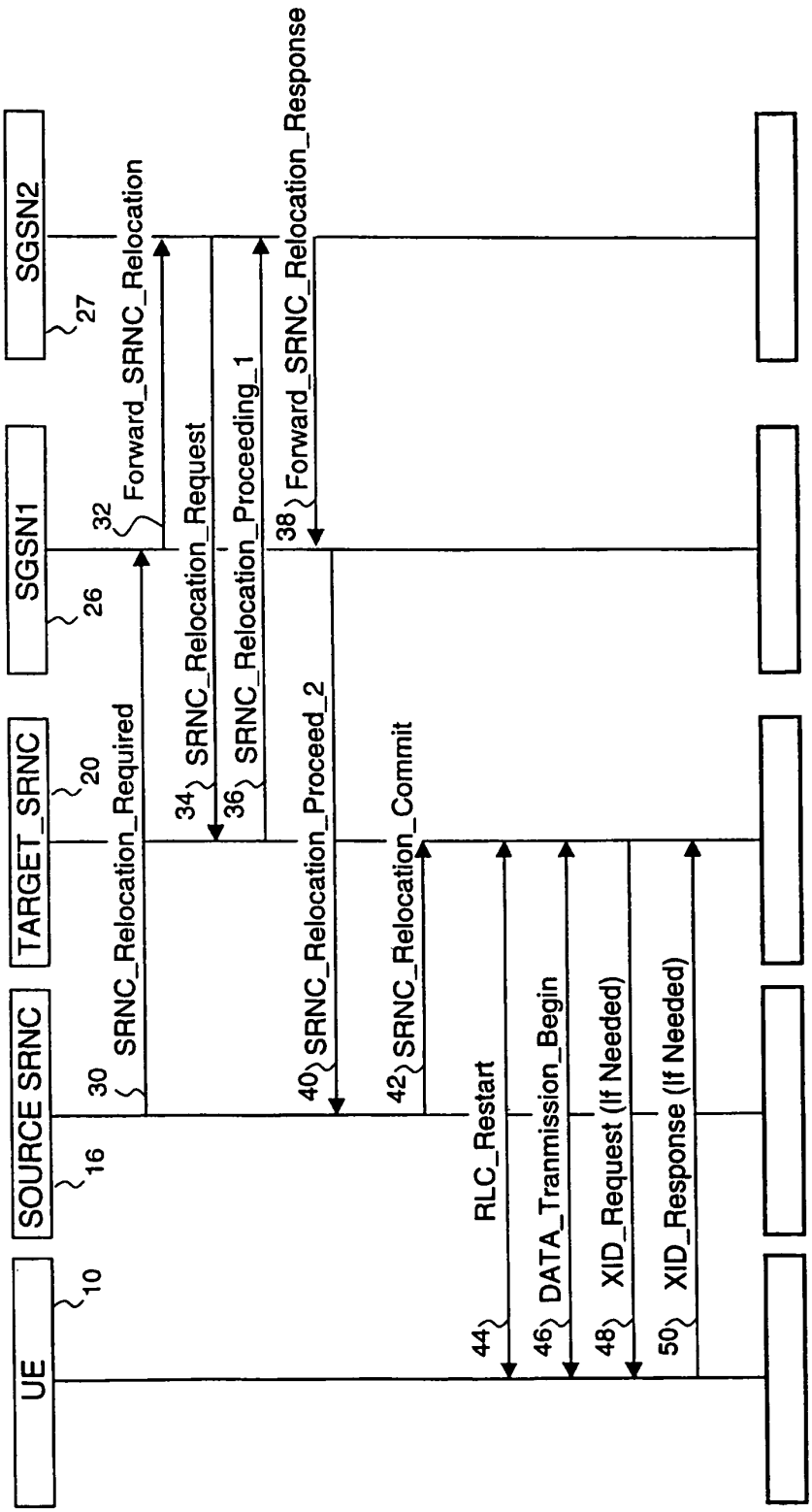

UE
10
SOURCE SRNC
16
TARGET_SRNC
20
SGSN1
26
SGSN2
27
30 SRNC_Relocation_Required
32 Forward_SRNC_Relocation
34 SRNC_Relocation_Request
36 SRNC_Relocation_Proceeding_1
38 Forward_SRNC_Relocation_Response
40 SRNC_Relocation_Proceed_2
42 SRNC_Relocation_Commit
44 RLC_Restart
46 DATA_Tranmission_Begin
48 XID_Request (If Needed)
50 XID_Response (If Needed)

FIG. 2

FIG. 3

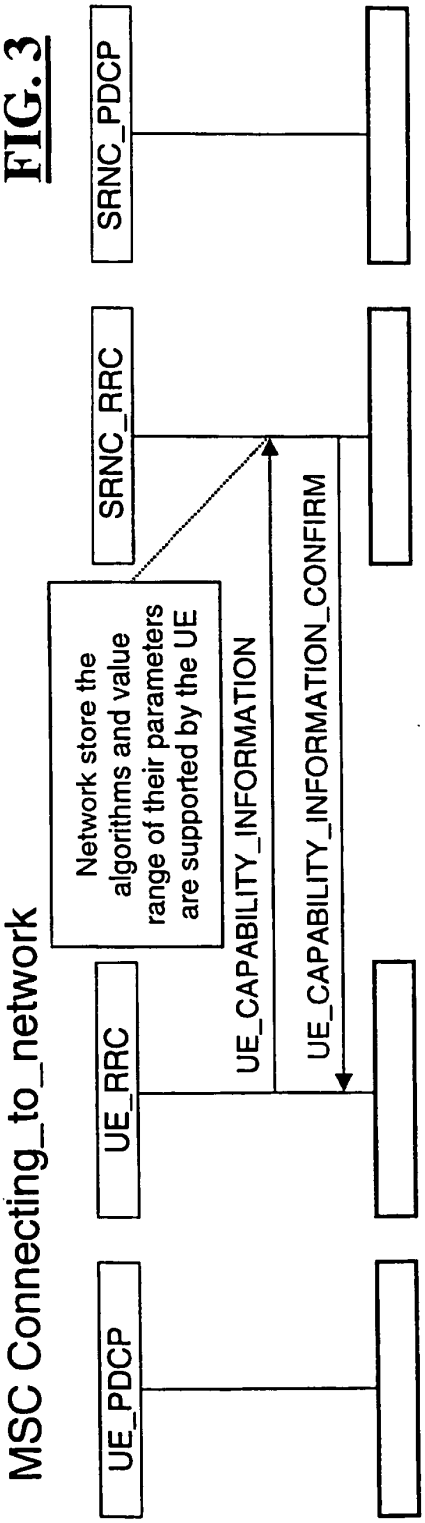
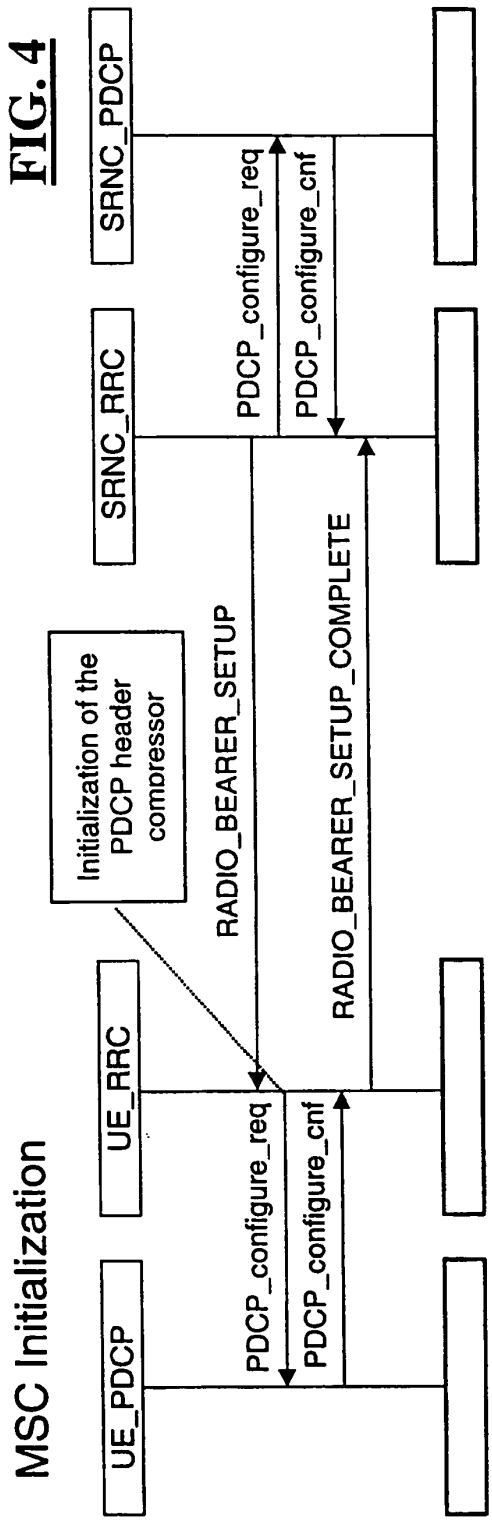

MSC Connecting_to_network
UE_PDCP
UE_RRC
SRNC_RRC
SRNC_PDCP
Network store the algorithms and value range of their parameters are supported by the UE
UE_CAPABILITY_INFORMATION
UE_CAPABILITY_INFORMATION_CONFIRM

FIG. 4


MSC Initialization
UE_PDCP
UE_RRC
SRNC_RRC
SRNC_PDCP
Initialization of the PDCP header compressor
RADIO_BEARER_SETUP
RADIO_BEARER_SETUP_COMPLETE
PDCP_configure_req
PDCP_configure_cnf
PDCP_configure_req
PDCP_configure_cnf

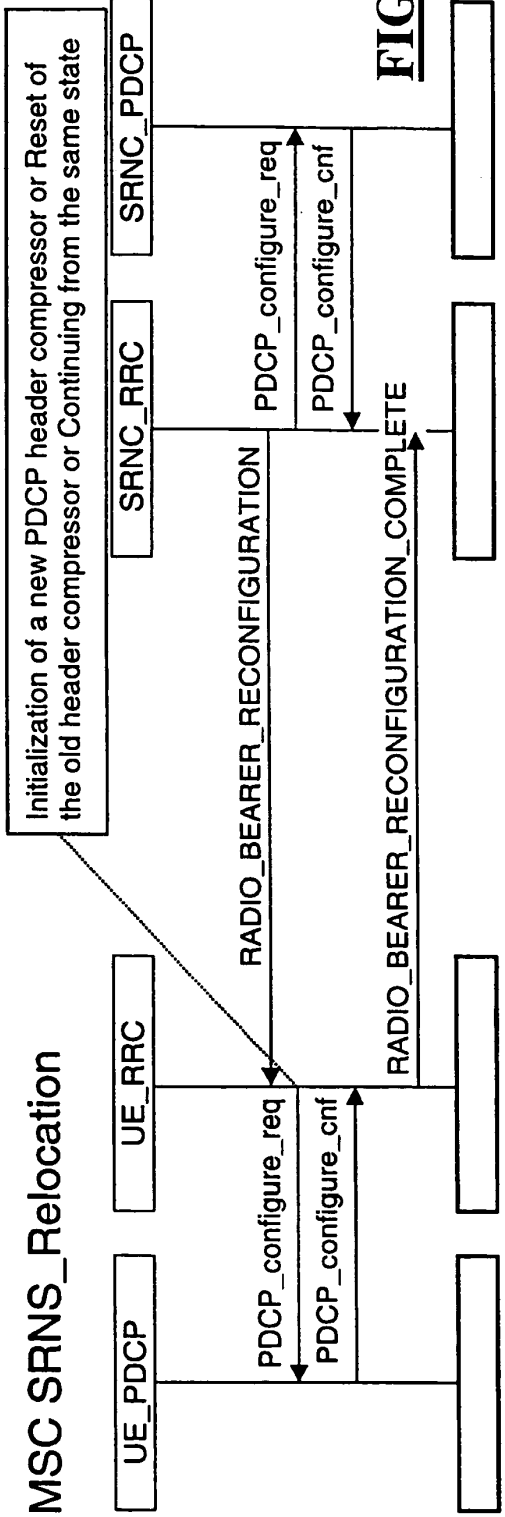

MSC SRNS_Relocation
UE_PDCP
UE_RRC
SRNC_RRC
SRNC_PDCP
Initialization of a new PDCP header compressor or Reset of the old header compressor or Continuing from the same state
RADIO_BEARER_RECONFIGURATION
PDCP_configure_req
PDCP_configure_cnf
RADIO_BEARER_RECONFIGURATION_COMPLETE
PDCP_configure_req
PDCP_configure_cnf

FIG. 5

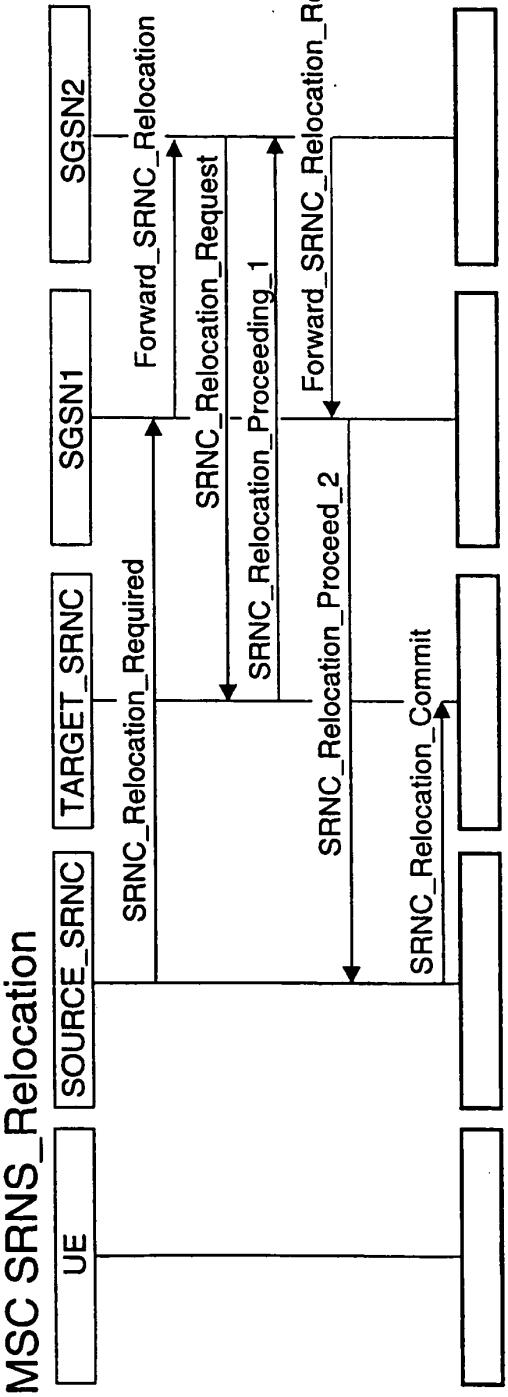

MSC SRNS_Relocation
UE
SOURCE_SRNC
TARGET_SRNC
SGSN1
SGSN2
SRNC_Relocation_Required
Forward_SRNC_Relocation
SRNC_Relocation_Request
SRNC_Relocation_Proceeding_1
Forward_SRNC_Relocation_Response
SRNC_Relocation_Proceed_2
SRNC_Relocation_Commit

FIG. 6

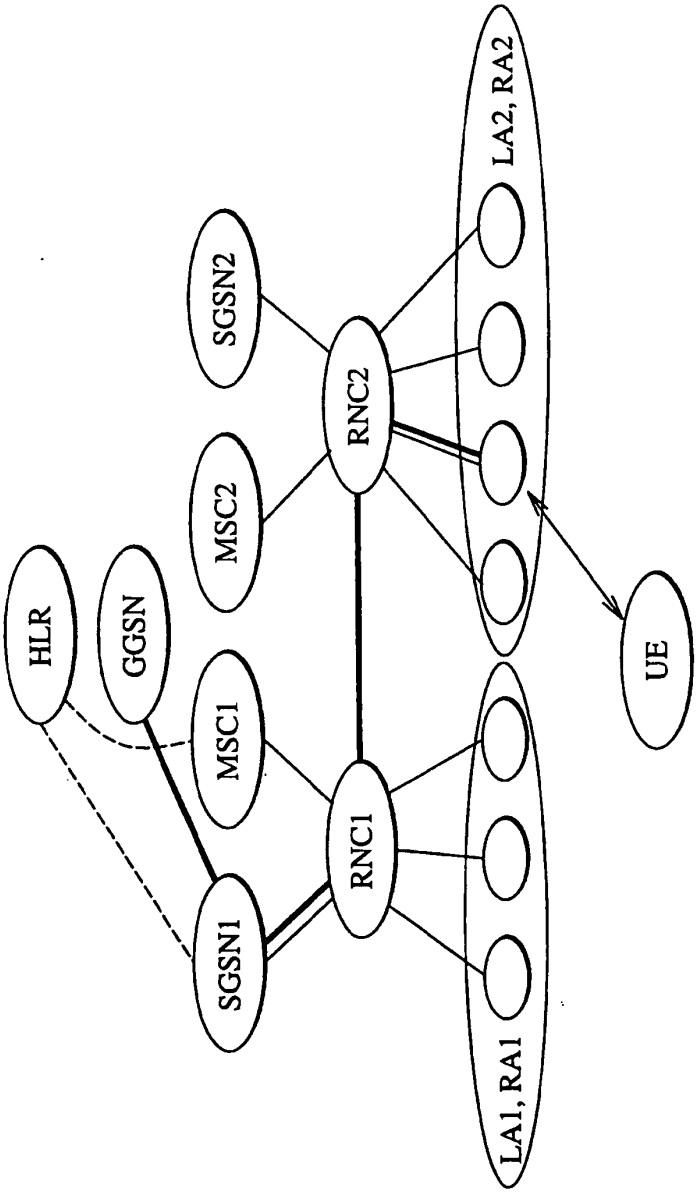


FIG. 7 (Before the SRNS relocation and location registration)

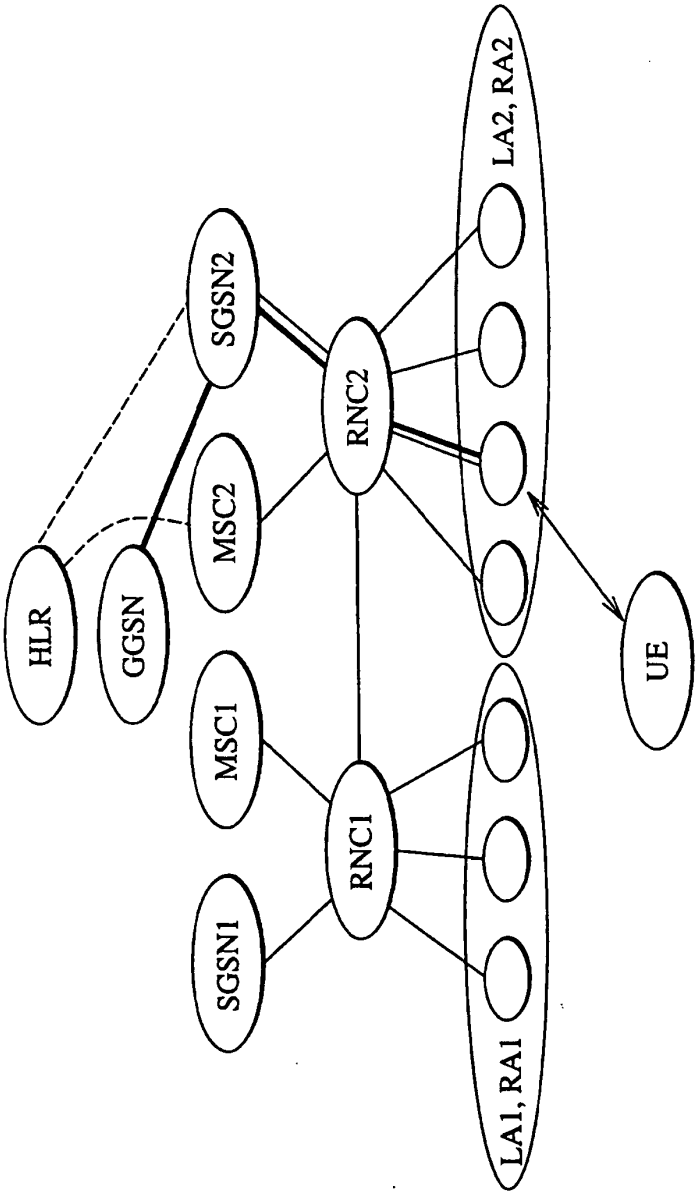


FIG. 8 (After the SRNS relocation and location registration)

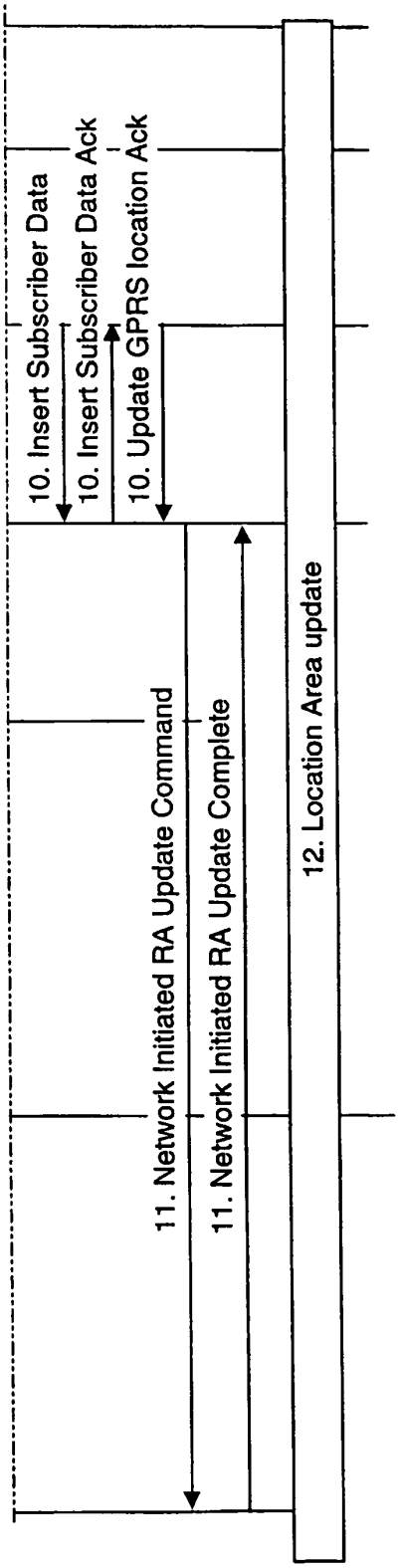


FIG. 9B (Interface information transfer for SRNS relocation update when changing SGSN area resulting in a change of registration location and followed by location registration in new Location Area)

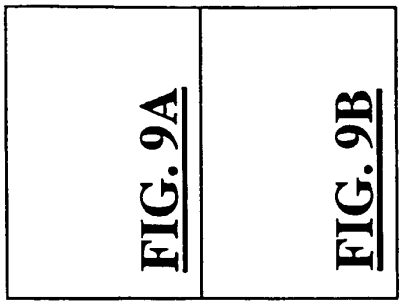


FIG. 9

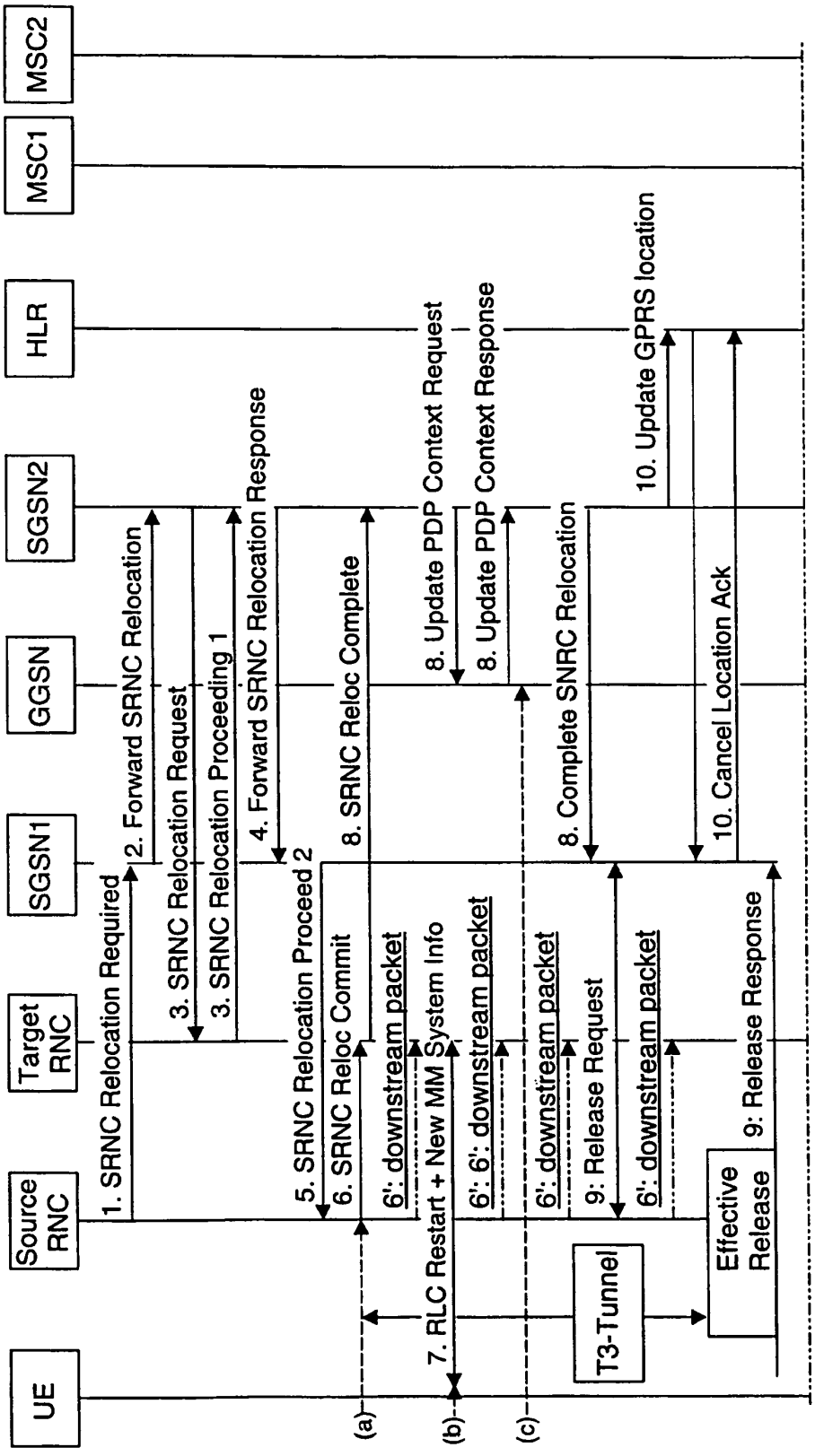

UE
Source RNC
Target RNC
SGSN1
GGSN
SGSN2
HLR
MSC1
MSC2
1. SRNC Relocation Required
2. Forward SRNC Relocation
3. SRNC Relocation Request
3. SRNC Relocation Proceeding 1
4. Forward SRNC Relocation Response
5. SRNC Relocation Proceed 2
6. SRNC Reloc Commit
8. SRNC Reloc Complete
6': downstream packet
7. RLC Restart + New MM System Info
8. Update PDP Context Request
8. Update PDP Context Response
6': 6': downstream packet
6': downstream packet
8. Complete SNRC Relocation
9: Release Request
6': downstream packet
10. Update GPRS location
10. Cancel Location Ack
9: Release Response
T3-Tunnel
Effective Release
(a)
(b)
(c)

FIG. 9A

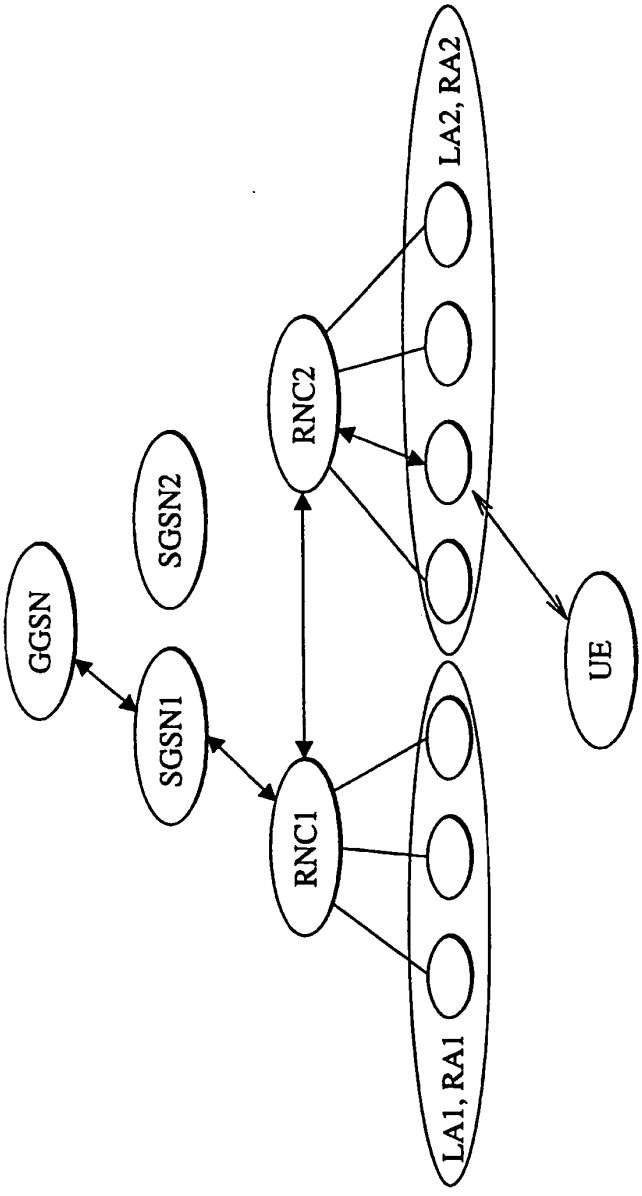


FIG. 10 (Data paths before the SRNS relocation has been actually committed (before point (a) in Figure 9))

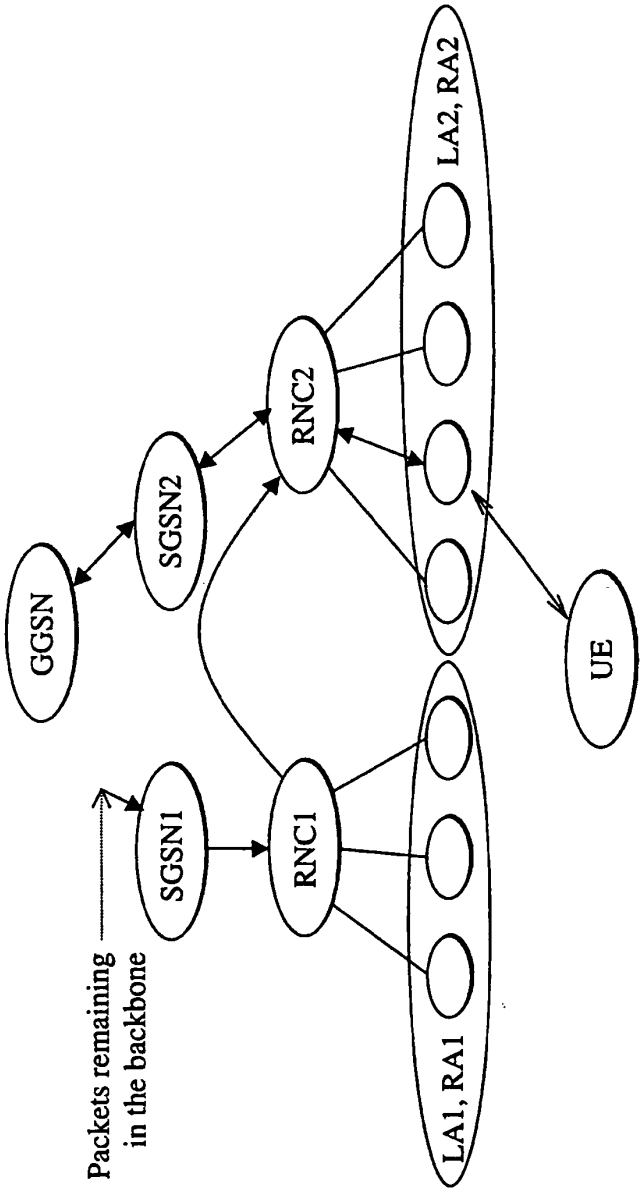


FIG. 11 Data paths after the GGSN update (after point (c) in Fig. 9)

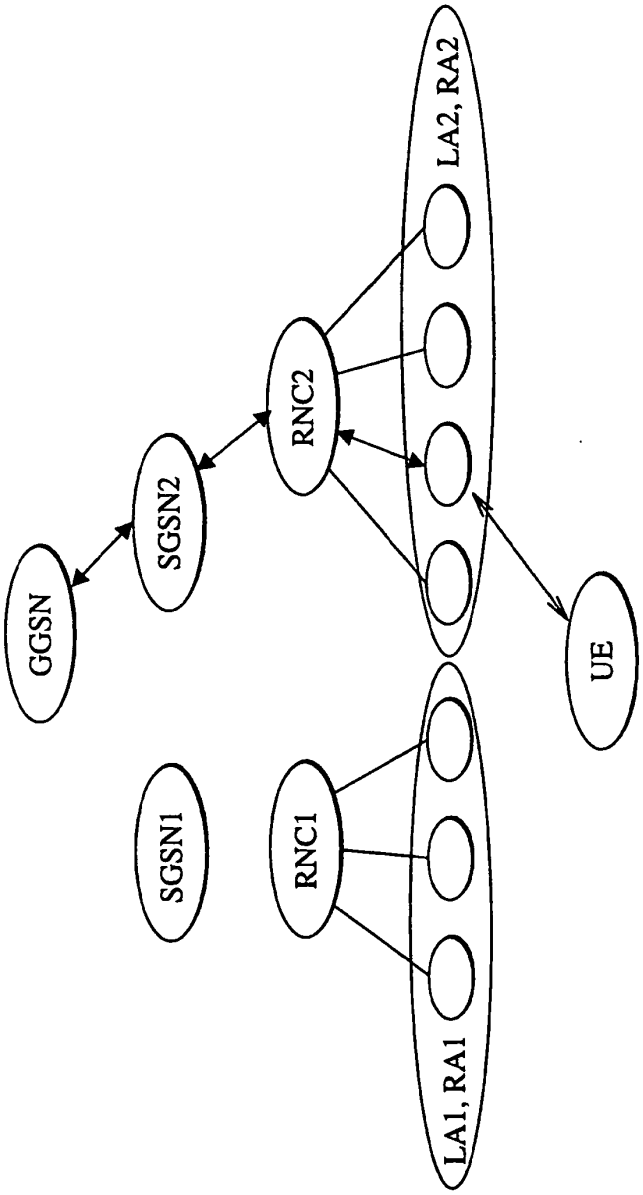


FIG. 12 Data paths after the resource release in source RNC (after point (d) in Figure 9))

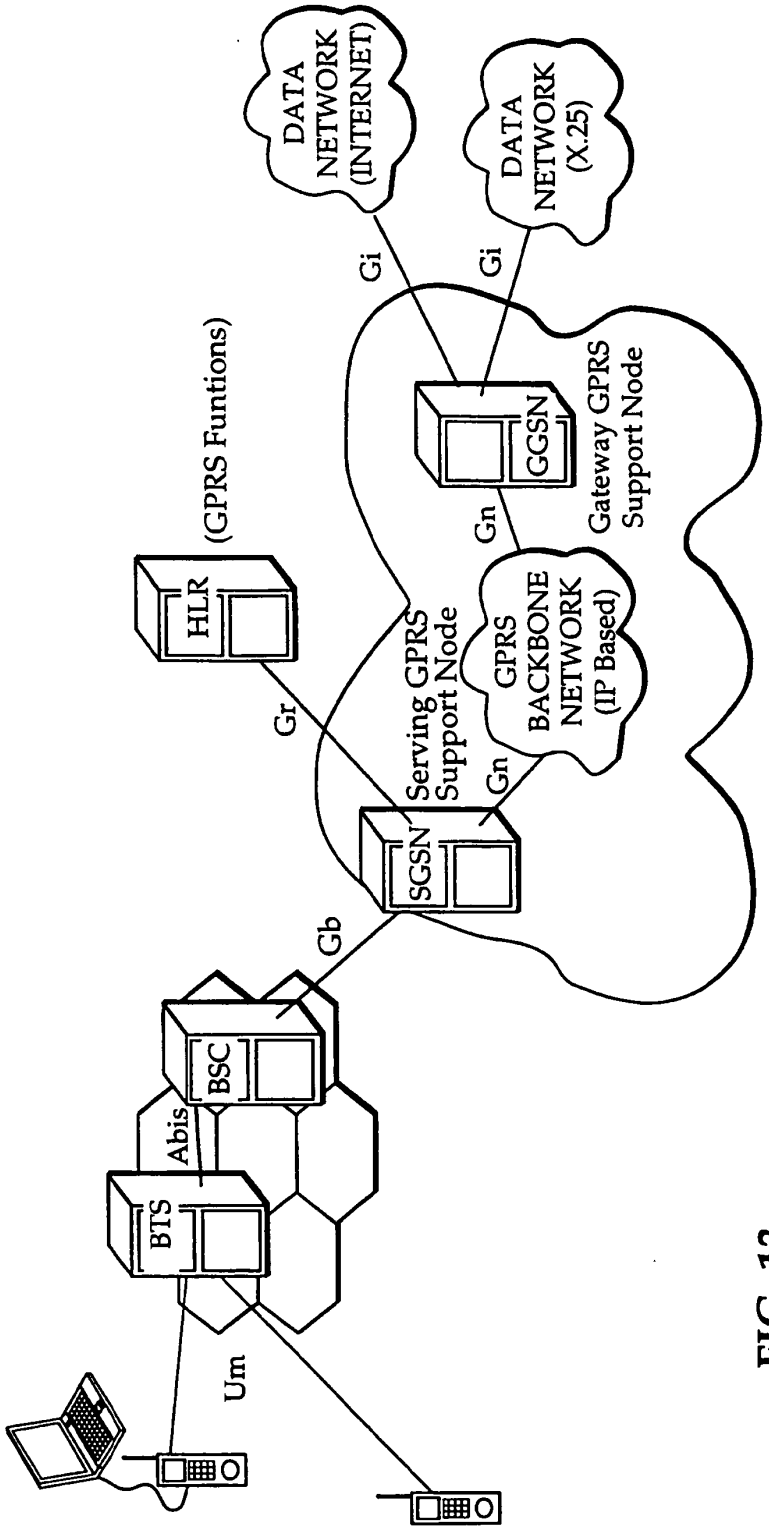


FIG. 13
(GPRS network architecture)

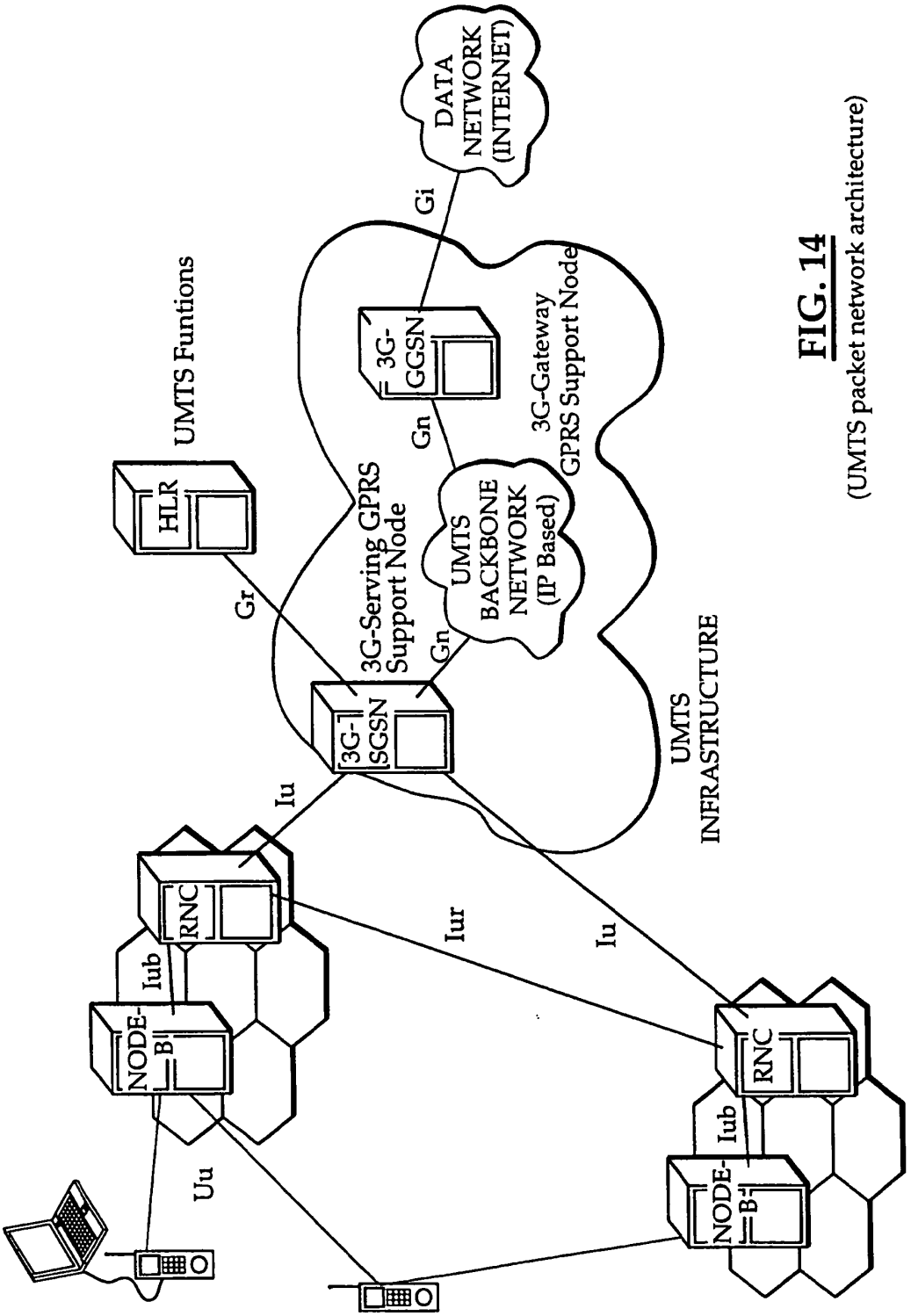
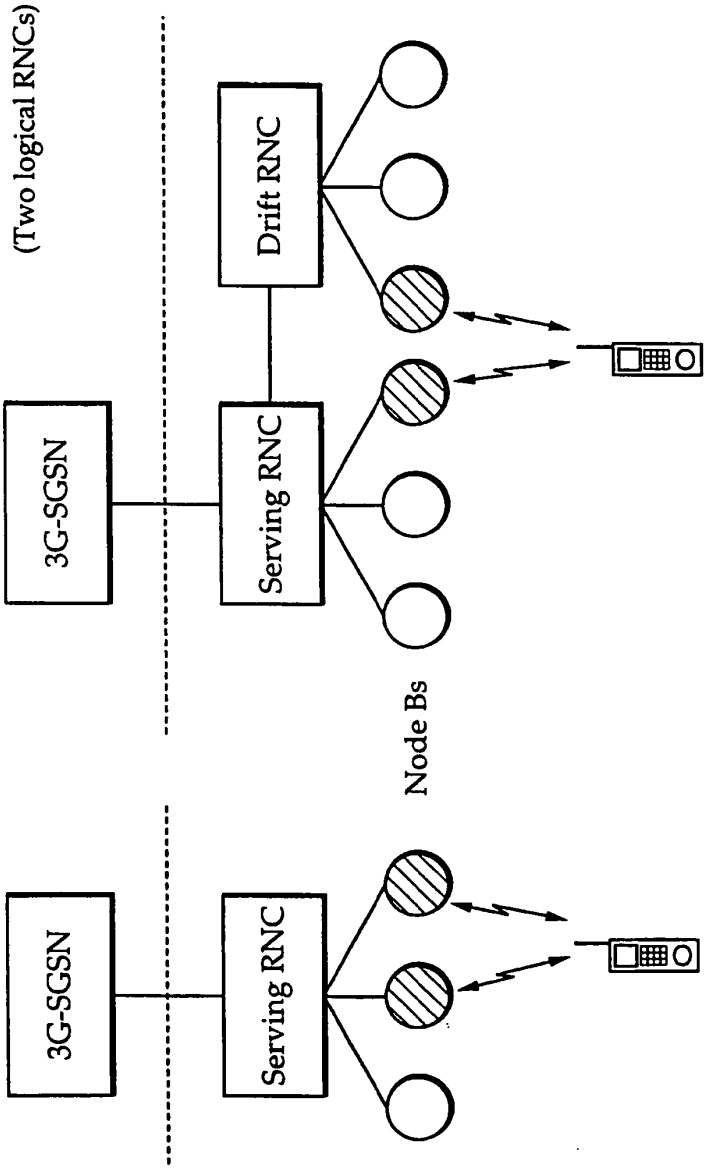


FIG. 14
(UMTS packet network architecture)

FIG. 15


(Two logical RNCs)
Drift RNC
3G-SGSN
Serving RNC
Node Bs
3G-SGSN
Serving RNC

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
31 May 2001 (31.05.2001)

PCT

(10) International Publication Number
WO 01/39528 A1

(51) International Patent Classification[7]: H04Q 7/22

(21) International Application Number: PCT/EP99/09043

(22) International Filing Date:
23 November 1999 (23.11.1999)

(25) Filing Language: English

(26) Publication Language: English

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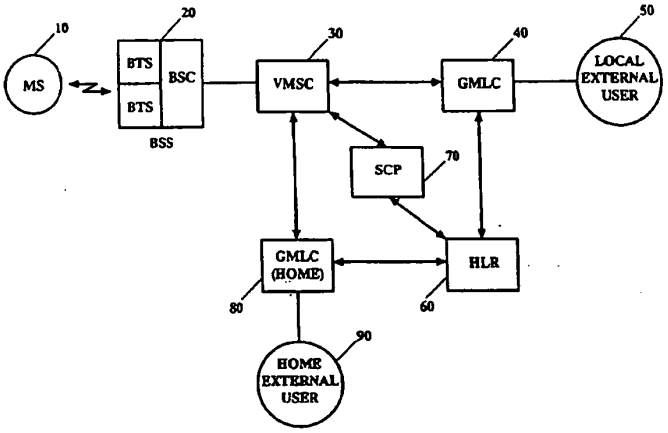
(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian 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), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*

[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.

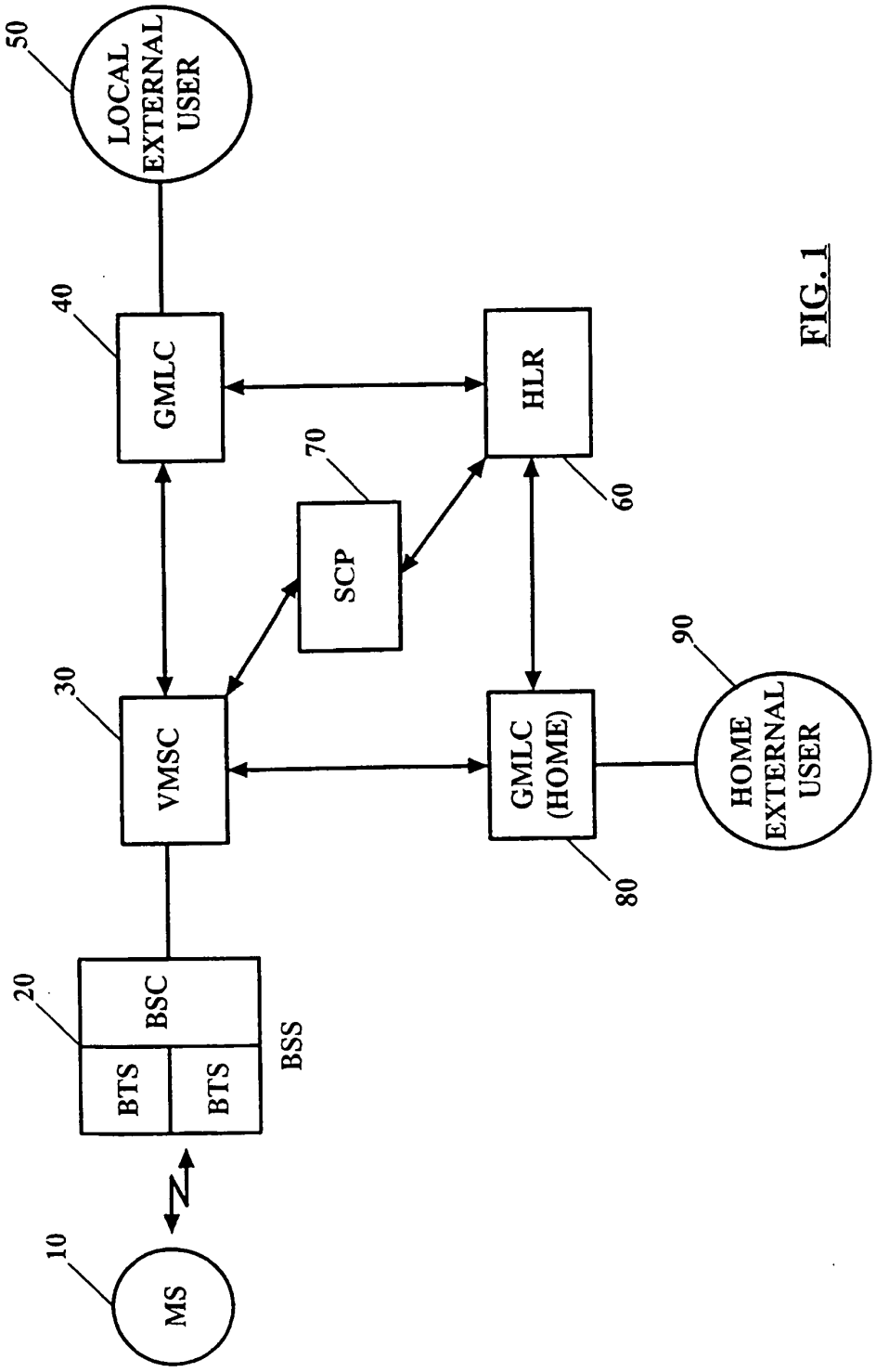

LOCAL EXTERNAL USER
50
GMLC
40
HLR
60
SCP
70
VMSC
30
GMLC (HOME)
80
HOME EXTERNAL USER
90
BSC
BTS
BTS
BSS
20
Z
MS
10

FIG. 1

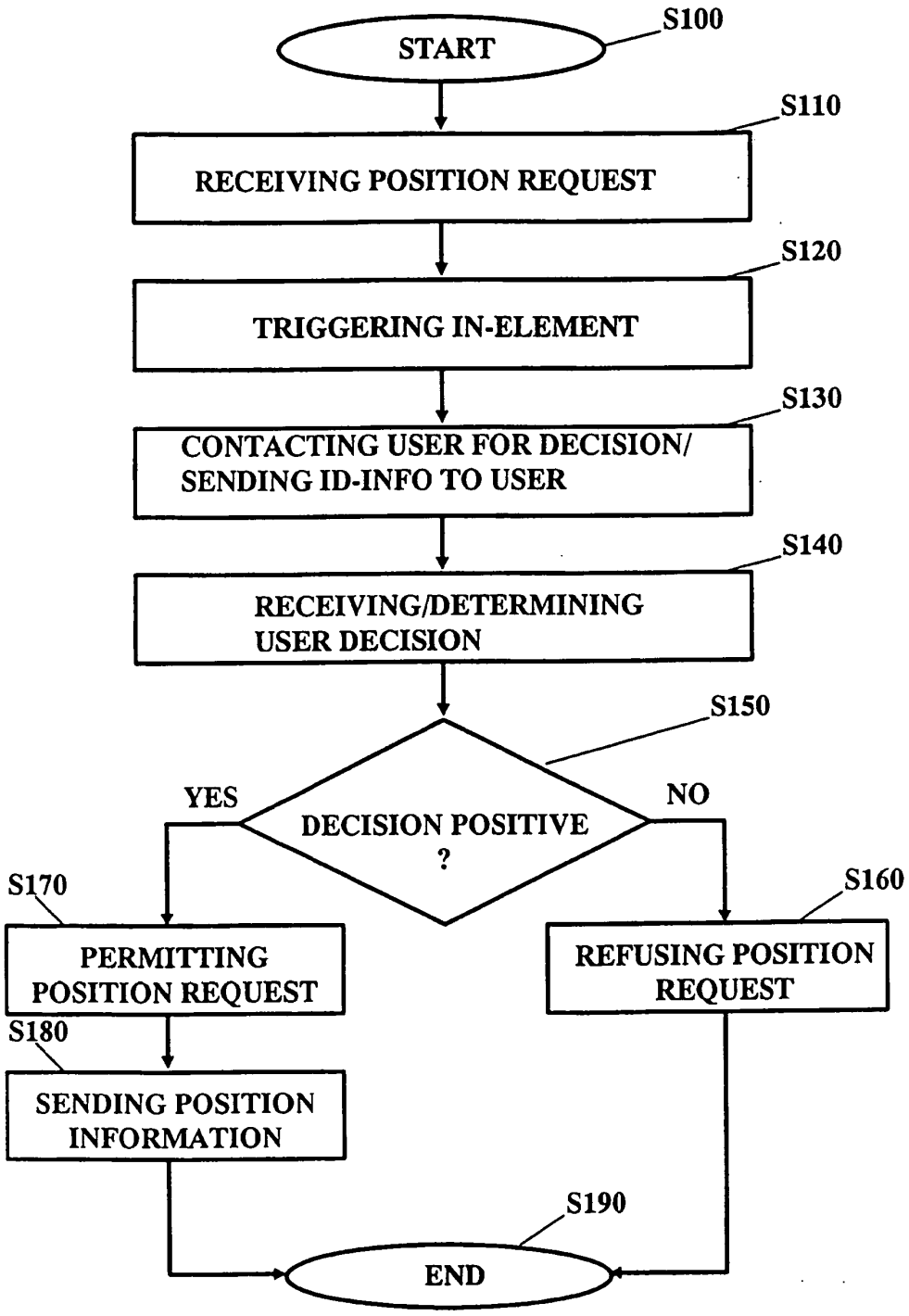

START
S100
RECEIVING POSITION REQUEST
S110
TRIGGERING IN-ELEMENT
S120
CONTACTING USER FOR DECISION/ SENDING ID-INFO TO USER
S130
RECEIVING/DETERMINING USER DECISION
S140
DECISION POSITIVE ?
S150
YES
NO
PERMITTING POSITION REQUEST
S170
REFUSING POSITION REQUEST
S160
SENDING POSITION INFORMATION
S180
END
S190

FIG. 2

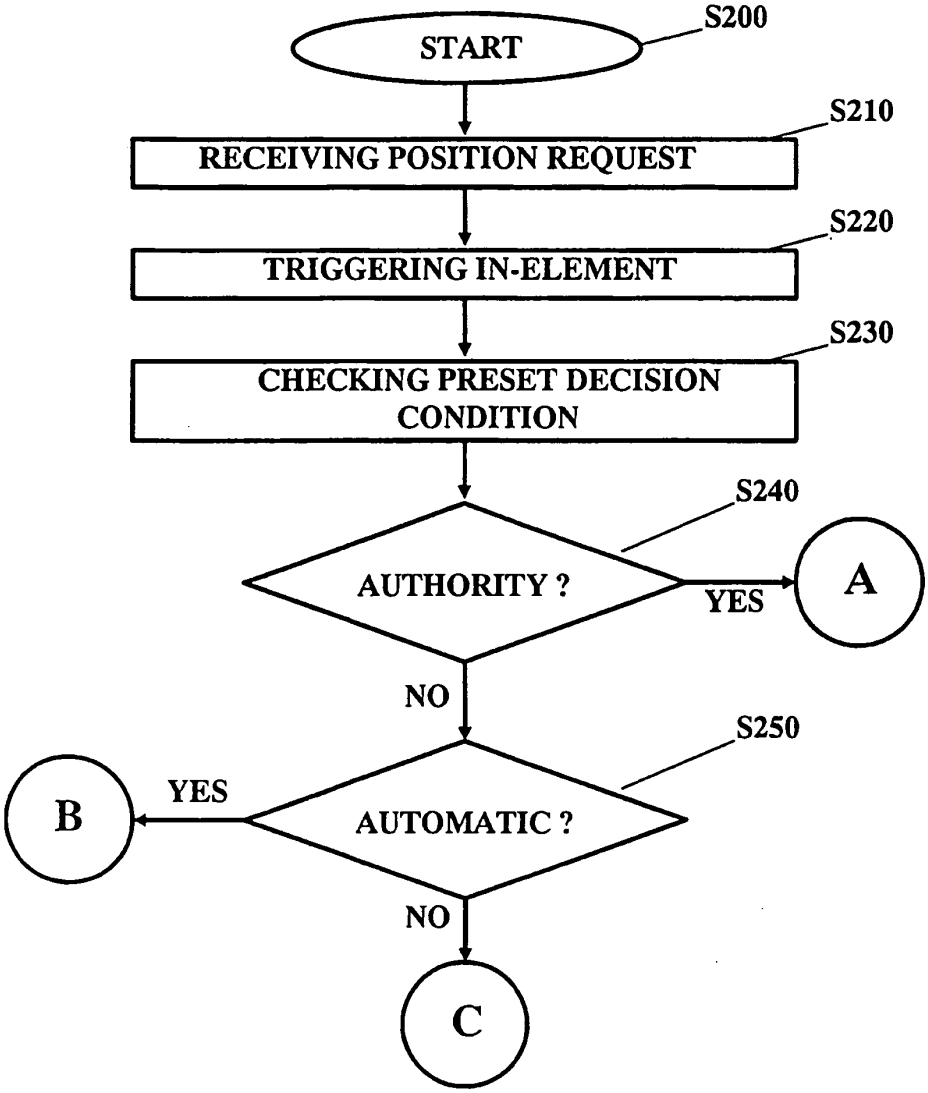

START
S200
RECEIVING POSITION REQUEST
S210
TRIGGERING IN-ELEMENT
S220
CHECKING PRESET DECISION CONDITION
S230
AUTHORITY ?
S240
YES
A
NO
AUTOMATIC ?
S250
YES
B
NO
C

FIG. 3

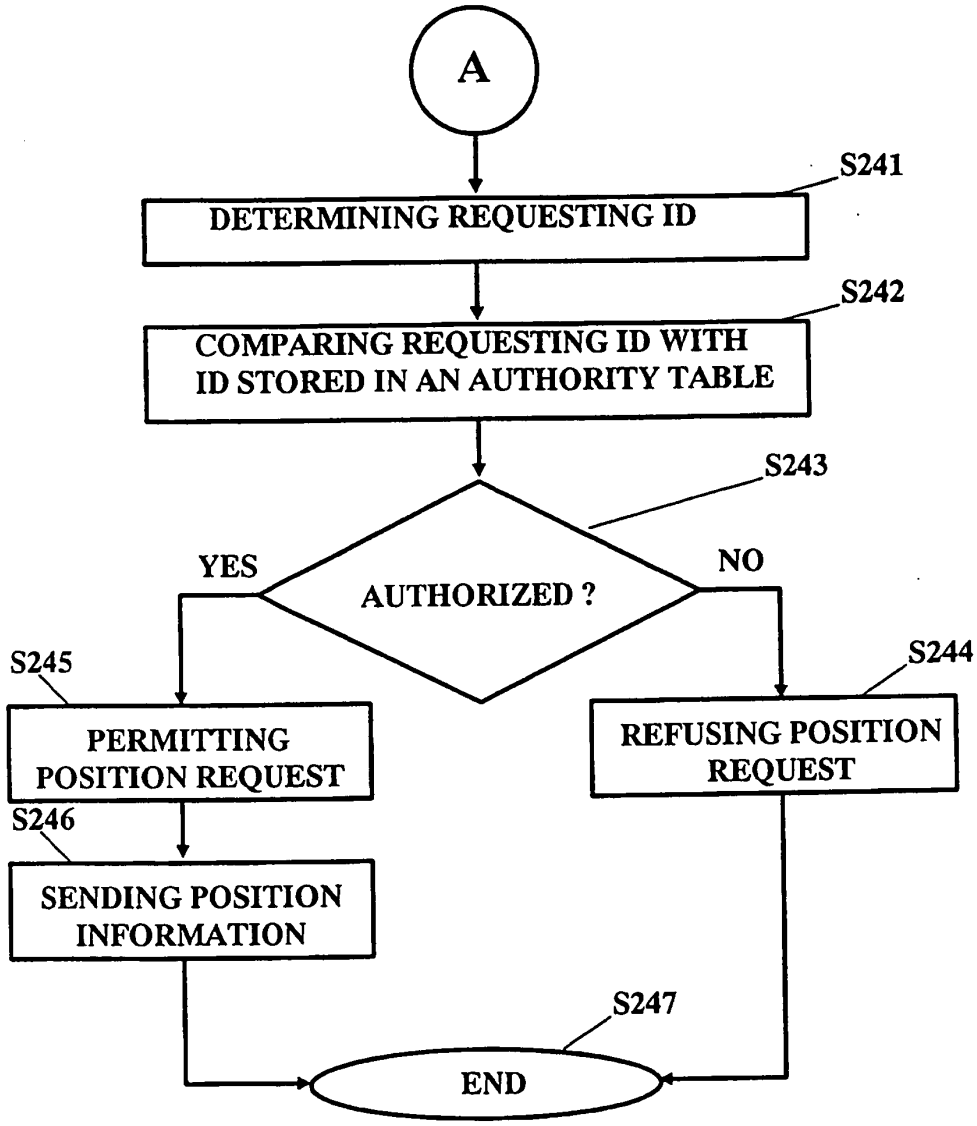

A
S241
DETERMINING REQUESTING ID
S242
COMPARING REQUESTING ID WITH ID STORED IN AN AUTHORITY TABLE
S243
AUTHORIZED ?
YES
NO
S245
PERMITTING POSITION REQUEST
S244
REFUSING POSITION REQUEST
S246
SENDING POSITION INFORMATION
S247
END

FIG. 4

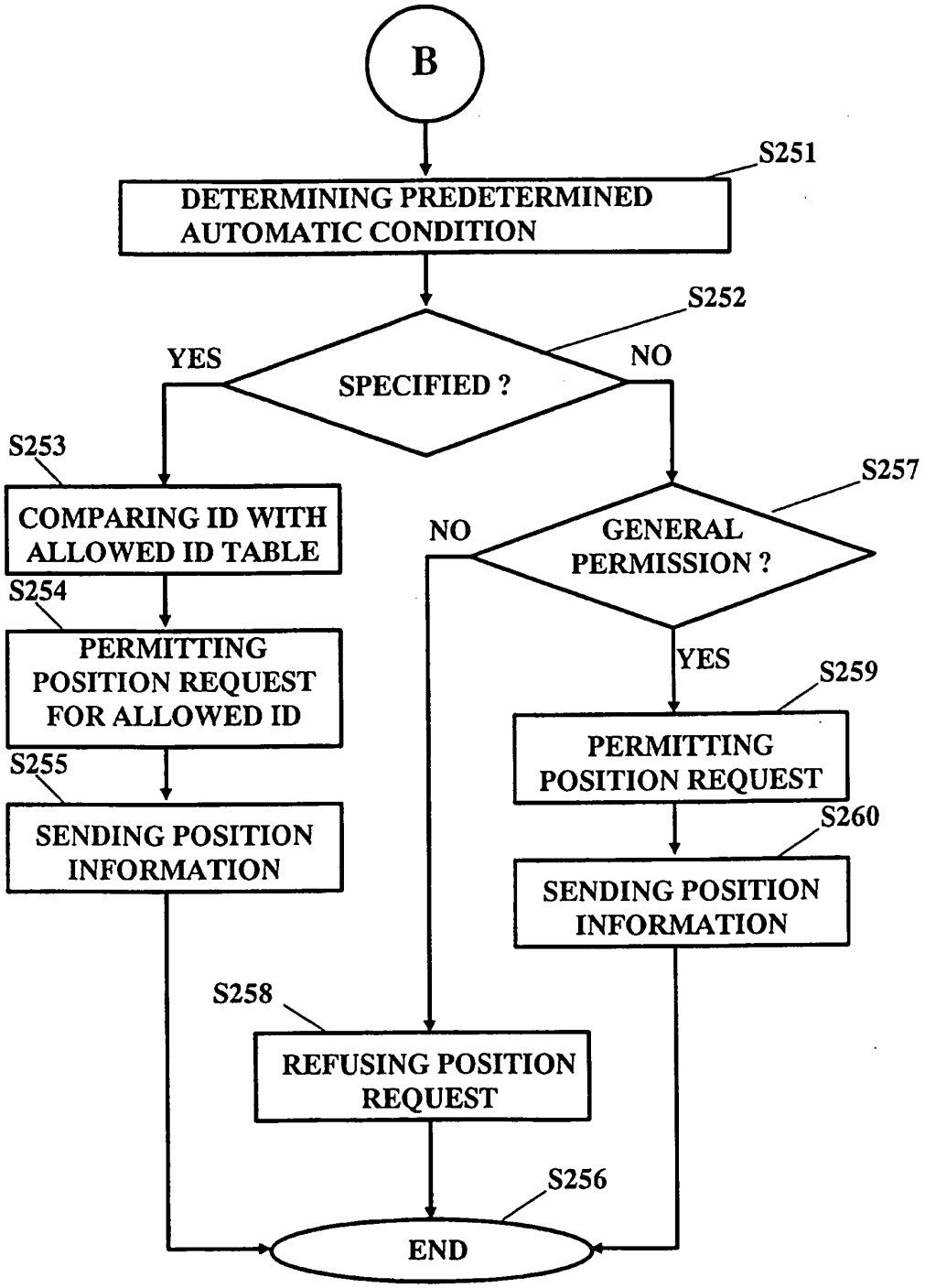

B
S251
DETERMINING PREDETERMINED AUTOMATIC CONDITION
S252
SPECIFIED ?
YES
NO
S253
COMPARING ID WITH ALLOWED ID TABLE
S254
PERMITTING POSITION REQUEST FOR ALLOWED ID
S255
SENDING POSITION INFORMATION
S257
GENERAL PERMISSION ?
NO
YES
S259
PERMITTING POSITION REQUEST
S260
SENDING POSITION INFORMATION
S258
REFUSING POSITION REQUEST
S256
END

FIG. 5

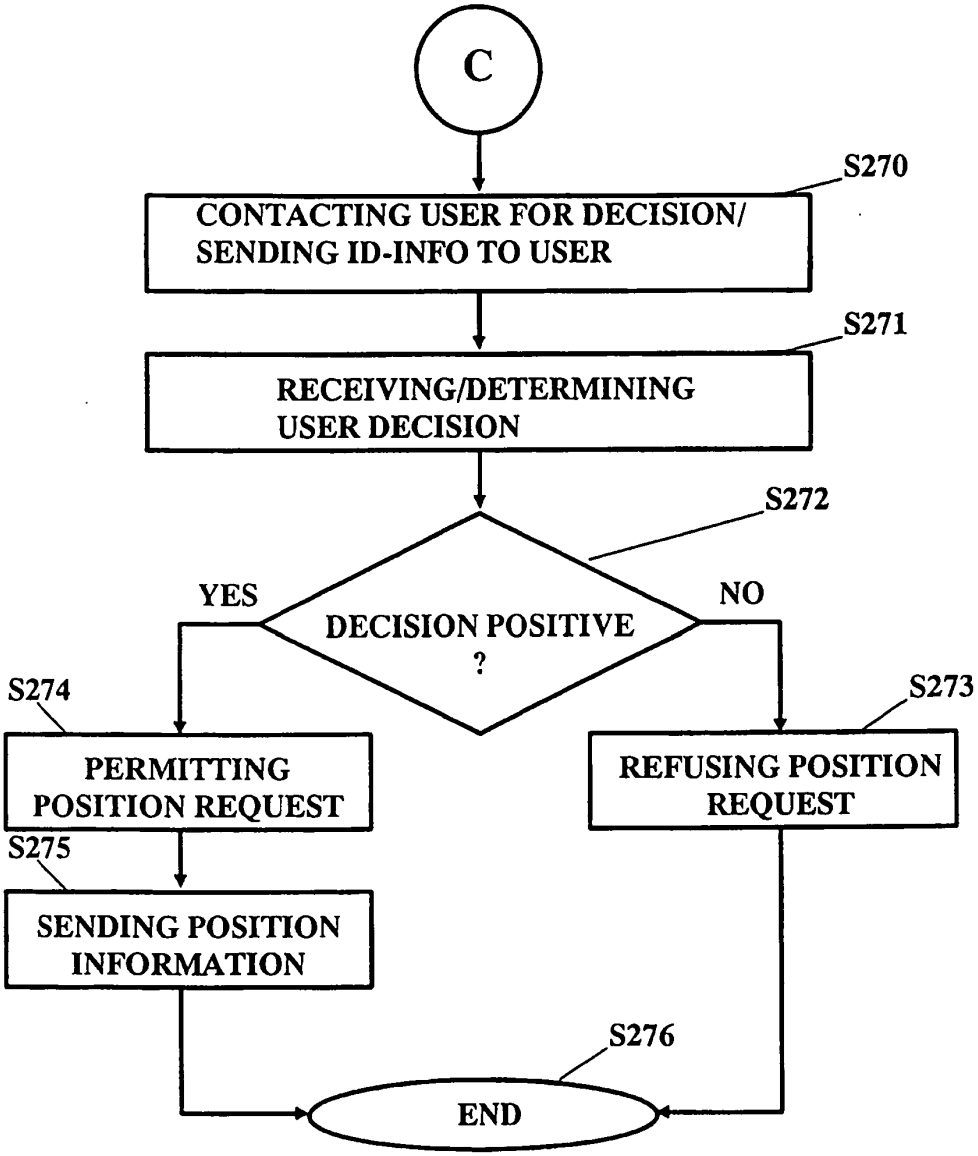

C
S270
CONTACTING USER FOR DECISION/ SENDING ID-INFO TO USER
S271
RECEIVING/DETERMINING USER DECISION
S272
YES
DECISION POSITIVE ?
NO
S274
PERMITTING POSITION REQUEST
S273
REFUSING POSITION REQUEST
S275
SENDING POSITION INFORMATION
S276
END

FIG. 6

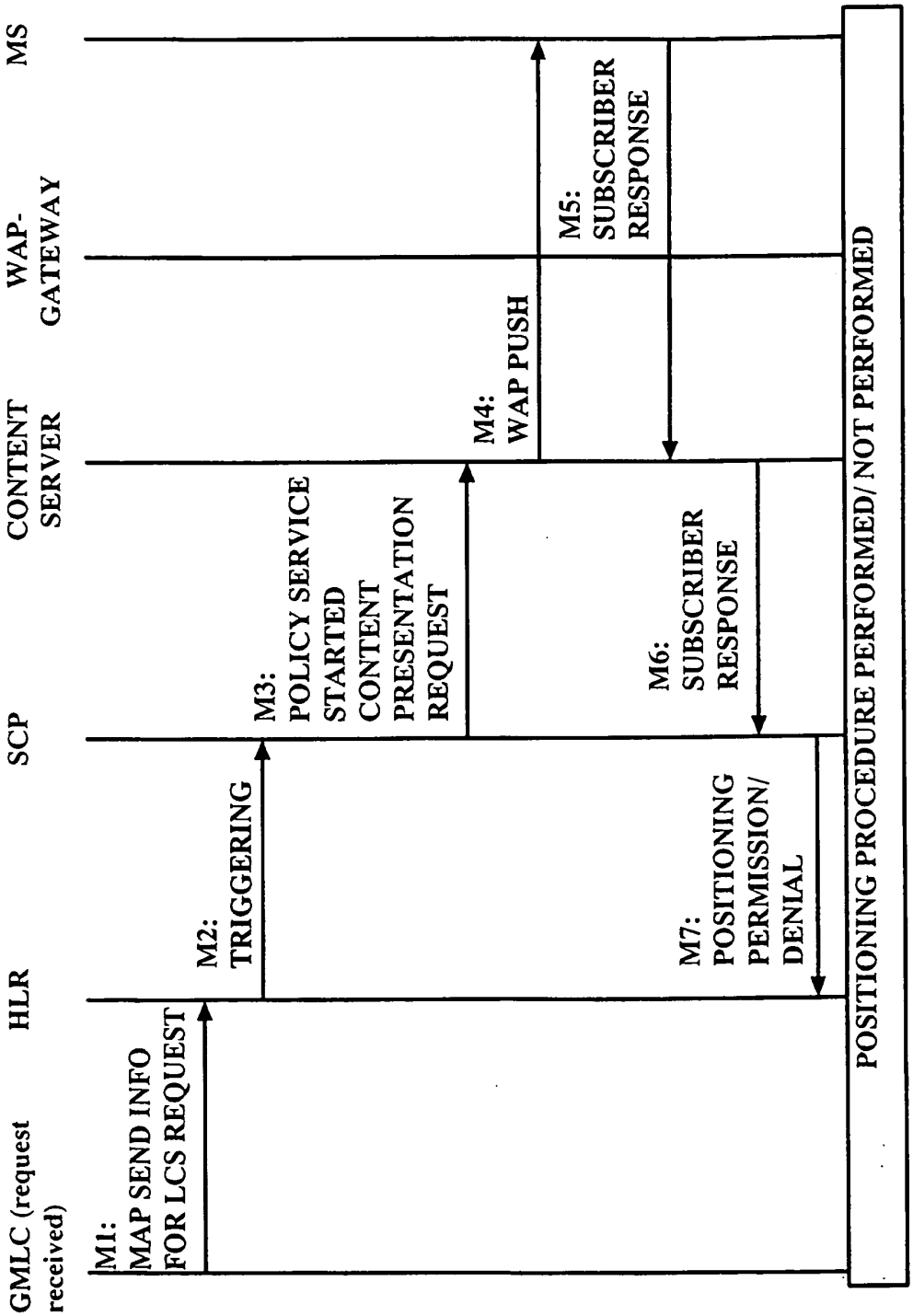

GMLC (request received)
HLR
SCP
CONTENT SERVER
WAP-GATEWAY
MS
M1: MAP SEND INFO FOR LCS REQUEST
M2: TRIGGERING
M3: POLICY SERVICE STARTED CONTENT PRESENTATION REQUEST
M4: WAP PUSH
M5: SUBSCRIBER RESPONSE
M6: SUBSCRIBER RESPONSE
M7: POSITIONING PERMISSION/ DENIAL
POSITIONING PROCEDURE PERFORMED/ NOT PERFORMED

FIG. 7

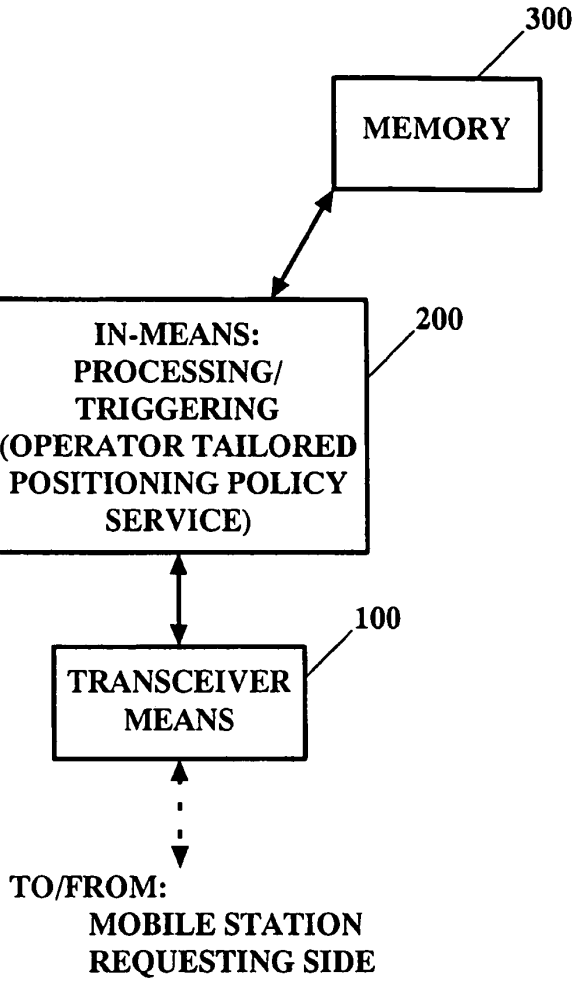

300
MEMORY
IN-MEANS:
PROCESSING/
TRIGGERING
(OPERATOR TAILORED
POSITIONING POLICY
SERVICE)
200
100
TRANSCEIVER
MEANS
TO/FROM:
MOBILE STATION
REQUESTING SIDE

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 :

"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

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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
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

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Int. ..tional 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

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

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)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
7 June 2001 (07.06.2001)

PCT

(10) International Publication Number
WO 01/41468 A2

(51) International Patent Classification[7]: H04Q 7/00

(21) International Application Number: PCT/EP00/12192

(22) International Filing Date:
30 November 2000 (30.11.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
9928416.8 1 December 1999 (01.12.1999) GB

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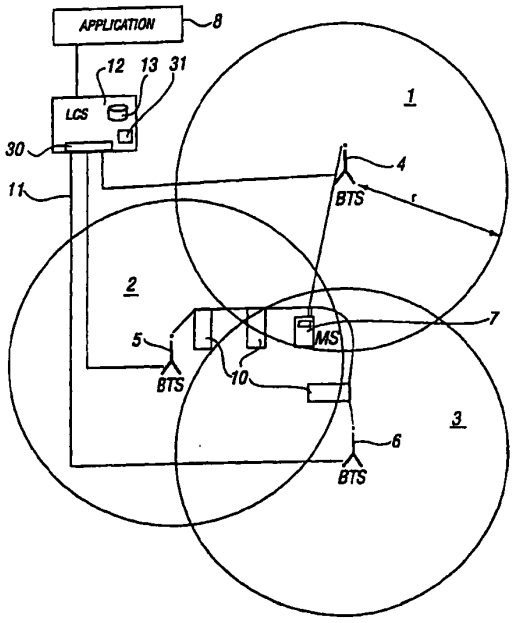
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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian 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).

[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.

WO 01/41468 A2

Published:

— *Without international search report and to be republished upon receipt of that 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.

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.

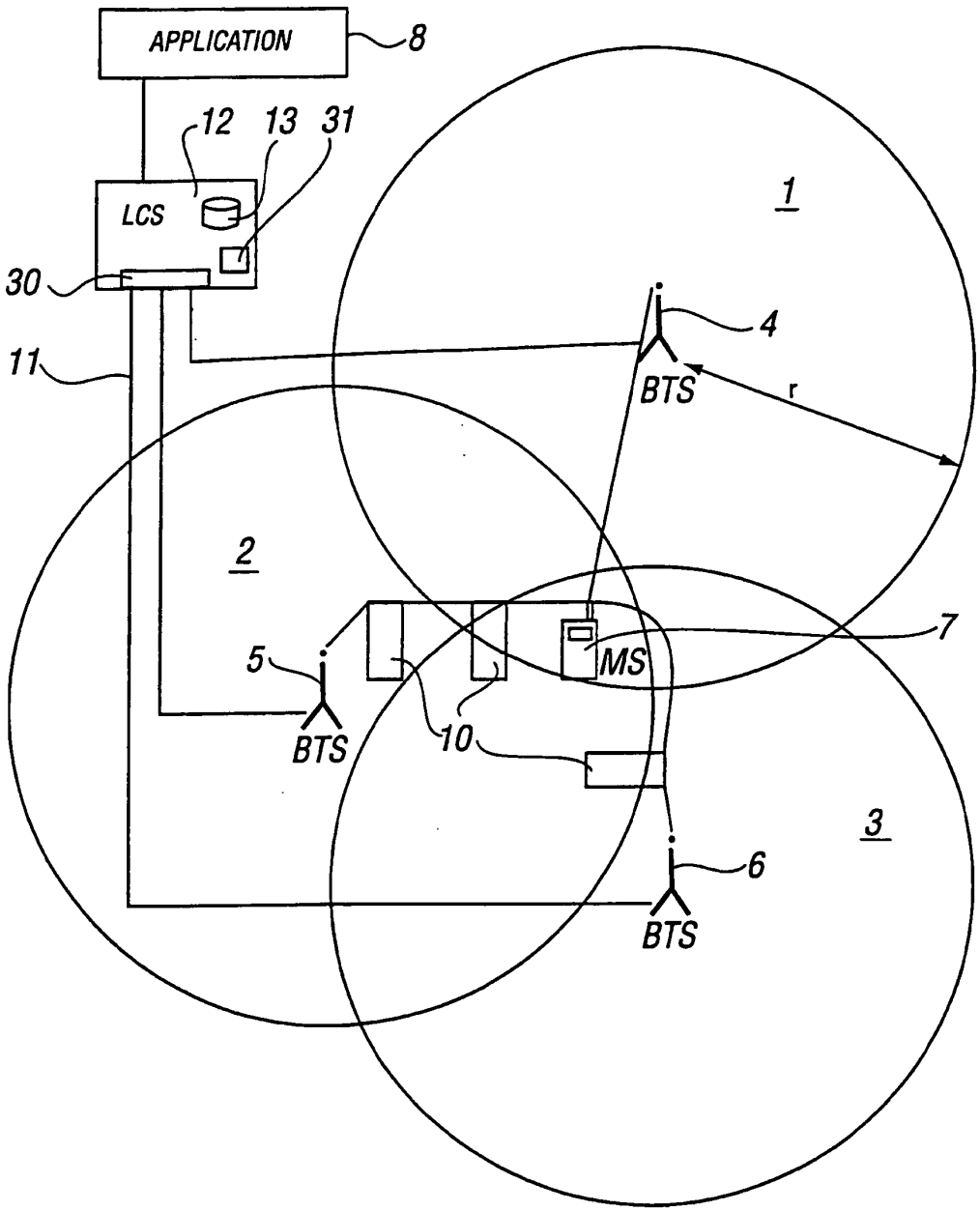


FIG. 1

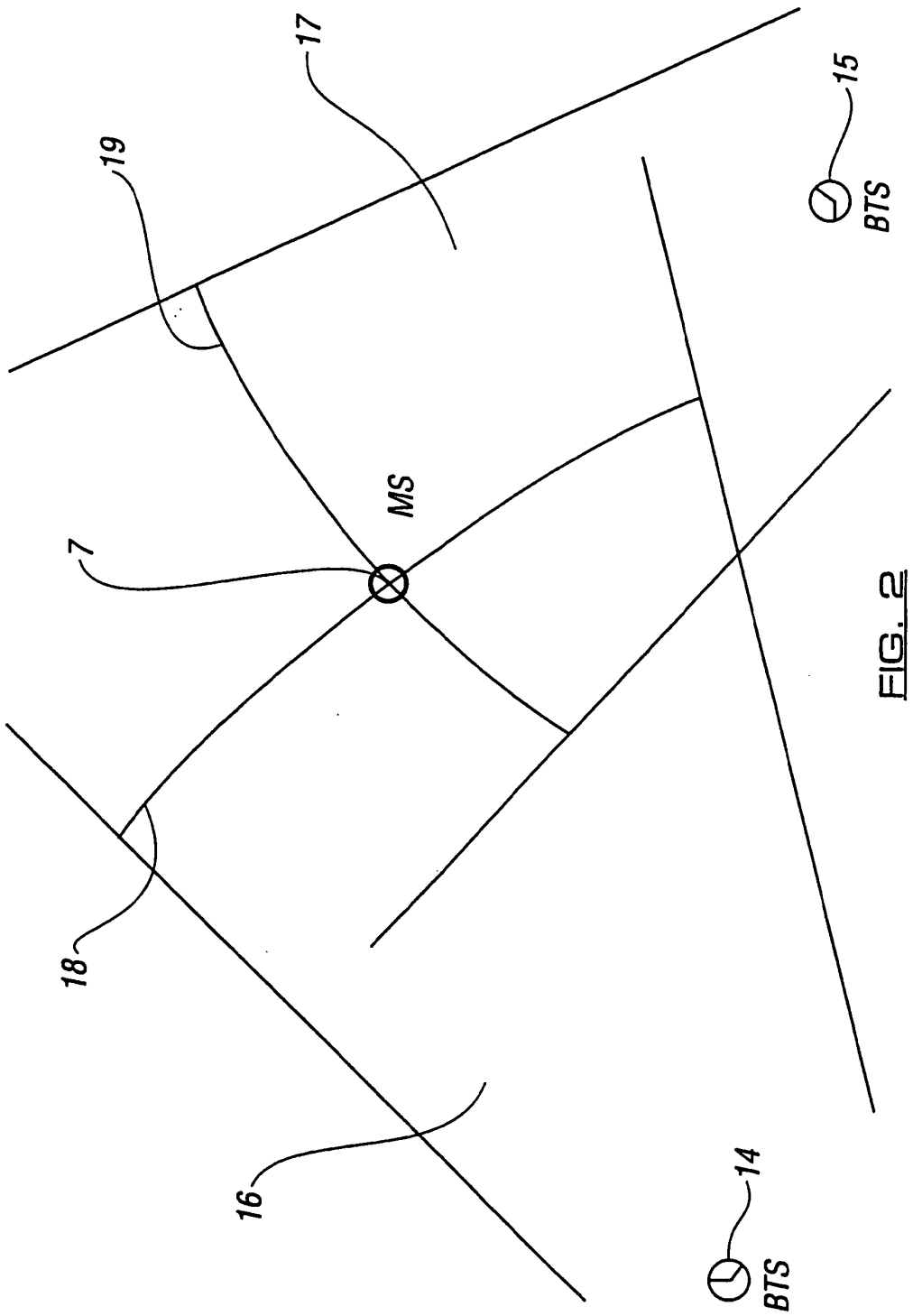


FIG. 2

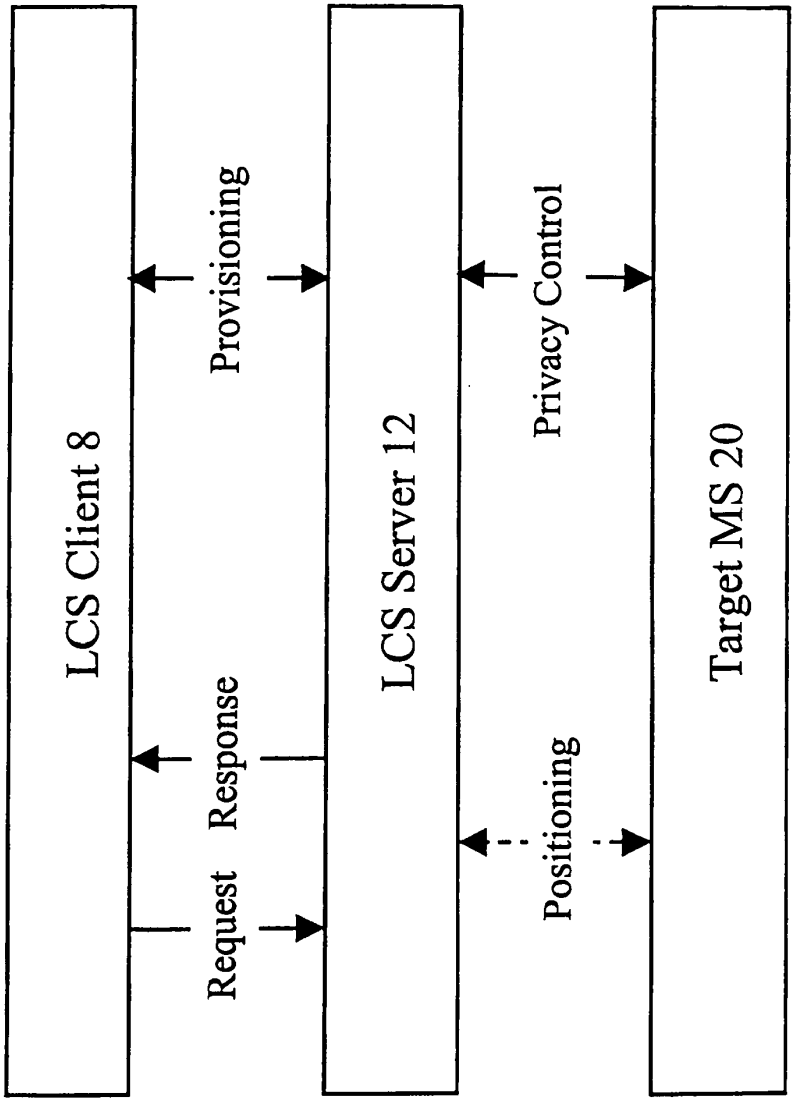

LCS Client 8
LCS Server 12
Target MS 20
Provisioning
Privacy Control
Request
Response
Positioning
Stage 1
Stage 2, 3

FIG. 3

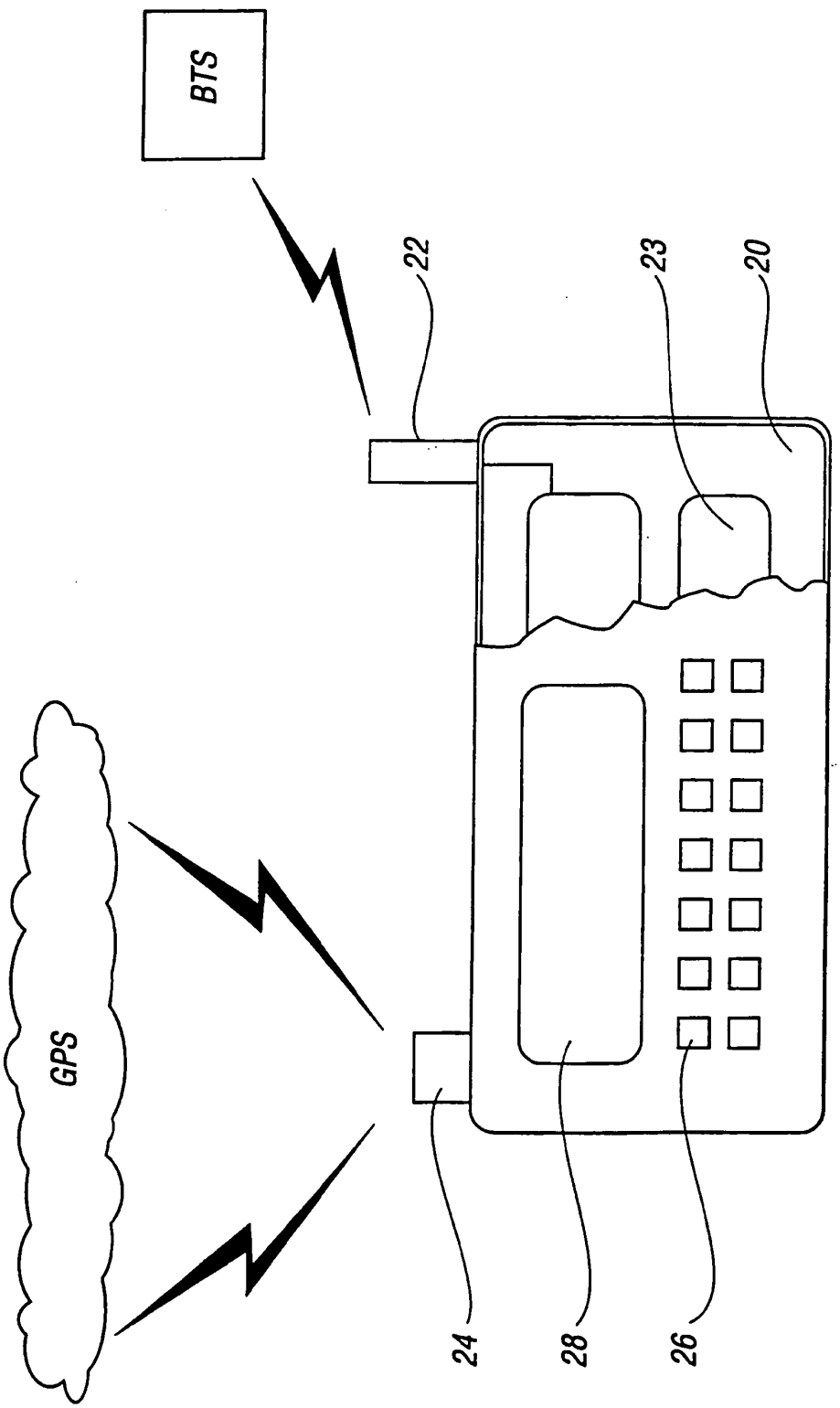


FIG. 4

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
12 July 2001 (12.07.2001)

PCT

(10) International Publication Number
WO 01/50544 A1

(51) International Patent Classification[7]: H01P 7/06

(21) International Application Number: PCT/IB00/01498

(22) International Filing Date: 18 October 2000 (18.10.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/474,724 29 December 1999 (29.12.1999) US

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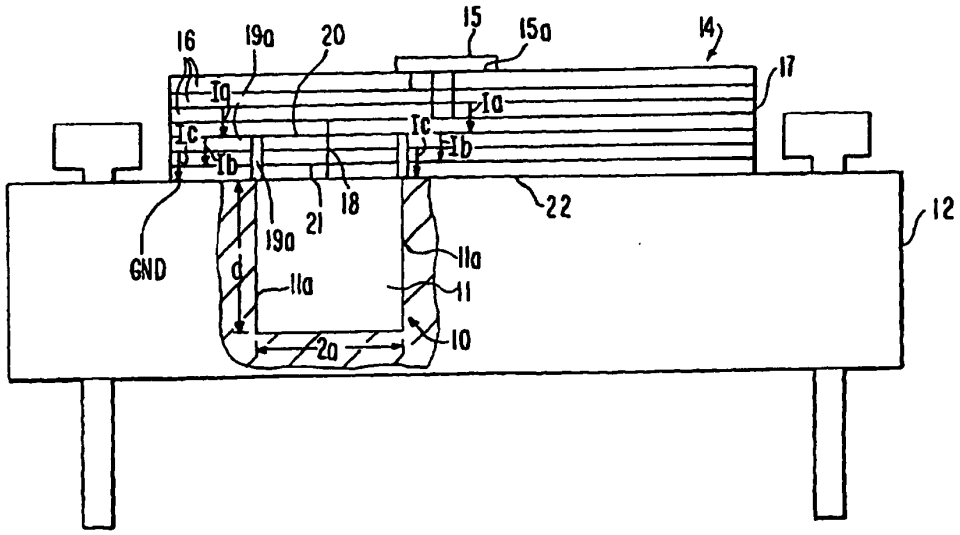
(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian 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), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

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.

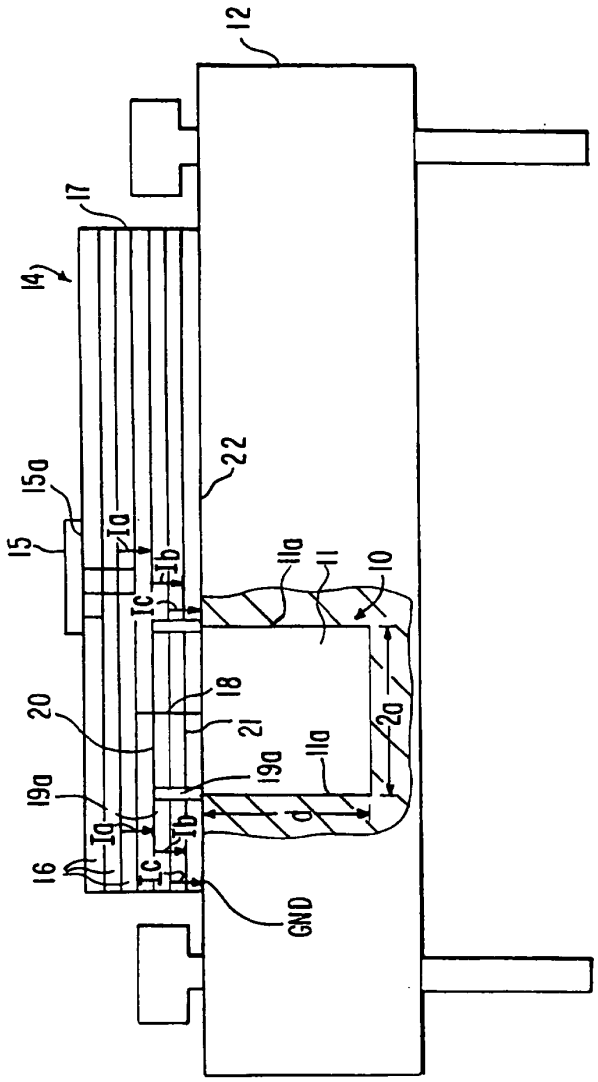

12
17
14
22
15a
15
10a
10b
10c
11b
11a
11
10
18
20
21
19a
20a
d
16
GND

FIG.1

FIG. 1a

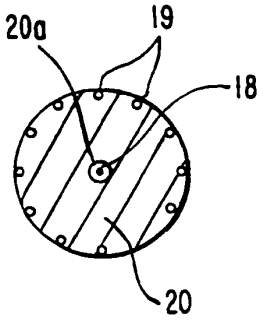


FIG. 1b

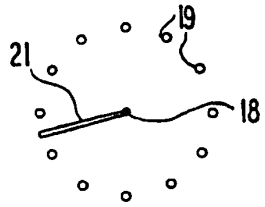


FIG. 1c

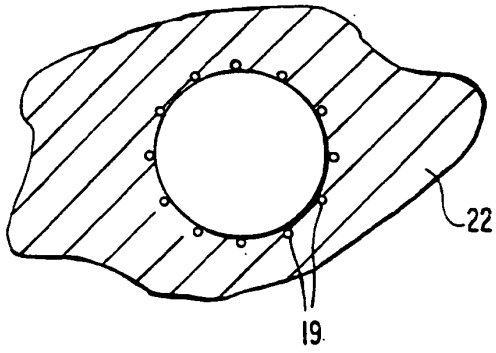
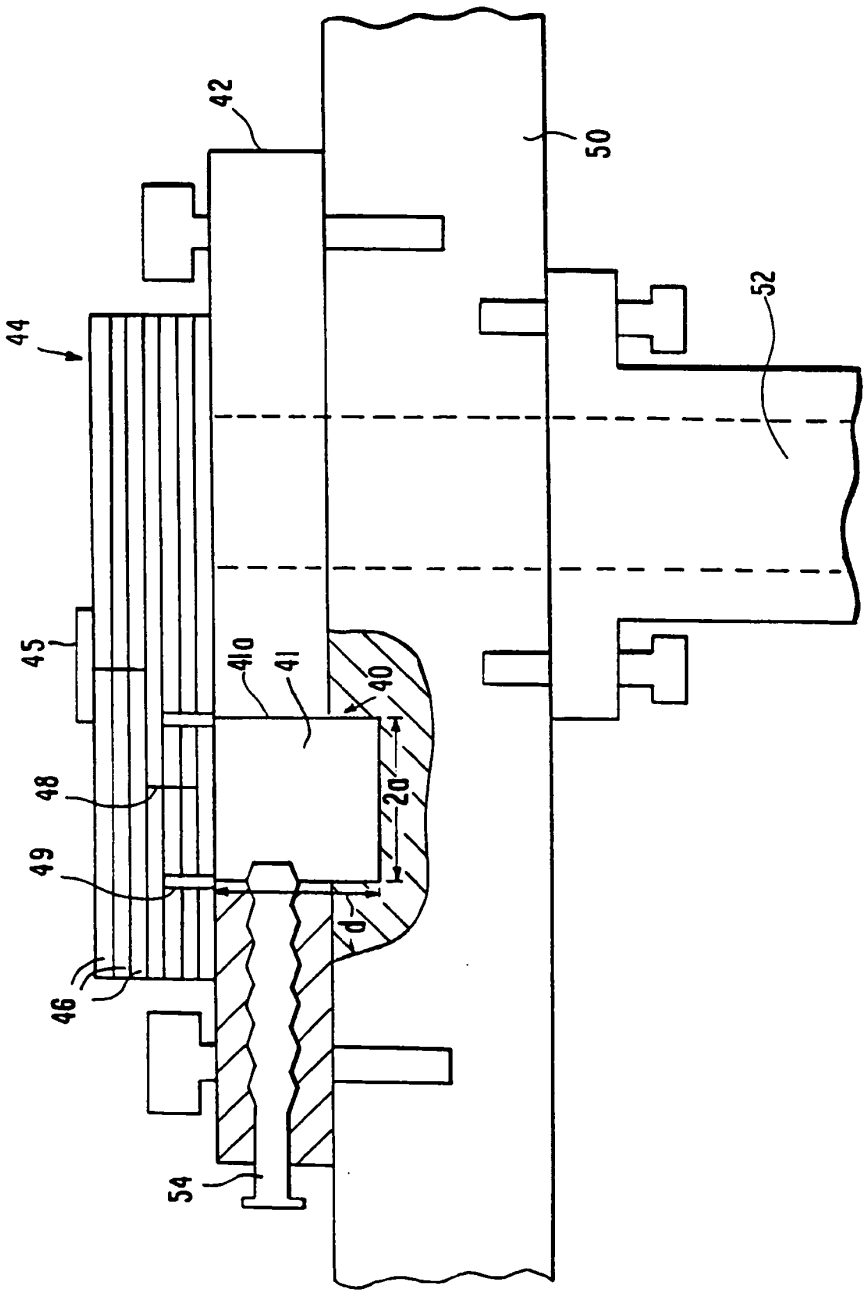


FIG. 2



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)
IPC 7 H01P

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

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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
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 ...al 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
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Form PCT/ISA/210 (patent family annex) (July 1992)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 November 2001 (15.11.2001)

PCT

(10) International Publication Number
WO 01/86880 A2

(51) International Patent Classification[7]: H04L 12/28, 12/56, H04B 7/005

(21) International Application Number: PCT/EP01/03950

(22) International Filing Date: 6 April 2001 (06.04.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0010983.5 5 May 2000 (05.05.2000) GB

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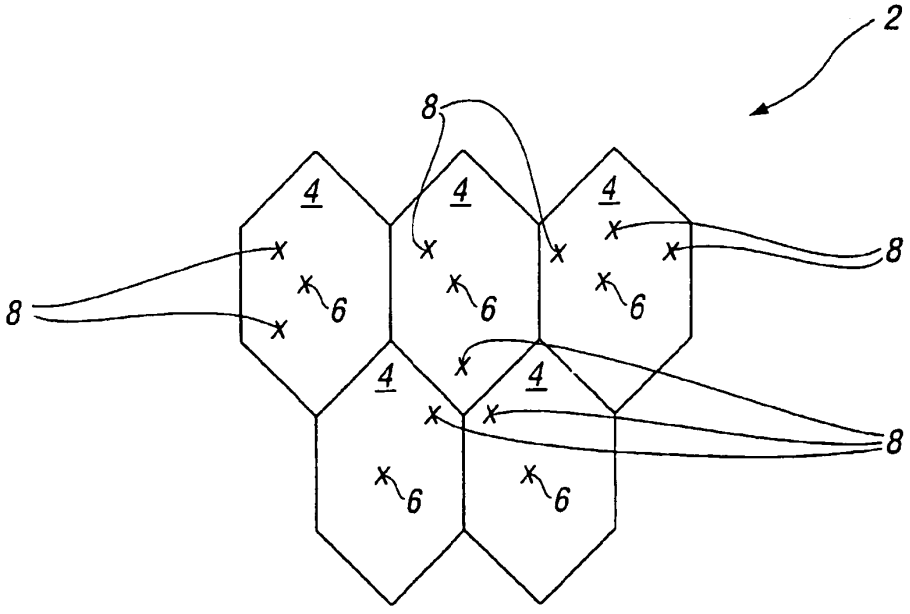
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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian 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).

[Continued on next page]

(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.

WO 01/86880 A2

Published:
— *without international search report and to be republished upon receipt of that 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.

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.

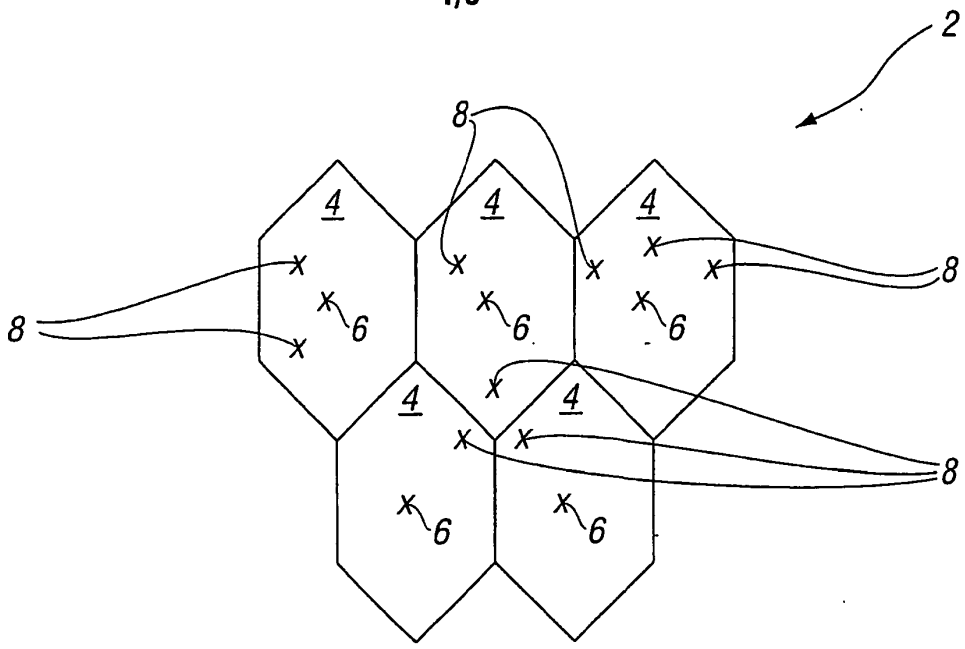

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FIG. 1

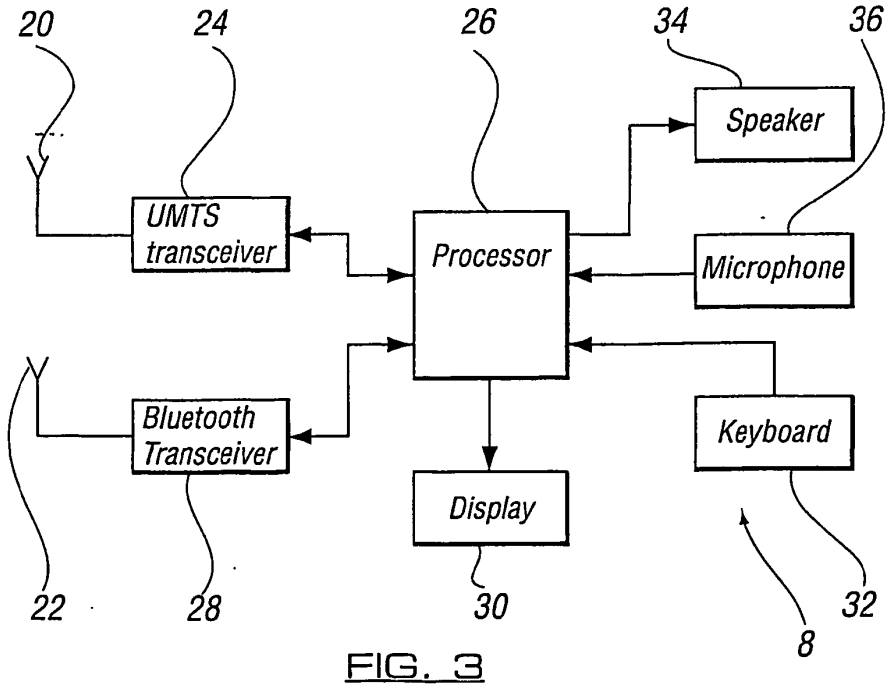

20
24
26
34
36
Speaker
UMTS transceiver
Processor
Microphone
Bluetooth Transceiver
Keyboard
Display
22
28
30
32
8

FIG. 3

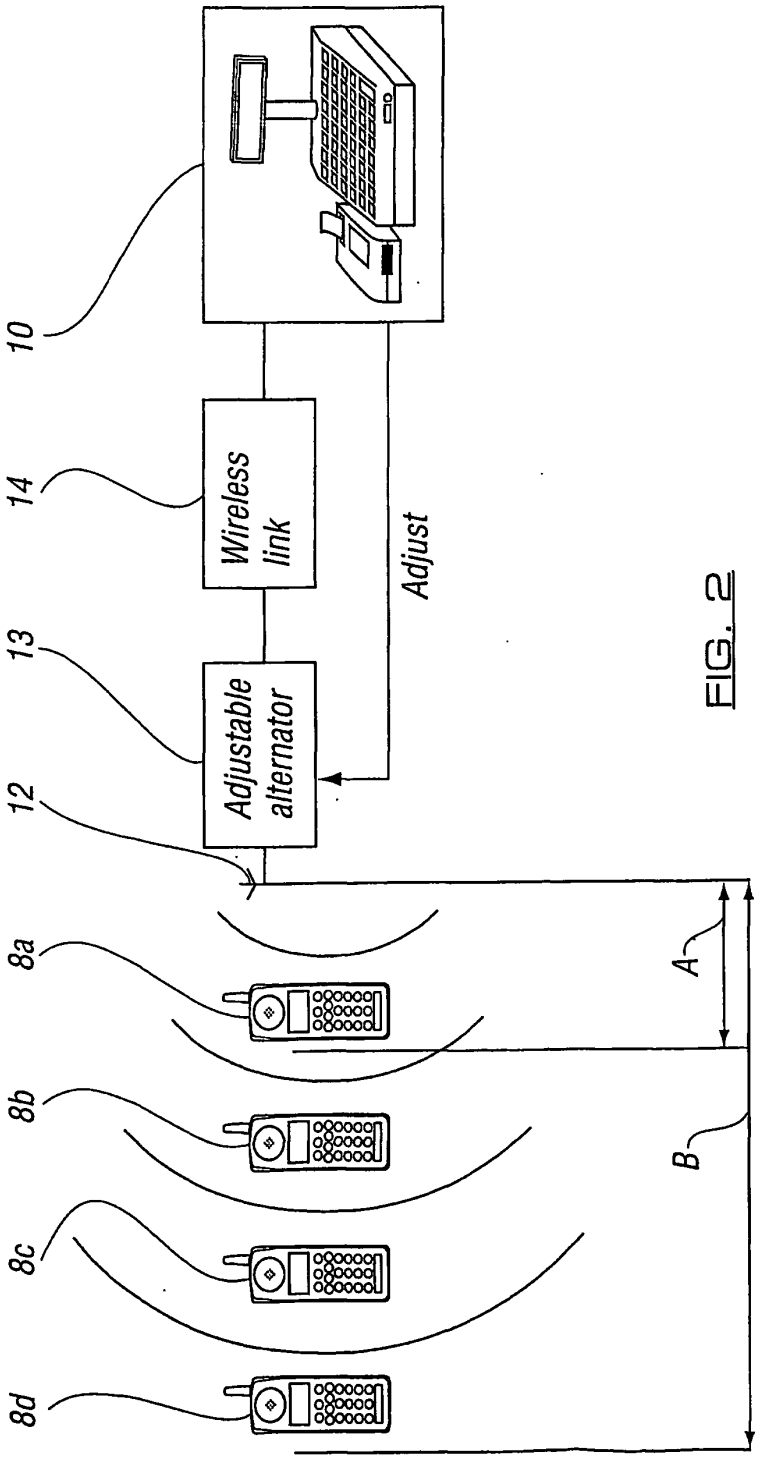

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14
Wireless link
13
Adjustable alternator
12
Adjust
8a
8b
8c
8d
A
B

FIG. 2

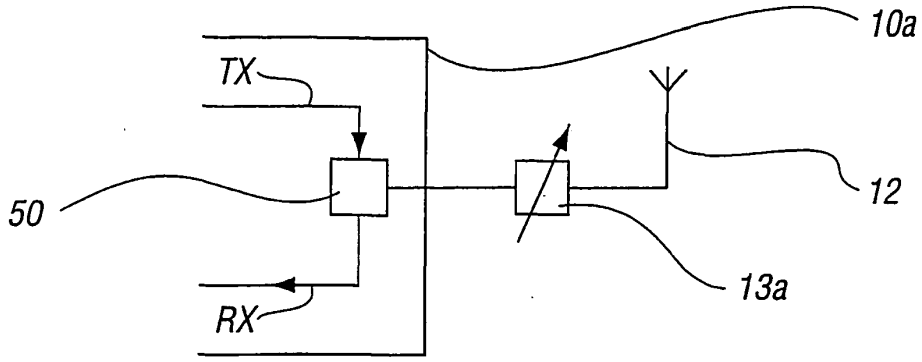


FIG. 4

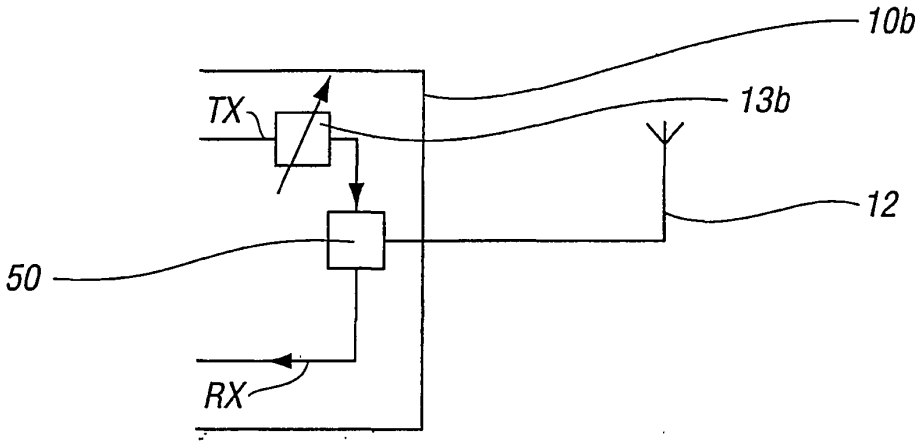


FIG. 5

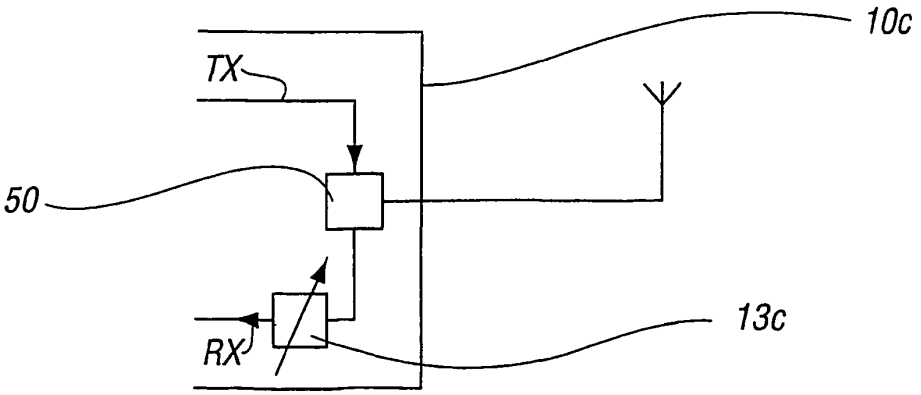


FIG. 6

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
22 November 2001 (22.11.2001)

PCT

(10) International Publication Number
WO 01/89251 A1

(51) International Patent Classification[7]: H04Q 7/38

(21) International Application Number: PCT/EP01/05306

(22) International Filing Date: 10 May 2001 (10.05.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0011913.1 17 May 2000 (17.05.2000) GB

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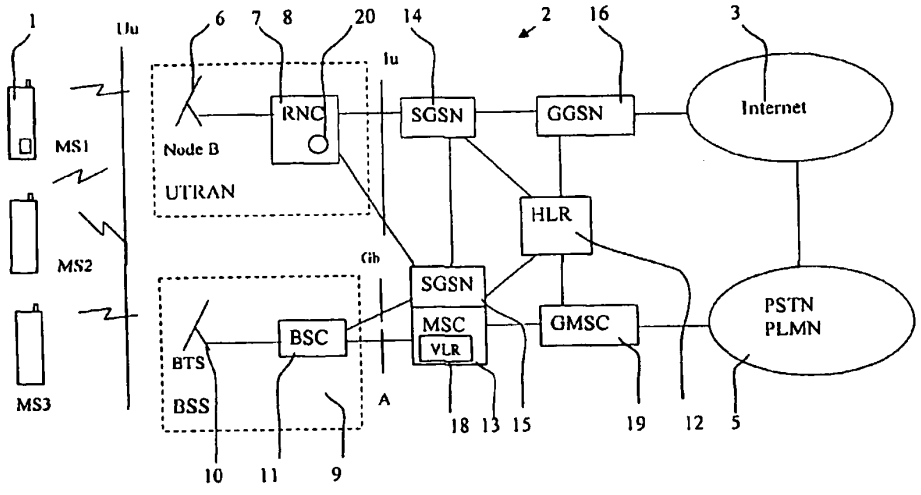
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian 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).

Published:
— *with international search report*

[Continued on next page]

(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.

WO 01/89251 A1

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

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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.

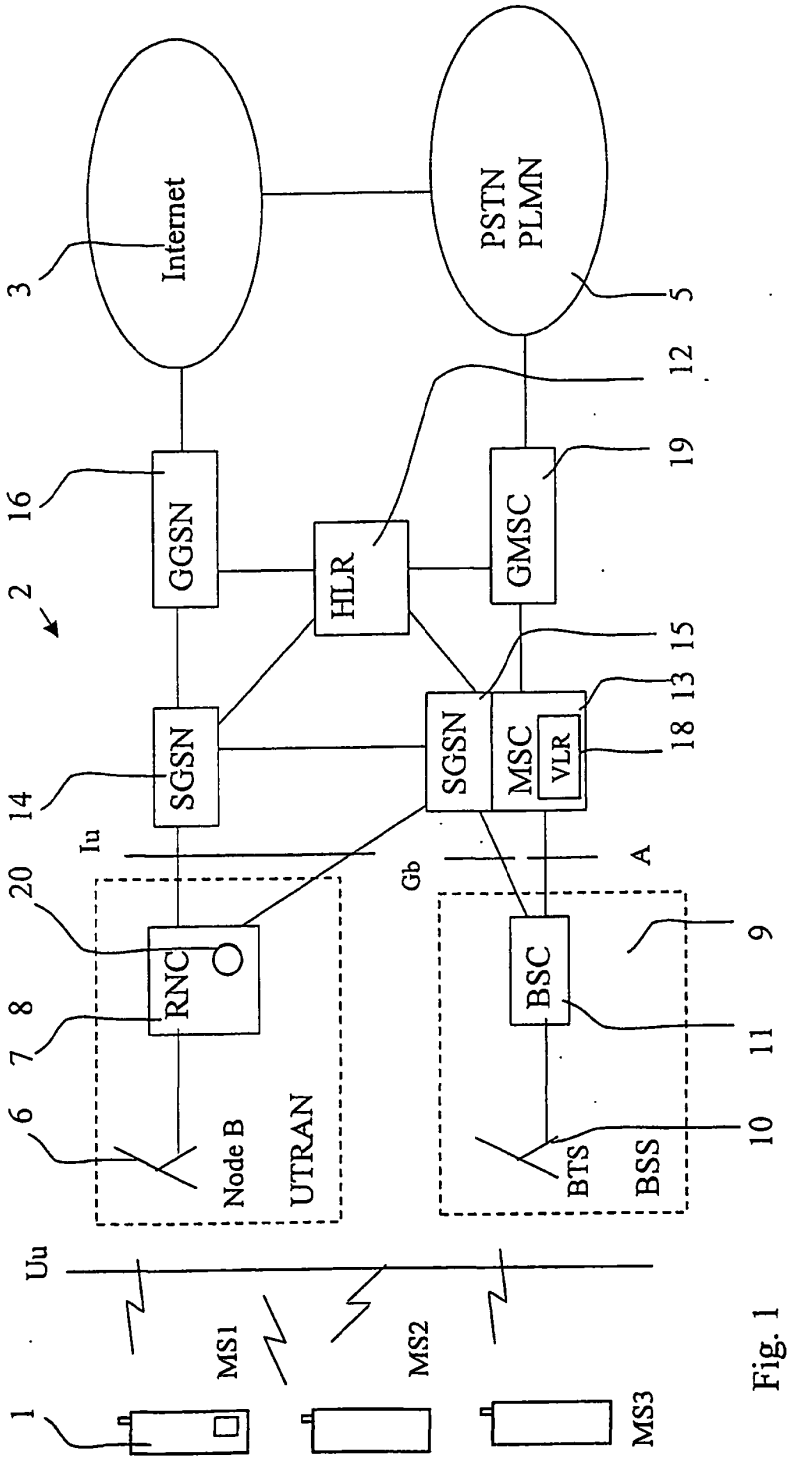

Internet
PSTN
PLMN
3
5
12
19
16
GGSN
HLR
GMSC
2
15
13
18
SGSN
MSC
VLR
14
Iu
Gb
A
20
RNC
BSC
9
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6
10
Node B
UTRAN
BTS
BSS
Uu
MS1
MS2
MS3
1

Fig. 1

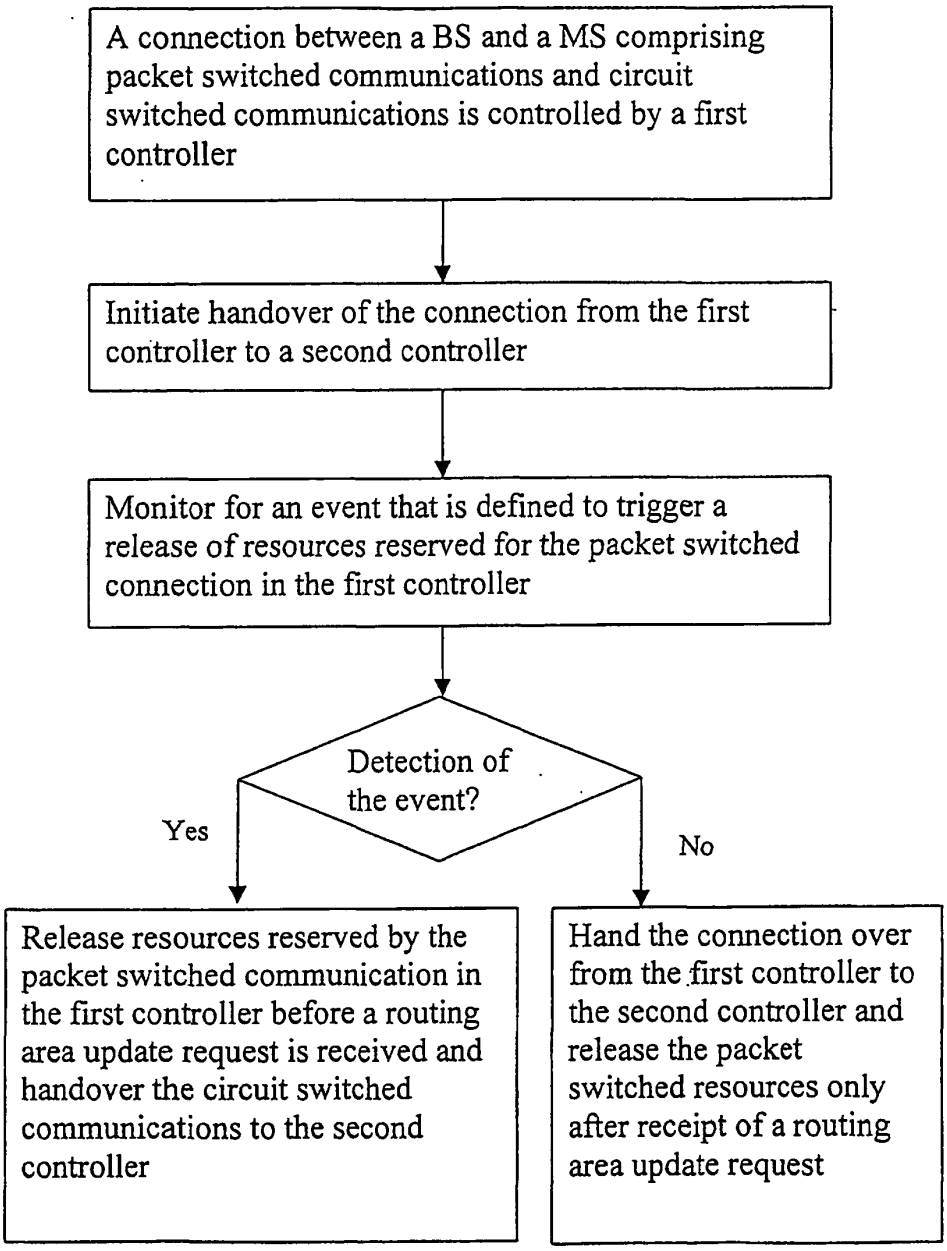

A connection between a BS and a MS comprising packet switched communications and circuit switched communications is controlled by a first controller
Initiate handover of the connection from the first controller to a second controller
Monitor for an event that is defined to trigger a release of resources 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

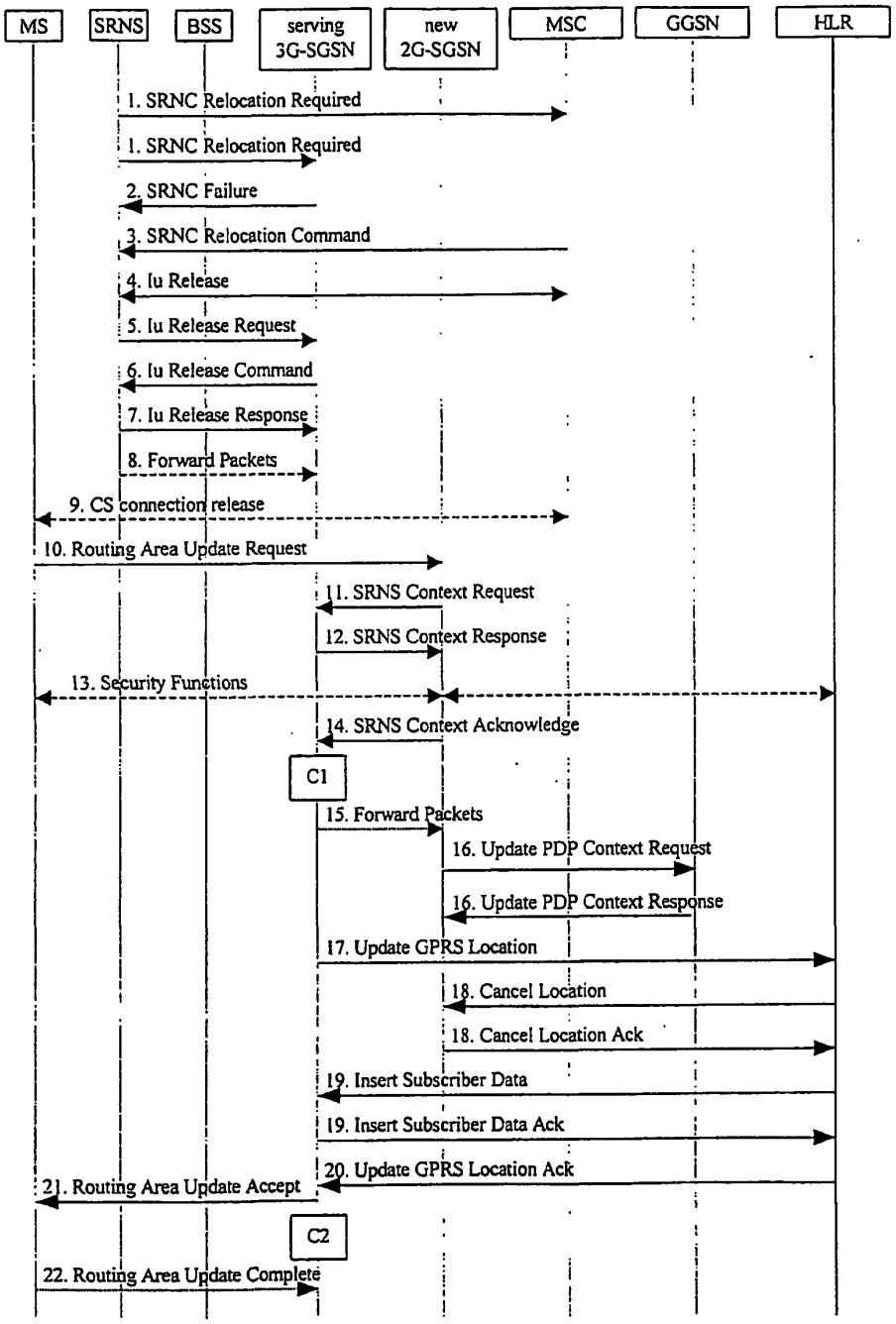

MS
SRNS
BSS
serving 3G-SGSN
new 2G-SGSN
MSC
GGSN
HLR
1. SRNC Relocation Required
1. SRNC Relocation Required
2. SRNC Failure
3. SRNC Relocation Command
4. Iu Release
5. Iu Release Request
6. Iu Release Command
7. Iu Release Response
8. Forward Packets
9. CS connection release
10. Routing Area Update 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

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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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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"P" document published prior to the international filing date but later than the priority date claimed

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

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 01/05306

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		EP 1021053 A2	19-07-2000

Form PCT/ISA/210 (patent family annex) (July 1992)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
10 January 2002 (10.01.2002)

PCT

(10) International Publication Number
WO 02/03718 A2

(51) International Patent Classification[7]: H04Q 7/00

(21) International Application Number: PCT/US01/11598

(22) International Filing Date: 10 April 2001 (10.04.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

09/546,207	10 April 2000 (10.04.2000)	US
09/546,208	10 April 2000 (10.04.2000)	US
09/709,716	13 November 2000 (13.11.2000)	US

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian 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).

Published:
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WO 02/03718 A2

(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

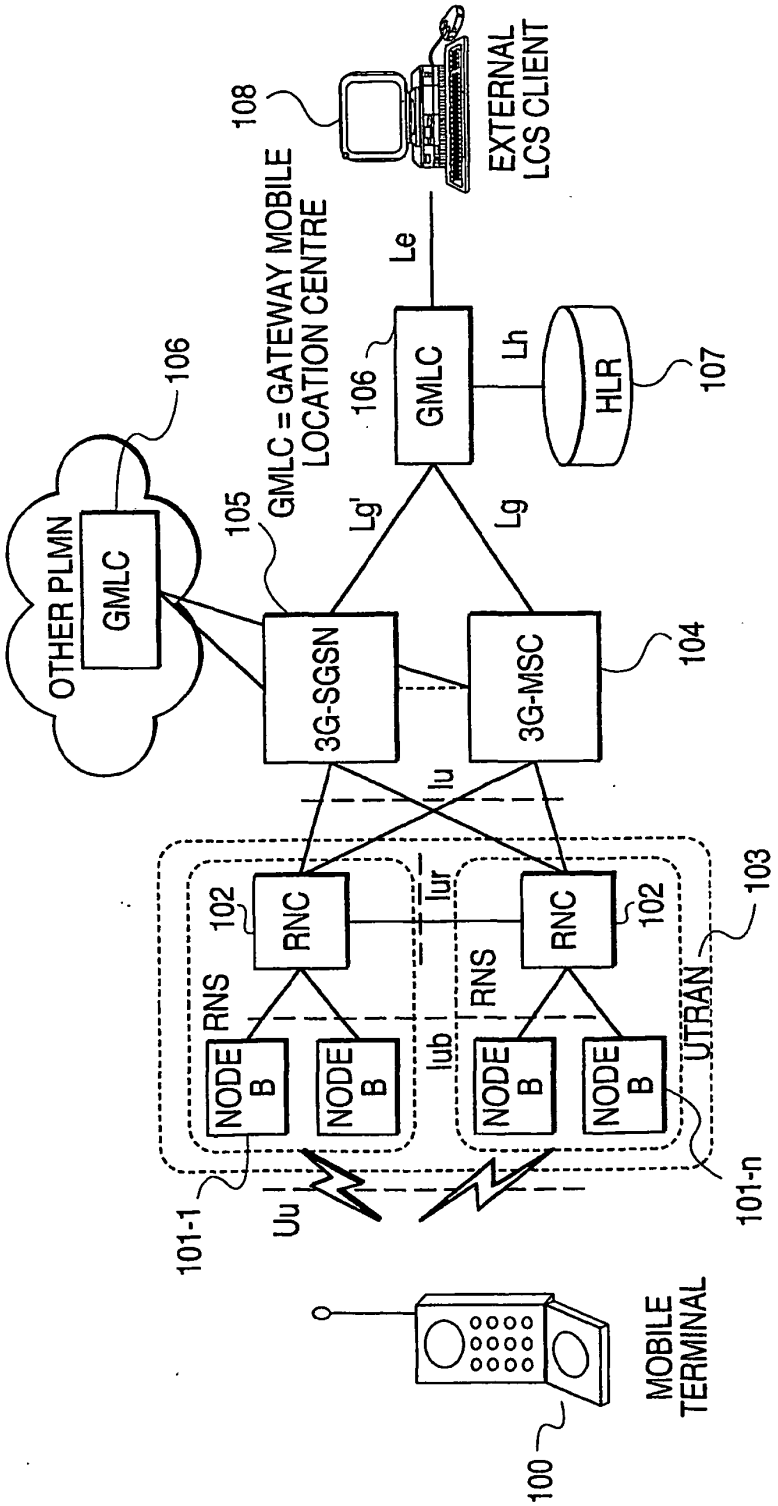

EXTERNAL LCS CLIENT
108
Le
GMLC = GATEWAY MOBILE LOCATION CENTRE
106
GMLC
Lh
HLR
107
OTHER PLMN
GMLC
106
105
Lg'
Lg
3G-SGSN
3G-MSC
104
Iu
Iur
RNC
102
RNC
102
103
RNS
RNS
Iub
NODE B
NODE B
NODE B
NODE B
UTRAN
101-1
Uu
101-n
MOBILE TERMINAL
100

FIG. 2

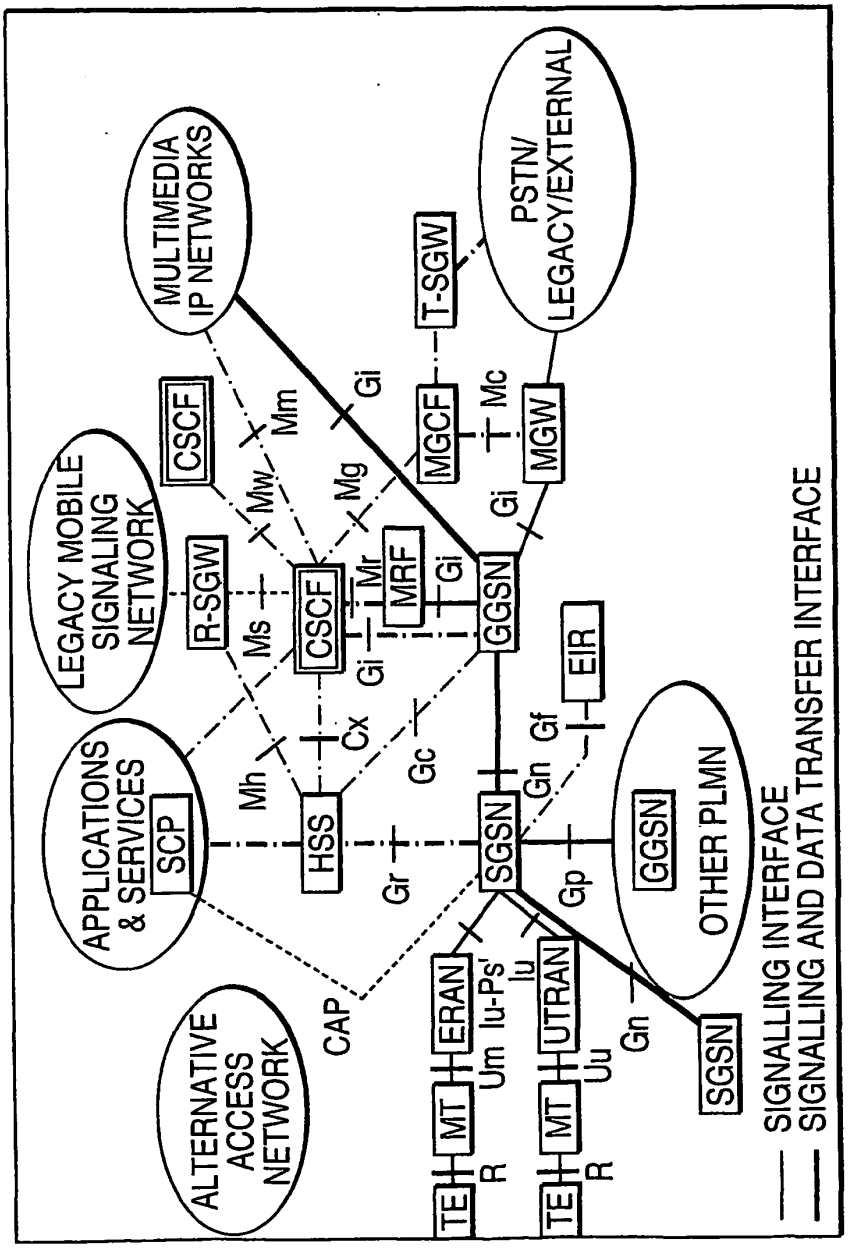

MULTIMEDIA IP NETWORKS
PSTN/ LEGACY/EXTERNAL
LEGACY MOBILE SIGNALING NETWORK
APPLICATIONS & SERVICES
ALTERNATIVE ACCESS NETWORK
OTHER PLMN
CSCF
T-SGW
MGCF
MGW
R-SGW
MRF
GGSN
EIR
SCP
HSS
SGSN
ERAN
UTRAN
MT
TE
CAP
Gi
Mm
Mw
Mg
Mc
Ms
Mr
Mh
Cx
Gc
Gr
Gn
Gf
Gp
Um
Iu-Ps'
Iu
Uu
R
SIGNALLING INTERFACE
SIGNALLING AND DATA TRANSFER INTERFACE

FIG. 3

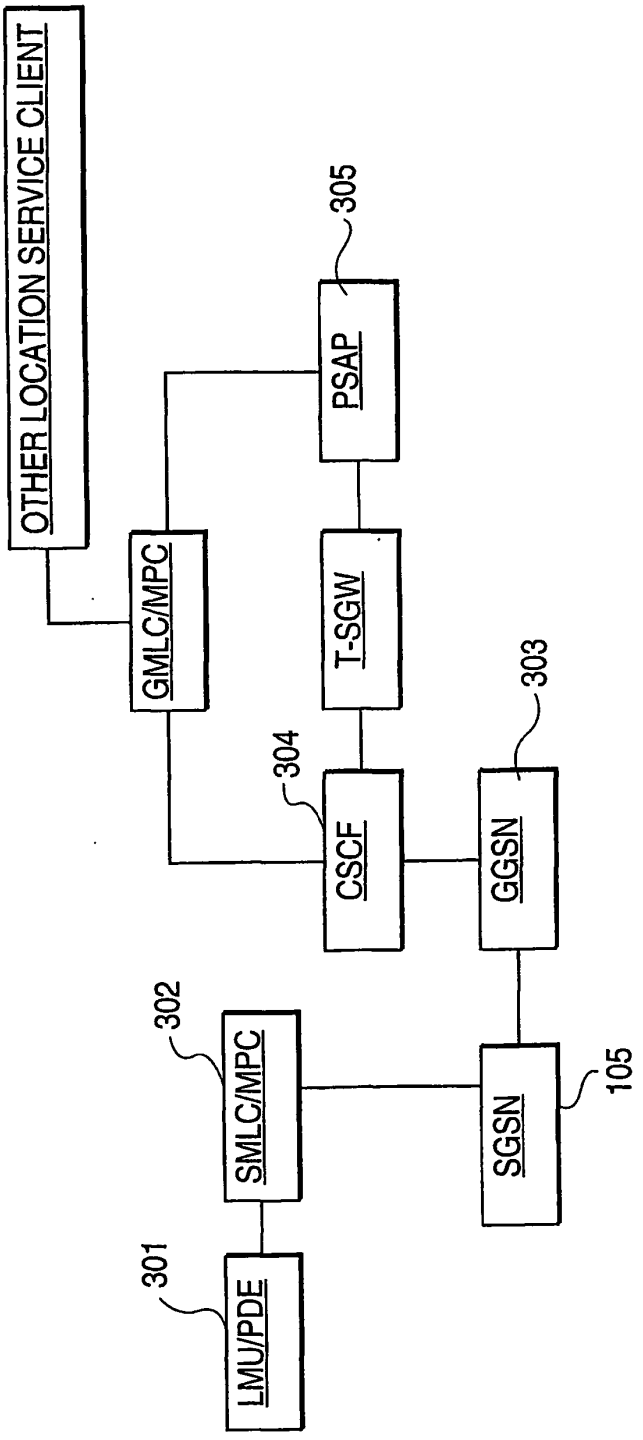

OTHER LOCATION SERVICE CLIENT
305
PSAP
GMLC/MPC
T-SGW
303
304
CSCF
GGSN
302
SMLC/MPC
SGSN
105
301
LMU/PDE

FIG. 4

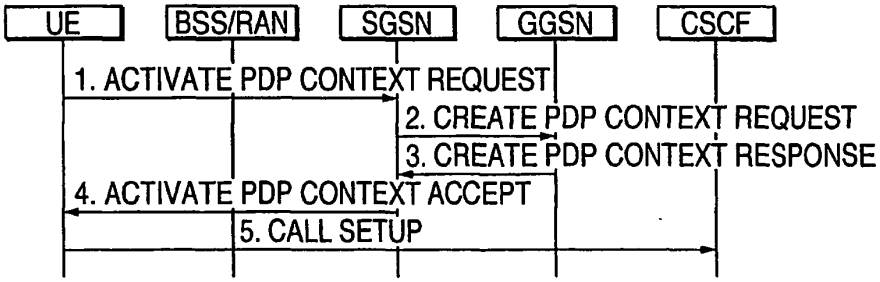

UE
BSS/RAN
SGSN
GGSN
CSCF
1. ACTIVATE PDP CONTEXT REQUEST
2. CREATE PDP CONTEXT REQUEST
3. CREATE PDP CONTEXT RESPONSE
4. ACTIVATE PDP CONTEXT ACCEPT
5. CALL SETUP

FIG. 5

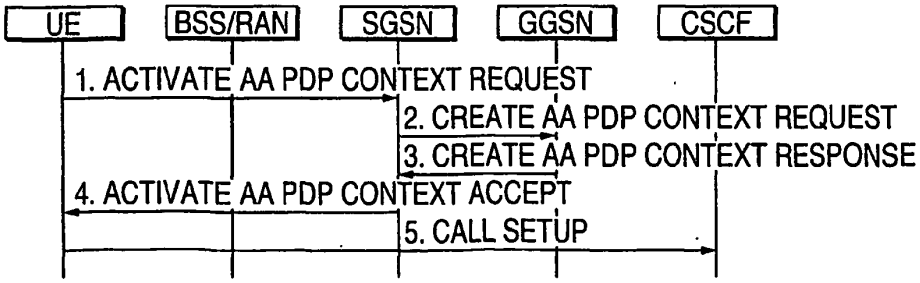

UE
BSS/RAN
SGSN
GGSN
CSCF
1. ACTIVATE AA PDP CONTEXT REQUEST
2. CREATE AA PDP CONTEXT REQUEST
3. CREATE AA PDP CONTEXT RESPONSE
4. ACTIVATE AA PDP CONTEXT ACCEPT
5. CALL SETUP

FIG. 6

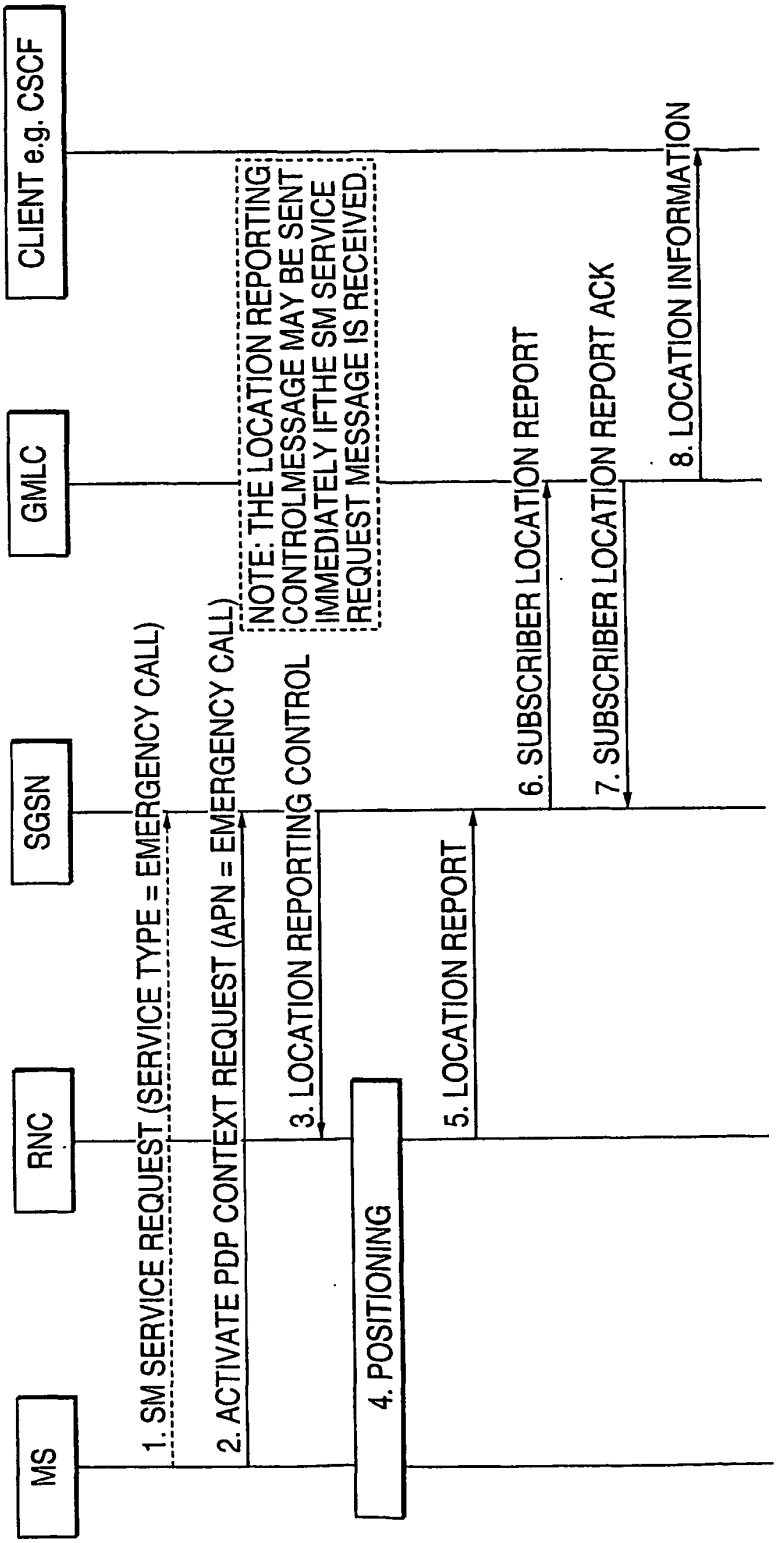

MS
RNC
SGSN
GMLC
CLIENT e.g. CSCF
1. SM SERVICE REQUEST (SERVICE TYPE = EMERGENCY CALL)
2. ACTIVATE PDP CONTEXT REQUEST (APN = EMERGENCY CALL)
3. LOCATION REPORTING CONTROL
NOTE: THE LOCATION REPORTING CONTROLMESSAGE MAY BE SENT IMMEDIATELY IFTHE SM SERVICE REQUEST MESSAGE IS RECEIVED.
4. POSITIONING
5. LOCATION REPORT
6. SUBSCRIBER LOCATION REPORT
7. SUBSCRIBER LOCATION REPORT ACK
8. LOCATION INFORMATION

FIG. 7

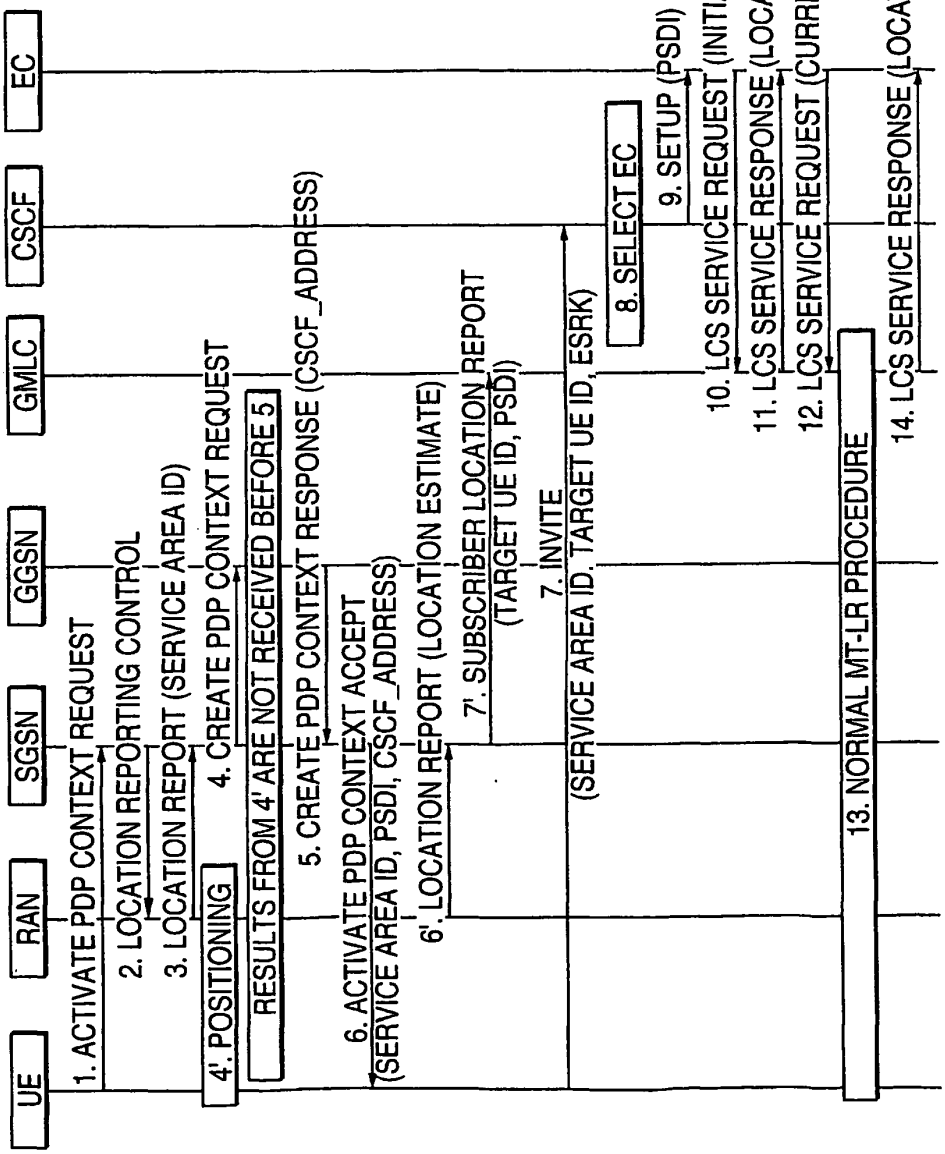

UE
RAN
SGSN
GGSN
GMLC
CSCF
EC
1. ACTIVATE PDP CONTEXT REQUEST
2. LOCATION REPORTING CONTROL
3. LOCATION REPORT (SERVICE AREA ID)
4'. POSITIONING
4. CREATE PDP CONTEXT REQUEST
RESULTS FROM 4' ARE NOT RECEIVED BEFORE 5
5. CREATE PDP CONTEXT RESPONSE (CSCF_ADDRESS)
6. ACTIVATE PDP CONTEXT ACCEPT (SERVICE 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

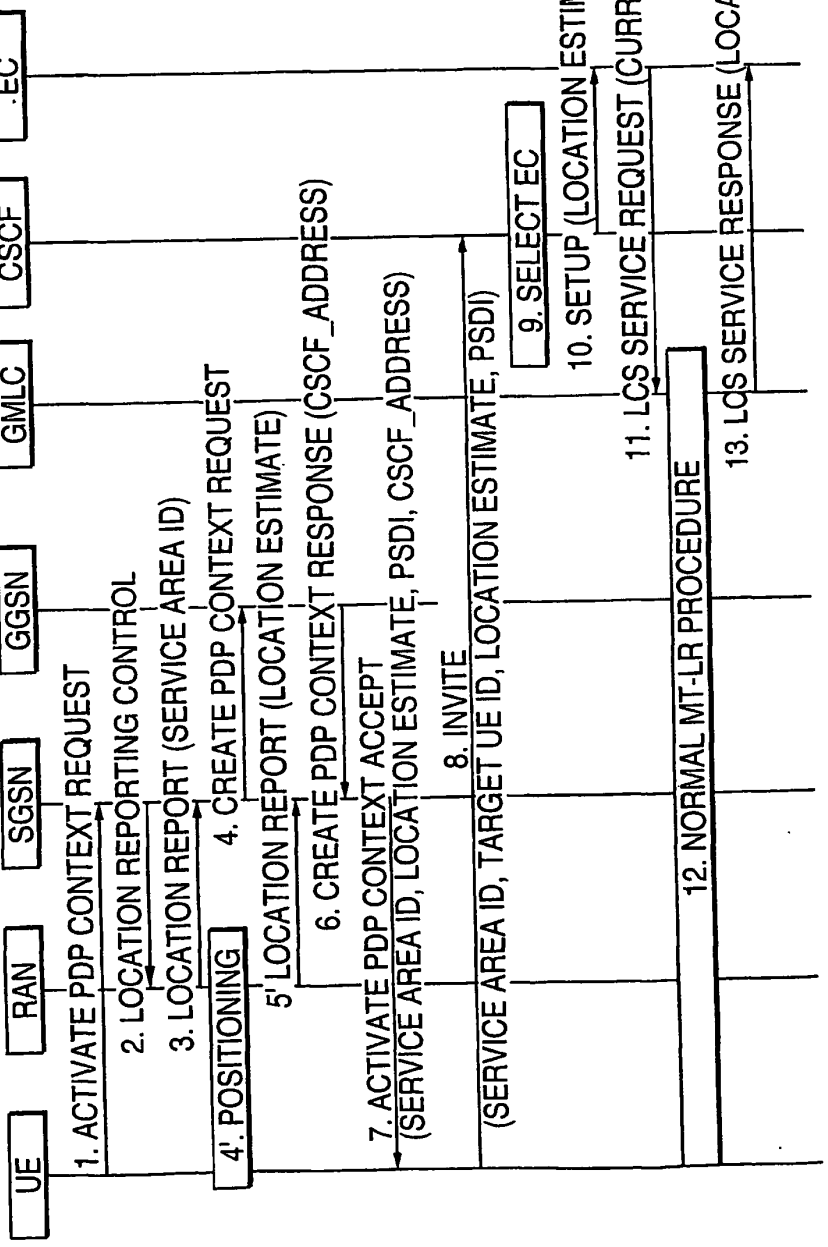

UE
RAN
SGSN
GGSN
GMLC
CSCF
EC
1. ACTIVATE PDP CONTEXT REQUEST
2. LOCATION REPORTING CONTROL
3. LOCATION REPORT (SERVICE AREA ID)
4' POSITIONING
4. CREATE PDP CONTEXT REQUEST
5' LOCATION REPORT (LOCATION ESTIMATE)
6. CREATE PDP CONTEXT RESPONSE (CSCF_ADDRESS)
7. ACTIVATE PDP CONTEXT ACCEPT (SERVICE AREA 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

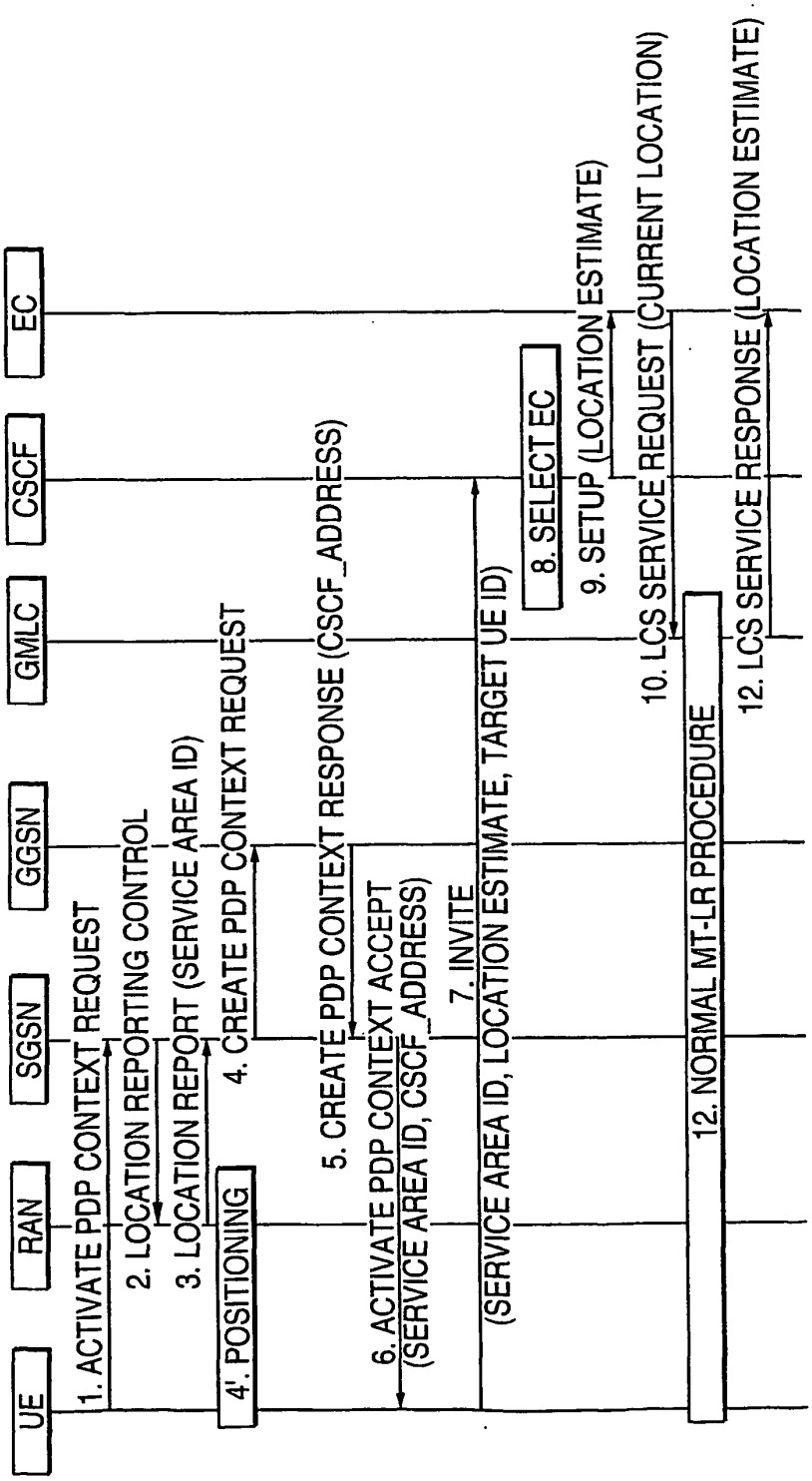

UE
RAN
SGSN
GGSN
GMLC
CSCF
EC
1. ACTIVATE PDP CONTEXT REQUEST
2. LOCATION REPORTING CONTROL
3. LOCATION REPORT (SERVICE AREA ID)
4'. POSITIONING
4. CREATE PDP CONTEXT REQUEST
5. CREATE PDP CONTEXT RESPONSE (CSCF_ADDRESS)
6. ACTIVATE PDP CONTEXT ACCEPT (SERVICE AREA ID, CSCF_ADDRESS)
7. INVITE (SERVICE 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

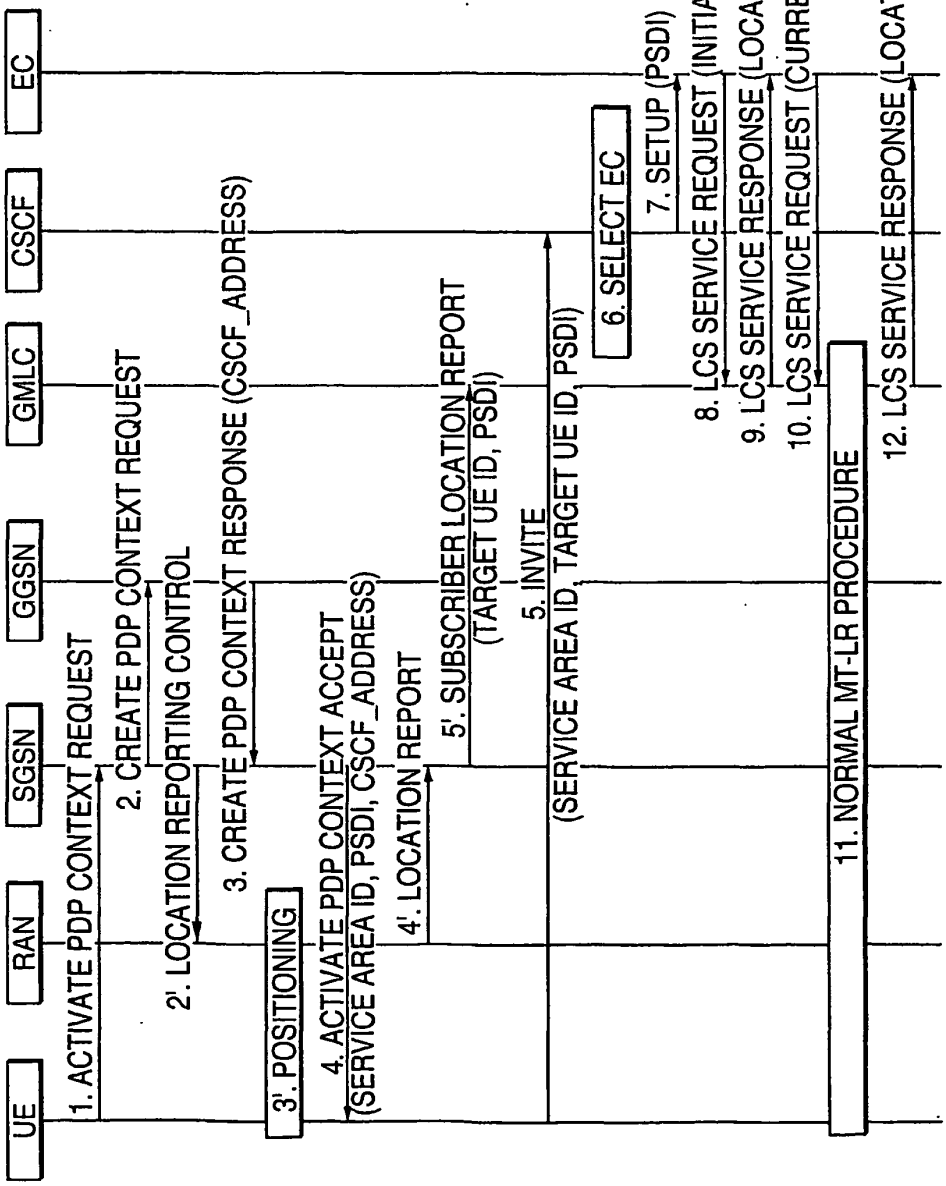
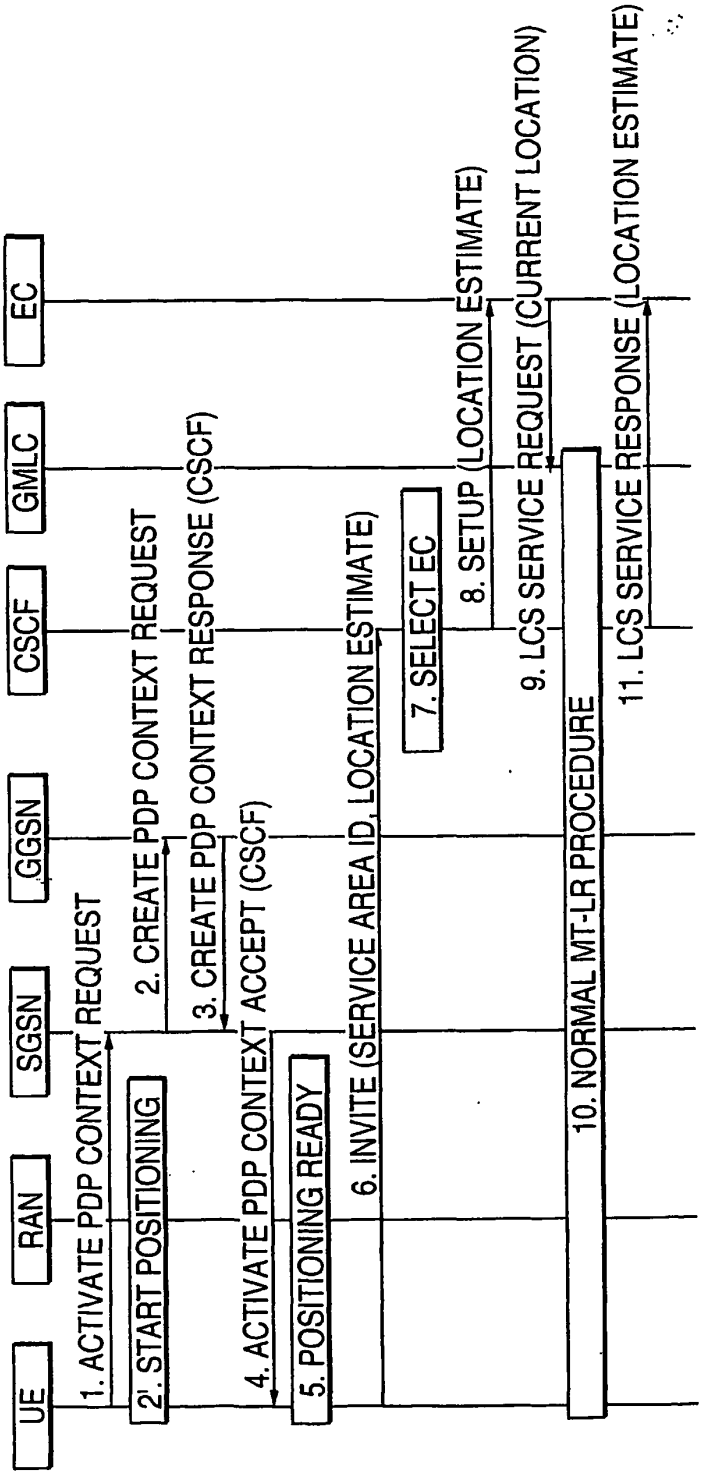

UE
RAN
SGSN
GGSN
GMLC
CSCF
EC
1. ACTIVATE PDP CONTEXT REQUEST
2. CREATE PDP CONTEXT REQUEST
2'. LOCATION REPORTING CONTROL
3. CREATE PDP CONTEXT RESPONSE (CSCF_ADDRESS)
3'. POSITIONING
4. ACTIVATE PDP CONTEXT ACCEPT (SERVICE AREA ID, PSDI, CSCF_ADDRESS)
4'. LOCATION REPORT
5'. SUBSCRIBER LOCATION REPORT (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. CREATE PDP CONTEXT REQUEST
3. CREATE PDP CONTEXT RESPONSE (CSCF)
4. ACTIVATE PDP CONTEXT ACCEPT (CSCF)
2'. START POSITIONING
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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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04Q 7/30, 7/38

A2

(11) International Publication Number: **WO 99/07170**

(43) International Publication Date: 11 February 1999 (11.02.99)

(21) International Application Number: PCT/FI98/00607

(22) International Filing Date: 31 July 1998 (31.07.98)

(30) Priority Data:
973169 31 July 1997 (31.07.97) FI

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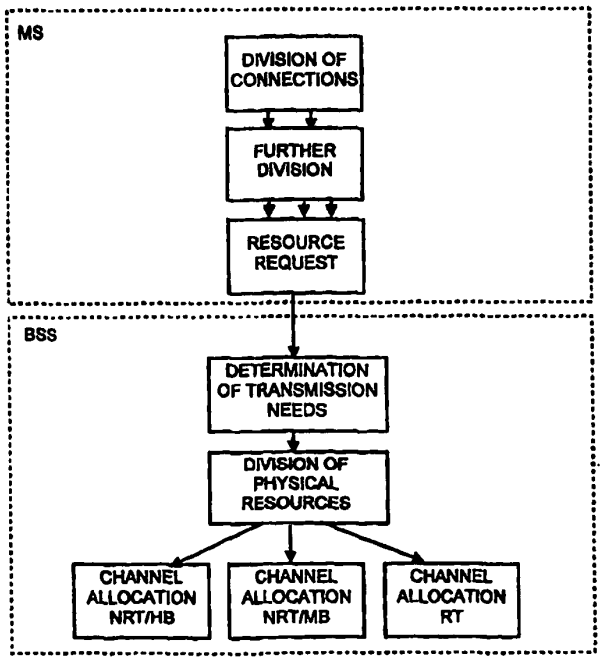
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian 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), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
Without international search report and to be republished upon receipt of that report.

(54) Title: METHOD OF CONTROLLING COMMUNICATION RESOURCES

(57) Abstract

According to the method of the invention, connections are divided into at least two different connection classes according to their requirements for transmission delay. The control system of the base station subsystem maintains a record of the transmission needs of the users logged in different categories and based thereon divides the available radio resources into slots of suitable capacity. For connections with stringent requirements for transmission delay, circuit–switched connections are allocated with a bandwidth which can be controlled dynamically. Then from the resource pool still unassigned after the resource allocation to the circuit–switched connections, a sufficient amount of resources are allocated on a time–limited basis allocation for each allocation period to connections having a higher tolerance for delay so as to accomplish transmission, e.g. of a given amount of data.



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Method of controlling communication resources

Scope of the Invention

The present invention relates to a method of controlling communication resources in a communication system, particularly a mobile telephone system.

Background of the Invention

In communication systems such as mobile telephone systems, the system possesses a given capacity of information transfer resources that can be used for establishing connections to the system users. The different types of connections requested by users have widely varying requirements in information transmission quality. For instance, while a voice signal is rather tolerant of transmission errors, it is virtually intolerant of transmission delay. On the other hand, program files to be transferred from one computer to another must not contain a single transfer error, whereas their transfer is fairly tolerant of transmission delay.

Broadly speaking, information transfer techniques can be categorized into circuit-switched and packet-switched methods. In circuit-switched networks, certain continuous communication resources which are deallocated only at the release instant of the user circuit are allocated for the use of the connection during the establishment step of the connection. By contrast, a plurality of different packet-switching communication protocols in the technology of packet-switched networks are known, whereby the connection established between terminal equipment and a base station is not continuous, but the information is carried instead in the form of packets with sequential transmission which have separating intervals of varying duration. Here, one benefit over circuit-switched networks is attained in that the radio resources required for a given connection are not needlessly reserved when a temporary pause occurs in the information transfer.

In packet-switched networks, the packets serving the information transfer of a number of separate connections utilize the same communication resources which can perform the transmission of a single packet at a time. As a result, the packets must queue for their allocated transmission position in the packet transmission sequence, which causes a greater transmission delay in packet-switched networks than in circuit-switched

networks. Generally speaking, it can be said that a circuit-switched connection is advantageously used for connections requiring a short transmission delay, such as voice signals, while a packet-switched network is suitable for connections tolerant of longer transmission delays.

For optimal service of connections of different types, the system should have a dual capability of both flexibly forming short-delay circuit-switched connections and simultaneously serving packet-switched connections with maximum utilization of information transfer resources. One conventional system capable of establishing both circuit-switched and packet-switched connections is a GPRS (General Packet Radio System) system adapted to operate in conjunction with a GSM (Global System for Mobile Communications) system. Here, the resources are allocated both permanently and dynamically between the two systems, whereby the resources allocated to the GSM system are used for establishing circuit-switched connections and the GPRS system resources serve packet-switched connections. However, if the GSM system does not occupy the channel defined by the allocated time slot, due for instance to a silent interval in the voice communication, the unused capacity of the channel cannot be utilized by the GPRS system.

Finnish patent application no. FI 964308, which at the filing date of the present application has not yet been disclosed to the public, is for a method of dividing the resources of the radio communication channel between the base station and the terminal equipment into frames which may be further subdivided into smaller units. Each frame has a two-dimensional structure. The first level of frame subdivision is based on time, which means that each frame is given a certain time duration which may be further subdivided into consecutive time slots. In a preferred embodiment of the invention, each frame contains a constant number of time slots, but the allocation of the time slots may vary from one frame to another. The second level of frame subdivision is based on time, frequency, or code. If the second subdivision level is also time-based, each time slot of a frame is further subdivided into smaller slots. If the second level of frame subdivision is frequency-based, the frame as a whole reserves a given frequency band, from which narrower sub-bands, or frequency channels, can be allocated for each time slot of a frame. When the performance of the second level of frame subdivision is code-based, a certain number of mutually orthogonal

codes are allocated to each time slot. Obviously, it is possible when so required to subdivide the slots obtained by division according to two of these subdivision variables into yet smaller allocation units on the basis of the third subdivision variable. The smallest resource unit that can be allocated from a given frame is called a slot, and an individual slot is always allocated for the sole use of a given connection.

Figure 1 shows a variation of a two-dimensional frame according to prior art. As noted above, the first dimension of the frame is time, while the other dimension may be time, frequency or code. In the case of Figure 1, the second subdivision of the frame is either time-based or code-based. The size of the frame in both dimensions must be so determined that the frame meets all other specifications of the system. In the illustrated example, the duration of the frame on the time scale is about 4.615 milliseconds, which is time-divided into eight time slots, each time slot reference numeral 15 having a duration of about 0.577 ms. The frequency bandwidth of the frame is about 1.6 MHz. When the second subdivision is time-based, the smallest contiguous units, or slots, of the frame have a bandwidth of 1.6 MHz, whereby their duration on the time scale may be 0.577 ms, or alternatively 0.114 ms. Reference numeral 16 designates a larger slot with dimensions 0.577 ms x 1.6 MHz, and reference numeral 17 designates a smaller slot with dimensions 0.114 ms x 1.6 MHz. When the second subdivision is code-based, the slots have a bandwidth of 1.6 MHz with 0.577 ms duration, but varying types of codes are used in the different slots. When code type 1 is used, the time slot can be allocated to only one connection at a time. When code type 2 is used, the same time slot can be utilized by four connections simultaneously. Because the use of a code increases the amount of information to be transferred, the overall quantity of information transferable by code type 2 remains smaller than with code type 1.

Resource allocation using the prior art techniques described above offers efficient facilities for serving the needs of connections of different types. However, there is no known method capable of controlling the allocation of communication resources such as radio resources in a sufficiently flexible and dynamic manner between connections having different requirements.

The object of the present invention is to fulfill this need by means of a method and apparatus described in the appended independent claims.

Summary of the Invention

The purpose of the invention is to form various kinds of communication services for different types of connections, optimally using a common communication resource.

In the method of the invention, connections are divided into at least two different connection classes according to their requirements for transmission delay. The control system of the base station subsystem maintains a record of the transmission needs of the users logged in the different categories and divides the available radio resources into slots of suitable capacity on the basis of this recorded information.

For connections with stringent requirements regarding transmission delay, circuit-switched connections are allocated with a bandwidth which can be controlled dynamically. Then, from the resource pool still unassigned after resource allocation to the circuit-switched connections, a sufficient amount of resources per allocation period are allocated on a time-limited basis to connections having a higher tolerance for delay so as to accomplish transmission, such as the transmission of a given amount of data. The allocation period comprises one or more time frames. Resources in the different transmission directions are allocated independently of each other.

According to one embodiment, the class of connections with a higher tolerance for delay is further divided into at least two subclasses according to the quantity of information to be transferred. For connections requiring only low volumes of information, a traffic channel is allocated for a limited time which is sufficient to transmit a given amount of data. For connections requiring the transference of high volumes of information a reservation identity RID is allocated. The RID is then used to signal the allocation of communications resources of subsequent allocation periods.

Brief Description of the Drawings

The invention is described in greater detail with reference to the appended drawings in which

Figure 1 shows a method for dividing the communication resources into slots according to prior art;

Figure 2 shows a protocol arrangement capable of implementing the functionality requirements according to the invention;

Figure 3A, 3B and 3C
each show a reservation table of a time frame,

Figure 4 shows signaling transfer for the allocation of radio resources for an uplink real time connection;

Figure 5 shows signaling transfer for the allocation of radio resources for a downlink real time for;

Figure 6 shows signaling transfer for the allocation of radio resources for an uplink non-real time for for a high bit rate;

Figure 7 shows signaling transfer for the allocation of radio resources for a downlink non-real time for for a high bit rate;

Figure 8 shows signaling transfer for the allocation of radio resources for an uplink non-real time for for a medium bit rate;

Figure 9 shows signaling transfer for the allocation of radio resources for a downlink non-real time for for a medium bit rate;

Figure 10 shows the functions needed for controlling the communications resources in the uplink direction; and

Figure 11 shows the functions needed for controlling the communications resources in the downlink direction.

Detailed Description of the Invention

We shall now study an exemplary implementation of the invention. Here, the invention is described in connection with the slot structure shown in Figure 1. It must, however, be noted that the use of the method according to the invention is not limited to this application. The only restriction of the invention is that the resources are divisible into slots, the smallest allocable units, and that there are at least two sizes of slots. The division of communications resources is not necessarily according to time, such as shown in Figure 1. Another example of possible division is code-frequency division.

First, a preferred protocol arrangement capable of implementing the functionality requirements according to the invention is discussed. Referring to Figure 2, a protocol stack is shown controlling the traffic at the radio interface of a mobile telephone system. Implemented in a base station system BSS and a mobile station MS, the diagram illustrates the physical layer L1 (Layer 1), the link layer L2 formed by the RLC/MAC (Radio Link Control/Medium Access Control) and LLC (Logical Link Control) sublayers, and the network layer L3. While a number of other layers above the network

layer are defined, their detailed discussion can be omitted here as irrelevant to the present invention.

The physical layer encodes, interleaves, and modulates the signal to be sent on the radio path. Respectively, the same layer disassembles the modulation, interleaving and channel coding of the received signal which has been transmitted over the radio path.

The MAC sublayer above the physical layer performs the control and allocation of radio resources with the required signaling, as well as the mapping of the logical channels on the physical channels. The control of the radio resources takes place in the base station subsystem located on the fixed network side.

The RLC unit, which is assigned on a per connection basis for each connection separately within the MAC layer, serves to maintain the quality of service (QoS) negotiated for the connection. In order to maintain quality at the negotiated level, the RLC unit selects for the connection a correct transmission format (RT/NRT) which contains error correction, the selection of the depth of the interleave and modulation method, as well as the control of retransmission for defective frames.

LLC establishes over the radio path a logical connection which utilizes the services offered by the underlying RLC/MAC layer. From the information received from the overlying layers as a result of transmission over the radio path, LLC forms LLC frames suitable for forwarding by the RLC layer, and in the opposite direction, LLC respectively combines the information carried over the radio path by the RLC layer in LLC frames into a format suitable for forwarding to the overlying layers.

We shall next study the layer 2 functions and especially the RLC/MAC layer more closely.

The overall layer 2 function is to realize radio bearers for layer 3 connections with respect to their QoS objectives. The first radio bearer, called the initial radio bearer, is mainly used to transport the radio network layer (RNL) signaling, plus any messages destined for the core network. Other radio bearers are used to transport user data and network signaling. The initial radio bearer is maintained as long as other radio bearers have data to transfer. It is the last one to be released.

The set-up procedure of the initial radio bearer is triggered by layer 3, either after the reception of a paging message or when the MS has a

message for the core network on the mobile station side. This procedure is different from the one used to establish other radio bearers in that the set-up request is sent on a common uplink channel in the format of a short burst, the timing advance being unknown. The network allocates in return an MAC level identity to the MS. The procedure deals with collision, and layer 3 resolves contention between mobiles in order to guarantee that the MAC level identity is allocated to one and only one mobile. The MAC level identity is retained as long as the initial radio bearer is maintained. It is valid inside a given cell and has to be exchanged at each intercell cell handover.

The messages used to establish other radio bearers are layer 3 messages transported on the initial radio bearer.

Although RLC/MAC has been defined as one layer which has one interface to the physical layer and one interface to the LLC layer, functions of the RLC part and MAC part can be separated. Therefore, layer 2 is composed of three types of protocol entities. The LLC and RLC entities are created in connection with a radio bearer and their function is to guarantee the negotiated QoS for the connection using the radio bearer. The mobile MAC and network MAC entities are shared by all the radio bearers and their main task is to split the radio resource dynamically between the bearers.

Each time a radio bearer is established, two RLCs (one in the MS and one in the network) are created by the management plane to handle the Service Data Unit SDU coming from the LLCs connected with the bearer. Their operating parameters are selected as a function of the QoS to be provided. The first task of the RLCs is to segment the SDU coming from the LLC. The second task is to meet the QoS objectives that were assigned to them. For this purpose, they have elaborate control mechanisms at their disposal in order to deal with fluctuations in radio link quality.

The RLC protocol is located in the BSS and the mobile station. It has two operating modes, the first one to cater for real time connections requiring a short transmission delay and the second one to cater for non-realtime connections having a higher tolerance for transmission delay. The RT mode employs power control and link adaptation mechanisms. The NRT mode uses power control and retransmission procedures.

In the RT mode, the source RLC is in charge of splitting the LLC flow to the traffic channels (TCHs) allocated to the radio bearer. The RLC deals with link adaptation and therefore signals resource change requests to

MACs in order to adapt to traffic or radio link quality variations. The transmission format (channel coding, interleaving, and modulation) for the bearer is selected from among a limited set of options. The actual coding rate can, however, be adjusted separately for each TCH. The RLC segments the LLC data into RLC PDUs in accordance with the transmission format, optionally computes a CRC (Cyclic Redundancy Code), and then delivers the PDU to the physical layer for transmission. The receiving RLC checks the CRC, if there is one, and signals the CRC check result to the MAC. The RLC assembles the PDUs received and delivers the resulting SDU to the LLC.

In the NRT mode, the source RLC indicates the size of the data to be transmitted to the MAC layer. The transmission format to be used is agreed on at the bearer set-up. The RLC deduces from this format the adapted segmentation and delivers Protocol Data Units PDU to layer 1 when requested by the MAC, i.e. when resources are allocated to the radio bearer by the network. The sink RLC checks the CRC and alerts the MAC when a corrupted PDU is received. It assembles the correct PDUs and delivers SDU to LLC.

One MAC entity per mobile manages all the radio bearers established by the mobile. The peer MAC in the network manages all the radio bearers of one cell. MAC messages are composed of a data field and a CRC field. The data field is used to transport MAC signaling exclusively. The MAC entity is not crossed by data flow coming from or destined for upper layers.

MAC entities are essentially in charge of allocating and releasing TCHs to the radio bearer :

- For RT radio bearers used for connections sensitive to transmission delay, the allocation mechanism is a circuit-switched type, i.e. the TCH allocation is valid until a release procedure has been executed.
- For NRT radio bearers used for connections having a higher tolerance for transmission delay, the allocation mechanism is a packet-switched type, i.e. the allocation is only valid during the allocation period. This mechanism allows speedy adaptation to load conditions because resources are not allocated for an indeterminate period of time. Furthermore, the MACs handle retransmission signaling when an RLC PDU is received with a corrupted CRC. This retransmission mechanism is able to adapt to the capabilities of the MS.

The base station subsystem (or a corresponding arrangement) maintains a reservation table, which is advantageously compatible with the size of the allocation period, and which indicates the size of each slot and the reservation status, as well as other possible slot-specific parameters in the allocation period. The contents of such a reservation table at three different moments are shown in Figures 3A, 3B and 3C. In the reservation table of Figure 3A, time slots 1, 2, 6, 11, 12 and 14 of the frame are allocated into 1/16 slots which are remained undivided. Time slots 4, 7 and 9 are divided into smaller 1/64 slots, and their resources are allocated for the use of connections of lower data transfer rate requirements. The reservation table contains information on the reservation status of physical channels only, and both the character and delay requirements of connections are of no relevance here.

Figure 3B illustrates the time frame of the next consecutive allocation period. As compared to the time frame of Figure 3A, the resources of time slots 1 and 11 are shown released. Additionally, it can be seen that the layer responsible for the allocation of the radio resources has found the number of connections requesting the 1/64 slots to be so high as to justify the subdivision of time slot 11 into 1/64 slots.

In the case of Figure 3C, the number of connections requesting a lower data transfer rate has dropped, thus permitting the unit serving the reservation of radio resources to release all the 1/64 slots of time slot 9.

It must be noted that the reservation is made on an allocation period basis, and the reserved channel does not necessarily have to include slots from every time frame of the allocation period. Therefore, all the time frames of an allocation period are not necessarily identical.

Prior to the reservation of a slot for the use of a new connection by the unit responsible for maintaining the reservation table and for subdividing the time slots into slots, some of the important criteria to be evaluated are the traffic situation, the information category (e.g., voice, video, data, etc.) of the new connection to be established, the priority class to be determined on the basis of the new connection (e.g. ordinary call, distress call), the overall transmission power level depending on the traffic situation, and the type of communication connection (e.g., realtime or non-realtime). Further criteria of the more advanced type include the interference sensitivity and the required transmission power of a certain slot.

The MAC sends the data units to be transmitted to layer 1 and reads those received from layer 1. It is also responsible for clearing the transmission and reception buffers. Further, the MAC decides when the decoding attempt of burst data is to be performed. The decoding is performed at layer 1 in response to a decoding request *L1-Decode Request* from the RLC/MAC layer.

In the RT operation mode, the burst data can be removed from the buffer as soon as it has been transmitted. On the receiving side, data can be removed from the buffer when the data unit has been decoded and passed to the RLC/MAC layer.

In the NRT operation, the data unit can be removed from the transmission buffers when it has been acknowledged. On the receiving side, data can be removed from the reception buffers when the data unit has been decoded and passed to the RLC/MAC and when the quality of the data unit has been judged sufficient. The quality can be determined by using a CRC check for the data unit, for example. The data unit is removed by layer 1 in response to a request *L1 Buffer Clear Request* from the RLC/MAC layer pointing to the bursts forming the data unit. If the RLC/MAC level ARQ (Automatic Repeat on reQuest) type of error correction is not used, the data unit can be cleared from the reception buffer immediately after decoding. If the RLC/MAC level ARQ is used, the data unit is cleared from the reception buffer when the RLC signals that the quality of the data unit is sufficient (i.e. when the CRC check shows no errors).

On the transmission side, the RT data units can be cleared from the buffer at the end of the interleaving period. The NRT data units are cleared according to the acknowledgments received from the receiver.

We shall next study the establishment of connections in the presented system.

To allocate a connection which is connected with a control channel or to inform the MS about a new location of a common control channel, the BSS-MAC uses a CTRL-Capacity Allocation (CTRL-CA) message. The message comprises an identifier identifying the connection, information about the physical channel allocated, and the type of control channel. The CTRL-Capacity Allocation Acknowledgment (CTRL-CAA) message is used by the MS to acknowledge the CTRL-Capacity Allocation. If the CTRL-CAA is not received by the BSS within a predefined time period, the status of the

allocation must be solved by the CTRL-CA or the CTRL-Capacity Deallocation (CTRL-CD) until the CTRL-CAA/CTRL-CDA has been received (CTRL-CDA = CTRL-Capacity Deallocation Acknowledgment).

The traffic channel resources can be allocated in different transmission directions (uplink/downlink) independently of each other, based purely on the transmission needs. The procedures used for allocating the traffic channels depend on the operation mode and will be examined next.

In the method according to the invention, the allocation of radio resources occurs basically in the same manner for both the realtime and non-realtime services: slots are allocated from the time frames for both needs. Information transfer over the radio path varies depending on the type of service, and whether it is realtime or non-realtime. Examples of applications requesting realtime or virtual realtime service are speech transmission in packets and a bidirectional video connection. In the simulation tests of the method according to the invention, the requirements for speech transmission between a base station and the terminal equipment were set at a max. allowable bit error rate (BER) of 10^{-3} and at a max. allowable transfer delay of 30 ms. In a video connection needed for a bidirectional video connection, corresponding limits are set at 10^{-6} and 100 ms, wherein the longer delay is due to the time interleaving of the video information to be transferred. These services utilize an error correction of the FEC (Forward Error Correction) type and a radio resource reservation scheme to be described later in more detail. A non-realtime type of service would be a file transfer during a conventional Internet connection, for example. This application uses packet-switched data transfer and an ARQ type of error correction protocol.

RT Operating Mode

An important characteristic of the RT operating mode is that it allocates the TCH for an indeterminate period of time. A release procedure is necessary to liberate the TCH. More than one radio bearer cannot be multiplexed on one TCH. The MAC uses an addressing scheme that allows the TCH to have a very precise granularity so that multiplexing is not necessary. (One TCH is mapped onto one physical channel. This mapping can be in each time frame, every second time frame, and soon up to every 128th time frame).

Network Initiated Procedure for RT Operating Mode

Network initiated procedures are for handling radio condition variations for uplink radio bearers and bit rate variations for downlink radio bearers. A signaling chart showing the procedure of allocating, changing the allocation, and deallocating an RT bearer is given in Figure 4.

There are three types of commands: the allocation of a TCH, the exchange of one TCH for another, and the de-allocation of a TCH. For example, whenever a network RLC asks the network MAC for more resources, the network MAC alerts the peer MAC with an *RT Capacity Allocation* (RT-CA) message. This message indicates the radio bearer concerned and the TCH allocated. It is acknowledged by an *RT Capacity Allocation Acknowledgment* (RT-CAA) message. The *RT Capacity Change* (RT-CC) and *RT Capacity Deallocation* (RT-CD) messages and their associated acknowledgments are used to exchange and liberate TCHs.

An acknowledgment message (e.g. RT-CAA, RT Capacity Deallocation Acknowledgment, RT Capacity Change Acknowledgment) can be substituted by the MS-MAC with any other uplink MAC message. In this case the cyclic redundancy code (CRC) for checking message integrity is calculated from the combined data of the DL-MAC message to be acknowledged and the substituting UL-MAC message to be transmitted.

An RT-CC message has fields for the old and the new TCH allocation. The MS or radio bearer concerned need not be identified, because they are identifiable from the old TCH. An RT-CD message indicates that the TCH has been deallocated. All the RT messages mentioned can use a message discriminator field to separate them from other signaling messages. All messages except the RT-CC type indicate the radio bearer concerned and also the MS, unless this is identifiable from the applied signaling channel.

Mobile Initiated Procedure for RT Operating Mode

The mobile initiated procedures are for handling radio condition variations for downlink radio bearers and bit rate variations for uplink radio bearers. A signaling chart is given in Figure 5 showing the procedure for allocating, changing the allocation, and deallocating an RT bearer.

Whenever a mobile RLC requests its MAC for a resource change, the MAC interprets the request as an *RT Capacity Request* (RT-CR) MAC message. This message includes an indication of the needed data transmis-

sion rate and identification of the message type, the radio bearer concerned, and the requesting mobile station, unless this is already identifiable from the applied signaling channel. The capacity allocation procedure is similar to the mobile initiated procedure as described in the network initiated procedure. However, channel allocation is initiated by an RT-CR message and not by a BSS RLC request.

Connections requesting realtime services may require a plurality of simultaneous uplink and downlink channels between the subscriber terminal equipment and the base station. Such simultaneous channels are called parallel connections. According to a preferred embodiment of the invention, a certain temporary logical identifier is assigned to the terminal equipment. This distinguishes the equipment from other terminal equipment communicating with the same base station subsystem. To distinguish between parallel connections, a short additional identifier (e.g., with a length of 4 bits) can be used.

NRT Operating Mode

In the NRT operating mode, the network knows the amount of data to transmit. The TCHs are allocated for each allocation period separately. The NRT operation mode can be divided into a high bitrate NRT used for high volumes of data and a medium bitrate NRT used for short or infrequent data transmissions.

For the high bitrate NRT only $1/16^{th}$ of the physical channels are used and the allocation period is fixed at two TDMA-frames. A data unit designates the two 1/16 bursts related to a TCH during one allocation period. Because the network has to announce the TCHs divided among the different NRT bearers for each allocation period, each active RLC is allocated a short Reservation Identity (noted RID) at the beginning of its source activity. This identity is valid until it is released by the BSS MAC.

For a medium bitrate NRT, all TCH types can be allocated and the allocation period length is variable (2-32 TDMA frames). Allocations for a medium bitrate NRT user are announced for each TCH separately and normal MAC and RLC identities are used.

Downlink High Bitrate NRT Allocation and Transmission

The allocation of resources and the transmission of data in downlink high bitrate NRT connections is shown in Figure 6. When the source of a downlink bearer activates and the BSS MAC decides to use the high bitrate NRT capacity, the network MAC sends a *High Bitrate NRT Capacity Allocation* message to the MS concerned, including a message discriminator, the RID, a bearer reference, and an MS identifier, if these are not identifiable from the channel. The message points to a pair of logical channels (the NRT Control Channel for Downlink Traffic, or DNCCH and the Forward Order Channel FOCH) as well. The location of a fixed DNCCH can be expressed as a carrier number, whereas the FOCH is given as a channel address. The mobile acknowledges the HB NRT-CA with an *HB NRT Capacity Allocation Acknowledgment* message.

The mobile MAC entity is now required to listen to the DNCCH. The splitting of the TCHs among the RIDs is announced for each allocation period in a *Downlink NRT Control* message on the DNCCH. The mobiles indicate the list of data units that should be sent by the BSS in a *Forward Order* message. This message is sent on the Forward Order Channel FOCH, a common channel shared by several mobiles. The scheduling of FOCH usage is announced on the DNCCH.

The forward order (FO) message transmitted on the FOCH includes an FO window and a list of NRT units to be transmitted. The FO window points to the start of unacknowledged data and the list is a binary word that indicates each ordered NRT unit with a 1-digit.

The downlink control (DNC) message transmitted on the DNCCH consists of a TCH list and a TCH and FOS (Forward Order Schedule) Scheduling list. The TCH list is a binary word whose length equals the number of possible transmission units during one allocation period, e.g. 16 for a 16-slot frame. A 1-digit in the list indicates that the corresponding resource is allocated for NRT use. The scheduling list indicates each RID that will receive data, whether or not they have permission to use their respective FO channels and in which of the resources reported in the TCH list each RID receives data.

After all the data has been transferred, the NRT connection is released when the MS is sent an *RID Release* message, which releases the

RID used in the connection. The mobile station acknowledges the message by sending the BSS MAC an *RID Release acknowledgment* message.

Uplink High Bitrate NRT Allocation and Transmission

When the NRT source of an uplink bearer activates, the mobile MAC sends an *NRT Capacity Request* message to the network, indicating the bearer reference and the data amount to be transmitted (see Figure 7). Depending on the requested data amount and the load situation in the cell, the BSS MAC allocates either high or medium bitrate NRT capacity to the MS. In the case of high bitrate allocation, the BSS MAC allocates in return an RID and announces the granted data amount in an *HB NRT Capacity Allocation* message. The message also points to a logical channel UNCCH (NRT Control Channel for Uplink traffic). Finally, the mobile sends an acknowledgment with an *NRT Capacity Allocation Acknowledgment* message.

The splitting of TCHs between RIDs for each allocation period is announced by the BSS MAC in an *Uplink NRT Control* message on the UNCCH. The *Uplink NRT Control* message also indicates the data units that should be sent through the allocated TCHs.

The retransmission procedures for high bitrate NRT

The NRT mode uses a very flexible signaling procedure which allows the use of various retransmission schemes. Since in any case all NRT data is ordered by the receiver, the algorithm on which the order is based need not be the same for all MSs. Depending on the capabilities of the mobile station, a more or less sophisticated retransmission scheme can be selected at bearer set-up. The simpliest ARQ algorithm could be the normal type 1 ARQ, according to which the RLC-CRC is checked and, depending on the findings, the PDU is either accepted or discarded and a request for retransmission is sent.

The highest efficiency is, however, assumed to be achieved with the following type II hybrid ARQ scheme: an RLC-PDU (RLC Packet Data Unit) is coded in such a way that after the first part of it has been transmitted, it is already possible to decode the data. If the decoding is not successful, then the rest of the coded data (containing redundancy of the first part) is transmitted. If the PDU decoding is not successful after having transmitted all

the data, then a request is made for retransmission of some data units, preferably the ones with lowest reception quality, until the decoding is successful.

Medium Bitrate NRT Transmissions

Whether the medium bitrate allocation is initiated by a BSS RLC request or by a MS MAC NRT Capacity request, the procedure is almost the same. The BSS MAC sends a *Medium Bitrate NRT Capacity Allocation* (MB NRT-CA) message containing the MAC-ID, the Bearer-ID, the TCH address, the length of the allocation period, and an allocation identifier. The downlink medium bitrate NRT transmission is shown in Figure 8, and the uplink medium bitrate NRT transmission is shown in Figure 9. The transmitting side transmits the NRT data accordingly. In the case of downlink NRT transmission, the MS acknowledges the data received when the decoding of it has been successful. If the decoding is not successful for either uplink or downlink transmission, the BSS MAC sends an MB NRT-CA message with the same allocation identifier, and the transmitter retransmits the same data. This procedure is repeated until the decoding is judged to be successful.

To sum up, the means needed in the BS and in the MS are shown in Figures 10 and 11. Figure 10 shows the means needed in the BSS for the allocation process presented for downlink channels. The means comprises

- first connection dividing means for dividing the connections according to their delay requirements into at least two classes. (This is implemented in protocols of layer 3 or above. The rest of the means are implemented in layer 2),
- second connection dividing means responsive to the first connection dividing means for dividing the NRT connections further into NRT/HB and NRT/MB-type connections,
- communication need determining means responsive to the first and the second connection divider for determining the communication needs,
- resource dividing means responsive to the communication need determining means for dividing the communication resources into slots based on the communication needs in different communication classes, and
- allocation means responsive to the resource dividing means and the communication need determining means for allocating different types of

channels, i.e. RT, NRT/HB or NRT/MB channels for communications of different classes.

Figure 11 shows the means needed in the MS and in the BSS for the presented uplink channel allocation. In the MS, the means comprises

- first connection dividing means for dividing the connections according to their delay requirements into at least two classes (This is implemented in protocols of layer 3 or above, the remaining means being implemented in layer 2),
- second connection dividing means responsive to the first connection dividing means for dividing the NRT connections further into NRT/HB and NRT/MB -type connections,
- requesting means responsive to the first and second connection dividing means for requesting resources for different types of connections.

In the BSS, the means comprises

- communication need determining means responsive to the requesting means of the mobile station for determining the communication needs,
- resource dividing means responsive to the communication need determining means for dividing the communication resources into slots based on the communication needs in different communication classes, and
- allocation means responsive to the resource dividing means and the communication need determining means for allocating different types of channels, i.e. RT, NRT/HB or NRT/MB channels for communications of different classes.

The BSS generally comprises base stations BS and a base station controller BSC, and the means presented can be implemented in either of these network elements. The means can be distributed between the BS and the BSC as well.

In non-realtime connections the same principle of parallel connections can be applied that was explained above in the description of realtime services.

The MAC layer also deals with timing advance (TA) management. This is used to align the transmission timing of a mobile so that the timing closely matches the slot boundaries of the base station with which the mobile is communicating, thus compensating for transmission path delay. The timing advance is managed for each MS. Finally, the MAC provides signaling to

control transmission power levels in both directions. This control is made for each radio bearer with an option to adjust the power level of each TCH.

The MS has to transmit periodically in order to provide BSS information needed to maintain the TA. If the MS has nothing to transmit, then a specific Timing Advance Probe (TAP) message can be sent.

In order to administer a dynamic channel assignment on behalf of the MS supporting multiple bearers, a BS-MAC must maintain a record of which physical channels are allocated to all of its bearers for transmission and reception to each MS. This record can be used as a basis for combining the time alignment measurements (made by layer 1) for all MS bearers to form a single estimate of time correction for the MS. Consequently, the BS-MAC (or a process associated with the BS-MAC) will continuously monitor the timing of an MS alignment based on measurements reported by layer 1.

If needed, the BS-MAC transmits a Timing Adjustment Correction (TAC) message which contains a TA correction to be applied to all the bursts transmitted. A TAC message can be transmitted through a common control channel such as Forward Access channel FACH used for broadcasting MAC-layer messages or a dedicated control channel such as the SDCCH (Stand-alone Dedicated Control Channel) or the FACCH (Fast Associated Control Channel).

The MS may stop the transmission of TA probes and then the MS will forfeit the time alignment. Such an MS seeking to start transmission to the BSS again has to send a TAP message in an access burst on the S-RACH. In response to the probe, the BSS will transmit a TAC message.

For slow power control, the Power Control (PC) message can be transmitted on an FACH, an N-RACH, or on any DCCH. For optional fast power control, the use of an FACCH, an SDCCH, or an FACH is inappropriate for the transfer of power level reports. Instead, a Public Power Control Channel PWCCH is adopted. This requires one 1/64 time slot per frame and indicates the differential power setting to be applied. It has the advantage that it can support unidirectional bearers or bearers operating a DTX, but, it has the disadvantage that mobiles must be able to monitor a broadcast for every frame.

When adaptive antennas are used, the MS has to transmit periodically to provide the BSS the information needed in order to estimate the

location of the MS. If the MS has nothing to transmit, then a specific probe (e.g. Timing Advance Probe message) can be sent.

ABBREVIATIONS OF THE APPLICATION TEXT

ARQ:	Automatic Repeat on reQuest
BSS:	Base Station System
CA:	Capacity Allocation
CAA:	Capacity Allocation Acknowledgement
CC:	Capacity Change
CD:	Capacity Deallocation
CR:	Capacity Request
CRC:	Cyclic Redundancy Code
DNCCH:	Downlink Control Channel
DNC:	Downlink Control
FACCH :	Fast Associated Control Channel
FEC:	Forward Error Correction
FO:	Forward Order
FOCH :	Forward Order Channel
FOS:	Forward Order Schedule
GPRS :	General Packet Radio System
GSM:	Global System for Mobile Communications
L1 :	Layer 1
L2:	Link Layer
L3:	Network Layer
LLC:	Logical Link Control
MAC:	Media Access Control
MB:	Medium Bitrate
MS:	Mobile Station
NRT:	Near Real Time
PC:	Power Control
PDU:	Protocol Data Unit
PWCCH :	Public Power Control Channel
QoS:	Quality of Service
RID:	Reservation Identity
RLC:	Radio Link Control
RNL :	Radio Network Layer
RT:	Real Time
SDCCH:	Stand-alone Dedicated Control Channel
SDU :	Service Data Unit
TA:	Timing Advance
TAC:	Time Adjustment Correction
TAP:	Timing Advance Probe
TCH:	Traffic channel
TDMA:	Time Division Multiple Access
UNCCH:	NRT Control Channel for Uplink Traffic

Claims

1. A method of controlling communication resources in a telecommunications system, in which the communication resources are divided into allocation periods, the allocation periods being further divisible into slots of at least two different sizes, a slot being the smallest allocable unit of communication resource, c h a r a c t e r i z e d in that

the connections are divided into at least two connection classes according to their delay requirements,

information concerning the current need for communication resources in each connection class is stored and updated,

the communication resources are dynamically divided into slots according to the current need for communication resources,

the connections with stringent requirements for transmission delay are allocated circuit-switched communication resources, and

for each successive allocation period the other connections having less stringent or no delay requirements are allocated resources sufficient for transmitting a determined amount of data.

2. A method according to claim 1, c h a r a c t e r i z e d in that the resources are allocated independently of one another in different transmission directions.

3. A method according to claim 1 in a mobile telecommunications system comprising a base station subsystem (BSS) and a plurality of mobile stations, c h a r a c t e r i z e d in that

in response to a changed need for a connection having stringent requirements for minimal transmission delay from the mobile station to the base station subsystem, the mobile station sends the base station subsystem a capacity request message indicating the amount of resources needed, and

in response to the request, the base station subsystem allocates the connection circuit-switched communication resources and informs the mobile station of the resources allocated by sending the mobile station a capacity allocation message indicating the resources allocated.

4. A method according to claim 1 in a mobile telecommunications system comprising a base station subsystem (BSS) and a plurality of mobile stations, c h a r a c t e r i z e d in that

in response to having determined a changed need for a connection having stringent requirements for minimal transmission delay from the base station subsystem to the mobile station, the base station subsystem allocates the connection circuit-switched communication resources and informs the mobile station of the resources allocated by sending the mobile station a capacity allocation message indicating the resources allocated.

5. A method according to claim 1, characterized in that the connections having less stringent requirements for transmission delay are further divided into at least two classes according to the amount of data to be transmitted, and the connections having a high volume of data to be transmitted are allocated a reservation identity used when signaling allocation of communication resources for successive allocation periods.

6. A method according to claim 1 in a mobile telecommunications system comprising a base station subsystem (BSS) and a plurality of mobile stations, characterized in that

the connections having less stringent requirements for transmission delay are further divided into at least two classes according to the amount of data to be transmitted,

for the subclasses having high or low volumes to be transmitted, subclass specific resource allocation methods are used,

in response to a need for a connection having less stringent requirements for transmission delay from the mobile station to the base station subsystem, the mobile station sends the base station subsystem a capacity request message indicating the amount of resources needed,

and in response to having received the request, the base station subsystem determines whether the connection belongs to the subclass having high volumes to be transmitted or to the subclass having low volumes to be transmitted, and

in response to having determined that the connection belongs to the subclass having high volumes to be transmitted, the allocation method is used which is specified for the subclass of high volumes to be transmitted, and

in response to determining that the connection belongs to the subclass having low volumes to be transmitted, the allocation method is used which is specified for the subclass of low volumes to be transmitted.

7. A method according to claim 6, c h a r a c t e r i z e d in that the allocation method specified for the subclass of high volumes to be transmitted is comprised of allocating a reservation identity to the connection and informing the mobile station in an allocation message sent to the mobile station of the reservation identity allocated.

8. A method according to claim 6, c h a r a c t e r i z e d in that the allocation method specified for the subclass of low volumes to be transmitted is comprised of allocating to the connection resources sufficient to transfer a given amount of data and informing the mobile station in an allocation message sent to the mobile station of the resources allocated.

9. A method according to claim 1 in a mobile telecommunications system comprising a base station subsystem (BSS) and a plurality of mobile stations, c h a r a c t e r i z e d in that

the connections having less stringent requirements for transmission delay are further divided into at least two classes according to the amount of data to be transmitted,

for the subclasses having high or low volumes to be transmitted, subclass specific resource allocation methods are used, in response to having determined the need for a connection having less stringent requirements for transmission delay from the base station subsystem to the mobile station, the base station subsystem determines whether the connection belongs to the subclass having high volumes to be transmitted or to the subclass having low volumes to be transmitted, and

in response to having determined that the connection belongs to the subclass having high volumes to be transmitted, the allocation method is used which is specified for the subclass of high volumes to be transmitted, and in response to having determined that the connection belongs to the subclass having low volumes to be transmitted, the allocation method is used which is specified for the subclass of low volumes to be transmitted.

10. A method according to claim 9, c h a r a c t e r i z e d in that the allocation method specified for the subclass of high volumes to be transmitted is comprised of allocating a reservation identity to the connection and informing the mobile station in an allocation message sent to the mobile station of the reservation identity allocated.

11. A method according to claim 9, c h a r a c t e r i z e d in that the allocation method specified for the subclass of low volumes to be transmitted is comprised of allocating the connection resources sufficient to transfer a given amount of data and informing the mobile station in an allocation message sent to the mobile station of the resources allocated.

12. A mobile telecommunications system comprising a base station subsystem (BSS) and a plurality of mobile stations, in which system the communication resources are divided into allocation periods, the allocation periods being further divisible into slots of at least two different sizes, a slot being the smallest allocable unit of communication resources

c h a r a c t e r i z e d in that the system comprises

first connection dividing means for dividing the connections according to their delay requirements into at least two connection classes,

determining means responsive to the first connection dividing means for determining the communication needs in different connection classes,

resource dividing means responsive to the determining means for dividing the physical radio resources into slots based on the communication needs, and

allocation means responsive to the determining means and the resource dividing means for allocating different types of channels for communications of different classes.

13. A mobile telecommunications system according to claim 12, c h a r a c t e r i z e d in that

the system further comprises

a second connection divider responsive to the first connection divider for dividing the connections according to the amount of data to be transmitted and

the communication need determining means are responsive to both the first and the second connection dividing means.

14. A mobile telecommunications system according to claim 12, c h a r a c t e r i z e d in that the allocation means comprises

means for allocating circuit-switched resources for connections requiring a short transmission delay and

means for allocating for each successive allocation period to the other connections resources sufficient for transmitting a determined amount of data.

15. A base station subsystem for a mobile telecommunications system comprising a base station subsystem (BSS) and a plurality of mobile stations, in which system the communication resources are divided into allocation periods, the allocation periods being further divisible into slots of at least two different sizes, a slot being the smallest allocable unit of communication resource,

characterized in that the base station subsystem comprises

first connection dividing means for dividing the connections according to their delay requirements into at least two connection classes,

determining means responsive to the first connection dividing means for determining the communication needs in different connection classes,

resource dividing means responsive to the determining means for dividing the physical radio resources into slots based on the communication needs, and

allocation means responsive to the determining means and the resource dividing means for allocating different types of channels for communications of different classes.

16. A base station subsystem according to claim 15, characterized in that

the system further comprises a second connection divider responsive to the first connection divider for dividing the connections according to the amount of data to be transmitted and

the communication need determining means are responsive to both the first and the second connection dividing means.

17. A base station subsystem according to claim 15, characterized in that the allocation means comprises

means for allocating circuit-switched resources for connections requiring a short transmission delay and means for allocating for each successive allocation period to the other connection resources sufficient for transmitting a determined amount of data.

18. A base station controller for a mobile telecommunications system comprises

a base station subsystem comprised of base stations and a base station controller controlling a plurality of base stations and

a plurality of mobile stations, whereby the communication resources of said mobile telecommunications system are divided into allocation periods, the allocation periods being further divisible into slots of at least two different sizes, a slot being the smallest allocable unit of communication resource,

c h a r a c t e r i z e d in that the base station controller comprises

first connection dividing means for dividing the connections according to their delay requirements into at least two connection classes,

determining means responsive to the first connection dividing means for determining the communication needs in different connection classes,

resource dividing means responsive to the determining means for dividing the physical radio resources into slots based on the communication needs, and

allocation means responsive to the determining means and the resource dividing means for allocating different types of channels for communications of different classes.

19. A base station controller according to claim 18, c h a r a c t e r i z e d in that

the system further comprises a second connection divider responsive to the first connection divider for dividing the connections according to the amount of data to be transmitted and

the communication need determining means are responsive to both the first and the second connection dividing means.

20. A base station controller according to claim 18, c h a r a c t e r i z e d in that the allocation means comprises

means for allocating circuit-switched resources for connections requiring a short transmission delay and

means for allocating for each successive allocation period to the other connection resources sufficient for transmitting a determined amount of data.

21. A mobile station for a mobile telecommunications system comprising a base station subsystem (BSS) and a plurality of mobile stations, in which system the communication resources are divided into allocation periods, the allocation periods being further divisible into slots of at least two different sizes, a slot being the smallest allocable unit of communication resource,

c h a r a c t e r i z e d in that the mobile station comprises

a first connection dividing means for dividing the connections according to their delay requirements into at least two connection classes and

requesting means responsive to the first connection dividing means for requesting resources for different types of connections.

22. A mobile station according to claim 21, c h a r a c t e r i z e d in that

the system further comprises a second connection divider responsive to the first connection divider for dividing the connections according to the amount of data to be transmitted and

the communication need determining means are responsive to both the first and the second connection dividing means.

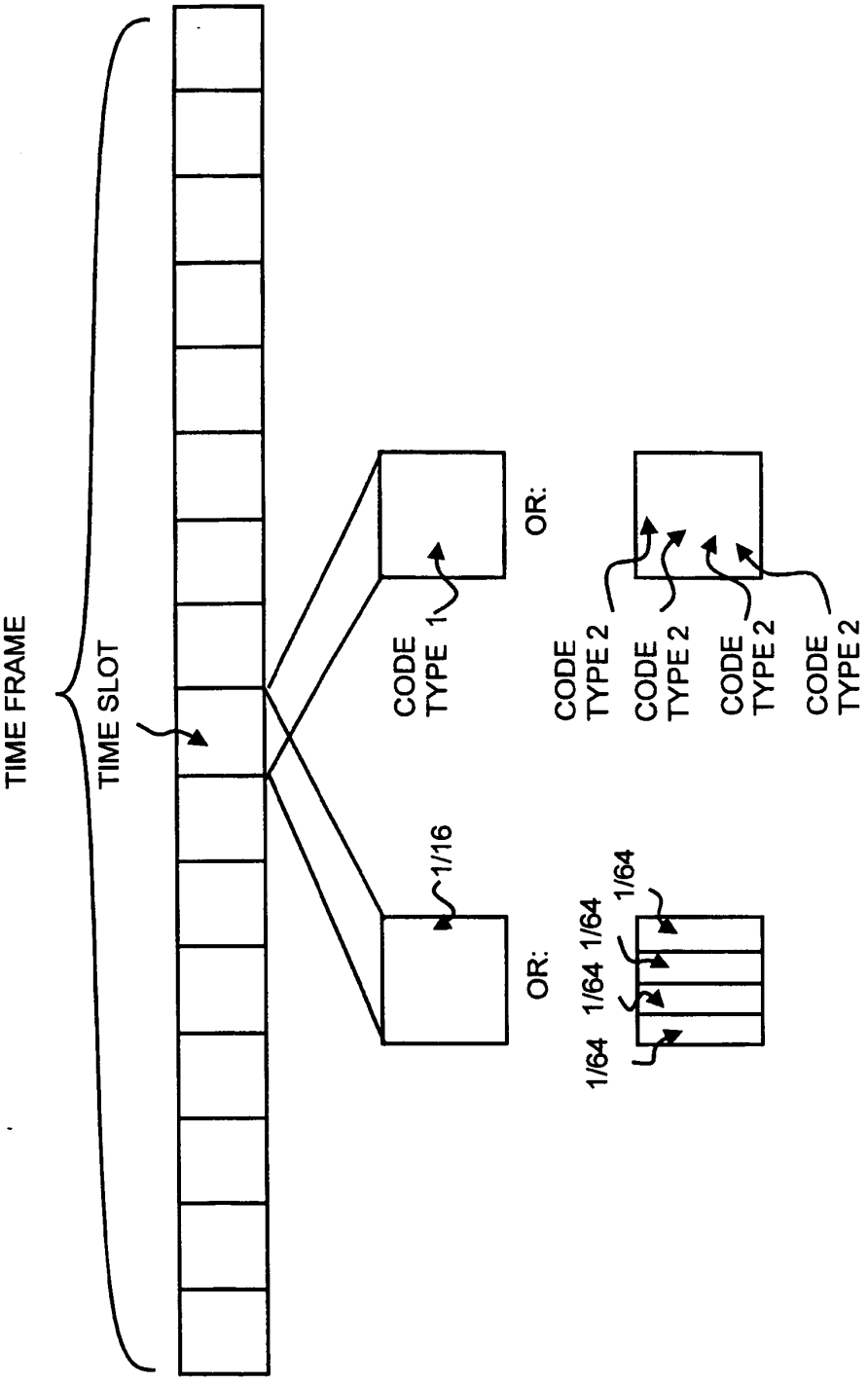

TIME FRAME
TIME SLOT
CODE TYPE 1
OR:
1/16
CODE TYPE 2
CODE TYPE 2
CODE TYPE 2
CODE TYPE 2
OR:
1/64
1/64
1/64
1/64

FIG. 1.

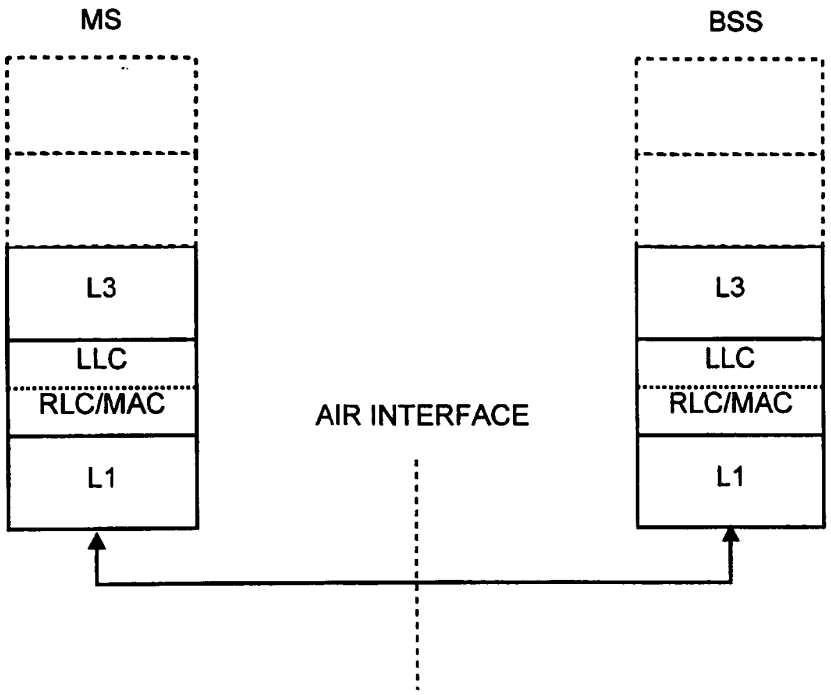


FIG. 2.

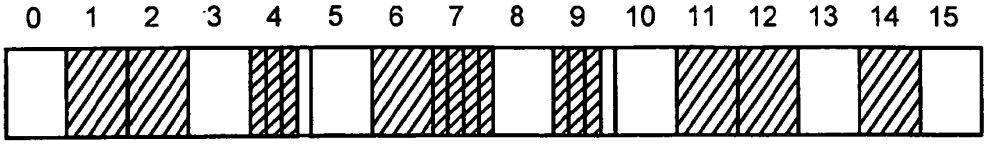


FIG. 3A .

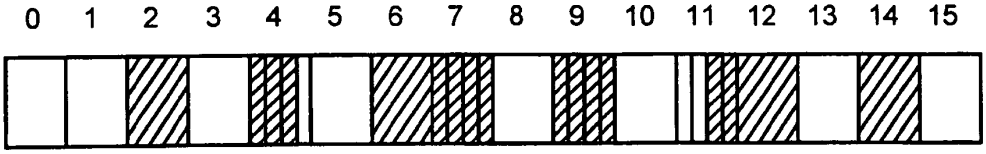


FIG. 3B.

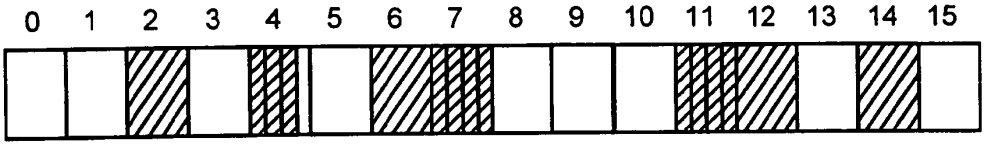


FIG. 3C.

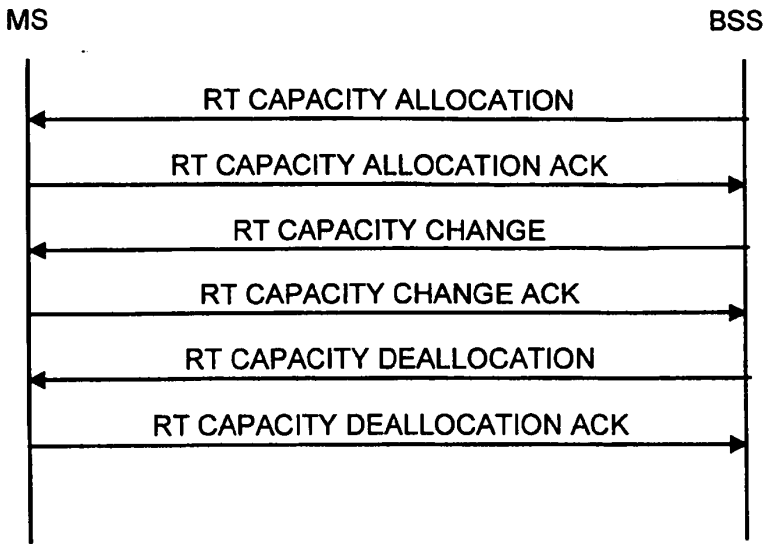

MS
BSS
RT CAPACITY ALLOCATION
RT CAPACITY ALLOCATION ACK
RT CAPACITY CHANGE
RT CAPACITY CHANGE ACK
RT CAPACITY DEALLOCATION
RT CAPACITY DEALLOCATION ACK

FIG. 4.

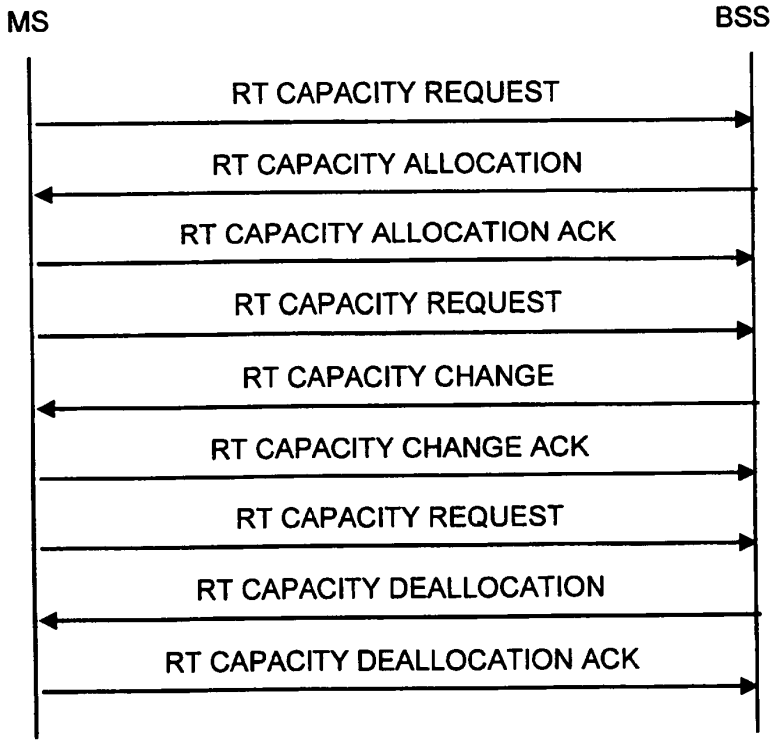

MS
BSS
RT CAPACITY REQUEST
RT CAPACITY ALLOCATION
RT CAPACITY ALLOCATION ACK
RT CAPACITY REQUEST
RT CAPACITY CHANGE
RT CAPACITY CHANGE ACK
RT CAPACITY REQUEST
RT CAPACITY DEALLOCATION
RT CAPACITY DEALLOCATION ACK

FIG. 5.

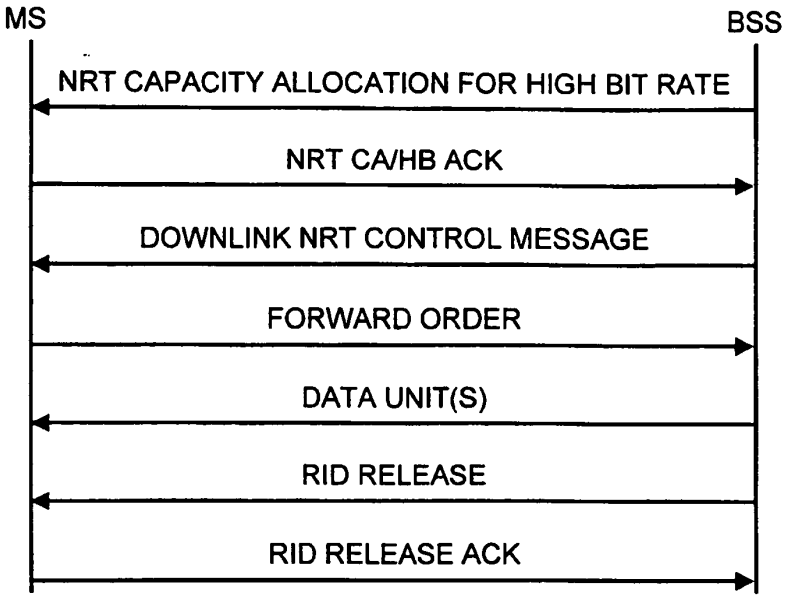

MS
BSS
NRT CAPACITY ALLOCATION FOR HIGH BIT RATE
NRT CA/HB ACK
DOWNLINK NRT CONTROL MESSAGE
FORWARD ORDER
DATA UNIT(S)
RID RELEASE
RID RELEASE ACK

FIG. 6.

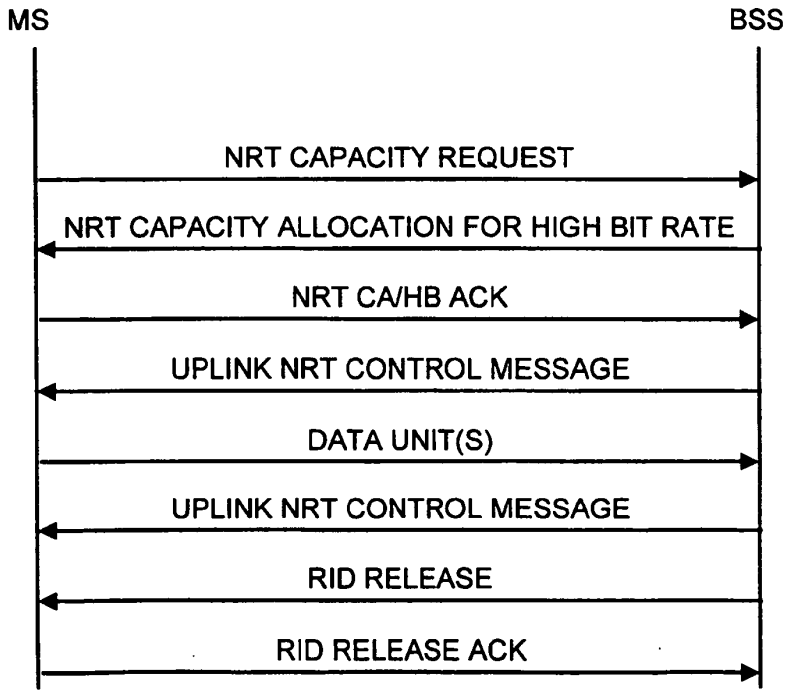

MS
BSS
NRT CAPACITY REQUEST
NRT CAPACITY ALLOCATION FOR HIGH BIT RATE
NRT CA/HB ACK
UPLINK NRT CONTROL MESSAGE
DATA UNIT(S)
UPLINK NRT CONTROL MESSAGE
RID RELEASE
RID RELEASE ACK

FIG. 7.

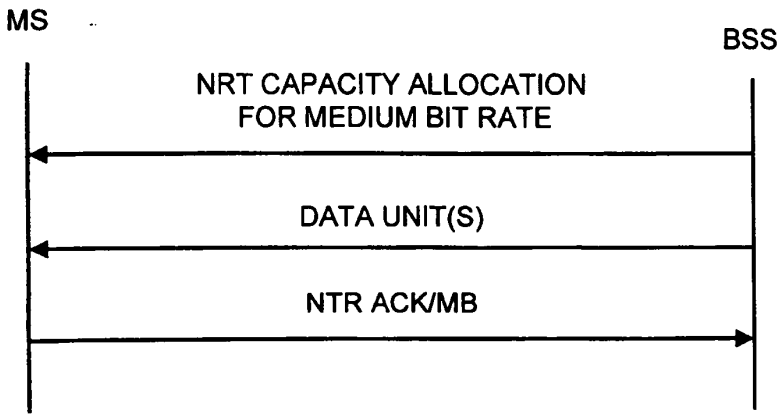

MS
BSS
NRT CAPACITY ALLOCATION
FOR MEDIUM BIT RATE
DATA UNIT(S)
NTR ACK/MB

FIG. 8.

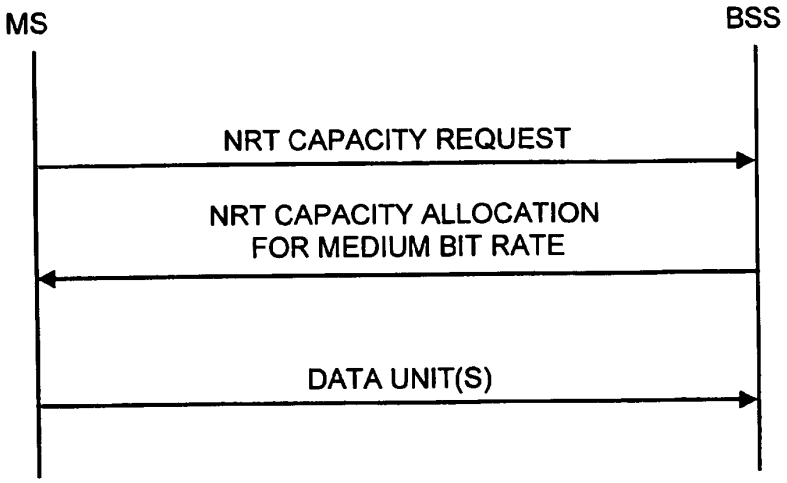

MS
BSS
NRT CAPACITY REQUEST
NRT CAPACITY ALLOCATION
FOR MEDIUM BIT RATE
DATA UNIT(S)

FIG. 9.

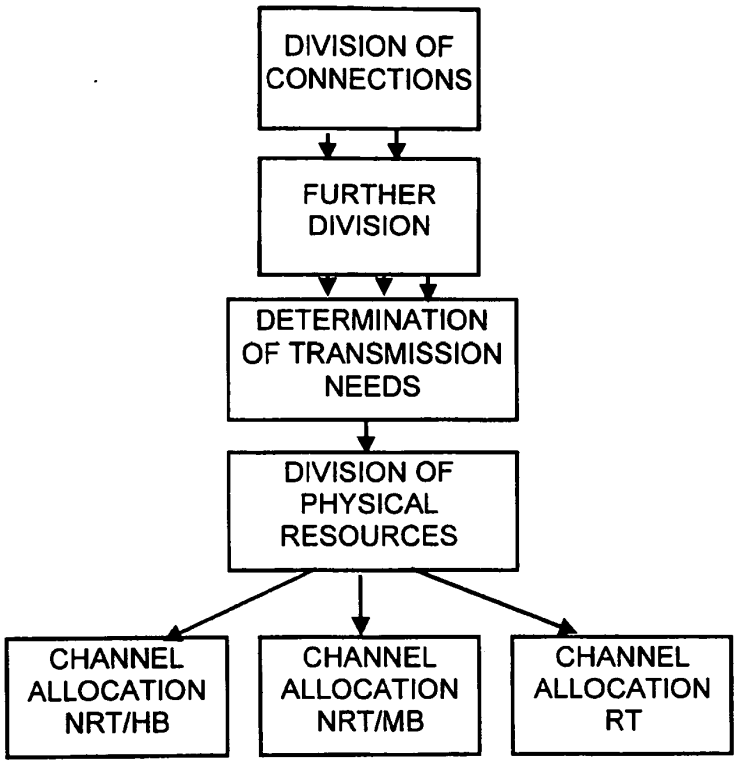

DIVISION OF CONNECTIONS
FURTHER DIVISION
DETERMINATION OF TRANSMISSION NEEDS
DIVISION OF PHYSICAL RESOURCES
CHANNEL ALLOCATION NRT/HB
CHANNEL ALLOCATION NRT/MB
CHANNEL ALLOCATION RT

FIG. 10.

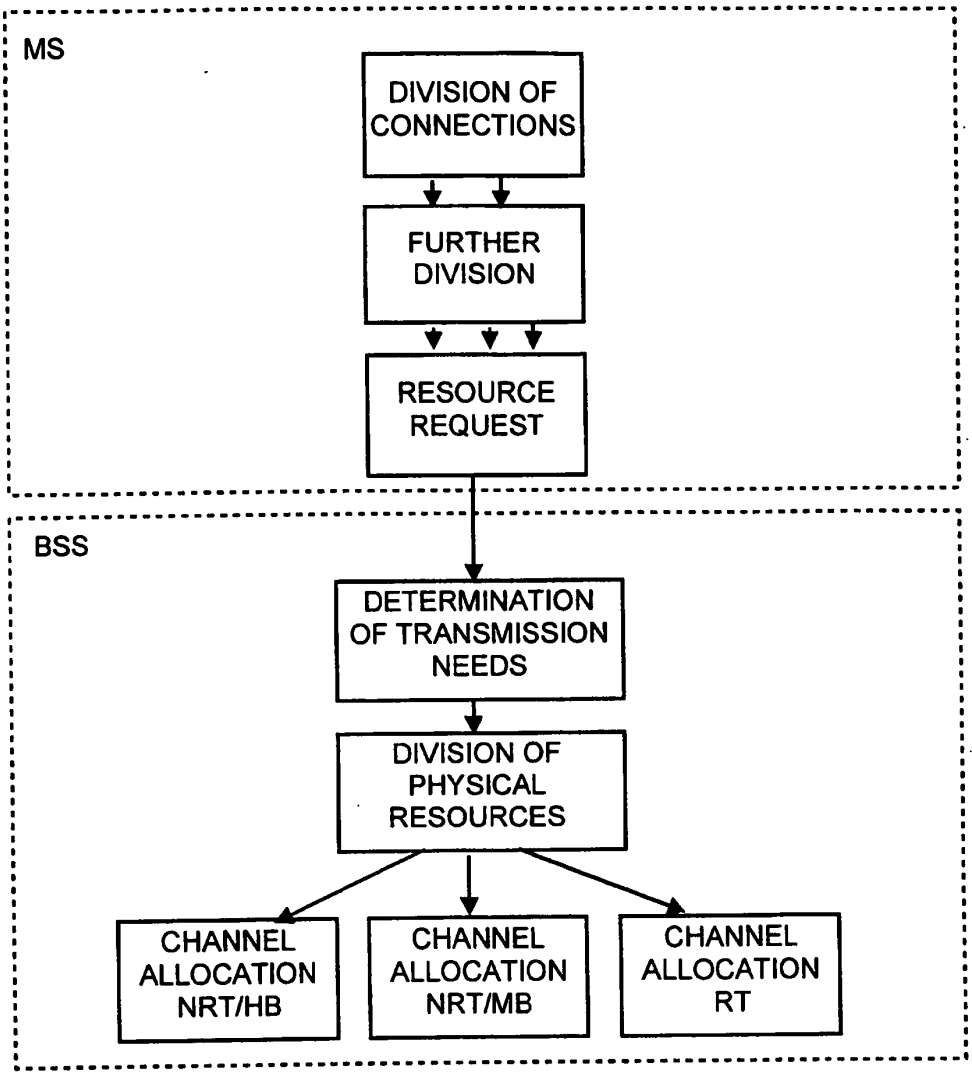

MS
DIVISION OF CONNECTIONS
FURTHER DIVISION
RESOURCE REQUEST
BSS
DETERMINATION OF TRANSMISSION NEEDS
DIVISION OF PHYSICAL RESOURCES
CHANNEL ALLOCATION NRT/HB
CHANNEL ALLOCATION NRT/MB
CHANNEL ALLOCATION RT

FIG. 11.

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04Q 7/38 | A2

(11) International Publication Number: **WO 99/09775**

(43) International Publication Date: 25 February 1999 (25.02.99)

(21) International Application Number: PCT/FI98/00633

(22) International Filing Date: 18 August 1998 (18.08.98)

(30) Priority Data:
973394 19 August 1997 (19.08.97) FI

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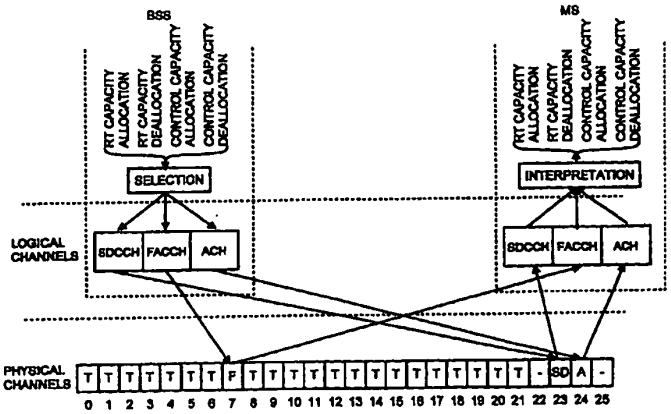
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(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian 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), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
In English translation (filed in Finnish).
Without international search report and to be republished upon receipt of that report.

(54) Title: INFORMATION TRANSMISSION IN A TELECOMMUNICATIONS SYSTEM



(57) Abstract

The idea of the present invention is to enable the transmission of control information via several logical channels and to select the transmission channel dynamically by using a predefined selection rule. There are at least two logical channels that can be selected for the transmission of information. These logical channels should preferably include at least one signalling channel which is allocated in a connection–specific manner. The signalling channels which are allocated in a connection–specific manner can be signalling channels which use the capacity of the traffic channel or independent signalling channels which are allocated separately from traffic channels. At least one of the logical channels available for selection should preferably also be a shared channel allocated to several connections for joint signalling. The parameters of the selection rule used in the logical channel selection can include, for example, the effect of the use of the logical channels on the quality of service of the connection which uses the traffic channel, the current usage rate of the logical channels, the number and priority of messages to be sent, and an estimate of the number and priority of messages to be sent in the near future.

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Information transmission in a telecommunications system

Field of the invention

The invention is related to the transmission of information, specifically control information, in a telecommunications system. In particular, the system is related to the transmission of information in a telecommunications system which consists of several subscriber units and at least one network element servicing the subscriber units.

Background of the invention

In addition to actual information, telecommunications systems must transmit control information to guarantee successful flow of information between the sender and the receiver. The required control information includes, for example, channel addressing, which indicates the transmission channel to the receiver. Additionally, the parties of the connection must agree upon connection set-up before data transmission and connection set-down after the transmission. In mobile communications systems, for example, the base station system must also locate the mobile station before connection set-up.

Channels can be defined as logical and physical channels. The term "logical channel" refers to a channel whose use is in some way determined. For example, traffic channels are used for transmitting user information and signalling channels for transmitting control information required for connection management. Signalling channels can be further divided into connection-specific channels and shared channels. In the case of a connection-specific channel, the channel itself determines the receiver of the message. In the case of a shared channel used by several connections, the receiver's identity is indicated by adding the receiver's identifier to the message. As a result, messages are slightly longer in shared channels than in connection-specific channels even though the actual information content is the same.

Connection-specific and shared signalling channels can be further divided, when necessary, into subcategories. In a mobile communications system, for example, shared signalling channels can be divided as follows: the Broadcast Control Channel (BCCH) intended for transmitting network managing information for all mobile stations, the Paging Channel (PCH)

which is used to send paging messages to specific mobile stations, and the Access Grant Channel (AGCH) which is used in call set-up.

The term "physical channel" refers to a specified section of the transmission band. In an FDMA/TDMA (FDMA = Frequency Division Multiple Access, TDMA = Time Division Multiple Access) system, for example, the physical channel consists of a specific frequency and time frame interval. Logical channels are mapped to physical channels so that a specific physical channel always provides for a specific logical channel. The information about the mapping of logical channels to physical channels must naturally be known both by the sender and the receiver, and, therefore, this information must be transmitted, during connection set-up phase, via predefined signalling channels, such as AGCH.

In known systems, there is a specific logical channel for each message that transmits control information. An example of such a system is shown in Figure 1. The figure displays the transmission of four different types of control information in a mobile communications system from the Base Station Subsystem (BSS) to the Mobile Station (MS). The message that conveys the Power Control (PWC) command for the Mobile Station, is sent via the Slow Associated Control Channel (SACCH). Correspondingly, all messages which relate to handover are sent via the Fast Associated Control Channel (FACCH). Messages which are related to paging of Mobile Stations are sent via the Paging Channel (PCH), and messages which are related to connection set-up before the allocation of a connection-specific channel are sent via the Access Grant Channel (AGCH).

In this example, intervals 0 through 22, defined by the physical channel are in connection-specific use of the connection under study, and intervals 23 and 24 are used by signalling channels shared by several connections, and interval 25, which defines the end of the frame, is empty. The SACCH is set, in accordance with system specifications, in interval 12 of a frame which consists of 26 consecutive intervals. In the figure, interval 12 is indicated by the symbol S which also signifies the logical channel. Thus, the receiver always knows that the information received through interval 12 belongs to the SACCH, and, on the basis of that knowledge, can interpret the message correctly. Correspondingly, all messages received through interval 23 belong to the logical Paging Channel (PCH), and all messages received through interval 24 belong to the logical Access Grant Channel (AGCH),

and, on the basis of this knowledge, the receiver can interpret them correctly.

Contrary to other logical channels, the mapping of the Fast Associated Control Channel (FACCH) to a physical channel has not been set by signalling or system specifications. Instead, it can use any interval T allocated to the traffic channel. In this case, the logical channel used in the interval must be indicated in the actual information sent through the interval. Known methods of separating the FACCH from the Traffic Channel are shown in Figures 2, 3A, and 3B.

Figure 2 shows a burst used in the call traffic across the radio interface between a Mobile Station and a Base Station Subsystem in a GSM system. The effective part of the burst consists of the first and second half-burst, their two signalling bits ("stealing bits"), and the instruction sequence used to estimate the channel characteristics. In this burst type, the first half-burst belongs to the signalling traffic of the logical FACCH channel if the first signalling bit is 1, and otherwise to the traffic of the Traffic Channel (TCH). Correspondingly, the second half-burst belongs to the signalling traffic of the logical FACCH channel if the second signalling bit is 1, and otherwise to the traffic of the Traffic Channel (TCH). Thus, it is possible to use the traffic channel burst for signalling either partially or entirely.

Different logical channels have different characteristics. Because of its limited physical channel capacity, the Slow Associated Control Channel (SACCH) is slow, and, therefore, it can only be used to transfer relatively small and delay-tolerant information streams. Another problem for this logical channel is that the channel reserves transmission resources available to the system even when it does not have any messages to carry. In a GSM system, for example, SACCH is used for downlink control of power and timing advance (from the Base Station Subsystem to the Mobile Station), and for uplink reporting of received signal measurements made by the Mobile Station (from the Mobile Station to the Base Station Subsystem).

The Fast Associated Control Channel (FACCH) is considerably faster than the Slow Associated Control Channel SACCH, because it can use the bandwidth allocated to traffic channels. On the other hand, the bandwidth adopted by FACCH from the Traffic Channel is no longer available to the Traffic Channel, resulting in the deterioration of the Quality of Service (QoS) of the Traffic Channel. In a GSM system, for example,

FACCH is used to send information, such as messages related to call set-up, authentication and handover.

The capacity of shared channels is limited and used by several Mobile Stations. In some cases, this can increase the transmission delay of messages sent via a shared channel. This is the reason why shared channels are used, in an existing GSM system, for example, only for sending messages before connection set-up between the transmitter and receiver. Such messages include paging messages and connection set-up messages.

The problem with solutions that are in accordance with the prior art is the rigidity of the signalling method described above. When large numbers of messages are transmitted via the Fast Associated Control Channel (FACCH), which uses the capacity of the Traffic Channel, the quality of the connection using the Traffic channel deteriorates. Other connection-specific channels reserve transmission capacity available to the system. Choosing the level of this capacity is a compromise between the signalling speed and the bandwidth allocated to channels. This results in slow signalling when a relatively large number of messages is generated. Because of slow signalling, the system control capacity deteriorates which, in turn, results in the non-optimal use of other resources. Correspondingly, when only a few signalling messages are sent, a separate channel allocated to signalling is a waste of system resources. Additionally, slow signalling channel allocation is typically connected to traffic channel allocation. As a result, the use of a slow signalling channel may, in some cases, cause a need to maintain the Traffic Channel even though the Traffic Channel is no longer needed for the transmission of user data.

If the shared signalling channels are to transmit messages at the rate required by the system, they must be allocated a fixed share of the transmission capacity available to the system. This capacity cannot be allocated to traffic channels. Because the transmission of messages via a shared channel is statistical in nature and varies considerably over time, some of the transmission resources allocated to the shared channel are left unused.

Thus, the problems in systems which are in accordance with the prior art include slowness of signalling, deterioration of connection quality, and non-optimal use of the transmission band.

The purpose of this invention is to remove or at least alleviate the problems caused by the above-mentioned solutions that are in accordance with the prior art. This goal can be attained by using the method and equipment described in an independent patent claim.

Summary of the invention

The idea of the present invention is to enable transmission of control information via several logical channels and to select channels used for transmission of information in a dynamic manner by using a predefined selection rule.

There are at least two logical channels that can be selected for information transmission. These logical channels include preferably at least one connection-specific signalling channel. Connection-specific signalling channels can be channels which assume some of the traffic channel capacity or signalling channels allocated independently of traffic channels. At least one of the available logical channels should preferably also be a shared channel allocated for shared signalling by several connections.

The parameters of the selection rule used for logical channel selection include the effect of the use of the logical channels on the quality of the connection using the Traffic Channel, the current usage rate of the logical channels, the number and priority of the messages to be sent, and an estimate of the number and priority of any messages to be sent in the near future.

According to one preferable embodiment, the logical signalling channel to be used is selected by a layer managing the radio resources of the transmission protocol, such as the Medium Access Control (MAC) layer.

Brief description of the figures

In the following, the invention is described in detail referring to the attached figures:

Figure 1 illustrates a signalling method in accordance with the prior art,
Figure 2 illustrates a known method for separating the signalling channel and the traffic channel,
Figure 3 illustrates an example of the signalling method according to the invention,

Figure 4 illustrates another example of the signalling method according to the invention, and

Figure 5 illustrates the protocol stack which controls the use of the transmission band.

Detailed description of the invention

Although it is not always possible to transfer signalling to shared channels (for instance, handover signalling due to delay requirements), it is possible in some cases. If the Mobile Station listens to shared channels anyway, it is not always optimal to use a part of the traffic channel capacity for signalling and thus deteriorate the quality of the connection using the traffic channel. Instead, it is beneficial to use any idle and otherwise wasted capacity of the shared channel for message transfer.

On the other hand, if a part of the traffic channel capacity is used for signalling, it does not in some cases cause significant or even noticeable deterioration in the Quality of Service of the connection of the Traffic Channel. In this case, for example, a signalling message which is transmitted via the Slow Associated Control Channel (SACCH) could be transmitted faster via the Fast Associated Control Channel (FACCH) which uses the traffic channel capacity. When the message is transmitted to the receiver faster, any control commands transmitted within the message can also be executed faster. Because of the faster control capability of this system, more efficient use can be made of the resources available to the system which, in turn, improves the total capacity of the system.

The signalling arrangement according to the invention is illustrated in Figures 3 and 4. Figure 3 illustrates the transmission of messages from the Mobile Station (MS) to the Base Station Subsystem (BSS). The messages are related to the physical channel allocation request made by the Mobile Station. According to the invention, it is possible to transmit these messages via different logical channels. The available signalling channels are the Stand-alone Dedicated Control Channel (SDCCH), which is allocated separately from traffic channels for each connection, the Fast Associated Control Channel (FACCH), which uses the traffic channel band, and the Normal Random Access Channel (N-RACH), which is shared by several connections. Different logical channels should preferably use slightly different message formats. In the shared N-RACH channel, for instance, the mes-

sage must include the connection identifier, which is not needed with connection-specific signalling channels. When sending a message at a particular point in time, the selection facilities of the Mobile Station are used to select, according to a predefined selection rule, the channel which is optimal for sending the message. This logical channel is mapped to a physical channel as shown in the figure. The message is sent across that physical channel by using the Mobile Station's transmission facilities. At the point in time shown in the figure, the intervals of the physical channels are allocated as follows: intervals 0 through 21 are allocated to traffic channels, intervals 22 and 23 can be allocated to connection-specific SDCCH channels, interval 24 is used by the multiple-access N-RACH channel, and interval 25 is empty. The Base Station Subsystem has been adapted to correctly interpret connection set-up requests from all logical SDCCH, FACCH, and N-RACH channels which are available for message transfer.

Figure 4 illustrates the transmission of messages related to physical channel allocation from the Base Station Subsystem (BSS) to the Mobile Station (MS). In accordance with the invention, the messages can be transmitted by using different logical channels. The available signalling channels are the Stand-alone Dedicated Control Channel (SDCCH), which is allocated separately from traffic channels for each connection, the connection-specific FACCH channel, which uses the traffic channel band, and the Allocation Channel (ACH), which is shared by several connections.

When sending a message at a particular point in time, the selection facilities of the Base Station Subsystem are used to select, according to a predefined selection rule, the channel which is optimal for sending the message. The Base Station Subsystem (BSS) consists of the Base Station Controller (BSC) and the Base Transceiver Stations (BTS). The selection of the logical channel and the transmission of the messages over the selected logical channel can be carried out by using the selection and transmission facilities located either at the Base Transceiver Station (BTS) or at the Base Station Controller (BSC). At the point in time shown in the figure, the intervals of the physical channels are allocated as follows: intervals 0 through 21 are allocated to traffic channels, intervals 22 and 23 can be allocated to connection-specific SDCCH channels, interval 24 is used by the Allocation Channel (ACH), and interval 25 is empty. The Mobile Station can correctly interpret

channel allocation messages from all logical SDCCH, FACCH and ACH channels which are available for message transfer.

An important observation is that it is preferable to send the control information via different logical channels in different situations. The information can be sent either by using a connection-specific signalling channel or one shared by several connections. In systems where one link (for example, the link between the Base Station Subsystem and the Mobile Station) contains several simultaneously active connections, link-specific signalling channels can be allocated

- as shared by all link connections,
- as shared by a group of link connections, or
- separately to some link connections.

In this application, the term "connection-specific signalling channel" refers, for the sake of simplicity, to all signalling channels which are allocated using some of these methods.

Connection-specific signalling channels include, for example, the FACCH and SDCCH. When using the Fast Associated Control Channel (FACCH), which "steals" some of the traffic channel band, the messages can be sent quickly and a certain speed level can be guaranteed for the connection. However, this limits the transmission band available to the traffic channel which may cause deterioration in the quality of the connection. When using the independent connection-specific SDCCH channel, which is allocated separately from the logical traffic channel, the messages can be sent quickly and in accordance with delay requirements. However, a sufficient number of physical channels must first be allocated to the SDCCH. As physical channels should not be kept allocated when they are not needed, adopting a SDCCH channel or changing the transmission bandwidth allocated to it, always requires extra signalling.

The drawback in connection-specific logical channels is their low statistical efficiency compared with shared logical channels allocated to several connections. The higher efficiency of channels shared by all system subscriber units, such as Mobile Stations or a group of subscriber units, is based on "statistical multiplexing". Statistical multiplexing can be efficiently used if the use of the channel for the messages from different connections can be controlled systematically. This can be achieved, for example, in a

mobile communications system when sending Base Station Subsystem (BSS) messages to several Mobile Stations (MS).

An example is used to explain the benefits of statistical multiplexing in the following. In this example, the Base Station Subsystem sends an average of ten messages per second to ten distinct subscriber units. The sending of one message always requires one interval. There is statistical deviation in the number of messages sent: in 95% of the cases, the number of messages to be sent to a single subscriber unit is under 15. Longer delays are not allowed for messages, and messages must be transmitted in 95% of the cases to the Base Station Subsystem with a delay of under one second.

For message transmission, it is possible to allocate separate transmission capacity to each connection between the Base Station Subsystem and the subscriber unit. To satisfy the requirements set for the transmission speed of messages, each user must be allocated 15 intervals per second. Thus, a total of 150 intervals per second must be allocated for message transmission. For most of the time, considerably less than 15 messages per second are sent to a single subscriber unit which means that a significant portion of the capacity allocated for message transfer is underused.

It is also possible to allocate a shared channel for message transmission which is used to transfer all messages sent to different subscriber units. In this case, a message receiver identifier must be added to each message. For example, a 3-bit identifier can be used to separate the messages of 10 different receivers. For the sake of simplicity, let us also assume that a message with an identifier fits in one interval. If the messages are transmitted via a shared channel, the independence of the messages sent to different subscriber units is an advantage. It is highly improbable that 15 or more messages would be sent to all subscriber units within a certain second. The average total number of messages sent to ten subscriber units (with an average of ten messages per subscriber unit and less than 15 in 95% of the cases) is less than 114 messages. Therefore, an allocation of 114 intervals per second is sufficient for a shared channel. Compared with the use of connection-specific channels, the resulting saving is 36 intervals, or 24%, in transmission capacity.

As mentioned above, the efficient use of statistical multiplexing requires the co-ordination of message transfer. For example, messages sent

by different Mobile Stations to the same Base Station via a shared channel cannot be co-ordinated without an Aloha-type random access method. If two or more mobile stations send their messages to the Base Station Subsystem simultaneously, a "message collision" occurs, and, typically, the Base Station Subsystem is unable to correctly interpret any of the messages sent to it. This limits the penetration of shared uplink channels to a degree where, for example, the penetration level of a channel allocated to ten users is a maximum of 39 per cent of the channel capacity.

The selection of the logical channel to be used can be affected, for example, by the number of messages to be sent. If a large number of signalling messages to be sent has accumulated in the buffer, the transfer of messages via the FACCH would significantly deteriorate the quality of the traffic channel. Correspondingly, the transfer of messages via the shared channel would take a significant portion of the shared channel bandwidth, which would cause other connections to suffer and decrease overall efficiency. In this case, it is best to use a separate connection-specific SDCCH channel for message transfer. Any allocation of the SDCCH required does not significantly add to the signalling, and the usage rate of the allocated channel capacity will be sufficiently high.

If there are only a few messages to be sent, it is not worthwhile to allocate a connection-specific SDCCH channel, because allocation itself causes too large a relative signalling need. Correspondingly, the sending of these messages does not significantly load the shared channel. In this case, the FACCH, which also uses the traffic channel capacity, is a better choice than the SDCCH, as there is no need to use a significant portion of the traffic channel bandwidth.

In addition to the number of messages already in the transmission buffer, the selection of a logical channel can also be based on the estimated number of messages to be sent in the near future. The number of messages to be sent in the near future can be estimated to be large at the start-up of call set-up, authentication or handover, for example. It may be useful to allocate a separate connection-specific SDCCH channel distinct from the traffic channel for such expected signalling needs. The allocation of the SDCCH is also useful for regular longer-term signalling needs. An example of such a signalling need is the feedback signalling of downlink power control in which a message is sent regularly, for example, every 500 milliseconds.

The third factor which affects the selection of a logical channel is the priority and delay requirements of the messages waiting in the transmission queue. When transferring delay-tolerant Non-Real Time (NRT) information, such as a computer program to be executed, the signalling can be a little slower. On the other hand, when the signalling is related to Real Time (RT) traffic with strict transmission delay requirements, it is important that, for example, the channel is allocated as fast as possible for the connection in order to satisfy the delay requirements set for the traffic channel. Therefore, the signalling delay requirements set to RT traffic must be significantly higher than those set to NRT traffic.

In addition to connection type, the contents of the message itself naturally have an effect on message priority and delay requirements. Some messages transfer information which must be delivered to the receiver very quickly, for example, to prevent the call from breaking off. An example of such a situation is handover caused by a sudden drop in signal level. On the other hand, a handover carried out only to get a slightly better channel is not as urgent because, if it is delayed, the call is not broken off.

Of the logical channels described in the above example, the shortest delay is typically guaranteed by the use of the FACCH channel which uses the traffic channel bandwidth. Messages can be transferred quickly via the SDCCH only if a sufficient capacity has already been allocated to the SDCCH. If the allocated capacity of the SDCCH must be changed to send messages, the signalling required by the allocation change causes additional delay. If messages are sent via a shared channel, the delay is heavily affected by the current usage rate of the shared channel.

The fourth factor which affects the selection of the logical channel is the effect of the use of the logical channel in question on the Quality of Service (QoS). For example, if the traffic channel of a video connection which requires a low bit/error ratio is taken into signalling use, the Quality of Service may deteriorate too much. On the other hand, if a portion of the same size is taken into signalling use from the traffic channel of a voice connection which allows a higher bit/error ratio, the quality of the voice connection may not deteriorate noticeably. The least problems from the taking of the traffic channel into signalling use are caused to delay-tolerant NRT-type connections for which the lower traffic channel capacity causes only a slight additional delay.

The fifth factor which affects the selection of the logical channel is the usage ratio of the channels allocated to signalling. If, for example, the SDCCH channel which has already been allocated for use by the connection and which is external to the traffic channel, contains unused capacity which has not yet been released, it is naturally preferable to use it for message transfer. Correspondingly, the usage rate of the shared channels affects the message delay. If the usage rate is low, it is worthwhile to send the message via the shared channel. This enables the use of some of the currently unused capacity allocated to the shared channel, which improves the channel's usage rate. On the other hand, it is not preferable to cause additional load to a shared signalling channel which is already heavily loaded. In mobile communications systems, the information about the shared channel load level is not available to Mobile Stations, but only to the Base Station Subsystem. Because of this, the load information can only be used when selecting the logical channel for messages sent from the Base Station Subsystem to the Mobile Station.

Let us study, in the following, a preferable protocol arrangement which implements functionality according to the invention. Figure 5 shows a protocol stack which controls the radio interface traffic of a mobile communications system. The figure shows the physical layer L1, the link layer L2 which consists of the sublayers RLC/MAC (RLC = Radio Link Control, MAC = Medium Access Control) and LLC (Logical Link Control), and the network layer L3. There are other layers above the network layer but they are not essential to this study.

The physical layer codes, multiplexes and modulates the signal for radio transmission. Correspondingly, the layer decodes the modulation, multiplexing and channel coding of the signal during radio reception.

The RLC/MAC sublayer located above the physical layer handles the management and allocation of radio resources and related signalling, and the mapping of logical channels to physical channels. The layer can be divided into the MAC section which is common to all connections, and to the connection-specific RLC section. The management of radio resources takes place in the Base Station System located within the fixed network.

Radio resources are allocated to various connections in a slightly different manner because of the differing nature of their transmission needs. For RT connections which place strict requirements on delay, MAC allocates

a circuit-switched channel which can be changed dynamically. The allocation is in effect until it is released by the next MAC message.

For NRT connections which have better delay tolerance, MAC allocates a packet-switched channel. On the packet-switched channel, MAC gives the connection permission to send a certain amount of data at a time. The channel can be allocated either for sending a specific packet group only or for a longer term connection for sending several sequential packet groups.

Within the RLC/MAC layer, the RLC unit, which is defined for each connection separately, handles the maintenance of the Quality of Service (QoS) which was negotiated for the connection. To keep the quality on the negotiated level, RLC selects the correct transmission format for the connection, which includes the selection of error correction, multiplexing depth and modulation method, and retransmission of faulty frames.

LLC establishes a logical connection for the radio transmission which uses the services offered by the RLC/MAC layer located beneath the LLC. LLC uses the information received from layers located above it to create LLC frames suitable for radio transmission by the RLC/MAC layer and, correspondingly, assembles the radio information contained in consecutive LLC frames received from the RLC/MAC layer for transmission to layers located above the LLC.

It is best to select the logical channel to be used for message transmission in the protocol layer, where most of the above-mentioned information which affects channel selection can be found. Additionally, the lower the protocol implementation level the more effective the functionality.

The information about the logical content of the physical channels is not available to the physical layer, so the functionality cannot be placed there. The best place for implementing the functionality according to the invention is the MAC/RLC layer. Regarding the above-mentioned information which improves the selection of the logical channel, the RLC/MAC layer and the RLC unit within it hold the information concerning the number of buffered messages. Additionally, the RLC unit can estimate the delay requirements and priority and expected number of the so-called MAC messages created by the RLC/MAC layer. The Quality of Service monitoring is also implemented in the RLC unit contained within the layer. Furthermore, the layer knows the usage rate of allocated channels since it is responsible for physical channel allocation. The only information that is directly missing in the

MAC layer is the estimate of the number and priority of the expected number of upper layer messages. Even this information can be directed to it, if necessary, by using the signalling between protocol layers.

Even though the invention is described above as implemented within the context of signalling which occurs over the radio interface of a mobile communications system, it is clear that the invention's scope of protection is not limited to this context. This invention can be used in all systems where several logical channels can be mapped in various ways to physical channels.

In addition to pure signalling data, this method can also be used to transfer small amounts of user information. For larger amounts of user information, it is naturally best to allocate a traffic channel in the normal manner. In some cases, however, it is best to transmit small user data packages, which may be separate from other link connections, such as DTMF control signals, by using a logical signalling channel (such as an already allocated connection-specific signalling channel or a signalling channel which is shared by several connections) which is selected according to this invention. A message type which separates the message from the signalling traffic should, naturally, be used for such user information.

Claims

1. A method of transmitting information from the sender to the receiver in a communications system which consists of several subscriber units and at least one network element servicing the subscriber units and in which links are formed between units for information transfer, in which the transmission resources which consist of physical channels are divided between logical channels which are separated according to their purpose of use, such as signalling channels intended for transmission of signalling information needed to maintain connection and traffic channels which are required for transmission of information from one user to another, c h a r a c t e r i z e d in that

at least two logical channels are defined for sending information,

the logical channel used for transmission of information is selected dynamically according to a predefined transmission rule, and

the information is sent to the receiver via the selected logical channel.

2. A method according to claim 1, c h a r a c t e r i z e d in that the information is control information related to controlling the connection.

3. A method according to claim 1, c h a r a c t e r i z e d in that the information to be sent is a signalling message related to controlling radio resources.

4. A method according to claim 1, c h a r a c t e r i z e d in that the information to be sent is utility data transmitted between the users.

5. A method according to claim 3, c h a r a c t e r i z e d in that the logical channels available for selection include at least one shared channel allocated for common signalling between all subscriber units and the network element which provides services for them.

6. A method according to claim 5, c h a r a c t e r i z e d in that the shared channel is allocated jointly to all subscriber units of the system.

7. A method according to claim 5, c h a r a c t e r i z e d in that the shared channel is allocated jointly to a group of subscriber units.

8. A method according to claim 1, c h a r a c t e r i z e d in that the logical channels which can be selected include at least one link-specific signalling channel which is common to a group of link connections.

9. A method according to claim 8, c h a r a c t e r i z e d in that the link-specific signalling channels include a signalling channel which uses the capacity allocated to the traffic channel.

10. A method according to claim 8, c h a r a c t e r i z e d in that the link-specific signalling channels include a signalling channel which is allocated to the connection separately from the allocation of traffic channels.

11. A method according to claim 1, c h a r a c t e r i z e d in that the logical channels which are available for selection include at least one signalling channel which is connection-specific to one of the link connections.

12. A method according to claim 11, c h a r a c t e r i z e d in that the connection-specific signalling channels include a signalling channel which uses the capacity allocated to the traffic channel.

13. A method according to claim 11, c h a r a c t e r i z e d in that the connection-specific signalling channels include a signalling channel which is allocated to the connection separately from the allocation of traffic channels.

14. A method according to claim 1, c h a r a c t e r i z e d in that the parameters of the selection rule used in logical channel selection include the quantity of buffered information to be sent.

15. A method according to claim 1, c h a r a c t e r i z e d in that the parameters of the selection rule used in the logical channel selection include an estimate of the quantity of information which will arrive for sending in the future.

16. A method according to claim 1, c h a r a c t e r i z e d in that the parameters of the selection rule used in the logical channel selection include the requirements to the transmission delay set by the information to be transmitted.

17. A method according to claim 1, c h a r a c t e r i z e d in that the parameters of the selection rule used in the logical channel selection include the priority of the information to be sent.

18. A method according to claim 1, c h a r a c t e r i z e d in that the parameters of the selection rule used in the logical channel selection include the change in the quality of service of the connection caused by the use of at least one logical channel available for the transmission of information.

19. A method according to claim 1, c h a r a c t e r i z e d in that the parameters of the selection rule used in the logical channel selection include the load level of at least one logical channel which is available for selection for the transmission of information.

20. A method according to claim 1, c h a r a c t e r i z e d in that the selection of the logical channel to be used is carried out by the unit which manages radio resources.

21. A method according to claim 1, c h a r a c t e r i z e d in that the information to be sent is transmitted over different logical channels in different message formats.

22. A base station controller for a mobile communications system which consists of at least one base station controller, base stations, and several mobile stations, in which it is possible to establish connections between mobile stations and base stations, and in which system the transmission resources which consist of physical channels are divided between logical channels separated according to their purpose of use, c h a r a c t e r i z e d in that the base station controller includes

selection facilities for dynamic selection of the logical channel to be used for sending the information from a group of logical channels which are available for transmission of information according to a predefined selection rule, and

transmission facilities for sending information to a mobile station via the selected logical channel.

23. A base station for a mobile communications system which consists of at least one base station controller, base stations, and several mobile stations, in which it is possible to establish connections between mobile stations and base stations, and in which system the transmission resources which consist of physical channels are divided between logical channels separated according to their purpose of use, c h a r a c t e r i z e d in that the base station includes

selection facilities for the dynamic selection of the logical channel to be used for sending the information from a group of logical channels which are available for the transmission of information according to a predefined selection rule, and

transmission facilities for sending information to a mobile station via the selected logical channel.

24. A mobile station for a mobile communications system which consists of at least one base station controller, base stations, and several mobile stations, in which it is possible to establish connections between mobile stations and base stations, and in which system the transmission resources which consist of physical channels are divided between logical channels separated according to their purpose of use, c h a r a c t e r i z e d in that the base station includes

selection facilities for the dynamic selection of the logical channel to be used for sending the information from a group of logical channels which are available for the transmission of information according to a predefined selection rule, and

transmission facilities for sending information to a base station via the selected logical channel.

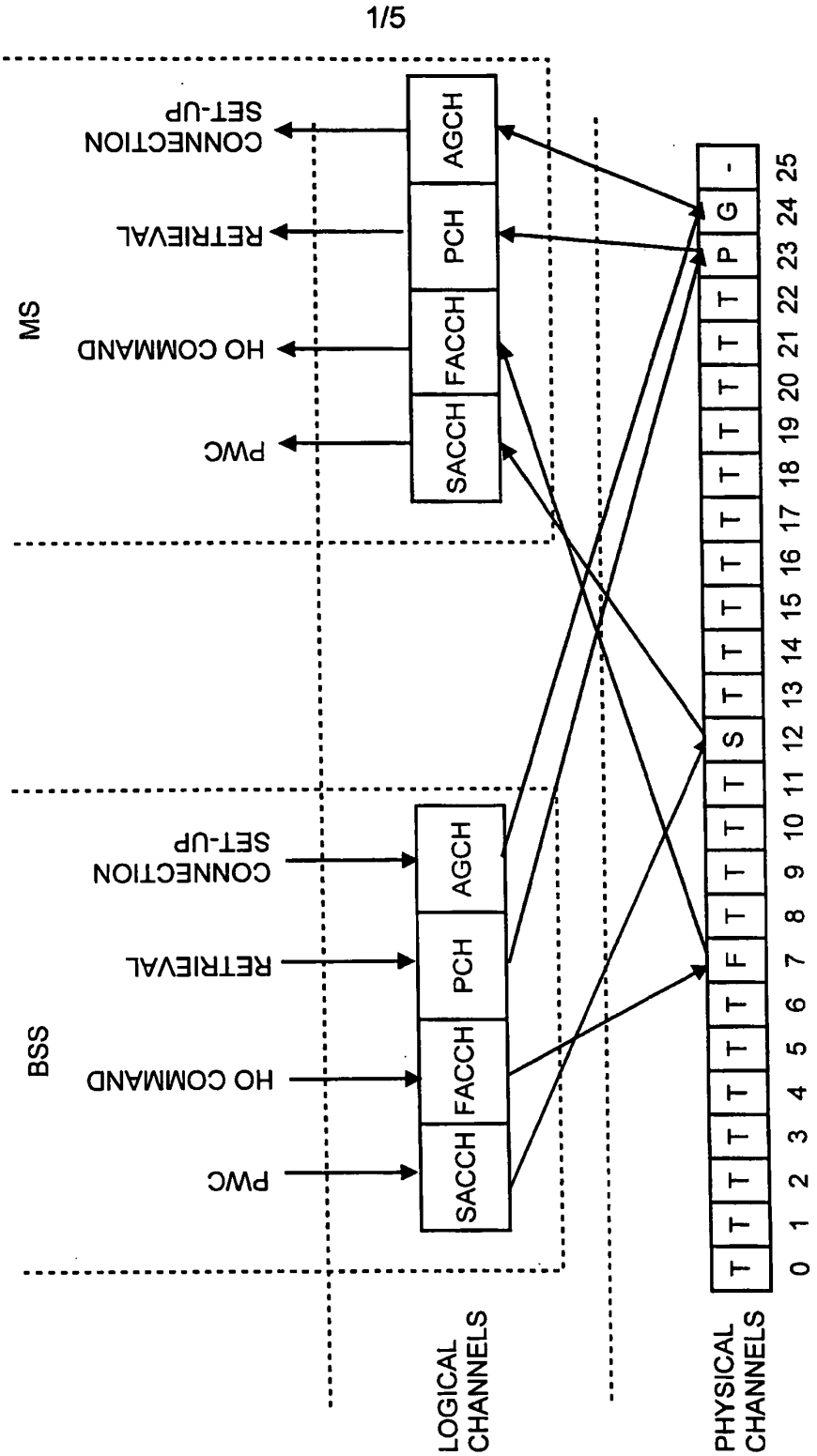

MS
BSS
CONNECTION SET-UP
RETRIEVAL
HO COMMAND
PWC
AGCH
PCH
FACCH
SACCH
LOGICAL CHANNELS
PHYSICAL CHANNELS
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
T T T T T T F T T T T T S T T T T T T T T T P G -

FIG. 1.

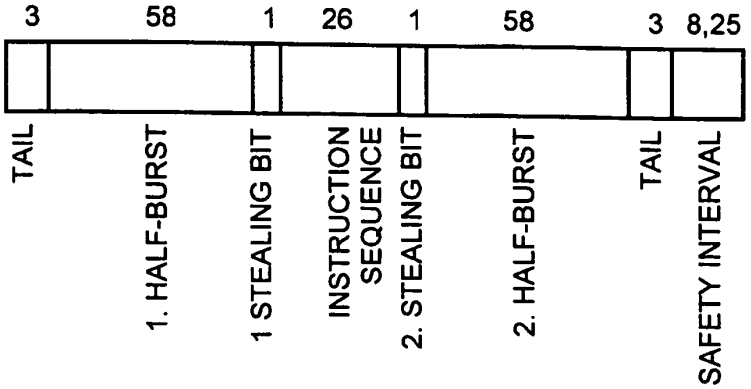

3
58
1
26
1
58
3
8,25
TAIL
1. HALF-BURST
1 STEALING BIT
INSTRUCTION SEQUENCE
2. STEALING BIT
2. HALF-BURST
TAIL
SAFETY INTERVAL

FIG. 2.

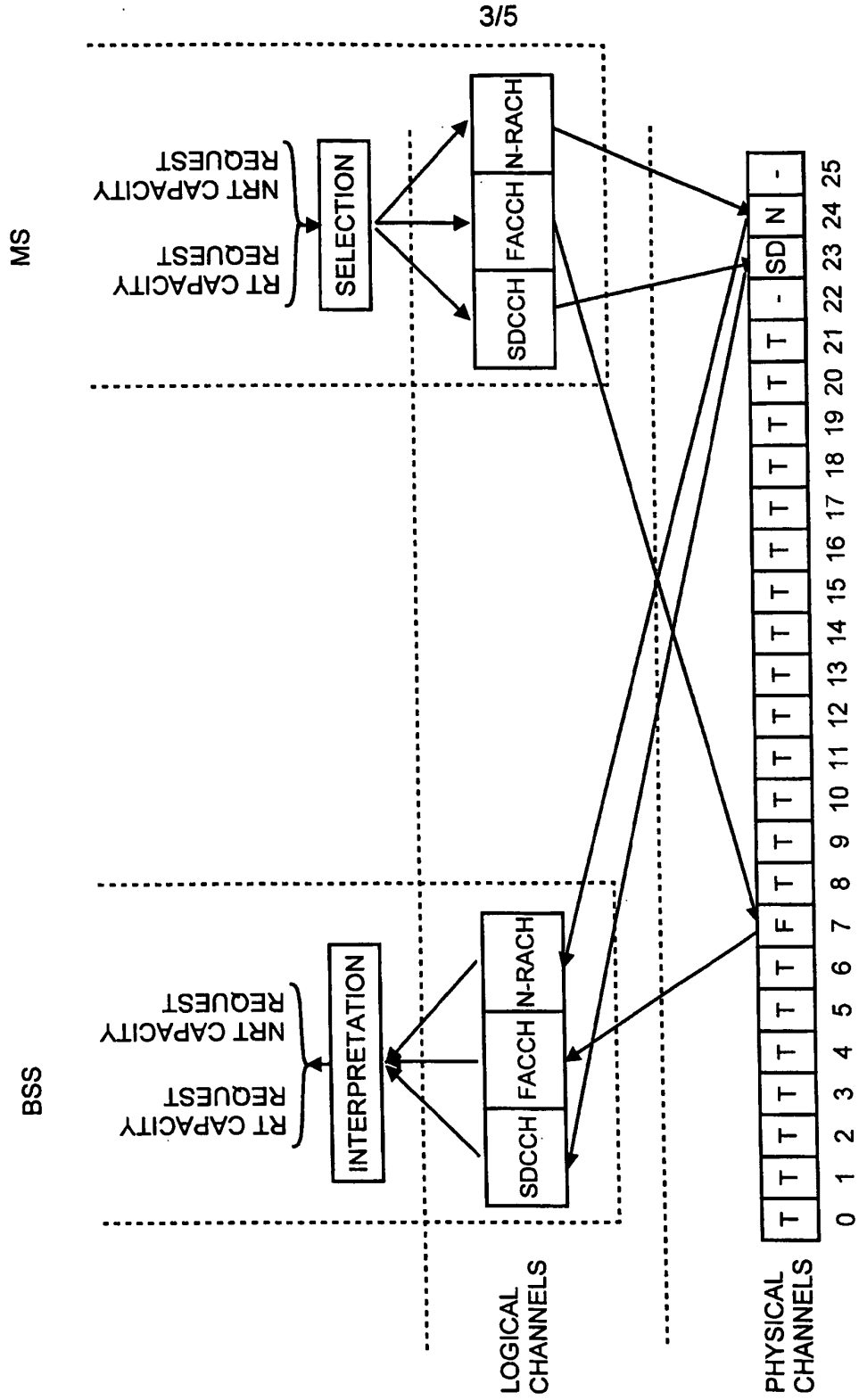

MS
BSS
RT CAPACITY REQUEST
NRT CAPACITY REQUEST
SELECTION
INTERPRETATION
SDCCH
FACCH
N-RACH
LOGICAL CHANNELS
PHYSICAL CHANNELS
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
T T T T T T F T T T T T T T T T T T T T T - SD N -

FIG. 3.

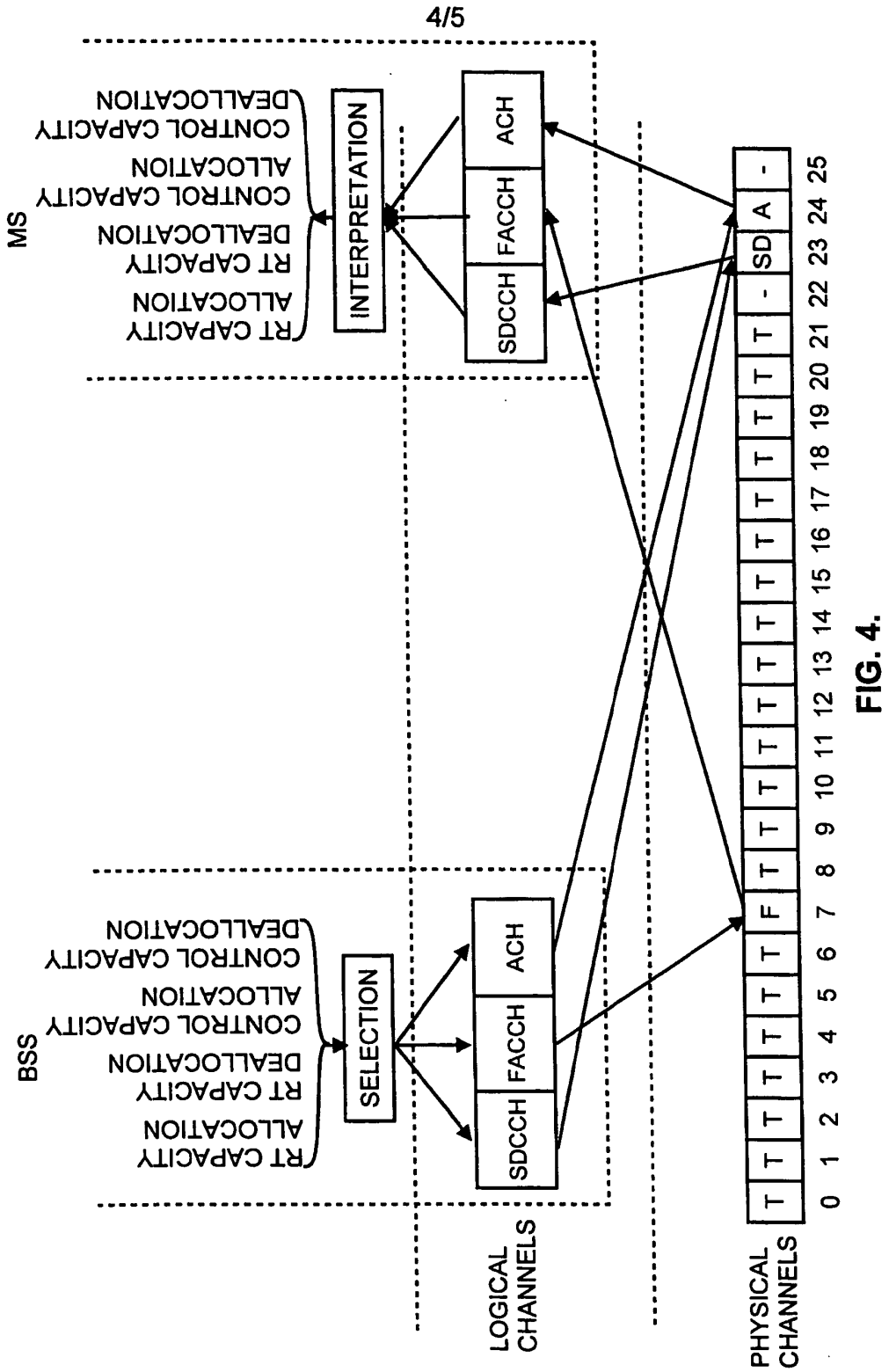

MS
BSS
INTERPRETATION
SELECTION
ACH
FACCH
SDCCH
RT CAPACITY ALLOCATION
RT CAPACITY DEALLOCATION
CONTROL CAPACITY ALLOCATION
CONTROL CAPACITY DEALLOCATION
LOGICAL CHANNELS
PHYSICAL CHANNELS
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
T T T T T T T F T T T T T T T T T T T T - SD A -

FIG. 4.

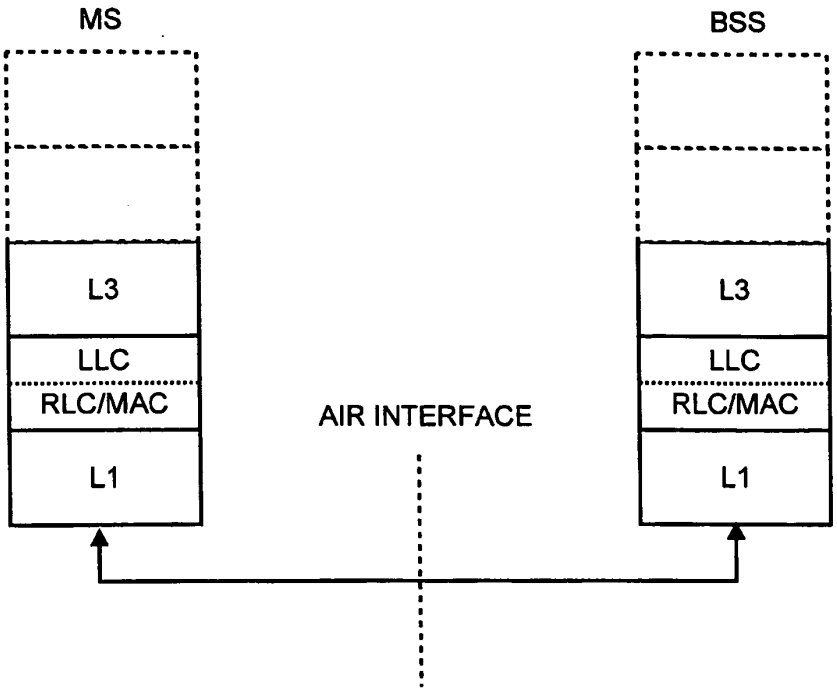


FIG. 5.

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04Q 7/38

A2

(11) International Publication Number: **WO 99/51051**

(43) International Publication Date: 7 October 1999 (07.10.99)

(21) International Application Number: PCT/FI99/00268

(22) International Filing Date: 31 March 1999 (31.03.99)

(30) Priority Data:
980736 31 March 1998 (31.03.98) FI

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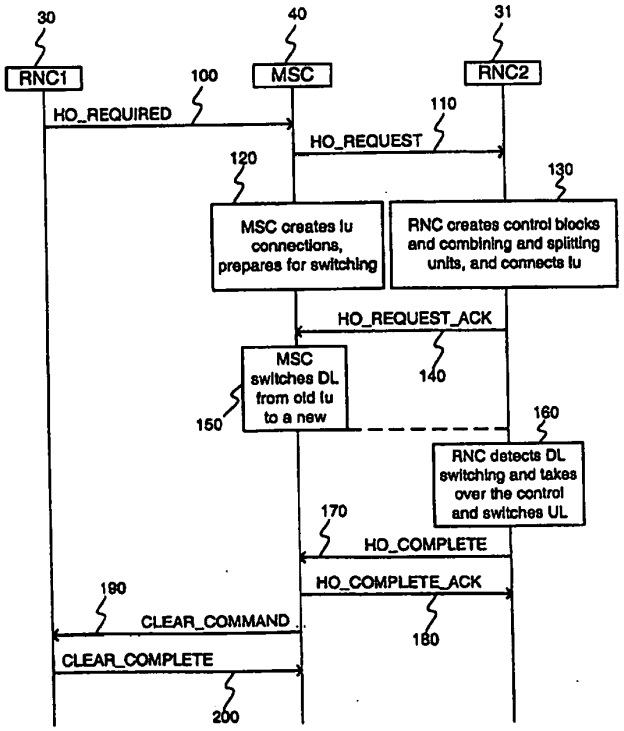
(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian 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), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
Without international search report and to be republished upon receipt of that report.

(54) Title: A METHOD FOR CONTROLLING CONNECTIONS TO A MOBILE STATION

(57) Abstract

The invention describes the realisation of transmission link optimisation in a situation, where a mobile station has moved from a network area controlled by a first radio network controller (RNC) RNC1 to a network area controlled by a second radio network controller RNC2. Signalling associated with the procedure is executed between the two RNC:s and a mobile switching center (MSC). The mobile station does not need to participate in the signalling, since the used radio resources remain the same. The object of this procedure is to optimise the utilisation of transmission links in the radio access network being used (RAN) and to minimise the transmission delay between the controlling RNC and the radio interface. This is realised by relocating the entities which control connections of a mobile station from the first RNC to the second RNC, and optimising the transmission links between the MSC and the second RNC. Such controlling entities may comprise e.g. the macrodiversity combining function, radio resource control block and associated user plane entities.



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A method for controlling connections to a mobile station

TECHNICAL FIELD OF THE INVENTION

The invention is directed to a method for optimisation of transmission links in a cellular telecommunications network.

BACKGROUND OF THE INVENTION

Figure 1 shows an example of a situation, which sometimes occur during a hard handover, i.e. when a mobile station 10 changes the base station or base stations 20 it uses. Such a situation may occur, for example, when a mobile station moves from one cell to another in a cellular telecommunication system. Figure 1 depicts two situations, situation A, when the mobile station 10 is still in the area of the first cell, and situation B, when the mobile station (MS) has moved to the area of the second cell. Figure 1 shows also base stations (BS) 20, which are controlled by radio network controllers (RNC) 30, 31. The radio network controllers are connected to a mobile switching center (MSC) 40. In the first situation, the mobile station 10 is in position marked by the letter A, having connections to base stations 20 controlled by the first RNC 30. The radio network controller 30 comprises combining 33 and splitting 34 units. Combining units 33 combine uplink signals belonging to same bearer coming from base stations, and splitting units replicate downlink signals to more than one base station. The RNC 30 also comprises a protocol control block, which executes the protocols needed for communication with the mobile station 10. The RNC 30 forwards the uplink data to and receives downlink data from the MSC 40, which communicates with the rest of the telecommunications network.

When the mobile station moves to the position marked by the letter B, the mobile station 10 establishes radio links to the base stations 20. During the handover signalling, the first RNC 30, i.e. RNC1 in figure 1, establishes the necessary connections B' via RNC2 to base stations 20 controlled by the RNC2, and releases the former connections A' to the base stations 20 controlled by the RNC1. The controlling RNC, i.e. RNC1 in figure 1, is commonly called the controlling RNC. The other RNC, i.e. RNC2 in figure 1, is commonly called the drift RNC. Further, in some specifications for the UMTS (Universal Mobile Telecommunication System), the interface between two RNC:s is called the Iur interface, and the interface between a MSC and a RNC is called the Iu interface. These interface names are used in this specification.

The system of figure 1, namely the use of a controlling RNC and a drift RNC, has certain drawbacks which arise from the fact, that in situation B the transmission links are routed via two RNC:s, instead of only one as in situation A. As the number of transmission links increase, also the delays created by the links increase. The increase of delays places more demands on the whole network, when the network has to fulfill strict delay requirements for constant delay services, such as speech. Further, since the number of transmission links in use increases, the load on the network increases.

SUMMARY OF THE INVENTION

An object of the invention is to optimize transmission links in a cellular telecommunications network, when a mobile station has moved from an area controlled by a first radio network controller to a second area controlled by a second radio network controller. Another object of the invention is to realize a method for reducing transmission delays between the controlling radio network controller and the base stations in a situation, when a mobile station has moved from an area controlled by a first radio network controller to a second area controlled by a second radio network controller. A further object of the invention is to realize a method for reducing network load in a situation, when a mobile station has moved from an area controlled by a first radio network controller to a second area controlled by a second radio network controller. A still further object of the invention is to alleviate the aforementioned problems.

The objects are reached by relocating the connection controlling entities from the first radio network controller to the second radio network controller, whereby the second radio network controller becomes the controlling radio network controller, and by optimising the links between the mobile switching center being used and the second radio network controller.

The method for handover according to the invention is characterized by that, which is specified in the characterizing part of the independent method claim directed to a method for handover. The method for setting up a connection according to the invention is characterized by that, which is specified in the characterizing part of the independent method claim directed to a method for setting up a connection. The system according to the invention is characterized by that, which is specified in the

characterizing part of the independent method claim directed to a system. The dependent claims describe further advantageous embodiments of the invention.

The invention describes the realisation of transmission link optimisation in a situation, where a mobile station has moved from a network area controlled by a first radio network controller (RNC) RNC1 to a network area controlled by a second radio network controller RNC2. Signalling associated with the procedure is executed between the two RNC:s and a mobile switching center (MSC). The mobile station does not need to participate in the signalling, since the used radio resources remain the same. The object of this procedure is to optimise the utilisation of transimission links in the radio access network being used (RAN) and to minimise the transmission delay between the controlling RNC and the radio interface. This is realised by relocating the entities which control connections of a mobile station from the first RNC to the second RNC, and optimising the transmission links between the MSC and the second RNC. Such controlling entities may comprise e.g. the macrodiversity combining function, radio resource control block and associated user plane entities.

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 a situation, which may occur in a prior art system after a hard handover,

Figure 2 illustrates a starting situation for the explanation of a method according to an advantageous embodiment of the invention,

Figure 3 illustrates the final situation after performing of a method according to an advantageous embodiment of the invention,

Figure 4 illustrates the signalling according to an advantageous embodiment of the invention, and

Figure 5 illustrates the signalling according to an advantageous embodiment of the invention.

Same reference numerals are used for similar entities in the figures.

DETAILED DESCRIPTION

An advantageous embodiment of the invention is described in the following with reference to figures 2, 3, and 4. Figure 2 shows an initial situation, where a mobile station 10 (MS) has connections to base stations 20, which are controlled by another RNC 31 than that RNC 30, which controls the connections to the mobile station. In this starting situation, RNC1 30 controls the connections to the mobile station, while the connections are routed via RNC2 31, which controls the base stations, in whose area the mobile station is currently located. This situation may arise from example, when the mobile station initiates connections while located within a cell controlled by RNC1 30, and later moves away from that cell to another, which is controlled by RNC2 31. A mobile switching center 40 (MSC) forwards the connections from the rest of the network (not shown in figure 2) to the RNC:s. The RNC:s further comprise combining and splitting units 33, 34. Combining units 33 combine uplink signals belonging to same bearer coming from base stations, and splitting units replicate downlink signals to more than one base station. The MSC comprises, among others, a switching block 41. Figure 3 illustrates the system of figure 2 after a handover. The signalling associated with a handover according to an advantageous embodiment of the invention is illustrated in figure 4.

The RNC which controls, i.e. manages the connections to the MS, communicates with the MS using certain protocols, such as the RLC (Radio Link Control), MAC (Medium Access Control) and RRC (Radio Resource Control) protocols. The RNC comprises certain functional blocks 32 for performing these protocols. These functional blocks are in the following called protocol control blocks 32. The protocol control blocks follow the protocol rules set by the network specifications, and include a memory for storing information associated with the current state of each protocol and other related information. These protocol control blocks are usually realised as computer programs, which take care of the procedures associated with each protocol.

In the starting situation, the mobile station has obtained radio resources from RNC2, since it is RNC2 that controls the base stations (BS) which the MS is currently using. The connections at the interface between RNC1 and RNC2, i.e. the Iur interface, have been set up by RNC1, at the time when the mobile station moved from a cell controlled by RNC1 to a cell controlled by RNC2. These connections

are identified by leg identifiers. The base station to RNC links are set up by the RNC controlling the base station in question, in this case by RNC2.

In practice, the MS may also be using radio resources from other RNCs. For simplicity, the initial situation shown in figure 2 only includes connections from base stations controlled by RNC2. In one embodiment of the invention, radio resources from other RNCs are released before performing a RNC handover described in the following. However, the invention is not limited to that embodiment. In other embodiments of the invention, radio resources from other RNCs may also be left unchanged during a RNC handover.

The handover procedure is initiated by a HO_REQUIRED message, which RNC1 30 sends 100 to the MSC 40. The message comprises information necessary for setting up the handover, namely identification of target RNC, leg identifiers for the Iur interface connections between RNC1 and RNC2, and protocol control block information specifying the protocols and the current state of the protocols in use.

Preferably, after sending of the HO_REQUIRED message, RNC1 is not allowed to change those characteristics of the connection or connections, which characteristics were specified in the HO_REQUIRED message. Otherwise, more signalling is needed between RNC1 and RNC2 before RNC2 takes over the connections in order to ensure, that RNC2 has correct information about the state of the connections.

Upon reception of the HO_REQUIRED message the MSC starts to create new Iu connections to the target RNC. The MSC also sends 110 a HO_REQUEST message to RNC2, which message includes the same information necessary for setting up the handover.

Normal Iu connection setup procedures can be used to create the new Iu connections to the target RNC. The setting up of the Iu connections can be performed before, roughly at the same time, or after sending of the HO_REQUEST message to RNC2, depending on the chosen Iu connection setup procedure. MSC also prepares itself, i.e. the switching block of the MSC, to be able to switch each old Iu connection to its newly established counterpart, without any loss of data. Figure 4 corresponds to such an embodiment of the invention, where the setting up 120 of Iu connections is performed after the sending of the HO_REQUEST message to RNC2.

The MSC is not the only entity suitable for creating the Iu connections between MSC and the target RNC. In another exemplary embodiment of the invention, the RNC2 performs the setting up of the new Iu connections between the RNC2 and the MSC, after receiving the HO_REQUEST message from the MSC.

MSC adds further information to the information received in the HO_REQUIRED message and passed on to RNC2 in the HO_REQUEST message, namely at least a handover identifier. In such an embodiment of the invention, where the MSC takes care of creating the new Iu interface links between the MSC and the target RNC, the MSC also adds identifiers of the new Iu links to the information passed on to the target RNC, in order to enable the target RNC to use the established Iu links in the particular handover.

The target RNC, RNC2, uses the Iur leg identifiers specified in the HO_REQUEST message to identify which of the currently active Iur interface legs are to be included in the handover procedure. The target RNC2 creates 130 protocol control blocks for the connections to the mobile station, and sets their state according to the protocol control block information contained in the message. Thereafter the protocol control blocks are able to take over controlling the MS after execution of the handover, and are set to wait for a trigger for starting the operation.

The HO_REQUIRED and HO_REQUEST messages also preferably comprise information about which identifier was used by RNC1 to identify itself to the active base stations. This information is needed after RNC2 takes over the connections to allow RNC2 to identify itself to the base stations and to allow the base stations to accept data from RNC2 and ignore data from RNC1.

The HO_REQUIRED message sent by the RNC1 may also in some embodiments of the invention comprise a time reference proposal for the execution time of the handover. However, other ways of specifying the execution time are specified later in this specification.

RNC2 creates 130 a combining unit for each of the uplink bearers and a splitting unit for each of the downlink bearers, whereafter RNC2 connects the new Iu links to corresponding splitting and combining units. A combining unit is a unit which combines the signals belonging to a single bearer from the base stations, which have received the same bearer. A splitting unit is a unit which distributes a bearer to multiple base stations for transmission.

RNC2 also prepares itself to switch the data stream coming from uplink combining units connected to the current Iur links identified by the leg identifiers in the HO_REQUEST message, to the new uplink combining units connected to the new Iu links. However, RNC2 can also prepare itself in other ways to switch the data stream. For example, in an another advantageous embodiment of the invention, RNC2 duplicates the uplink data stream and directs the duplicate to a newly created combining unit connected to the newly created Iu link, instructing the combining unit not to output any data yet. After such preparations, RNC2 can start sending data via the new Iu link simply by allowing the combining unit to output data.

The HO_REQUEST message sent by the MSC may also in some embodiments of the invention comprise a time reference proposal for the execution time of the handover. However, other ways of specifying the execution time are specified later in this specification.

The RNC2 needs information about the timing of the base stations in order to be able to adjust the sending time of downlink data units correctly, so that the data units are received by the base stations at the correct time for inclusion in the desired CDMA radio frames. The new protocol control blocks of RNC2 receive timing information determined by RNC1 as a part of the protocol control block information of the HO_REQUEST message. Since the transmission delays to the base stations are different at RNC2, the timing information needs to be checked. The timing information typically comprises information on the frame timing at each base station and transmission delays from the RNC to the base stations. Current cellular network systems and the UMTS specifications, for example, specify various methods for obtaining information about base station timing and transmission delays, any of which methods can be used in an embodiment of the invention. Therefore, these methods are not described here in further detail. RNC1 preferably includes in the timing information of the HO_REQUEST message also information about the length and the starting frames of the interleaving periods of the involved bearers, i.e. information concerning the services provided by the network for the mobile station. This service information does not need to be checked by the RNC2.

In such a situation, where the mobile station has active connections through more than one RNC, the target RNC, i.e. RNC2 in the present example, also creates new Iur links to and from the other RNC:s.

At the following stage, RNC2 signals MSC that preparations for the handover are completed by sending 140 a HO_REQUEST_ACK message to the MSC. This message comprises the identifier of the handover, for which RNC2 has prepared itself. The HO_REQUEST_ACK message sent by the RNC2 may also in some embodiments of the invention comprise a time reference proposal for the execution time of the handover. However, other ways of specifying the execution time are specified later in this specification.

After receiving the HO_REQUEST_ACK message from RNC2, the MSC prepares 150 itself for switching from the old Iu connections to RNC1 to the new Iu connections to the RNC2.

First, the switching of uplink connections in the MSC is discussed. In one embodiment of the invention, the MSC commands the switching element of the MSC to perform the switching immediately, when any activity at the new Iu uplink connection is detected. In another advantageous embodiment of the invention, the MSC sets up a multipoint-to-point connection connecting the Iu links participating in the handover from RNC1 and RNC2 to the MSC. In the multiparty connection embodiment, data coming from either of the RNC:s is forwarded by the MSC towards the intended destination. In one exemplary embodiment, the MSC sets up the multiparty connection by creating a combining means, which receives the uplink data from both RNC1 and RNC2, and outputs data, whenever any data is received in either of the inputs. Such a combining means may be created by setting up the switching elements of the switching unit of the MSC to perform such functions. In another advantageous embodiment of the invention, the combining unit also performs selection of data, which in case of same data arriving from both inputs, selects which of the two data streams is copied to output of the combining means. The combining means therefore removes duplicates if the same data is received from both inputs. The combining unit may perform this selection by checking, whether either of received units of data is incorrect, and by selecting the correct unit of data.

Next, the downlink arrangements at the MSC are discussed. The MSC starts to send data to the RNC2. In an advantageous embodiment of the invention, MSC duplicates the downlink data and sends them both through the old Iu links to RNC1 and through the new Iu links to RNC2. In this embodiment using data duplication, information indicating that the data is duplicated is preferably added to the downlink data units. This information identifying duplicated data simplifies the data

processing at the base stations, if the base stations receive the same data both from RNC1 and RNC2.

In another embodiment of the invention, the MSC simply switches the downlink data transmission from RNC1 Iu links to RNC2 Iu links. This embodiment corresponds to the description of stage 150 in figure 4.

In an advantageous embodiment of the invention, the handover execution time is determined as follows. When RNC2 detects 160 that downlink data is coming from the MSC, it takes over controlling of the connections to the mobile station, and starts to send uplink data coming from the mobile station directly to the MSC through the new Iu uplink links. The switching block of RNC2 switches all uplink data to the new uplink combining unit, and ceases to forward the uplink data to the old Iur links towards RNC1. Similarly, the RNC2 ceases to forward downlink data coming from the RNC1 towards the base stations. This embodiment corresponds to the description of stage 160 in figure 4.

In another advantageous embodiment of the invention, the exact time of handover execution is found as follows. When the first data unit arrives through the new Iu links to the RNC2, the protocol control blocks examine the timing information described previously, and determine in which CDMA frame the data unit will be transmitted. The protocol control blocks perform this examining and determining for all bearers, and the first data unit to be sent towards the base stations determines the actual handover execution time.

The handover execution time can also be determined based on bearer interleaving periods. This procedure is explained later in this specification.

In some embodiments of the invention, the RNC handover execution time may be determined by a mobile station during a hard handover procedure, i.e. when a mobile station changes the base station it is using. The RNC handover procedure in conjunction with a hard handover procedure is explained later in this specification.

The data units are sent to base stations by the protocol control blocks through one or more splitting units, which replicate the data units to all base stations. The protocol control blocks also create any necessary header information, such as rate information or Frame Control Headers (FCH) needed for the CDMA frames.

In an advantageous embodiment of the invention, all information created by the protocol control blocks in the RNC2 are marked with a RNC identifier identifying RNC2 as the creator of the information, in order to allow base stations to determine, that the information is generated after the handover execution. The identifier can be included, for example, to CDMA frame labels attached to each data and header unit. The identifier is advantageously selected by the new RNC. To avoid the same identifier to be selected, the old serving RNC, i.e. RNC1, indicates its identifier to the new serving RNC during the handover signalling, for example in the HO_REQUIRED message as described previously. However, the RNC identifiers can in some embodiments of the invention be specified by the MSC or some other controlling entity. Consequently, when a base station receives data units or control information related to the same connection, targeted to the same CDMA frame or frames and having different serving RNC identifiers, the base station discards the data units and control information marked with the old serving RNC identifier.

In such a situation, where the mobile station has active connections through more than one RNC, the target RNC, i.e. RNC2 in the present example, also begins forwarding data to and from the newly created Iur links links to and from the other RNC:s.

After completing the previous steps, RNC2 sends 170 a HO_COMPLETE message to the MSC, which message acknowledges that RNC2 has succesfully completed the handover. After receiving the HO_COMPLETE message, MSC releases old connections to and from RNC1, and instructs RNC1 to release the connections as well by sending 190 a CLEAR_COMMAND message. In some embodiments of the invention, RNC1 may reply by sending a CLEAR_COMPLETE message after releasing the connections and performing any necessary other cleanup procedures.

In some embodiments of the invention, the MSC may also send 180 an acknowledgment message HO_COMPLETE_ACK back to the RNC2.

The handover procedure explained in connection with figures 2 and 3 is only one exemplary embodiment of the invention. The handover procedure can be realised with many other signalling sequences as well. For example, RNC1 does not necessarily need to route the HO_REQUIRED message via the MSC. In a further exemplary embodiment of the invention, RNC1 initiates the handover by sending a HO_REQUIRED message directly to RNC2, and sends a separate HO_REQUIRED_MSC message to the MSC to command the MSC to begin

preparations for the handover. As an another example, in some embodiments of the invention, RNC1 may send the HO_REQUIRED message directly to RNC2, after which RNC2 sends a corresponding message to the MSC to inform the MSC of the need for a handover.

In this specification, certain names have been used for various commands sent between the various functional entities. One example of such a command name is HO_REQUIRED. The invention is not limited to any specific command names; the command names can be different in different embodiments of the invention. Also, the names of various functional entities, such as the MSC and the RNC, may be different in different cellular networks. The names used in this specification are used in a specific exemplary design for a third generation mobile cellular network, and are not intended to limit the invention in any way.

Organising of interleaving periods

Typically, a cellular network provides various services to the user. The data transmission requirements such as transmission rate, the allowed bit error rate, or maximum delay of the services are often different from service to service. Different requirements result in different interleaving periods being used for different bearers. With an interleaving period of 1, one data unit is sent in every frame. With an interleaving period of 2, one half of a data unit is sent in one frame. Generally, interleaving period may be n frames or other basic time units, where n is an integer between 1 and a specified maximum limit. In the general case, $1/n$:th part of a data unit is sent in one frame. Quite often, more than one of such parts from more than one data units are sent in one frame, in order not to decrease the data transmission rate too much. The length of the interleaving period of a connection is set during the setup of the connection, as well as the starting frame of the interleaving period.

In an advantageous embodiment of the invention, the timing of each bearer is set in such a way, that the interleaving periods of as many bearers as possible start at the same frame as often as possible. Optimally, the timing is set in such a way, that the interleaving periods of all bearers start at the same frame from time to time, with as small repetition period as possible. This kind of timing simplifies the RNC handover, since then the handover can be executed at the beginning of a frame, at which the interleaving periods of the bearers start. Without such interleaving period setup, strict time synchronization is required between the transmission of the

various bearers in order not to exceed the specified interleaving periods during a handover.

Preferably the starting points of interleaving periods are set in such a way, that the starting frame of the interleaving period can be deduced from a simple rule, minimizing required calculations. For example, the interleaving periods are advantageously set to start at a frame, where the global frame number modulo the length of the interleaving period is a predefined number, such as one, or preferably zero. The global frame number is a number, which identifies the transmission frames. The global frame numbering scheme is commonly used in cellular telecommunication systems.

In a further advantageous embodiment of the invention, the lengths interleaving periods are also adjusted according to a rule in order to simplify further processes. Preferably, the lengths of the interleaving periods are set to be powers of two, for example 2, 4, 8, or 16 frames and so on. When the length is a power of two the calculation, if the global frame number modulo the length of the interleaving period is zero, becomes extremely simple.

In this specification and in the accompanied claims, the length of interleaving periods is specified as the number of transmission frames, such as CDMA frames.

While the RNC handover can advantageously be timed to be executed at such a frame, when interleaving periods start, the alignment of interleaving periods according to the invention can also be utilized in other ways as well. For example, the alignment of interleaving periods also simplifies a normal hard handover, even when a RNC handover is not necessary.

RNC handover driven by a hard handover procedure

In an advantageous embodiment of the invention, the RNC handover is initiated by a so called hard handover, i.e. a handover of a mobile station from one base station to another, which base stations in this case are under control of different RNC:s. Figure 5 illustrates one example of signalling used in an advantageous embodiment of the invention. This example corresponds to the situation, when a mobile station moves from a cell controlled by RNC1 to a cell controlled by RNC2.

For clarity, most of the typical signalling between a mobile station and the network associated with a hard handover is not shown in figure 5. Figure 5 presents only signalling associated directly with the RNC handover. Also, most of the signals and procedural steps shown in figure 5 were described in detail in connection with figure 4, and therefore a detailed description of these signals and procedural steps is not reproduced here.

First, RNC1 30 sends 100 a HO_REQUIRED message to MSC 40, which message preferably comprises the information described in connection with figure 4. The MSC sends a corresponding HO_REQUEST message to RNC2 31, and starts 120 the preparations for the handover. When RNC2 receives the HO_REQUEST message, RNC2 performs 130 the necessary preparations for handover. When RNC2 is ready for handover, it informs MSC by sending 140 an acknowledgement message HO_REQUEST_ACK to the MSC.

After receiving the acknowledgement, MSC starts to transmit downlink data via RNC2. Advantageously MSC sends the data both to RNC1 and RNC2, which corresponds to the example in figure 5. In other embodiments of the invention, MSC can switch the downlink data transmission from RNC1 to RNC2, thereby finishing downlink data transmission to RNC1.

Next, the MSC sends 152 a HO_COMMAND message to RNC1 indicating, that the handover may take place. RNC1 sends 154 a corresponding HO_COMMAND message to the mobile station. After receiving the HO_COMMAND message, the mobile station may trigger the handover at any time by sending 156 a HO_ACCESS_REQUEST message to RNC2.

In another advantageous embodiment of the invention, RNC2 creates the HO_COMMAND message, and includes the message in the HO_REQUEST_ACK-message it sends to MSC. Subsequently the MSC merely forwards the HO_COMMAND message to RNC1.

In a further advantageous embodiment of the invention, the HO_COMMAND message comprises information about the radio resources for use in the access request or in the activity after the access request. Such information may comprise, for example, channel information specifying the channel, on which the access request should be made. Such information may further comprise information about

which channels have been received for the mobile station by the RNC2 for communication after the handover.

In the example of figure 5 the mobile station decides, when the handover is to be executed. However, the invention is not limited to this embodiment. For example, any of the known methods for triggering a hard handover may be used. Therefore, in other embodiments of the invention, RNC1 may act as the entity which decides the execution time for the hard handover and consequently the RNC handover. In other embodiments of the invention, RNC2 may act as that entity. For example, RNC1 and RNC2 may perform the preparations for the handover, after which RNC1 sends a message to RNC2, informing RNC2 that the RNC2 may execute the handover at any time. Since a hard handover can be executed also by the MSC, the MSC may as well decide the execution time in some embodiments of the invention.

When RNC2 receives the HO_ACCESS_REQUEST message, it performs the handover by taking over the control of the connections to the mobile station. In some embodiments of the invention, RNC2 may send 162 a HO_DETECT message to inform MSC, that RNC2 has detected the mobile station. Such a message is used in the GSM system. However, sending of the HO_DETECT message is not necessary in all embodiments of the invention, since the invention is not in any way limited to the GSM system.

After completing the previous steps, RNC2 sends 170 a HO_COMPLETE message to the MSC, which message acknowledges that RNC2 has succesfully completed the handover. After receiving the HO_COMPLETE message, MSC releases old connections to and from RNC1, and instructs RNC1 to release the connections as well by sending 190 a CLEAR_COMMAND message. In some embodiments of the invention, RNC1 may reply by sending a CLEAR_COMPLETE message after releasing the connections and performing any necessary other cleanup procedures.

In some embodiments of the invention, the MSC may also send 180 an acknowledgment message HO_COMPLETE_ACK back to the RNC2.

Further embodiments of the invention

In some embodiments of the invention, more than one mobile switching centers (MSC) are involved in the handover. This is the case when, for example, RNC1 is under control of a first MSC and RNC2 is under control of a second MSC. An

another example of the involvement of more than one mobile switching centers or corresponding entities is an inter-system handover. For example, when a mobile station moves from a cell of a first cellular system, say a GSM system, to a cell of a second cellular system, say a W-CDMA based system, the involved radio network controllers in each system are controlled by a MSC or a corresponding entity of the particular system. The various signalling sequences described previously in connection with figures 4 and 5 can be used in such a situation as well, with the only change that the RNC:s send and receive messages to and from their respective controlling MSC:s, not to and from the same MSC. The participating MSC:s need to execute some signalling as well, for example, execute an inter-MSC handover. However, since various inter-MSC handover methods are known by the man skilled in the art, this signalling is not discussed here in further detail. Inter-MSC handover is discussed, for example, in the PCT patent application WO 95/08898.

In some embodiments of the invention, a single RNC may have connections to and from more than one MSC. For example, the mobile station may have more than one connections, each of which come through a different MSC. Such a situation may arise for example in the UMTS system presently under development, when more than one call or connection is received from more than one core network through a single radio access network. In such an embodiment, the RNC:s participating in the handover procedure preferably repeat the previously described signalling with each of the participating MSC:s or corresponding core network entities.

The invention is not limited to identifying the source RNC of data units by attaching RNC identifiers to the data units transmitted to base stations. In a further advantageous embodiment of the invention, a base station recognizes the RNC which transmitted a data unit from the transmission channel from which the data unit was received by the base station. For example, if the RNC2 sets up a new AAL2 layer connection to the base station, the connection setup signalling informs the base station, that the new connection comes from the RNC2. Afterwards the base station knows without explicit tagging of the data units that any data units received from the new AAL2 connection come from RNC2. The source RNC may also be identified by a certain AAL5 channel, a certain PCM communication link channel, or by any other specific channel. Similarly, the base station may know that data units from a certain second channel come from RNC1. Consequently, when the base station receives a data unit from the first radio network controller and a data unit from the second radio network controller, and said data units are directed to be

sent in the same transmission frame, said base station discards said data unit received from the first radio network controller.

In a further advantageous embodiment, these source RNC identification methods may be used in combination. For example, the RNC1 can be identified by RNC identifiers attached to data units, and RNC2 by the communication channel transmitting the data units to the base station.

Although in the previous examples the mobile station is in connection with more than one base station simultaneously, the invention is not limited only to systems, in which a mobile station can have connections to multiple base stations. The method according to the invention can be used in any cellular telecommunication system using routing of connections via a controlling and a drift radio network controller or a corresponding entity.

The name of a given functional entity, such as the radio network controller, is often different in the context of different cellular telecommunication systems. For example, in the GSM system the functional entity corresponding to a RNC is the base station controller (BSC). Therefore, the term radio network controller in the claims is intended to cover all corresponding functional entities regardless of the term used for the entity in the particular cellular telecommunication system.

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. A method for handover of at least one connection to a mobile station in a cellular telecommunication system having at least two radio network controllers, **characterized** in that the handover method comprises the steps of
- transmitting state information of at least one protocol control block controlling at least one communications protocol, which protocol governs the communication of data between a mobile station and a radio network controller, from a first radio network controller to a second radio network controller, and
- relocating control of said at least one communications protocol from said first radio network controller to said second radio network controller.

2. A method according to claim 1, **characterized** in that the method further comprises steps, in which
- said first radio network controller attaches a RNC identifier to downlink data units for informing base stations receiving said data units of the source of said data units, and
- said second radio network controller attaches a RNC identifier to downlink data units for informing base stations receiving said data units of the source of said data units.

3. A method according to claim 2, **characterized** in that if a base station receives a data unit identified by the identifier of said first radio network controller and a data unit identified by the identifier of said second radio network controller, and said data units are directed to be sent in the same transmission frame, said base station discards the data unit identified by the identifier of said first radio network controller.

4. A method according to claim 1, **characterized** in that the method further comprises steps, in which
a base station receives a data unit from one of said first and second radio network controllers via a communication link, and
said base station identifies which of said first or second radio network controllers transmitted said data unit based on via which communication channel said data unit was received.

5. A method according to claim 4, **characterized** in that if a base station receives a data unit from said first radio network controller and a data unit from said second

radio network controller, and said data units are directed to be sent in the same transmission frame, said base station discards said data unit received from said first radio network controller.

6. A method according to claim 1, **characterized** in that said second radio network controller determines the handover execution time.

7. A method according to claim 1, **characterized** in that the mobile station determines the handover execution time.

8. A method according to claim 1, **characterized** in that the handover is executed at the beginning of a transmission frame, at which the interleaving periods of at least two bearers start.

9. A method for setting up a connection of a mobile station in a cellular telecommunication system, **characterized** in that when a new connection is opened to the mobile station, the starting time of the interleaving period of said connection is set according to a first predefined rule for aligning the starting times of the interleaving periods of the connections of the mobile station.

10. A method according to claim 9, **characterized** in that according to said first rule, the starting frame of said interleaving period of said connection is set to a frame, at which frame the global frame number modulo the length of said interleaving period is a predefined number.

11. A method according to claim 10, **characterized** in that said predefined number is zero.

12. A method according to claim 9, **characterized** in that the length of said interleaving period is set according to a second predefined rule for increasing the frequency of such frames, at which the interleaving periods of the connections start.

13. A method according to claim 12, **characterized** in that according to said second predefined rule, the length of said interleaving period is set to be a power of two.

14. A system for controlling connections to a mobile station in a cellular telecommunications network, **characterized** in that the system comprises
- a first radio network controller for controlling the connections to mobile stations,
- a protocol control block in said first radio network controller for controlling at least one communication protocol controlling at least one connection, and
- a second radio network controller;
and in that
- said first radio network controller is arranged to send information specifying the state of said protocol control block to said second radio network controller, and
- said second radio network controller is arranged to take over the control of said at least one connection as a response to the receiving of said information.

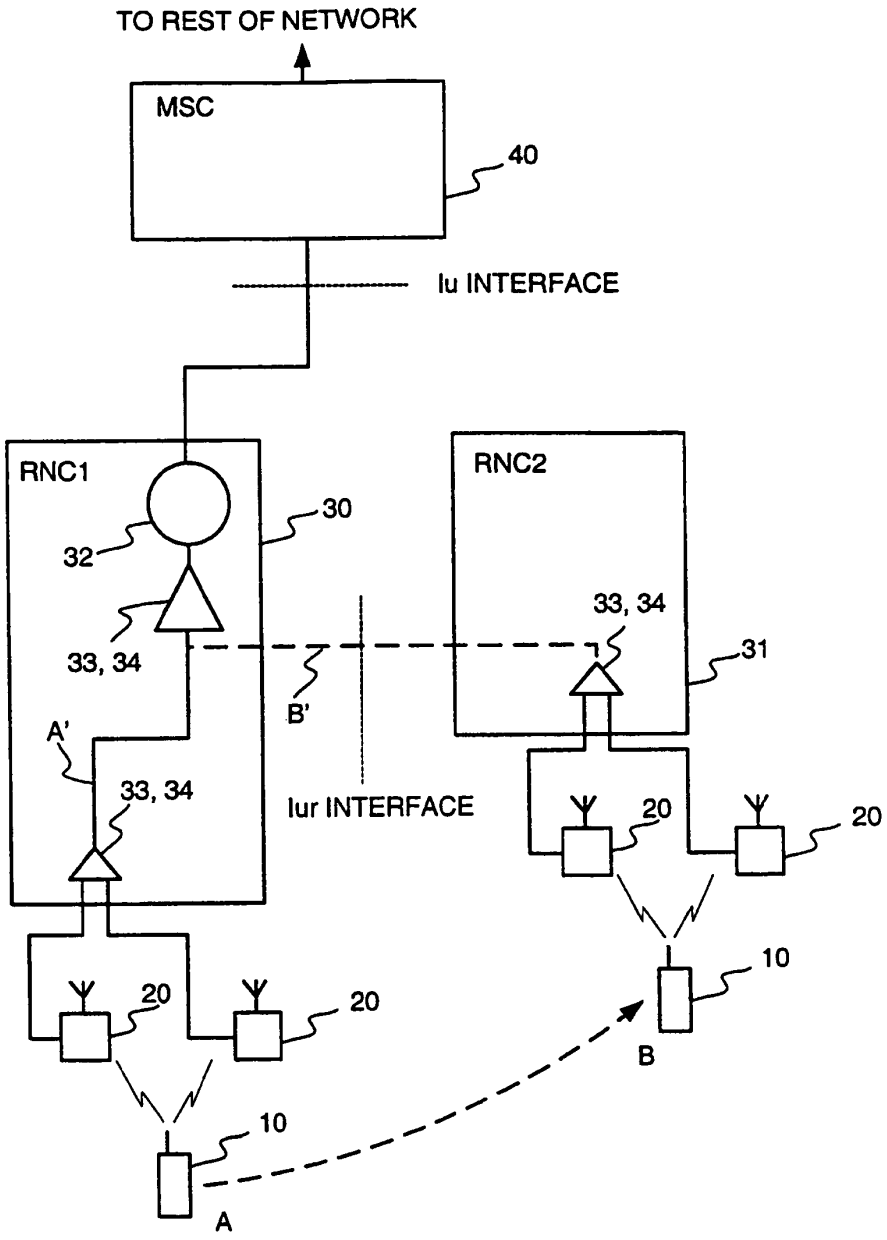


Fig. 1
PRIOR ART

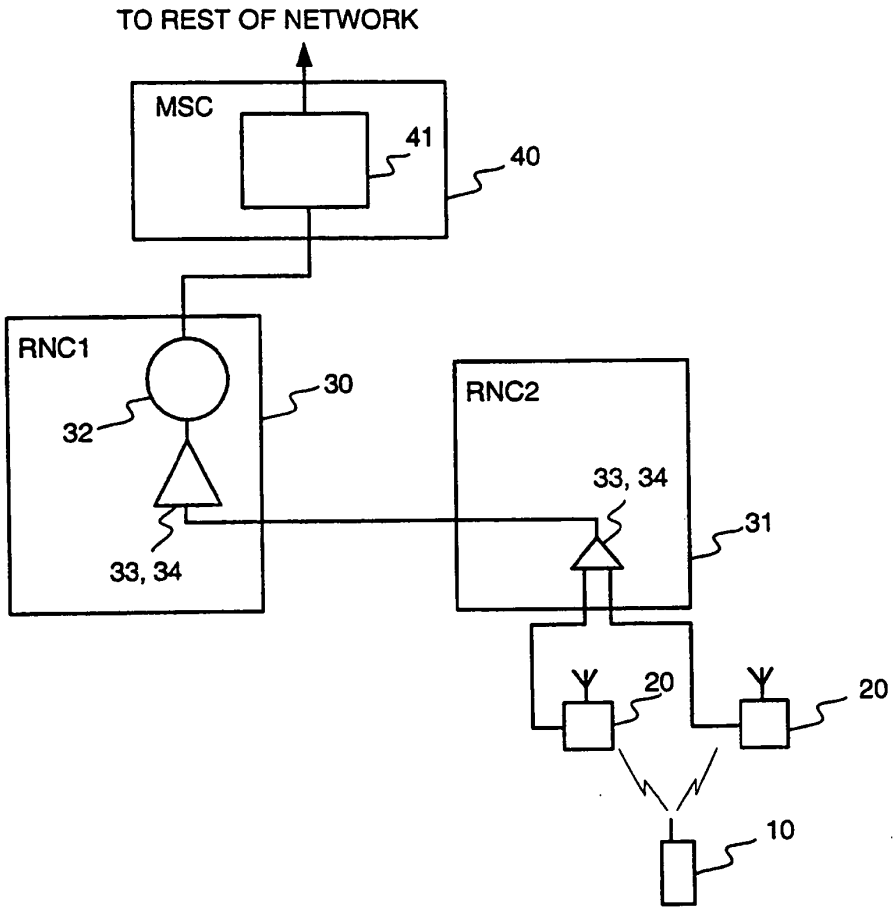

TO REST OF NETWORK
MSC
41
40
RNC1
30
32
33, 34
RNC2
33, 34
31
20
20
10

Fig. 2

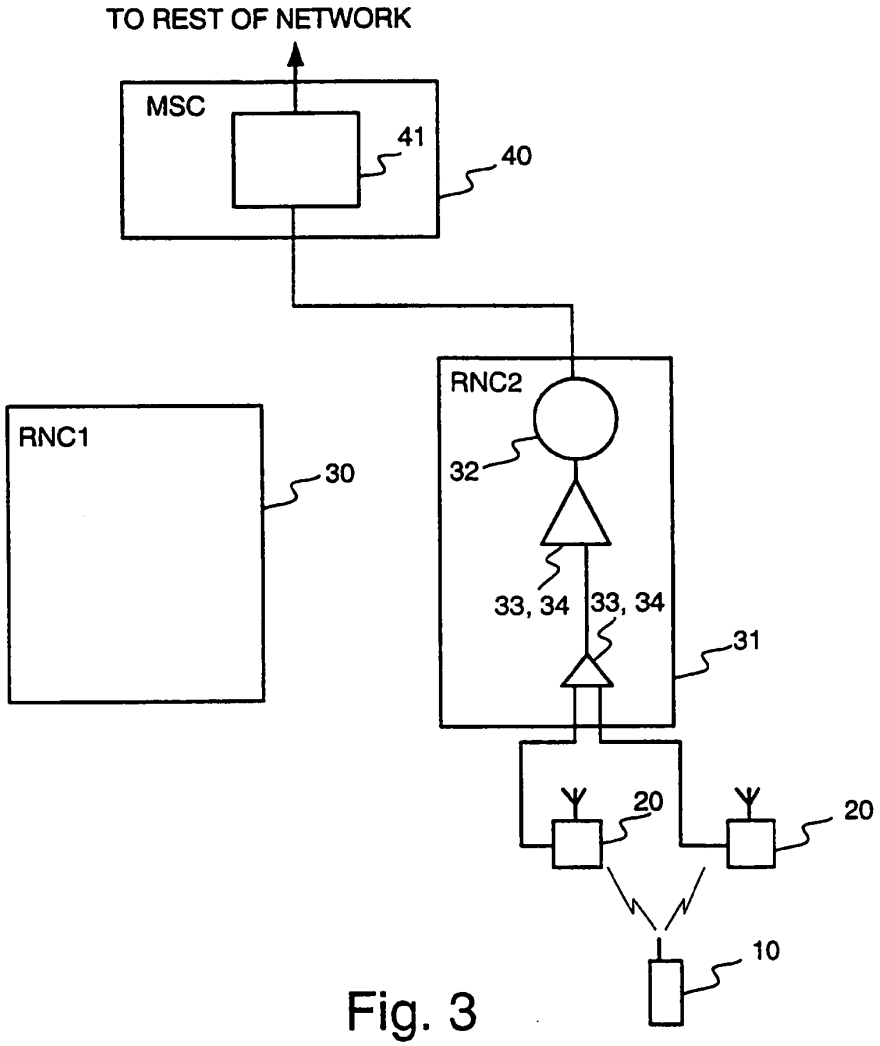

TO REST OF NETWORK
MSC
41
40
RNC2
RNC1
30
32
33, 34
33, 34
31
20
20
10

Fig. 3

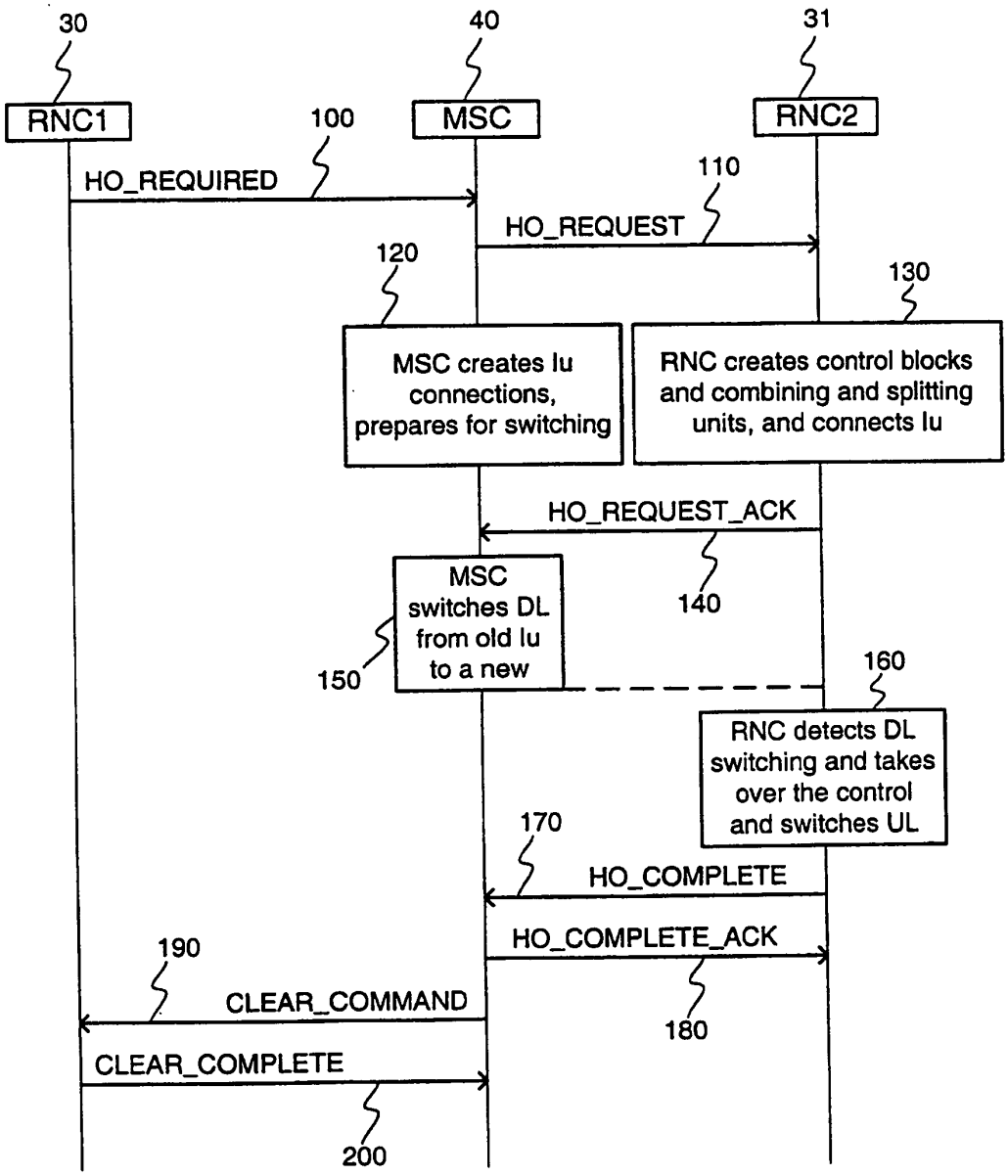

30
40
31
RNC1
MSC
RNC2
100
HO_REQUIRED
110
HO_REQUEST
120
130
MSC creates Iu connections, prepares for switching
RNC creates control blocks and combining and splitting units, and connects Iu
HO_REQUEST_ACK
140
MSC switches DL from old Iu to a new
150
160
RNC detects DL switching and takes over the control and switches UL
170
HO_COMPLETE
HO_COMPLETE_ACK
180
190
CLEAR_COMMAND
CLEAR_COMPLETE
200

Fig. 4

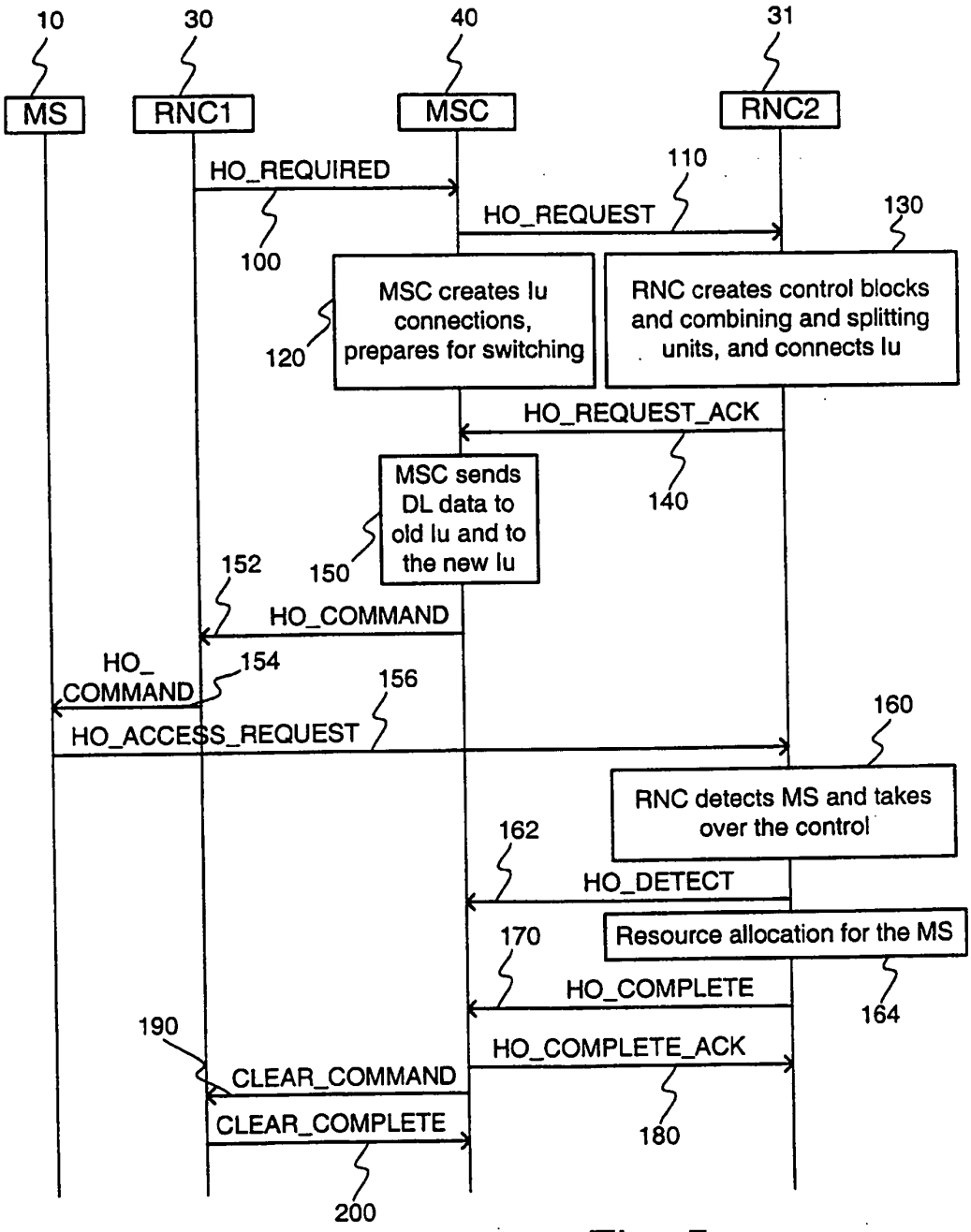

10
30
40
31
MS
RNC1
MSC
RNC2
HO_REQUIRED
110
HO_REQUEST
130
100
MSC creates Iu connections, prepares for switching
120
RNC creates control blocks and combining and splitting units, and connects Iu
HO_REQUEST_ACK
140
MSC sends DL data to old Iu and to the new Iu
150
152
HO_COMMAND
HO_ COMMAND
154
156
HO_ACCESS_REQUEST
160
RNC detects MS and takes over the control
162
HO_DETECT
170
Resource allocation for the MS
164
HO_COMPLETE
190
HO_COMPLETE_ACK
CLEAR_COMMAND
CLEAR_COMPLETE
180
200

Fig. 5

Electronic Patent Application Fee Transmittal

Application Number:	11387384
Filing Date:	22-Mar-2006
Title of Invention:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
First Named Inventor/Applicant Name:	Jeffrey D. Mullen
Filer:	Jeffrey David Mullen
Attorney Docket Number:	JDM/002 CON

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for continued examination	2801	1	465	465
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**645**

Electronic Acknowledgement Receipt	
EFS ID:	11060211
Application Number:	11387384
International Application Number:	
Confirmation Number:	7999
Title of Invention:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
First Named Inventor/Applicant Name:	Jeffrey D. Mullen
Customer Number:	32733
Filer:	Jeffrey David Mullen
Filer Authorized By:	
Attorney Docket Number:	JDM/002 CON
Receipt Date:	27-SEP-2011
Filing Date:	22-MAR-2006
Time Stamp:	16:02:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$645
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	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
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	Non Patent Literature		66	117	
Warnings:					
Information:					
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Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Form (SB08)	JDM-002CON--PTOSB08A.pdf	80094 534e843239e5bb5779a4cd8840d4c128f6707d3d	no	8
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Information:					
7	Fee Worksheet (SB06)	fee-info.pdf	31760 39cb86f5f97a0883e1c1acb015d35a99f23b821f	no	2
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32733 7590 11/23/2011

JEFFREY D. MULLEN
731 SOUTH NEGLEY
APT. 2
PITTSBURGH, PA 15232

EXAMINER	
NGUYEN, QUYNH H	
ART UNIT	PAPER NUMBER
2614	

DATE MAILED: 11/23/2011

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/387,384	03/22/2006	Jeffrey D. Mullen	JDM/002 CON	7999

TITLE OF INVENTION: SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$870	$300	$0	$1170	02/23/2012

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A. Pay TOTAL FEE(S) DUE shown above, or

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PTOL-85 (Rev. 02/11)

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(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/387,384	03/22/2006	Jeffrey D. Mullen	JDM/002 CON	7999

TITLE OF INVENTION: SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$870	$300	$0	$1170	02/23/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, QUYNH H	2614	455-404100

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❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

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NGUYEN, QUYNH H	
ART UNIT	PAPER NUMBER
2614	

DATE MAILED: 11/23/2011

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 11/387,384	Applicant(s) MULLEN, JEFFREY D.	
	Examiner QUYNH NGUYEN	Art Unit 2614	

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

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *RCE and IDS filed 9/27/11*.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are *3-8,10-22,24-30,32-40,42-48 and 50-53 renumbered as claims 1-46*.

4. ☐ 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 the:
      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)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 9/27/11
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/Quynh H Nguyen/
Primary Examiner, Art Unit 2614

EAST Search History

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	9	(transmit$4 with ((wireless cell cellular mobile) near2 location) with (remote near server)).clm.	US-PGPUB	OR	ON	2011/11/19 21:23
L2	5345	455/404.1,404.2,410,456.1-456.2,457.ccls.	US-PGPUB	OR	ON	2011/11/19 21:23
L3	5	1 and 2	US-PGPUB	OR	ON	2011/11/19 21:24
L4	0	((alert$3 near3 messag$3) and (privacy adj profile)).clm.	US-PGPUB	OR	ON	2011/11/19 21:24
L5	0	((transmit$4 send$3) with messag$3 with (authori$6 adj2 (user subscriber)) with distance).clm.	US-PGPUB	OR	ON	2011/11/19 21:25
L6	9	((receiv$3 adj3 (location position) adj3 request$3) and (display$3 adj3 map with (wireless device cell cellular))).clm.	US-PGPUB	OR	ON	2011/11/19 21:25
L7	102	((chang$3 add$3) with user with profile with (cell mobile cellular wireless)).clm.	US-PGPUB	OR	ON	2011/11/19 21:26
L8	0	6 and 7	US-PGPUB	OR	ON	2011/11/19 21:27
L9	179	((transmit$4 send$3) with location with (remote near2 server)).clm.	US-PGPUB	OR	ON	2011/11/19 21:27
L10	0	7 and 9	US-PGPUB	OR	ON	2011/11/19 21:27

11/19/2011 9:27:59 PM
C:\Users\qnguyen\Documents\EAST\Workspaces\11387384.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11387384	MULLEN, JEFFREY D.
	Examiner	Art Unit
	QUYNH NGUYEN	2614

SEARCHED			
Class	Subclass	Date	Examiner
455	404.1, 404.2, 410, 456.1-456.3, 457	11/19/11	QN

SEARCH NOTES		
Search Notes	Date	Examiner
search east, uspat, uspgpub, epo, jpo	11/19/11	QN
inventor search in PALM	11/19/11	QN

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
455	404.1, 404.2, 410, 456.1-456.3, 457	11/19/11	QN
	interference search history printout	11/19/11	QN

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				***Complete if known***	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	11/387,384
				Filing Date	March 22, 2006
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
(use as many sheets as necessary)				**Examiner Name**	Quynh H. Nguyen
Sheet	1	of	8	**Attorney Docket Number**	JDM/002 CON

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
/QN/		4,654,879	03/31/1987	Goldman et al.	
/QN/		5,043,736	08/27/1991	Darnell et. al	
/QN/		5,086,390	02/04/1992	Matthews	
/QN/		5,097,416	03/17/1992	Matthews	
/QN/		5,197,092	03/23/1993	Bamburak	
/QN/		5,305,201	04/19/1994	Matthews	
/QN/		5,327,144	07/05/1994	Stilp et al.	
/QN/		5,337,334	08/09/1994	Antero Alvesalo	
/QN/		5,341,410	08/23/1994	Aron et al.	
/QN/		5,384,824	01/24/1995	Alvesalo	
/QN/		5,338,147	02/07/1995	Grimes	
/QN/		5,442,805	08/15/1995	Sagars et al.	
/QN/		5,479,482	12/26/1995	Grimes	
/QN/		5,502,757	03/26/1996	Bales et al.	
/QN/		5,519,760	05/21/1996	Borkowski et al.	
/QN/		5,537,460	07/16/1996	Holliday, Jr. et al.	
/QN/		5,548,816	08/20/1996	DeVaney	
/QN/		5,551,058	08/27/1996	Hutcheson et al.	
/QN/		5,555,286	09/10/1996	Tendler	
/QN/		5,719,563	02/17/1998	Thompson	
/QN/		5,767,788	06/16/1998	Ness	
/QN/		5,778,315	07/07/1998	Proietti	
/QN/		5,796,634	08/18/1998	Craport et al.	

Examiner Signature	/Quynh Nguyen/	Date Considered	11/19/2011

*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.**

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (use as many sheets as necessary)				***Complete if known***	
				Application Number	11/387,384
				Filing Date	March 22, 2006
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
				Examiner Name	Quynh H. Nguyen
Sheet	2	of	8	**Attorney Docket Number**	JDM/002 CON

/QN/		5,805,999	09/08/1998	Inoue		
/QN/		5,815,538	09/29/1998	Grell et al.		
/QN/		5,832,381	11/03/1998	Kauppi		
/QN/		5,847,976	12/08/1998	Lescourret		
/QN/		5,875,398	02/23/1999	Snapp		
/QN/		5,890,062	03/30/1999	Courtney et al.		
/QN/		5,920,820	07/06/1999	Qureshi et al.		
/QN/		5,929,752	07/27/1999	Janky et al.		
/QN/		5,950,125	09/07/1999	Buhrmann et al.		
/QN/		5,961,569	10/05/1999	Craport et al.		
/QN/		5,961,572	10/05/1999	Craport et al.		
/QN/		5,978,747	11/02/1999	Craport et al.		
/QN/		6,023,241	02/08/2000	Clapper		
/QN/		6,028,537	02/22/2000	Suman et al.		
/QN/		6,032,042	02/29/2000	Kauppi		
/QN/		6,035,198	03/07/2000	Wiehe		
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/QN/		6,038,446	03/14/2000	Courtney et al.		
/QN/		6,047,051	04/04/2000	Ginzboorg		
/QN/		6,049,711	04/11/2000	Ben-Yehezkel		
/QN/		6,061,561	05/21/2000	Alanara et al.		
/QN/		6,091,959	07/18/2000	Souissi et al.		
/QN/		6,138,003	10/2000	Kingdon et al.		
/QN/		6,157,841	12/05/2000	Bolduc et al.		
/QN/		6,166,626	12/26/2000	Janky et al.		
/QN/		6,173,182	01/09/2001	Cha		

Examiner Signature	/Quynh Nguyen/	Date Considered	11/05/2011

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				Filing Date	March 22, 2006
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
				Examiner Name	Quynh H. Nguyen
Sheet	3	of	8	**Attorney Docket Number**	JDM/002 CON

/QN/		6,201,803	03/13/2001	Munday et al.	
/QN/		6,208,866	03/27/2001	Rouhollahzadeh et al.	
/QN/		6,236,359	05/22/2001	Watters et al.	
/QN/		6,236,858	05/22/2001	Griffith	
/QN/		6,240,069	05/21/2001	Alperovich	
/QN/		6,246,376	06/12/2001	Bork et al.	
/QN/		6,246,861	06/12/2001	Messier et al.	
/QN/		6,256,543	06/26/2001	Camp	
/QN/		6,256,498	07/03/2001	Ludwig	
/QN/		6,259,923	07/10/2001	Lim et al.	
/QN/		6,275,771	08/14/2001	Berstis et al.	
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/QN/		6,314,365	11/06/2001	Smith	
/QN/		6,317,718	11/13/2001	Fano	
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/QN/		6,324,404	11/27/2001	Dennison et al.	
/QN/		6,330,452	12/11/2001	Fattouche et al.	
/QN/		6,360,101	03/19/2002	Irvin	
/QN/		6,360,102	03/2002	Havinis	
/QN/		6,360,167	03/19/2002	Millington et al.	
/QN/		6,374,306	04/16/2002	Tognazzini	102(e) 03/12/1999
/QN/		6,377,810	04/23/2002	Geiger et al.	102(e) 06/11/1999
/QN/		6,393,274	05/21/2002	Peltonen	102(e) 06/08/1999
/QN/		6,397,065	05/28/2002	Huusko et al.	102(e) 12/07/1999
/QN/		6,400,946	06/04/2002	Vazvan	102(e) 03/08/1996
/QN/		6,400,956	06/02/2002	Richton	102(e) 11/15/1999

Examiner Signature	/Quynh Nguyen/	Date Considered	11/19/2011

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				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
				Examiner Name	Quynh H. Nguyen
Sheet	4	of	8	**Attorney Docket Number**	JDM/002 CON

/QN/		6,408.186	06/18/2002	Park et al.	102(e) 06/21/2000
/QN/		6,421,009	07/16/2002	Suprunov	102(e) 05/08/1998
/QN/		6,438,376	08/20/2002	Elliott et al.	102(e) 05/11/1999
/QN/		6,438,381	08/20/2002	Alberth, Jr. et al.	102(e) 06/08/2000
/QN/		9,446,118	09/03/2002	Gottlieb	102(e) 02/29/2000
/QN/		6,449,486	09/10/2002	Rao	102(e) 05/25/1999
/QN/		6,456,854	09/2002	Chern	
/QN/		6,466,788	10/2002	Carlsson	
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/QN/		6,564,064	05/13/2003	Ciganer et al.	102(e) 12/01/1999
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/QN/		6,580,918	06/17/2003	Leickel	102(e) 07/23/1998
/QN/		6,584,314	06/24/2003	Haumont	102(e) 06/09/2000
/QN/		6,587,691	07/2003	Granstam	
/QN/		6,603,969	08/05/2003	Vuoristo	102(e) 11/25/1998
/QN/		6,610,687	08/26/2003	Clark	102(e) 11/15/1999
/QN/		6,618,593	09/09/2003	Drutman et al.	102(e) 09/08/2000
/QN/		6,618,671	09/09/2003	Dooley et al.	102(e) 09/20/2001
/QN/		6,622,020	09/16/2003	Seki	102(e) 07/12/1995
/QN/		6,628,938	09/30/2003	Rachabathuni et al.	102(e) 08/14/2000
/QN/		6,665,389	12/2003	Haste III	
/QN/		6,677,894	01/13/2004	Sheynblat	102(e) 11/30/1998
/QN/		6,714,791	03/30/2004	Friedman	102(e) 02/23/2001
/QN/		6,716,101	04/06/2004	Meadows et al.	102(e) 06/28/2000
/QN/		6,735,564	05/11/2004	Puhakainen	102(e) 11/09/2000
/QN/		6,778,837	08/17/2004	Bade et al.	102(e) 03/22/2001

Examiner Signature	/Quynh Nguyen/	Date Considered	11/19/2011

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				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
				Examiner Name	Quynh H. Nguyen
Sheet	5	of	8	**Attorney Docket Number**	JDM/002 CON

/QN/		6,795,710	09/21/2004	Creemer	102(e) 01/05/2001
/QN/		6,798,358	09/28/2004	Joyce et al.	102(e) 07/03/2001
/QN/		6,779,094	09/28/2005	Vaida et al.	102(e) 09/03/2001
/QN/		6,806,813	10/19/2004	Cheng et al.	102(e) 06/04/1999
/QN/		6,816,735	11/09/2004	Rayburn et al.	102(e) 03/29/2001
/QN/		6,826,398	11/30/2004	Lagerstrom et al.	102(e) 10/08/1998
/QN/		6,836,667	12/28/2004	Smith	102(e) 09/19/2000
/QN/		6,870,822	03/22/2005	Balogh	102(e) 02/20/2001
/QN/		6,879,838	04/12/2005	Rankin et al.	102(e) 04/20/2001
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/QN/		6,882,856	04/2005	Alterman	
/QN/		6,885,874	04/2005	Grube	
/QN/		6,912,398	06/28/2005	Domnitz	102(e) 04/10/2000
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/QN/		7,013,148	03/2006	Ganesh	
/QN/		7,072,956	07/2006	Parupudi	
/QN/		7,203,674	04/2007	Cohen	
/QN/		7,177,651	02/2007	Almassy	
/QN/		7,215,965	05/2007	Fournier et al.	

Examiner Signature	/Quynh Nguyen/	Date Considered	11/19/2011

*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.
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Substitute for form 1449A/PTO				***Complete if known***	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	11/387,384
				Filing Date	March 22, 2006
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
(use as many sheets as necessary)				**Examiner Name**	Quynh H. Nguyen
Sheet	6	of	8	**Attorney Docket Number**	JDM/002 CON

/QN/		7,269,426	09/2007	Kokkonen et al.	
/QN/		7,269,428	09/2007	Wallenius	
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/QN/		2002/0115453	08/2002	Poulin et al.	
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/QN/		2002/0086683	07/2002	Kohar	
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/QN/		2004/0180669	09/16/2004	Jan Kall	06/07/2001 (PCT)
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/QN/		D464,033	10/08/2002	Piano Poirier	102(e) 01/23/2002

FOREIGN PATENT DOCUMENTS						
Examiner	Cite	Foreign Patent Document	Publication Date	Name of Patentee or	Pages, Columns,	T^6

Examiner Signature	/Quynh Nguyen/	Date Considered	11/19/2011

*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.
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				Filing Date	March 22, 2006
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
(use as many sheets as necessary)				**Examiner Name**	Quynh H. Nguyen
Sheet	7	of	8	**Attorney Docket Number**	JDM/002 CON

initials*	No.[1]	Country Code[3] - Number[4] - Kind Code[5] *(if known)*	MM-DD-YYYY	Applicant of Cited Documents	Lines, Where Relevant Passages or Relevant Figures Appear	
/QN/		WO 99/000717	02-11-1999	Nokia Telecommunications		
/QN/		WO 99/009775	02-25-1999	Nokia Telecommunications		
/QN/		WO 99/051051	03-31-1999	Nokia Telecommunications		
/QN/		WO 00/028760	05-18-2000	Nokia Networks		
/QN/		WO 00/035228	06-15-2000	Nokia Networks		
/QN/		WO 00/038350	06-29-2000	Nokia Networks		
/QN/		WO 00/064075	10-26-2000	Nokia Networks		
/QN/		WO 00/076194	12-14-2000	Nokia Networks		
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/QN/		WO 01/010718	01-04-2001	Nokia Networks		
/QN/		WO 01/003406	01-11-2001	Nokia Networks		
/QN/		WO 01/003454	01-11-2001	Nokia Networks		
/QN/		WO 01/003461	01-11-2001	Nokia Networks		
/QN/		WO 01/020938	03-22-2001	Nokia Networks		
/QN/		WO 01/033885	05-10-2001	Nokia Networks		
/QN/		WO 01/039525	05-31-2001	Nokia Networks		
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/QN/		WO 01/041468	06-07-2001	Nokia Networks		
/QN/		WO 01/050544	07-12-2001	Nokia Networks		
/QN/		WO 01/086880	11-15-2001	Nokia Networks		
/QN/		WO 01/089251	11-22-2001	Nokia Networks		

Examiner Signature	/Quynh Nguyen/	Date Considered	11/19/2011

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				Application Number	11/387,384
				Filing Date	March 22, 2006
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
				Examiner Name	Quynh H. Nguyen
Sheet	8	of	8	**Attorney Docket Number**	JDM/002 CON

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]
/QN/		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]
/QN/		ETSI TS 101 513. "Digital Cellular Telecommunications System (Phase 2): Location Services (LCS)," GSM 12.71, version 8.0.1. 1999.	
/QN/		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	/Quynh Nguyen/	Date Considered	11/19/2011

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Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11387384	MULLEN, JEFFREY D.
	Examiner	**Art Unit**
	QUYNH NGUYEN	2614

ORIGINAL		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
455	404.1	H	0	4	M	11 / 04 (2006.01.01)						

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
455	404.2	410	456.1	456.2	456.3
455	457				

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1	12	17	28	33		49								
	2	14	18	29	34	43	50								
1	3	16	19	30	35	44	51								
2	4	17	20	31	36	45	52								
3	5	18	21	32	37	46	53								
4	6	19	22	33	38										
5	7		23	34	39										
6	8	20	24	35	40										
	9	21	25		41										
7	10	22	26	36	42										
8	11	23	27	37	43										
15	12	24	28	38	44										
13	13	25	29	39	45										
9	14	26	30	40	46										
10	15		31	41	47										
11	16	27	32	42	48										

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	46	
/QUYNH NGUYEN/ Primary Examiner.Art Unit 2614	11/21/11	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	16

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (10-08)
Approved for use through 11/30/2008. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	11387384	Filing Date	2006-03-22	Docket Number (if applicable)	JDM/002 CON	Art Unit	2614
First Named Inventor	Jeffrey D. Mullen			Examiner Name	Quynh H. Nguyen		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

☐ Other _____

☒ Enclosed

☐ Amendment/Reply

☒ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 503855

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☐ Patent Practitioner Signature

☒ Applicant Signature

PTO/SB/30EFS (10-08)
Approved for use through 11/30/2008. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Applicant Signature			
Applicant 1		Remove	
Signature	/Jeffrey D. Mullen/	Date (YYYY-MM-DD)	2012-02-23
Name	Jeffrey D. Mullen		
Click ADD for additional Applicant Signature		Add	

This collection of information is required by 37 CFR 1.114. 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 1.11 and 1.14. This collection is estimated to take 12 minutes 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.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

JDM/002 CON

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
Application No.	:	11/387,384
Confirmation No.	:	7999
Filed	:	March 22, 2006
For	:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
Group Art Unit	:	2614
Examiner	:	Quynh H. Nguyen

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

Pittsburgh, PA 15237
February 23, 2012

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

A Request for Continued Examination is applicable hereto and being submitted herewith. 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

6,078,578	06/2000	Matsumoto	(8)
6,215,863	04/2001	Bennett et al.	(8)
6,647,257	11/2003	Owensby	(8)
7,130,630	10/2006	Enzmann	(8)
7,324,823	01/2008	Rosen	(8)
2002/0141434	10/2012	Grundvig	(8)

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.

Documents above marked with a (1) were cited in Application No. 10/400,296. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (3) were cited in Application No. 11/462,201. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (4) were cited in Application No. 11/462,201. Applicant respectfully requests the Examiner review the prosecution history of this

application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (5) were cited in Application No. 11/834,674. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (6) were cited in Application No. 11/841,734. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (7) were cited in Application No. 11/841,750. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (8) were cited in Application No. 11/841,765. Applicant respectfully requests

the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Applicant hereby submits that not all of the patent documents and non-patent literature submitted herein may be, in fact, prior art to the present application. Applicant reserves the right to dispute whether references, or subject matter within references, are prior art to the present application (e.g., continuation-in-part subject matter filed after the filing date of the present application).

This Statement is being submitted after a first Office Action on the merits. Accordingly, pursuant to 37 CFR 1.97(c), the fee set forth in Section 1.17(p) is provided herewith.

Applicant respectfully submits that this application, including the pending claims, is in condition for allowance. A favorable action is respectfully requested.

The Director is hereby authorized to charge any fees associated with this filing, or credit any overpayment of the same, to Deposit Account No. 50-3855.

Respectfully Submitted,

/Jeffrey D. Mullen/
Jeffrey D. Mullen
Applicant (Reg. No. 52,056)
Customer No. 32733
731 South Negley, Apt. 2
Pittsburgh, PA 15232
Tel.: (914) 837-7741

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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Substitute for form 1449A/PTO **SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (use as many sheets as necessary)				***Complete if known***	
				Application Number	11/387,384
				Filing Date	March 22, 2006
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
				Examiner Name	Quynh H. Nguyen
Sheet	1	of	1	**Attorney Docket Number**	JDM/002 CON

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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		6,215,863	04/2001	Bennett et al.	
		6,647,257	11/2003	Owensby	
		7,130,630	10/2006	Enzmann	
		7,324,823	01/2008	Rosen	
		2002/0141434	10/2012	Grundvig	

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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		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.**

Electronic Patent Application Fee Transmittal	
Application Number:	11387384
Filing Date:	22-Mar-2006
Title of Invention:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
First Named Inventor/Applicant Name:	Jeffrey D. Mullen
Filer:	Jeffrey David Mullen
Attorney Docket Number:	JDM/002 CON
Filed as Small Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for continued examination	2801	1	465	465
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**645**

Electronic Acknowledgement Receipt	
EFS ID:	12144777
Application Number:	11387384
International Application Number:	
Confirmation Number:	7999
Title of Invention:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
First Named Inventor/Applicant Name:	Jeffrey D. Mullen
Customer Number:	32733
Filer:	Jeffrey David Mullen
Filer Authorized By:	
Attorney Docket Number:	JDM/002 CON
Receipt Date:	23-FEB-2012
Filing Date:	22-MAR-2006
Time Stamp:	15:47:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$645
RAM confirmation Number	2585
Deposit Account	503855
Authorized User	MULLEN,JEFFREY D.
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	JDM-002C--RCE.pdf	697283 079204c95dfb37c3f10b440ec13a2b4e6e09d618	no	3
Warnings:					
Information:					
2	Transmittal Letter	JDM-002CON--SIDS.pdf	10082 9414512b3b959dac4b08ece93c4d2d2d2fab0bad	no	5
Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Form (SB08)	JDM-002CON--SIDS--PTOSB08A.pdf	11426 80072bda2c1bea616e7e607559e7ff255ece10ab	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
4	Fee Worksheet (SB06)	fee-info.pdf	31761 1689805777707b14ca5867d9c737227e6446d4530	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	750552		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

32733 7590 05/24/2012

JEFFREY D. MULLEN
731 SOUTH NEGLEY
APT. 2
PITTSBURGH, PA 15232

EXAMINER
NGUYEN, QUYNH H

ART UNIT	PAPER NUMBER
2614	

DATE MAILED: 05/24/2012

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/387,384	03/22/2006	Jeffrey D. Mullen	JDM/002 CON	7999

TITLE OF INVENTION: SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$870	$300	$0	$1170	08/24/2012

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

32733 7590 05/24/2012

JEFFREY D. MULLEN
731 SOUTH NEGLEY
APT. 2
PITTSBURGH, PA 15232

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/387,384	03/22/2006	Jeffrey D. Mullen	JDM/002 CON	7999

TITLE OF INVENTION: SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$870	$300	$0	$1170	08/24/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, QUYNH H	2614	455-404100

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:

❑ Issue Fee

❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): (**Please first reapply any previously paid issue fee shown above**)

❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. 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 12 minutes 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, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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

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.
11/387,384	03/22/2006	Jeffrey D. Mullen	JDM/002 CON	7999

32733 7590 05/24/2012

JEFFREY D. MULLEN
731 SOUTH NEGLEY
APT. 2
PITTSBURGH, PA 15232

EXAMINER	
NGUYEN, QUYNH H	
ART UNIT	PAPER NUMBER
2614	

DATE MAILED: 05/24/2012

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 11/387,384	Applicant(s) MULLEN, JEFFREY D.	
	Examiner QUYNH NGUYEN	Art Unit 2614	

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

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☐ This communication is responsive to *RCE and IDS filed 2/23/12*.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *3-8,10-22,24-30,32-40,42-48 and 50-53 renumbered as claims 1-46*.
4. ☐ 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 the:
      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)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 2/23/12
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/Quynh H Nguyen/
Primary Examiner, Art Unit 2614

EAST Search History

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	5748	455/404.1,404.2,410,456.1-456.2,457.ccls.	US-PGPUB	OR	ON	2012/05/20 23:32
L2	9	(transmit$4 with ((wireless cell cellular mobile) near2 location) with (remote near server)).clm.	US-PGPUB	OR	ON	2012/05/20 23:33
L3	5	1 and 2	US-PGPUB	OR	ON	2012/05/20 23:33
L4	0	((alert$3 near3 messag$3) and (privacy adj profile)).clm.	US-PGPUB	OR	ON	2012/05/20 23:33
L5	9	((receiv$3 adj3 (location position) adj3 request$3) and (display$3 adj3 map with (wireless device cell cellular))).clm.	US-PGPUB	OR	ON	2012/05/20 23:34
L6	0	((transmit$4 send$3) with messag$3 with (authori$6 adj2 (user subscriber)) with distance).clm.	US-PGPUB	OR	ON	2012/05/20 23:35
L7	112	((chang$3 add$3) with user with profile with (cell mobile cellular wireless)).clm.	US-PGPUB	OR	ON	2012/05/20 23:35
L8	112	((chang$3 add$3) with user with profile with (cell mobile cellular wireless)).clm.	US-PGPUB	OR	ON	2012/05/20 23:35
L9	0	5 and 8	US-PGPUB	OR	ON	2012/05/20 23:36
L10	201	((transmit$4 send$3) with location with (remote near2 server)).clm.	US-PGPUB	OR	ON	2012/05/20 23:36
L11	1	8 and 10	US-PGPUB	OR	ON	2012/05/20 23:36

5/ 20/ 2012 11:37:17 PM
C:\ Users\ qnguyen\ Documents\ EAST\ Workspaces\ 11387384.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11387384	MULLEN, JEFFREY D.
	Examiner	Art Unit
	QUYNH NGUYEN	2614

SEARCHED			
Class	Subclass	Date	Examiner
455	404.1, 404.2, 410, 456.1-456.3, 457	11/19/11	QN
	above updated	5/20/12	QN

SEARCH NOTES		
Search Notes	Date	Examiner
search east, uspat, uspgpub, epo, jpo	11/19/11	QN
inventor search in PALM	11/19/11	QN

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
455	404.1, 404.2, 410, 456.1-456.3, 457	11/19/11	QN
	interference search history printout	11/19/11	QN
	interference search history printout	5/20/12	QN

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11387384	MULLEN, JEFFREY D.
	Examiner	**Art Unit**
	QUYNH NGUYEN	2614

ORIGINAL		INTERNATIONAL CLASSIFICATION									
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED				
455	404.1	H	0	4	M	11 / 04 (2006.01.01)					

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
455	404.2	410	456.1	456.2	456.3
455	457				

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1	12	17	28	33		49								
	2	14	18	29	34	43	50								
1	3	16	19	30	35	44	51								
2	4	17	20	31	36	45	52								
3	5	18	21	32	37	46	53								
4	6	19	22	33	38										
5	7		23	34	39										
6	8	20	24	35	40										
	9	21	25		41										
7	10	22	26	36	42										
8	11	23	27	37	43										
15	12	24	28	38	44										
13	13	25	29	39	45										
9	14	26	30	40	46										
10	15		31	41	47										
11	16	27	32	42	48										

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	46	
/QUYNH NGUYEN/ Primary Examiner.Art Unit 2614	5/20/12	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	16

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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Substitute for form 1449A/PTO **SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (use as many sheets as necessary)				***Complete if known***	
				Application Number	11/387,384
				Filing Date	March 22, 2006
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
				Examiner Name	Quynh H. Nguyen
Sheet	1	of	1	**Attorney Docket Number**	JDM/002 CON

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
/QN/		6,078,578	06/2000	Matsumoto	
/QN/		6,215,863	04/2001	Bennett et al.	
/QN/		6,647,257	11/2003	Owensby	
/QN/		7,130,630	10/2006	Enzmann	
/QN/		7,324,823	01/2008	Rosen	
/QN/		2002/0141434	10/2012	Grundvig	

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	/Quynh Nguyen/	Date Considered	05/20/2012

*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/30EFS (10-08)
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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	11387384	Filing Date	2006-03-22	Docket Number (if applicable)	JDM/002 CON	Art Unit	2614
First Named Inventor	Jeffrey D. Mullen			Examiner Name	Quynh H. Nguyen		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☐ Amendment/Reply
- ☒ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 503855

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☐ Patent Practitioner Signature

☒ Applicant Signature

PTO/SB/30EFS (10-08)
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Applicant Signature			
Applicant 1		Remove	
Signature	/Jeffrey D. Mullen/	Date (YYYY-MM-DD)	2012-08-24
Name	Jeffrey D. Mullen		
Click ADD for additional Applicant Signature		Add	

This collection of information is required by 37 CFR 1.114. 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 1.11 and 1.14. This collection is estimated to take 12 minutes 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.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

JDM/002 CON

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
Application No.	:	11/387,384
Confirmation No.	:	7999
Filed	:	March 22, 2006
For	:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
Group Art Unit	:	2614
Examiner	:	Quynh H. Nguyen

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

Pittsburgh, PA 15237
August 24, 2012

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

A Request for Continued Examination is applicable hereto and being submitted herewith. 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

6,144,336	Preston et al.	11/2001	(1)
6,603,977	Walsh et al	08/2003	(1)
6,662,014	Walsh et al	12/2003	(1)

Foreign Patent Documents

WO 01/001718	Nokia Networks	01/04/2001	(1)

Non-Patent Literature

WROLSTAD, JAY, "Sprint Claims First With E911-Capable Phone," newsfactor.com (as viewed at http://www.newsfactor.com/perl/story/13952.html on January 22, 2007), October 4, 2001) (1)

WROLSTAD, JAY, "Sprint Rolls Out E911 Services," newsfactor.com (as viewed at http://www.newsfactor.com/perl/story/15506.html on January 22, 2007), December 26, 2001) (1)

"Sprint PCS First Quarterly E911 Implementation Report," Before the Federal Communications Commission, In the Matter of Revision of the Commission's Rules To Ensure Compatibility With Enhanced 911 Emergency Calling Systems , CC Docket No. 944-102, February 1, 2002 (1)

"Who is Integrated Data Communications?," presented at the FCC E-911 Automatic Location Identification Round Table, June 28, 1999. (1)

"Wireless Telecommunications Bureau Seeks Comment On Request To Commence Rulemaking To Establish Fair Location Information Practices," WT Docket No. 01-72, DA 01-696, (as viewed at http://www.fcc.gov.Bureaus/Wireless/PublicNotices/9001/da010696.html on January 22, 2007), March 16, 2001. (1)

"Go2 Systems & Integrated Data Communications to Deliver Location Services Automatically to Wireless Phones; Alliance Enables Automatic Recognition of Wireless Caller's Location," Business Wire (as viewed at http://www.findarticles.com/p/articles/mi_m0EIN/is_2000_Feb_28/ai/59621222 on January 22, 2007), February 28, 2000. (1)

"Before the Federal Communications Commission: In the Matter of: E-911 Automatic Location Identification Round Table," Transcript, June 28, 1999. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.16jan01.txt on January 22, 2007), January, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.26feb01.txt on January 22, 2007), February, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.26mar01.txt on January 22, 2007), March, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.05apr01.txt on January 22, 2007), April, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.01may01.txt on January 22, 2007), May, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.10jun01.txt on January 22, 2007), June, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.05jul01.txt on January 22, 2007), July, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.01aug01.txt on January 22, 2007), August, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.04sep01.txt on January 22, 2007), September, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.02oct01.txt on January 22, 2007), October, 2001.	(1)
"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.02nov01.txt on January 22, 2007), November, 2001.	(1)
"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.03dec01.txt on January 22, 2007), December, 2001.	(1)
"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.07jan02.txt on January 22, 2007), January, 2002.	(1)
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"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.04mar02.txt on January 22, 2007), March, 2002.	(1)

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.

Documents above marked with a (1) were cited in Application No. 10/400,296. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (3) were cited in Application No. 11/462,201. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (4) were cited in Application No. 11/462,201. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (5) were cited in Application No. 11/834,674. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United

States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (6) were cited in Application No. 11/841,734. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (7) were cited in Application No. 11/841,750. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (8) were cited in Application No. 11/841,765. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Applicant hereby submits that not all of the patent documents and non-patent literature submitted herein may be, in fact, prior art to the present application. Applicant

reserves the right to dispute whether references, or subject matter within references, are prior art to the present application (e.g., continuation-in-part subject matter filed after the filing date of the present application).

This Statement is being submitted after a first Office Action on the merits. Accordingly, pursuant to 37 CFR 1.97(c), the fee set forth in Section 1.17(p) is provided herewith.

Applicant respectfully submits that this application, including the pending claims, is in condition for allowance. A favorable action is respectfully requested.

The Director is hereby authorized to charge any fees associated with this filing, or credit any overpayment of the same, to Deposit Account No. 50-3855.

Respectfully Submitted,

/Jeffrey D. Mullen/
Jeffrey D. Mullen
Applicant (Reg. No. 52,056)
Customer No. 32733
1310 Riverfront Drive
Pittsburgh, PA 15238
Tel.: (914) 837-7741

Substitute for form 1449A/PTO				***Complete if known***	
SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary)				**Application Number**	11/387,384
				Filing Date	March 22, 2006
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
				Examiner Name	Quynh H. Nguyen
Sheet	1	of	1	**Attorney Docket Number**	JDM/002 CON

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		6,144,336	11/2001	Preston et al.	
		6,603,977	08/2003	Walsh et al	
		6,662,014	12/2003	Walsh et al	

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		WO 01/001718	01/04/2001	Nokia Networks		

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		WROLSTAD, JAY, "Sprint Rolls Out E911 Services," newsfactor.com (as viewed at http://www.newsfactor.com/perl/story/15506.html on January 22, 2007), December 26, 2001)	
		"Sprint PCS First Quarterly E911 Implementation Report," Before the Federal Communications Commission, In the Matter of Revision of the Commission's Rules To Ensure Compatibility With Enhanced 911 Emergency Calling Systems , CC Docket No. 944-102, February 1, 2002	
		"Who is Integrated Data Communications?," presented at the FCC E-911 Automatic Location Identification Round Table, June 28, 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.
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				Art Unit	2614
(use as many sheets as necessary)				**Examiner Name**	Quynh H. Nguyen
Sheet	2	of	1	**Attorney Docket Number**	JDM/002 CON

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Examiner Signature		Date Considered	

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				Filing Date	March 22, 2006
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(use as many sheets as necessary)				**Examiner Name**	Quynh H. Nguyen
Sheet	3	of	1	**Attorney Docket Number**	JDM/002 CON

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		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.02nov01.txt on January 22, 2007), November, 2001.	
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.03dec01.txt on January 22, 2007), December, 2001.	
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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
4 January 2001 (04.01.2001)

PCT

(10) International Publication Number
WO 01/01718 A1

(51) International Patent Classification[7]: H04Q 7/38

(21) International Application Number: PCT/FI00/00357

(22) International Filing Date: 26 April 2000 (26.04.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
991466 28 June 1999 (28.06.1999) FI

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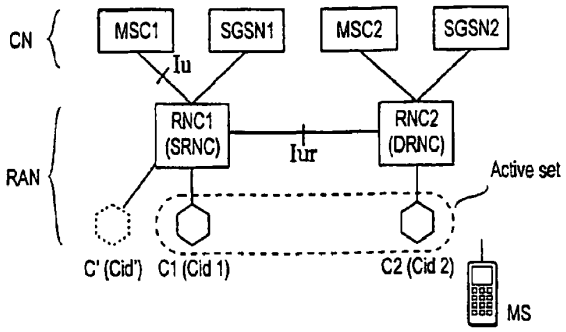
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KR (utility model), KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian 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), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

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: LOCATION MANAGEMENT FOR CELLULAR SYSTEMS



(57) Abstract: A method for indicating a mobile station's (MS) location. A first radio network controller, RNC, acts as the mobile station's serving RNC (SRNC), for reporting the mobile station's location to the core network (CN). A second RNC acts as the mobile station's drift RNC (DRNC), for maintaining a radio connection with the mobile station. In response to fulfilment of at least one criterion in a first set of criteria, the mobile station (MS) sends location information about its location to the second RNC (DRNC) which forwards the location information to the first RNC (SRNC) for reporting to the core network (CN). There is also a second set of criteria for transforming the location information. In response to fulfilment of at least one criterion in the second set, the first RNC (SRNC) sends falsified information about the mobile station's location to the core network (CN).

WO 01/01718 A1

Location management for cellular systems

Background of the invention

The invention relates to methods and equipment for reporting a mobile terminal's location. The invention can be used e.g. for implementing handover in a mobile communications system. The invention is particularly useful in a system which is at least partly a third generation (3G) mobile communications system. 3G mobile communications systems, such as the UMTS (Universal Mobile Telecommunications System) are being standardised by the UMTS Forum and the European Telecommunication Standard Institute ETSI. The current vision is that 3G systems will include both circuit-switched and packet-switched components.

Fig. 1 is a block diagram of a telecommunications system showing the components which are essential for understanding the invention. A UMTS Mobile Station MS consists of Mobile Equipment ME and a USIM card (User and Services and Identity Module). There is a radio interface Uu between the MS and a Radio Access Network RAN, which comprises Base Stations BS under control of Radio Network Controllers RNC. For circuit-switched services, the RNCs are connected, via an Iu interface, to Mobile services Switching Centres MSC, and for packet-switched services, there is a connection, via a Gb interface, to Serving GPRS Support Nodes SGSN (GPRS = General Packet Radio Service). The MSC and SGSN elements may include separate UMTS addition sections. Subscriber data related to the MS is stored permanently in a Home Location Register HLR and for circuit-switched operation, the data is transferred to the Visitor Location Register VLR of the MSC which currently serves the MS. There may be separate Interworking units IWU for adapting the A and Gb interfaces of GSM/GPRS systems to the Iu interface of the UMTS. For storing equipment-related data, the network comprises an Equipment Identity Register EIR. For entering and updating subscriber-specific data, there is an Operation and Maintenance O&M section having a Man-Machine Interface MMI. For creating and managing supplementary services, there is typically a dedicated Service Control Node SCN which can be seen as an evolved version of a Service Control Point (SCP) of Intelligent Networks.

Only the packet-switched section will be described in more detail, and it is assumed that this section will resemble a GPRS system. The GPRS infrastructure comprises support nodes such as a GPRS gateway support node (GGSN) and a GPRS serving support node (SGSN). The main functions

of the GGSN nodes involve interaction with the external data network. The GGSN updates the location directory using routing information supplied by the SGSNs about an MS's path and routes the external data network protocol packet encapsulated over the GPRS backbone to the SGSN currently serving the MS. It also decapsulates and forwards external data network packets to the appropriate data network and handles the billing of data traffic.

The main functions of the SGSN are to detect new GPRS mobile stations in its service area, handle the process of registering the new MSs along with the GPRS registers, send/receive data packets to/from the GPRS MS, and keep a record of the location of the MSs inside of its service area. The subscription information is stored in a GPRS register (HLR) where the mapping between a mobile's identity (such as MS-ISDN or IMSI) and the PSPDN address is stored. The GPRS register acts as a database from which the SGSNs can ask whether a new MS in its area is allowed to join the GPRS network.

The GPRS gateway support nodes GGSN connect an operator's GPRS network to external systems, such as other operators' GPRS systems, data networks 11, such as an IP network (Internet) or a X.25 network, and service centres. Fixed hosts 14 can be connected to the data network 11 e.g. by means of a local area network LAN and a router 15. A border gateway BG provides access to an inter-operator GPRS backbone network 12. The GGSN may also be connected directly to a private corporate network or a host. The GGSN includes GPRS subscribers' PDP (Packet Data Protocol) addresses and routing information, i.e. SGSN addresses. Routing information is used for tunnelling protocol data units PDU from data network 11 to the current switching point of the MS, i.e. to the serving SGSN. The functionalities of the SGSN and GGSN can be connected to the same physical node.

The home location register HLR of the GSM network contains GPRS subscriber data and routing information and it maps the subscriber's IMSI into an SGSN address and one or more pairs of the PDP type and PDP address. The HLR also maps each PDP type and PDP address pair into a GGSN node. The SGSN has a Gr interface to the HLR (a direct signalling connection or via an internal backbone network 13). The HLR of a roaming MS and its serving SGSN may be in different mobile communication networks.

The intra-operator backbone network 13, which interconnects an operator's SGSN and GGSN equipment, can be implemented, for example, by

means of a local network, such as an IP network. It should be noted that an operator's GPRS network can also be implemented without the intra-operator backbone network, e.g. by providing all features in one computer.

Fig. 2 shows the protocol stacks used at various points in a 3G network.

A mobile station (MS) engaged in GPRS traffic sends a CELL UPDATE (CU) message after detecting that it has changed its cell. A number of cells constitute a routing area (RA), and when the routing area changes, the MS sends a ROUTING AREA UPDATE (RAU) message. In the UMTS the cell update messages are not sent to the SGSN, only to the RNC. Therefore the SGSN is not aware of the exact cell of the MS. For an active MS, the SGSN only knows an identifier of the RNC which handles the MS. For an idle MS, the SGSN only knows the MS's routing area identifier.

A first problem underlying the invention will now be described with reference to Fig. 3. A 3G system may pose certain problems which do not exist in 2G systems, such as the GSM and the GPRS. For example, when the MS is changing its cell, it is possible that a connection-oriented connection is not handled by the RNC controlling the MS's active cells but by another RNC. The former RNC is called a 'drift RNC' and the latter RNC is called a 'serving RNC'. In Fig. 3, RNC1 is the serving RNC (SRNC) and RNC2 is the drift RNC (DRNC). In such a case, the CU and RAU messages are transmitted over the air interface piggybacked to the channel which is reserved for the circuit-switched connection (connection-oriented connection), and they terminate at the serving RNC. In a GPRS core network, if the Radio Access Network (RAN) inserts a cell ID (identifier) into the CU or RAU messages, thereby indicating where the MS is actually located, and if that cell is not controlled by the serving RNC, the SGSN may use another RNC for the packet-switched connections. This is not possible, however, because all simultaneous connections for one user should be handled by one RNC. In other words, there may be an ambiguity concerning the RNC which the SGSN should use. The same holds in a UMTS system if the Radio Access Network (RAN) inserts a cell ID (identifier) into a RAU message or an equivalent.

A second, related problem is that current GPRS or 3G systems do not offer a smooth Inter-SGSN routing area update (RAU) procedure. A lot of signalling is needed between the new SGSN and the old SGSN, the HLR, MSC and the GGSN(s). In particular, the new SGSN must receive the sub-

scriber data from the old SGSN before it can be sure that it can accept the RAU and continue signalling. This signalling causes a delay of up to several seconds, which in some cases could be unacceptable. Moreover, in packet traffic a virtual connection can last for several days. Therefore, the existing concepts of an anchor-MSC and float-MSC are not appropriate.

Disclosure of the invention

It is an object of the invention to provide a method and equipment for eliminating the first problem associated with prior art systems. The object is attained with the method and equipment which are characterized by what is disclosed in the characerizing part of the appended independent claims. Solutions to the second problem and preferred solutions to the first problem are disclosed in the appended dependent claims.

The invention is based on the idea that for a terminal sending information on the basis of which its location can be determined (such as a mobile station having a connection-oriented connection while sending a CU or RAU message), the terminal's location information (e.g. its cell ID) can betransformed, e.g. by using a masked or falsified (faked) location information, such as a fake cell ID. The fake location information is preferably chosen so that the SGSN assumes the location of the MS to be under the serving RNC. A certain pool or group of cell addresses can be used for this purpose. It might be beneficial to choose the addresses so that the SRNC (or SGSN) can detect that the traffic has been forwarded.

According to various preferred embodiments of the invention, the information about the MS's location indicates one or more of the following:

a location (e.g. a cell) which is controlled by the SRNC and which is part of the MS's active set, if such a cell exists;

a virtual location (e.g. cell), which is not controlled by either RNC, in case the MS's active set does not comprise a cell which is controlled by the SRNC;

the last location (e.g. a cell) which is controlled by the SRNC and which has been part of the MS's active set in case the MS's active set does not comprise a cell which is controlled by the SRNC;

a location (e.g. a cell) controlled by the DRNC in case the MS's active set does not comprise a cell controlled by the SRNC; and/or

a location (e.g. a cell) whose location information the MS received last.

The fact that the MS's location information indicates one of these cells has two possible interpretations. The MS's location information may indicate such a cell either explicitly or implicitly. An explicit indication means that the location information contains actual cell identifiers. An implicit indication means that the location information contains some information (e.g. one or more routing or location area identifiers) on the basis of which a cell can be identified (if so desired). It is also feasible to transfer only some location-related data and use it for calculating the MS's location.

The criteria for sending location information preferably comprises a change of the MS's location, activation of a PDP context for the MS and expiry of a recurring period of time.

As briefly noted above, the information about the MS's location may indicate a location, such as a cell, whose location information the MS received last. When a mobile station has at least one active connection, it receives system information only via its dedicated signalling connection. This system information comprises e.g. current location (such as routing area, location area and cell identity) of the mobile station. The system information is similar in nature to the information which the MS receives via a broadcast control channel BCCH when it does not have any active connections. The SRNC only sends system information about the cells controlled by it. In other words, it does not send system information about cells controlled by the DRNC. Based on the system information, the MS can determine whether or not it has moved into a new routing or location area. The SRNC sends this information as necessary. One suitable criterion for sending it is that the MS has moved and its active set does not contain the cell whose system information the SRNC has sent last, or after an SRNC handover (relocation).

Use of the transformed location, such as a fake cell ID, causes another problem, however. When the MS's last connection-oriented connection is terminated and the serving RNC deleted from the MS-URAN connection, the SGSN must be informed about the new (correct) RNC. This holds also for cases where the serving RNC is changed. This problem can be solved as follows. If the MS's last connection-oriented connection is terminated or if the serving RNC is changed, an additional CU or RAU must be performed for the MS, even if the MS's location information has not changed.

The location reporting functionality performed by a serving RNC can be summarised as follows:

1. Check if RNC handover should be performed. If not, then:

2. Select a location, such as a cell which is controlled by the serving RNC and which is part of the MS's active set, if such a cell exists. (N.B. The active set must also comprise at least one cell controlled by the drift RNC, otherwise the concept of drift RNC would not exist.)

If no handover was performed in step 1 or no cell was found in step 2, then do one of the following:

3A. Select a virtual location, such as a cell. A virtual cell is not a real cell (i.e. it is not covered by radio transceivers); or

3B. Select, among the cells controlled by the serving RNC, the last one used by the MS.

If step 3A is taken, i.e. a virtual location is selected, the core network elements (the MSC and/or the SGSN) must determine that the location information does not refer to reallocation. Such a determination can be made on the basis of a suitable cell ID numbering plan or a translation table.

Brief description of the drawings

The invention will now be described in connection with its preferred embodiments, with reference to the accompanying drawings, in which:

Fig. 1 is a block diagram of a telecommunications system showing the components which are essential for understanding the invention;

Fig. 2 shows the protocol stacks used at various points in a 3G network;

Fig. 3 is a simplified block diagram for pointing out the problem more clearly;

Fig. 4 shows a routing area update (RAU) procedure for a GPRS network; and

Fig. 5 shows an alternative Inter-SGSN routing area update procedure according to a preferred embodiment of the invention.

Detailed description of the invention

Fig. 4 shows a routing area update (RAU) procedure for a GPRS network. In step 4-1 the MS sends a ROUTING AREA UPDATE REQUEST via RNC2 (drift RNC) to RNC1 (serving RNC). In step 4-2 RNC1 adds the MS's location information and forwards the RAU Request to SGSN1. In step 4-3 SGSN2 requests the MS's PDP context from SGSN1 which responds in step 4-4. In step 4-5 SGSN1 begins to forward MS-terminated (MT) packets to

SGSN2. Security functions have been shown as step 4-6. In step 4-7 SGSN2 sends an UPDATE PDP CONTEXT REQUEST to the GGSN node which responds in step 4-8. In step 4-9 the MS's location is updated in the HLR. In step 4-10 the HLR cancels the MS's location in SGSN1 which acknowledges this in step 4-11. In step 4-12 the HLR sends an INSERT SUBSCRIBER DATA to SGSN2 which acknowledges in step 4-13. In step 4-14 the HLR sends to SGSN2 an acknowledgement to the message sent in step 4-9. In step 4-15, if the MS is IMSI-attached and does not have a circuit-switched connection, the SGSN-VLR association must be updated. SGSN2 updates the MS's location and SGSN number in the VLR, which acknowledges these in step 4-16. In steps 4-17 and 4-18 the RAU process is completed.

Fig. 5 shows an alternative Inter-SGSN routing area update procedure according to a preferred embodiment of the invention. This embodiment and its alternative modifications solve the second problem underlying the invention.

Due to macrodiversity, the triggering of a RAU is less clear than in 2G systems. A RAU could be triggered e.g. if all cells in the MS's active set belong to the new RA, or if more than half of the cells belong to it. In step 5-1 the MS sends a ROUTING AREA UPDATE REQUEST via RNC2 (drift RNC) to RNC1 (serving RNC). The MS sends the RAU request via its uplink connection, if one exists. Because of the coexistence of the drift RNC and the serving RNC, the update is received by the SRNC which does not control the MS's new routing area. The MS should suspend its session management procedures. In step 5-2 RNC1 adds the MS's location information and forwards the RAU REQUEST to SGSN1. This is in contrast to prior art GPRS systems where the RAU REQUEST is sent to SGSN2. In step 5-3 security functions may be performed, as usual. A benefit of sending the RAU REQUEST to SGSN1 is that SGSN1 already knows the MS's digital signature (PTMSI signature in GPRS terms), and it is likely to have authentication triplets for it. Thus there is no need to fetch these separately, whereby the delays due to the inter-SGSN handover can be shortened.

In step 5-4, if the security functions are completed successfully, the SGSN1 sends a FORWARD RAU REQUEST to SGSN2. This message includes parameters for resuming the connection(s) after the RAU. Such parameters include session management data and eventually Iu information (address of

RNC2). SGSN1 may start a timing period during which it will keep the MS's data in its memory.

In step 5-5 SGSN2 updates the MS's location (IMSI, SGSN address) in the HLR. In step 5-6 the HLR inserts the subscriber data (IMSI, subscription details) into SGSN2 which validates the MS's presence in the new RA. If all regional and other checks are passed, SGSN2 establishes an MM (Mobility Management) context for the MS and returns an acknowledgement to the HLR in step 5-7.

In step 5-8 SGSN2 may establish an Iu link to RNC2 which may send some radio parameters to resume quickly a connection with the MS. This feature is especially useful if the MS has a delay-sensitive application (this can be determined by checking the MS's session management context).

In step 5-9 SGSN2 returns an accept message to the message sent in step 5-4. The accept message includes the new RA index, the MS's new temporary identity (P-TMSI in GPRS terms) and/or its new digital signature. Additionally, some radio parameters or codes obtained from RNC2 may be sent. SGSN1 should immediately acknowledge this message to facilitate error handling. In step 5-10 SGSN1 sends to the MS an RAU ACCEPT message which preferably contains the same parameters as the message of step 5-9. Additionally, if an acknowledgement transmission is active, it may contain some protocol state information known by SGSN1 (this corresponds to LLC acknowledgement in GPRS).

In step 5-11 SGSN1 suspends downlink data transmission for acknowledged mode, in order to keep the protocol state intact. Depending on the QoS, SGSN1 may continue data transmission for unacknowledged mode.

In step 5-12 the MS acknowledges with a RAU COMPLETE message which contains the new temporary identity (P-TMSI) and some protocol state information known by the MS, such as an LLC acknowledgement for each LLC connection used by the MS (which confirms all MT N-PDUs transferred succesfully before the start of the update procedure. If the packet acknowledgement (equivalent to LLC acknowledgement in GPRS) confirms reception of certain N-PDUs, these N-PDUs will be discarded by SGSN1. This message will trigger RNC relocation (which in this embodiment is triggered by the MS).

In step 5-13 the MS establishes a radio connection with RNC2. If radio parameters were sent in step 5-10 (RAU ACCEPT), the MS could set up a radio connection immediately with these parameters. Otherwise, the MS

should re-establish the radio connection by accessing the common channel, which causes a longer break in the connection. This is why sending the radio parameters in step 5-10 may be QoS-dependent. The MS should send an uplink packet (not shown) to SGSN2 in case the RAU COMPLETE message was lost because of error handling. An alternative embodiment, omitting step 5-13, will be described later.

In step 5-14 SGSN1 sends a FORWARD RAU COMPLETE message to SGSN2. In step 5-15 SGSN1 cancels the Iu links towards RNC1 and begins to forward downlink packets to SGSN2. It may keep the MS's context and forward MT packets until the expiry of the optional timing period which was started in step 5-4. In step 5-16, when SGSN2 receives the FORWARD RAU COMPLETE message, it resumes data transmission towards the MS.

In step 5-17 SGSN2 sends to the relevant GGSN(s) an UPDATE PDP CONTEXT REQUEST (SGSN2 address, Tunnel Identifier, QoS Negotiated). The GGSNs update their PDP context fields and return a response in step 5-18. N.B: Steps 5-17 and 5-18 may take place any time after step 5-5.

In step 5-19 the HLR cancels the MS's location in SGSN1. This message contains the MS's IMSI, and the cancellation type is set to Update procedure. If the optional timer was not set in step 5-4, SGSN1 deletes the MS's MM and PDP contexts. Otherwise it waits until the timer expires. The timing period allows SGSN1 to complete forwarding of N-PDUs. It also ensures that the MS's MM and PDP contexts are kept in case the MS initiates another Inter-SGSN RAU before completing the ongoing RAU. In step 5-20 SGSN1 acknowledges with a CANCEL LOCATION ACK.

According to an alternative embodiment step 5-13 is omitted. Instead, during step 5-15 RNC1 receives an indication from SGSN1 that the RNC could now be relocated. RNC1 will inform RNC2 which will start handling the MS directly.

In general, the invention is equally applicable if the SGSN is replaced by a 3G MSC (or an MSC/SGSN combination). For this embodiment, the MSC and/or SGSN could be called 'switching elements' since they route packets and/or establish circuit-switched connections.

In GSM systems no location area updates are performed during connection, in order not to confuse the relay and anchor MSCs. With macro diversity the LAU could reach the old MSC directly, whereby it is possible to have a LAU during a call. However, in a hard inter-MSC handover, a special

message (LAU with an active call indication) may be needed. Such a message could trigger the new MSC to establish a connection with the old MSC and try to resume the call. A problem is that this would happen especially between the GSM and the UMTS, which means that a GSM MSC would need to interpret this special LAU message.

It should be noted that figures 4 and 5 illustrate worst-case scenarios in the sense that both RNCs are under different SGSN nodes or MSCs. If the SGSNs or the MSCs are the same, these scenarios could be simplified accordingly.

Claims

1. A method for indicating a terminal's (MS) location in a telecommunications system comprising:

a core network (CN); and

an access network (RAN) comprising a first network controller, which at least temporarily acts as the terminal's serving network controller (SRNC), for reporting the terminal's location to the core network, and a second network controller, which at least temporarily acts as the terminal's drift network controller (DRNC), for maintaining a connection with the terminal; wherein

there is a first set of predetermined criteria for sending information about the terminal's (MS) location to the core network (CN); and

in response to fulfilment of at least one criterion in the first set, the terminal (MS) sends to the second network controller (DRNC) location information (4-1, 5-1) on the basis of which the terminal's location can be determined; and the second network controller (DRNC) forwards the location information to the first network controller (SRNC) for reporting to the core network (CN);

characterized in that

there is a second set of at least one predetermined criterion for transforming the location information;

the first network controller (SRNC) checks whether at least one criterion in the second set is fulfilled; and

in response to fulfilment of at least one criterion in the second set, the first network controller (SRNC) sends transformed information (4-2, 5-2) about the terminal's location to the core network (CN).

2. A method according to claim 1, characterized in that in response to terminating the last connection-oriented connection with the terminal, the first network controller (SRNC) reports the terminal's correct location to the core network (CN).

3. A method according to claim 1 or 2, characterized in that the information about the terminal's (MS) location indicates a location which is controlled by the first network controller (SRNC) and which is part of the terminal's active set, if such a location exists.

4. A method according to claim 3, characterized in that if the terminal's active set does not comprise a location which is controlled by the first network controller (SRNC), the information about the terminal's (MS) location indicates a virtual location, which is not controlled by either of said network controllers.

5. A method according to claim 3, characterized in that if the terminal's active set does not comprise a location which is controlled by the first network controller (SRNC), the information about the terminal's (MS) location indicates the last location which is controlled by the first network controller and which has been part of the terminal's active set.

6. A method according to claim 3, characterized in that if the terminal's active set does not comprise a location which is controlled by the first network controller (SRNC), said information about the terminal's (MS) location indicates a location which is at least partially controlled by the first network controller.

7. A method according to any one of the preceding claims, characterized in that the information about the terminal's (MS) location indicates a location the location information of which the terminal received last.

8. A method according to any one of the preceding claims, characterized in that if the terminal's (MS) active set does not comprise a location controlled by the first network controller (SRNC), the information about the terminal's (MS) location indicates a location controlled by the second network controller (DRNC).

9. A method according to any one of the preceding claims, characterized in that said information about the terminal's (MS) location indicates at least one cell identifier, routing area identifier or location area identifier.

10. A method according to any one of the preceding claims, characterized in that said first set of criteria comprises a change of the terminal's location, activation of a PDP context for the terminal and expiry of a recurring period of time.

11. A method according to any one of the preceding claims, characterized in that

the first and the second network controller (RNC1, RNC2) are associated, respectively, with a first and a second switching element (SGSN1, SGSN2) for maintaining subscription information related to the terminal (MS); and

information about the terminal's location is received by the first switching element (SGSN1) sends (5-4) information about the terminal's location to the second switching element (SGSN2) without a separate request.

12. A method according to claim 11, characterized in that said information about the terminal's location comprises the terminal's Packet Data Protocol and/or Mobility Management context.

13. A method according to claim 11 or 12, characterized in that each of the first and the second switching element (SGSN1, SGSN2) is substantially an SGSN node, a Mobile services Switching Centre or a combination of both.

14. A method according to any one of the preceding claims, characterized in that said terminal is a mobile station, said access network is a radio access network and said network controller is a radio network controller.

15. A first network controller for supporting a terminal (MS) in a telecommunications system which comprises a core network (CN) and an access network (RAN);

wherein said first network controller is adapted to act, at least temporarily, as the terminal's serving network controller (SRNC) in said access network (RAN), for reporting the terminal's location to the core network (CN); and

the first network controller (SRNC) is adapted to receive location information from a drift network controller (DRNC) and to report it to the core network (CN) for determining the terminal's (MS) location;

characterized in that

the first network controller (SRNC) is adapted to transform said information about the terminal's location before reporting it to the core network (CN).

Fig. 1

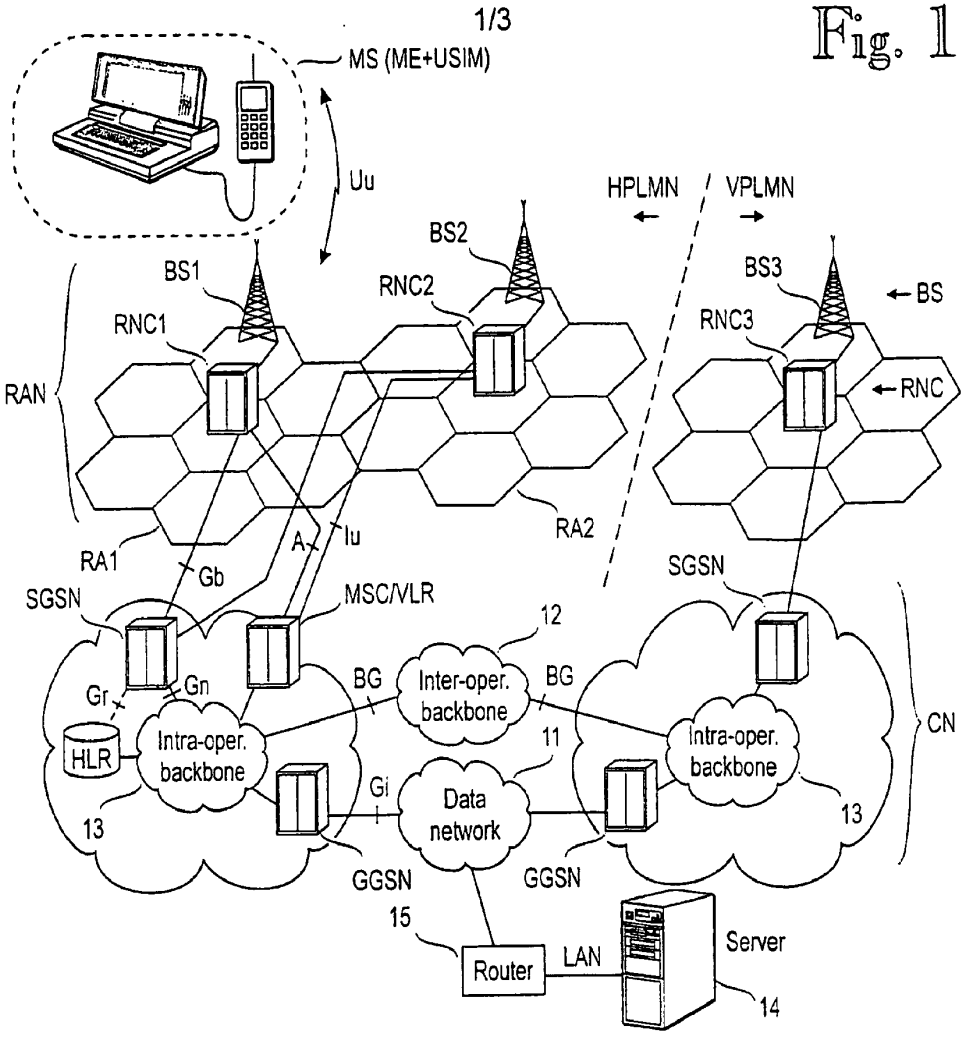
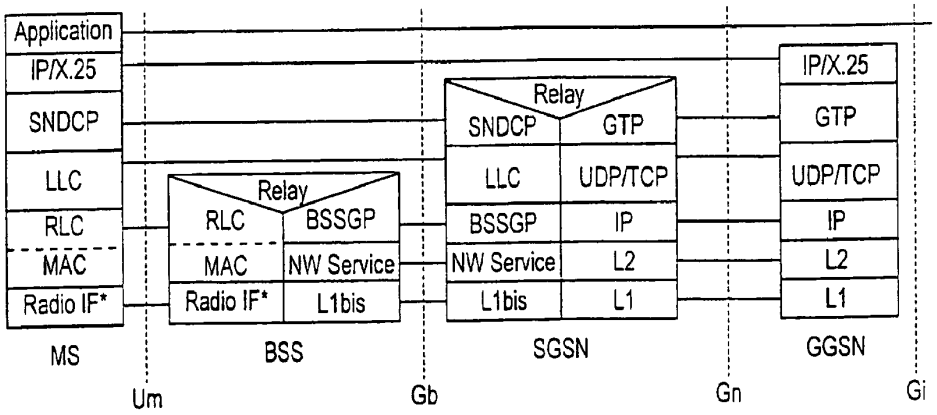


Fig. 2



*WCDMA in 3G

Fig. 3

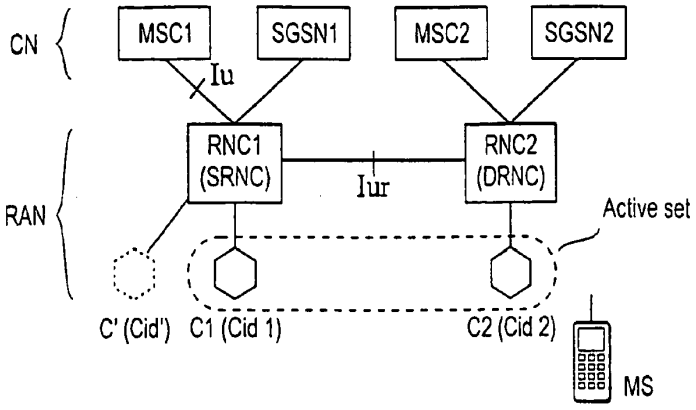

CN
MSC1
SGSN1
MSC2
SGSN2
Iu
RNC1
(SRNC)
Iur
RNC2
(DRNC)
RAN
Active set
C' (Cid')
C1 (Cid 1)
C2 (Cid 2)
MS

Fig. 4

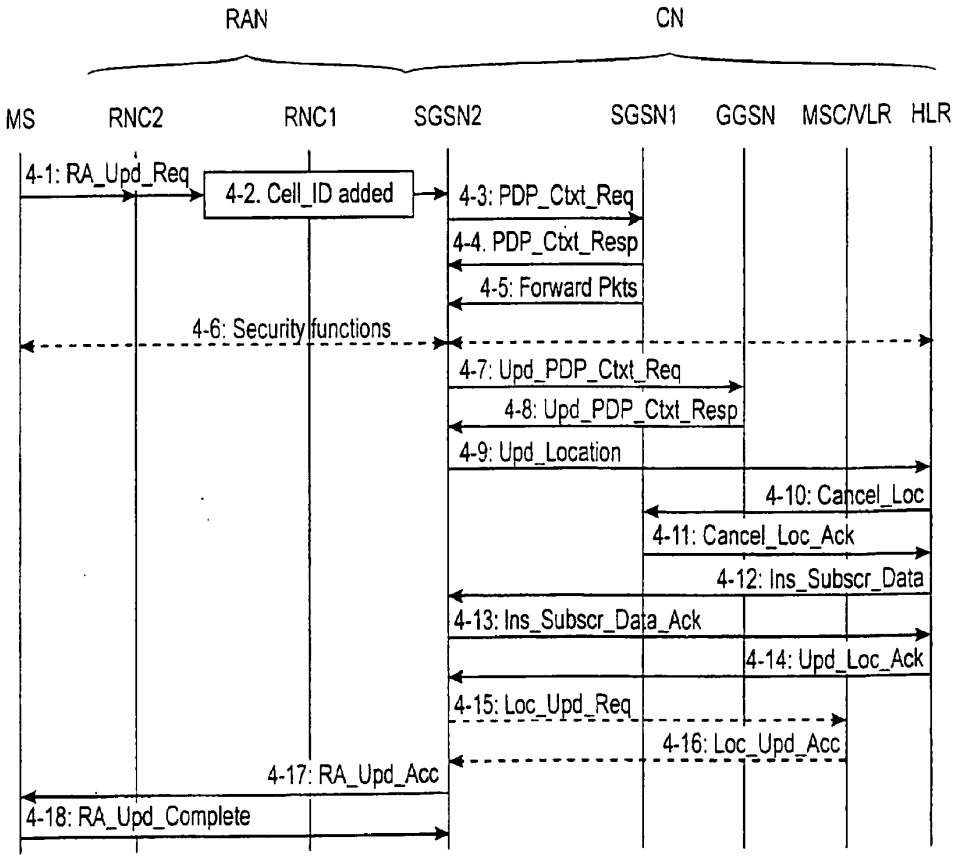
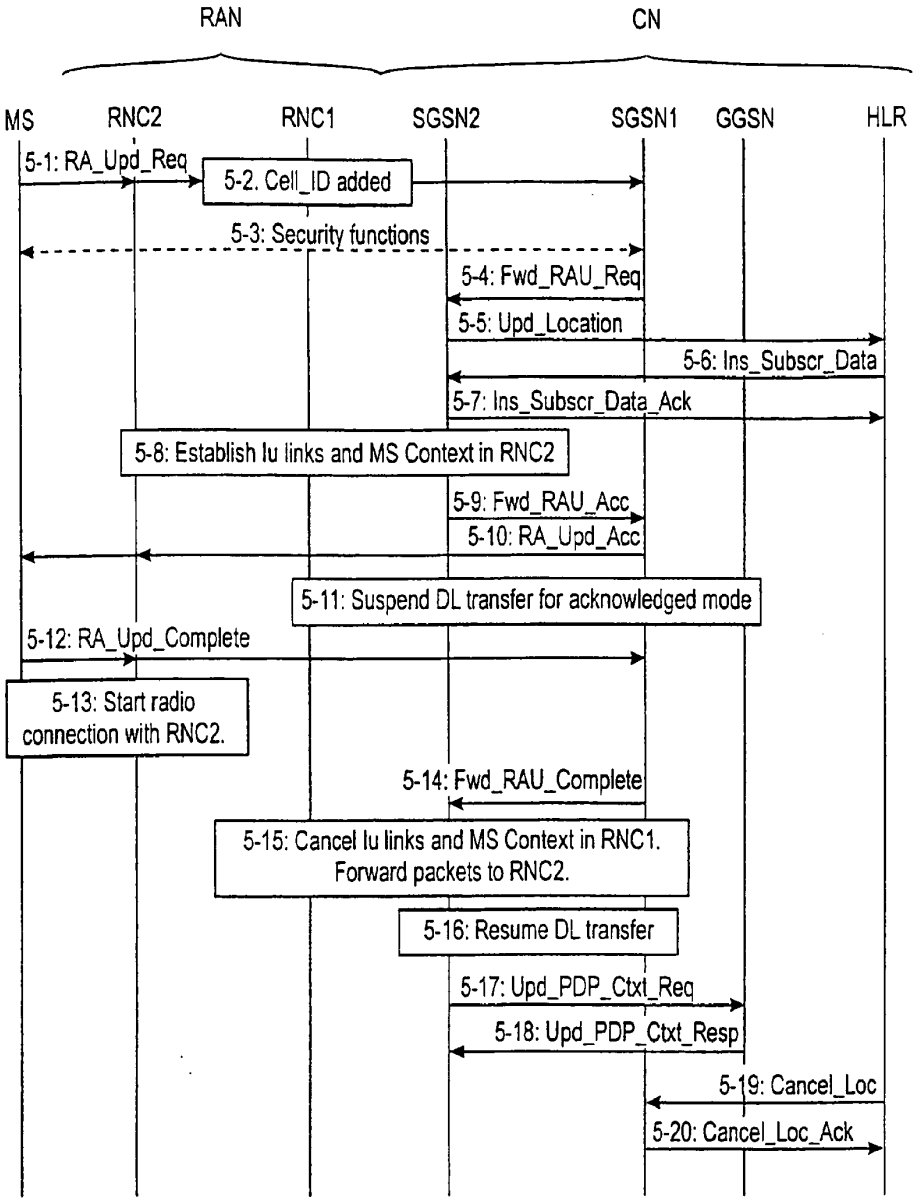

RAN
CN
MS
RNC2
RNC1
SGSN2
SGSN1
GGSN
MSC/VLR
HLR
4-1: RA_Upd_Req
4-2. Cell_ID added
4-3: PDP_Ctxt_Req
4-4. PDP_Ctxt_Resp
4-5: Forward Pkts
4-6: Security functions
4-7: Upd_PDP_Ctxt_Req
4-8: Upd_PDP_Ctxt_Resp
4-9: Upd_Location
4-10: Cancel_Loc
4-11: Cancel_Loc_Ack
4-12: Ins_Subscr_Data
4-13: Ins_Subscr_Data_Ack
4-14: Upd_Loc_Ack
4-15: Loc_Upd_Req
4-16: Loc_Upd_Acc
4-17: RA_Upd_Acc
4-18: RA_Upd_Complete

Fig. 5


RAN
CN
MS
RNC2
RNC1
SGSN2
SGSN1
GGSN
HLR
5-1: RA_Upd_Req
5-2. Cell_ID added
5-3: Security functions
5-4: Fwd_RAU_Req
5-5: Upd_Location
5-6: Ins_Subscr_Data
5-7: Ins_Subscr_Data_Ack
5-8: Establish Iu links and MS Context in RNC2
5-9: Fwd_RAU_Acc
5-10: RA_Upd_Acc
5-11: Suspend DL transfer for acknowledged mode
5-12: RA_Upd_Complete
5-13: Start radio connection with RNC2.
5-14: Fwd_RAU_Complete
5-15: Cancel Iu links and MS Context in RNC1. Forward packets to RNC2.
5-16: Resume DL transfer
5-17: Upd_PDP_Ctxt_Req
5-18: Upd_PDP_Ctxt_Resp
5-19: Cancel_Loc
5-20: Cancel_Loc_Ack

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00357

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.
P,X	WO 9966740 A2 (EINOLA), 23 December 1999 (23.12.99), page 3, line 7 - page 7, line 24	15
P,A	--	1-14
P,A	WO 0011878 A2 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 2 March 2000 (02.03.00), page 6, line 18 - page 8, line 13	1-15
	--	
A	WO 9920071 A1 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 22 April 1999 (22.04.99), page 5, line 6 - page 7, line 3, abstract	1-15
	--	

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
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"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
13 October 2000	17 -10- 2000
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 Jaana Raivio/mj Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/08/00

International application No.
PCT/FI 00/00357

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9966740 A2	23/12/99	AU 4554499 A	05/01/00
		AU 5900699 A	21/03/00
		EP 1025668 A	09/08/00
		WO 0012593 A	09/03/00
WO 0011878 A2	02/03/00	AU 5664599 A	14/03/00
WO 9920071 A1	22/04/99	AU 9468798 A	03/05/99
		SE 9703697 A	11/04/99

Form PCT/ISA/210 (patent family annex) (July 1992)

Electronic Patent Application Fee Transmittal	
Application Number:	11387384
Filing Date:	22-Mar-2006
Title of Invention:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
First Named Inventor/Applicant Name:	Jeffrey D. Mullen
Filer:	Jeffrey David Mullen
Attorney Docket Number:	JDM/002 CON
Filed as Small Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for continued examination	2801	1	465	465
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**645**

Electronic Acknowledgement Receipt	
EFS ID:	13578287
Application Number:	11387384
International Application Number:	
Confirmation Number:	7999
Title of Invention:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
First Named Inventor/Applicant Name:	Jeffrey D. Mullen
Customer Number:	32733
Filer:	Jeffrey David Mullen
Filer Authorized By:	
Attorney Docket Number:	JDM/002 CON
Receipt Date:	24-AUG-2012
Filing Date:	22-MAR-2006
Time Stamp:	09:12:26
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$645
RAM confirmation Number	7741
Deposit Account	503855
Authorized User	MULLEN,JEFFREY D.
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

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1	Request for Continued Examination (RCE)	JDM-002C--RCE.pdf	697862 ecf717b2cc197c895cfe6213a162c5736ad22e98	no	3
Warnings:					
Information:					
2	Transmittal Letter	JDM-002CON--SIDS.pdf	99599 1aebf7136f1cc6a2e84f3f00d480cf3149fd9ca0	no	7
Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Form (SB08)	JDM-002CON--SIDS--PTOSB08A.pdf	285031 0aa685e5c9fd13a9058c0fecbc6a85b04feffc41	no	3
Warnings:					
Information:					
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4	Foreign Reference	foreignreference.pdf	796616 7144c8f9d0a3287b254a2dc4fc8999f1dfd47fbe	no	19
Warnings:					
Information:					
5		references-part1.pdf	6115809 94db060740e435f5b7b1f0c138210ab81920b738	yes	167

Multipart Description/PDF files in .zip description

Document Description	Start	End
Non Patent Literature	1	5
Non Patent Literature	6	10
Non Patent Literature	11	12
Non Patent Literature	13	164
Non Patent Literature	165	167

Warnings:

Information:					
6		references-part3.pdf	9091724 0c7c7b97926190 0f04bccbcab2454af7c14152ee	yes	158

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	Non Patent Literature	34	48
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	Non Patent Literature	81	95
	Non Patent Literature	96	112
	Non Patent Literature	113	133
	Non Patent Literature	134	149
	Non Patent Literature	150	158

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Information:

7		references-part2.pdf	15620225 65c9c9d8af21e8d82b20b2c8af909c84b2c4e200	yes	169

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	Non Patent Literature	103	117
	Non Patent Literature	118	134

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	Non Patent Literature		146	157	
	Non Patent Literature		158	169	
Warnings:					
Information:					
8	Fee Worksheet (SB06)	fee-info.pdf	31761 d2a478343ee184515f463c9431a7b27076c0817a	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	32738627		

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NOTICE OF ALLOWANCE AND FEE(S) DUE

32733 7590 10/01/2012

JEFFREY D. MULLEN
731 SOUTH NEGLEY
APT. 2
PITTSBURGH, PA 15232

EXAMINER	
NGUYEN, QUYNH H	
ART UNIT	PAPER NUMBER
2614	

DATE MAILED: 10/01/2012

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/387,384	03/22/2006	Jeffrey D. Mullen	JDM/002 CON	7999

TITLE OF INVENTION: SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$870	$300	$0	$1170	01/02/2013

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

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If the SMALL ENTITY is shown as NO:

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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

32733 7590 10/01/2012

JEFFREY D. MULLEN
731 SOUTH NEGLEY
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PITTSBURGH, PA 15232

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(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/387,384	03/22/2006	Jeffrey D. Mullen	JDM/002 CON	7999

TITLE OF INVENTION: SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$870	$300	$0	$1170	01/02/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, QUYNH H	2614	455-404100

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

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Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

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❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies _____

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❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/387,384	03/22/2006	Jeffrey D. Mullen	JDM/002 CON	7999

32733 7590 10/01/2012

JEFFREY D. MULLEN
731 SOUTH NEGLEY
APT. 2
PITTSBURGH, PA 15232

EXAMINER	
NGUYEN, QUYNH H	
ART UNIT	PAPER NUMBER
2614	

DATE MAILED: 10/01/2012

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 11/387,384	Applicant(s) MULLEN, JEFFREY D.	
	Examiner QUYNH NGUYEN	Art Unit 2614	

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

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *RCE and IDS filed 8/24/12*.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *3-8,10-22,24-30,32-40,42-48 and 50-53 renumbered as claims 1-46*.
4. ☐ 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 the:
      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)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/Quynh H Nguyen/
Primary Examiner, Art Unit 2614

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11387384	MULLEN, JEFFREY D.
	Examiner	**Art Unit**
	QUYNH NGUYEN	2614

ORIGINAL		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
455	404.1	H	0	4	M	11 / 04 (2006.01.01)						

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
455	404.2	410	456.1	456.2	456.3
455	457				

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1	12	17	28	33		49								
	2	14	18	29	34	43	50								
1	3	16	19	30	35	44	51								
2	4	17	20	31	36	45	52								
3	5	18	21	32	37	46	53								
4	6	19	22	33	38										
5	7		23	34	39										
6	8	20	24	35	40										
	9	21	25		41										
7	10	22	26	36	42										
8	11	23	27	37	43										
15	12	24	28	38	44										
13	13	25	29	39	45										
9	14	26	30	40	46										
10	15		31	41	47										
11	16	27	32	42	48										

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	46	
/QUYNH NGUYEN/ Primary Examiner.Art Unit 2614	9/20/12	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	16

PTO/SB/08A (10-01)
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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				***Complete if known***	
SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	11/387,384
				Filing Date	March 22, 2006
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
(use as many sheets as necessary)				**Examiner Name**	Quynh H. Nguyen
Sheet	1	of	1	**Attorney Docket Number**	JDM/002 CON

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
		6,144,336	11/2001	Preston et al.	
		6,603,977	08/2003	Walsh et al	
		6,662,014	12/2003	Walsh et al	

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]
		WO 01/001718	01/04/2001	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]
		WROLSTAD, JAY, "Sprint Claims First With E911-Capable Phone," newsfactor.com (as viewed at http://www.newsfactor.com/perl/story/13952.html on January 22, 2007), October 4, 2001)	
		WROLSTAD, JAY, "Sprint Rolls Out E911 Services," newsfactor.com (as viewed at http://www.newsfactor.com/perl/story/15506.html on January 22, 2007), December 26, 2001)	
		"Sprint PCS First Quarterly E911 Implementation Report," Before the Federal Communications Commission, In the Matter of Revision of the Commission's Rules To Ensure Compatibility With Enhanced 911 Emergency Calling Systems , CC Docket No. 944-102, February 1, 2002	
		"Who is Integrated Data Communications?," presented at the FCC E-911 Automatic Location Identification Round Table, June 28, 1999.	

Examiner Signature	/Quynh Nguyen/	Date Considered	09/20/2012

*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.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /QN/

PTO/SB/08A (10-01)
Approved for use through 10/31/2002. OMB 0651-0031
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SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	11/387,384
				Filing Date	March 22, 2006
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
(use as many sheets as necessary)				**Examiner Name**	Quynh H. Nguyen
Sheet	2	of	1	**Attorney Docket Number**	JDM/002 CON

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]
		"Wireless Telecommunications Bureau Seeks Comment On Request To Commence Rulemaking To Establish Fair Location Information Practices," WT Docket No. 01-72, DA 01-696, (as viewed at http://www.fcc.gov.Bureaus/Wireless/PublicNotices/9001/da010696.html on January 22, 2007), March 16, 2001.	
		"Go2 Systems & Integrated Data Communications to Deliver Location Services Automatically to Wireless Phones; Alliance Enables Automatic Recognition of Wireless Caller's Location," Business Wire (as viewed at http://www.findarticles.com/p/articles/mi_m0EIN/is_2000_Feb_28/ai/59621222 on January 22, 2007), February 28, 2000.	
		"Before the Federal Communications Commission: In the Matter of: E-911 Automatic Location Identification Round Table," Transcript, June 28, 1999.	
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.16jan01.txt on January 22, 2007), January, 2001.	
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.26feb01.txt on January 22, 2007), February, 2001.	
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.26mar01.txt on January 22, 2007), March, 2001.	
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.05apr01.txt on January 22, 2007), April, 2001.	
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.01may01.txt on January 22, 2007), May, 2001.	
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.10jun01.txt on January 22, 2007), June, 2001.	

Examiner Signature	/Quynh Nguyen/	Date Considered	09/20/2012

*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.**

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PTO/SB/08A (10-01)
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Substitute for form 1449A/PTO				***Complete if known***	
SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	11/387,384
				Filing Date	March 22, 2006
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				Art Unit	2614
(use as many sheets as necessary)				**Examiner Name**	Quynh H. Nguyen
Sheet	3	of	1	**Attorney Docket Number**	JDM/002 CON

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]
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.05jul01.txt on January 22, 2007), July, 2001.	
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.01aug01.txt on January 22, 2007), August, 2001.	
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.04sep01.txt on January 22, 2007), September, 2001.	
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.02oct01.txt on January 22, 2007), October, 2001.	
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.02nov01.txt on January 22, 2007), November, 2001.	
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.03dec01.txt on January 22, 2007), December, 2001.	
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.07jan02.txt on January 22, 2007), January, 2002.	
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.04feb02.txt on January 22, 2007), February, 2002.	
		"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.04mar02.txt on January 22, 2007), March, 2002.	

Examiner Signature	/Quynh Nguyen/	Date Considered	09/20/2012

*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.
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /QN/

JDM/002 CON

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
Application No.	:	11/387,384
Confirmation No.	:	7999
Filed	:	March 22, 2006
For	:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
Group Art Unit	:	2614
Examiner	:	Quynh H. Nguyen

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

Pittsburgh, PA 15237
August 24, 2012

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

A Request for Continued Examination is applicable hereto and being submitted herewith. 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

6,144,336	Preston et al.	11/2001	(1)
6,603,977	Walsh et al	08/2003	(1)
6,662,014	Walsh et al	12/2003	(1)

/Quynh Nguyen/ 09/20/2012

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /QN/

Foreign Patent Documents

WO 01/001718	Nokia Networks	01/04/2001	(1)

Non-Patent Literature

WROLSTAD, JAY, "Sprint Claims First With E911-Capable Phone," newsfactor.com (as viewed at http://www.newsfactor.com/perl/story/13952.html on January 22, 2007), October 4, 2001)	(1)
WROLSTAD, JAY, "Sprint Rolls Out E911 Services," newsfactor.com (as viewed at http://www.newsfactor.com/perl/story/15506.html on January 22, 2007), December 26, 2001)	(1)
"Sprint PCS First Quarterly E911 Implementation Report," Before the Federal Communications Commission, In the Matter of Revision of the Commission's Rules To Ensure Compatibility With Enhanced 911 Emergency Calling Systems , CC Docket No. 944-102, February 1, 2002	(1)
"Who is Integrated Data Communications?," presented at the FCC E-911 Automatic Location Identification Round Table, June 28, 1999.	(1)
"Wireless Telecommunications Bureau Seeks Comment On Request To Commence Rulemaking To Establish Fair Location Information Practices," WT Docket No. 01-72, DA 01-696, (as viewed at http://www.fcc.gov.Bureaus/Wireless/PublicNotices/9001/da010696.html on January 22, 2007), March 16, 2001.	(1)
"Go2 Systems & Integrated Data Communications to Deliver Location Services Automatically to Wireless Phones; Alliance Enables Automatic Recognition of Wireless Caller's Location," Business Wire (as viewed at http://www.findarticles.com/p/articles/mi_m0EIN/is_2000_Feb_28/ai/59621222 on January 22, 2007), February 28, 2000.	(1)
"Before the Federal Communications Commission: In the Matter of: E-911 Automatic Location Identification Round Table," Transcript, June 28, 1999.	(1)

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"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.16jan01.txt on January 22, 2007), January, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.26feb01.txt on January 22, 2007), February, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.26mar01.txt on January 22, 2007), March, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.05apr01.txt on January 22, 2007), April, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.01may01.txt on January 22, 2007), May, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.10jun01.txt on January 22, 2007), June, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.05jul01.txt on January 22, 2007), July, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.01aug01.txt on January 22, 2007), August, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.04sep01.txt on January 22, 2007), September, 2001. (1)

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"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.02nov01.txt on January 22, 2007), November, 2001. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.03dec01.txt on January 22, 2007), December, 2001. (1)

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"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.04feb02.txt on January 22, 2007), February, 2002. (1)

"Pulver.com's Location Based Services Report," pulver.com (as visited at http://pulver.com/lbareport/lastlbareport.04mar02.txt on January 22, 2007), March, 2002. (1)

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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /QN/

Documents above marked with a (1) were cited in Application No. 10/400,296. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (3) were cited in Application No. 11/462,201. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (4) were cited in Application No. 11/462,201. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (5) were cited in Application No. 11/834,674. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /QN/

States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (6) were cited in Application No. 11/841,734. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (7) were cited in Application No. 11/841,750. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Documents above marked with a (8) were cited in Application No. 11/841,765. Applicant respectfully requests the Examiner review the prosecution history of this application including all communications from the United States Patent and Trademark Office contained therein (e.g., the Office Actions contained therein).

Applicant hereby submits that not all of the patent documents and non-patent literature submitted herein may be, in fact, prior art to the present application. Applicant

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /QN/

reserves the right to dispute whether references, or subject matter within references, are prior art to the present application (e.g., continuation-in-part subject matter filed after the filing date of the present application).

This Statement is being submitted after a first Office Action on the merits. Accordingly, pursuant to 37 CFR 1.97(c), the fee set forth in Section 1.17(p) is provided herewith.

Applicant respectfully submits that this application, including the pending claims, is in condition for allowance. A favorable action is respectfully requested.

The Director is hereby authorized to charge any fees associated with this filing, or credit any overpayment of the same, to Deposit Account No. 50-3855.

Respectfully Submitted,

/Jeffrey D. Mullen/
Jeffrey D. Mullen
Applicant (Reg. No. 52,056)
Customer No. 32733
1310 Riverfront Drive
Pittsburgh, PA 15238
Tel.: (914) 837-7741

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /QN/

EAST Search History

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	6102	455/404.1,404.2,410,456.1-456.2,457.ccls.	US-PGPUB	OR	ON	2012/09/20 22:00
L2	5	1 and (transmit$4 with ((wireless cell cellular mobile) near2 location) with (remote near server)).clm.	US-PGPUB	OR	ON	2012/09/20 22:01
L3	0	((alert$3 near3 messag$3) and (privacy adj profile)).clm.	US-PGPUB	OR	ON	2012/09/20 22:01
L4	114	((chang$3 add$3) with user with profile with (cell mobile cellular wireless)).clm.	US-PGPUB	OR	ON	2012/09/20 22:27
L5	1	4 and ((transmit$4 send$3) with location with (remote near2 server)).clm.	US-PGPUB	OR	ON	2012/09/20 22:27

9/ 20/ 2012 10:27:48 PM
C:\ Users\ qnguyen\ Documents\ EAST\ Workspaces\ 11387384.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11387384	MULLEN, JEFFREY D.
	Examiner	Art Unit
	QUYNH NGUYEN	2614

SEARCHED			
Class	Subclass	Date	Examiner
455	404.1, 404.2, 410, 456.1-456.3, 457	11/19/11	QN
	above updated	5/20/12	QN
	above updated	9/20/12	QN

SEARCH NOTES		
Search Notes	Date	Examiner
search east, uspat, uspgpub, epo, jpo	11/19/11	QN
inventor search in PALM	11/19/11	QN

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
455	404.1, 404.2, 410, 456.1-456.3, 457	11/19/11	QN
	interference search history printout	11/19/11	QN
	interference search history printout	9/20/12	QN

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11387384	03/22/2006	Jeffrey D. Mullen	JDM/002 CON	7999

TITLE OF INVENTION:

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$870	$300	$0	$1170	01/02/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☑ Issue Fee

☑ Publication Fee (No small entity discount permitted)

☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

☐ A check is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 50-3855 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature /Jeffrey D. Mullen/ Date 01/02/2013

Typed or printed name Jeffrey D. Mullen Registration No. 52,056

This collection of information is required by 37 CFR 1.311. 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 12 minutes 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, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	11387384
Filing Date:	22-Mar-2006
Title of Invention:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
First Named Inventor/Applicant Name:	Jeffrey D. Mullen
Filer:	Jeffrey David Mullen
Attorney Docket Number:	JDM/002 CON

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl issue fee	2501	1	885	885
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1185**

Electronic Acknowledgement Receipt	
EFS ID:	14594735
Application Number:	11387384
International Application Number:	
Confirmation Number:	7999
Title of Invention:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
First Named Inventor/Applicant Name:	Jeffrey D. Mullen
Customer Number:	32733
Filer:	Jeffrey David Mullen
Filer Authorized By:	
Attorney Docket Number:	JDM/002 CON
Receipt Date:	02-JAN-2013
Filing Date:	22-MAR-2006
Time Stamp:	13:00:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1185
RAM confirmation Number	7903
Deposit Account	503855
Authorized User	MULLEN, JEFFREY D.
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	JDM-002CON--ptol85b.pdf	72069 119c84e23f8f5da71822df8abc3805ba0923bed5	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	31597 d99361b63bde9de444cea38dde70ac2bfaf2e986	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	103666		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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	Complete if known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	11/387,394
	Filing Date	March 22, 2006
	First Named Inventor	Jeffrey D. Mullen
(use as many sheets as necessary)	Art Unit	2814
	Examiner Name	Quynh H. Nguyen
Sheet 5 of 8	Attorney Docket Number	JDM/002 CON

/QN/		6,795,710	09/21/2004	Creemer	102(e) 01/05/2001
/QN/		6,798,358	09/28/2004	Joyce et al.	102(e) 07/03/2001
/QN/		6,799,094	09/28/2004	Valdia et al.	102(e) 09/03/2001
/QN/		6,806,813	10/19/2004	Cheng et al.	102(e) 06/04/1999
/QN/		6,816,735	11/09/2004	Rayburn et al.	102(e) 03/29/2001
/QN/		6,826,366	11/30/2004	Lagerstrom et al.	102(e) 10/08/1999
/QN/		6,836,667	12/28/2004	Smith	102(e) 09/19/2000
/QN/		6,870,822	03/29/2005	Balogh	102(e) 02/20/2001
/QN/		6,879,839	04/12/2005	Rankin et al.	102(e) 04/20/2001
/QN/		6,882,837	04/19/2005	Fernandez et al.	102(e) 01/23/2002
/QN/		6,882,856	04/2005	Alterman	
/QN/		6,885,874	04/2005	Grube	
/QN/		6,912,398	06/28/2005	Domnitz	102(e) 04/10/2000
/QN/		6,912,545	06/28/2005	Lundy et al.	102(e) 06/12/2001
/QN/		6,920,319	07/19/2005	Knutsson et al.	102(e) 05/07/2001
/QN/		6,920,329	07/2005	Wollrab	
/QN/		6,926,279	08/09/2005	Seligmann et al.	102(e) 02/27/2003
/QN/		6,932,699	08/23/2005	Sprogis	102(e) 01/31/2002
/QN/		6,944,447	09/13/2005	Portman et al.	102(e) 09/04/2001
/QN/		6,968,179	11/2005	De Vries	
/QN/		6,975,938	12/2005	Jones	
/QN/		7,013,148	03/2006	Ganesh	
/QN/		7,072,958	07/2006	Parupudi	
/QN/		7,203,674	04/2007	Cohen	
/QN/		7,177,651	02/2007	Almasey	
/QN/		7,215,965	05/2007	Fournier et al.	

Examiner Signature	/Quynh Nguyen/	Date Considered	11/19/2011

*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
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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 6 of 8

Complete if known	
Application Number	11/387,384
Filing Date	March 22, 2006
First Named Inventor	Jeffrey D. Mullen
Art Unit	2614
Examiner Name	Quynh H. Nguyen
Attorney Docket Number	JDM/002 CON

/QN/		7,289,428	09/2007	Kokkonen et al.	
/QN/		7,289,428	09/2007	Wallenius	
/QN/		7,272,220	09/2007	Zhang	
/QN/		7,409,429	08/2008	Kaufman	
/QN/		7,570,958	08/2009	Kraemer	
/QN/		2001/0029184	10/2001	L'Areon et al.	
/QN/		~~2002/0086684~~ 2003/0045301	~~07/2002~~ 07/2005	Wollrab	
/QN/		2002/0086683	07/2002	Kohar et al.	
/QN/		2002/0102889	08/2002	Calvert et al.	
/QN/		2002/0115453	08/2002	Poulin et al.	
/QN/		2002/0164998	11/2002	Younis	
/QN/		2002/0042277	04/11/2002	Steven Smith	102(e) 01/18/2001
/QN/		2002/0086683	07/2002	Kohar	
/QN/		2003/0013458	01/2003	Bates	
/QN/		2003/0023726	01/2003	Rios et al.	
/QN/		2003/0119522	06/2003	Barclay et al.	
/QN/		2004/0054428	03/2004	Sheha	
/QN/		2004/0127231	07/01/2004	Dorr	07/23/2001 (PCT)
/QN/		2004/0180669	09/16/2004	Jani Kall	06/07/2001 (PCT)
/QN/		2008/0288355	11/2008	Rosen	
/QN/		2009/0029717	01/2009	Bates et al.	
/QN/		D464,033	10/08/2002	Piano Poirier	102(e) 01/23/2002

FOREIGN PATENT DOCUMENTS

Examiner	Cite	Foreign Patent Document	Publication Date	Name of Patentee or	Pages, Columns	T*

Examiner Signature	/Quynh Nguyen/	Date Considered	11/19/2011

*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 make 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.

JDM/002 CON

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Jeffrey D. Mullen
Application No.	:	11/387,384
Confirmation No.	:	7999
Filed	:	March 22, 2006
For	:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
Group Art Unit	:	2614
Examiner	:	Quynh H. Nguyen

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

Pittsburgh, PA 15237
August 24, 2012

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

A Request for Continued Examination is applicable hereto and being submitted herewith. 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

Change(s) applied to document, /J.F/ 1/8/2013				
	6,144,336	Preston et al.	11/~~2001~~ 2000	(1)
	6,603,977	Walsh et al	08/2003	(1)
	6,662,014	Walsh et al	12/2003	(1)

/Quynh Nguyen/ 09/20/2012

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /QN/

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (use as many sheets as necessary) Sheet 3 of 8	***Complete if known***	
	Application Number	11/387,384
	Filing Date	March 22, 2006
	First Named Inventor	Jeffrey D. Mullen
	Art Unit	2614
	Examiner Name	Quynh H. Nguyen
	Attorney Docket Number	JDM/002 CON

Change(s) applied to document, /J.F./ 1/8/2013

/QN/		6,201,803	03/13/2001	Munday et al.	
/QN/		6,208,866	03/27/2001	Rouhollahzadeh et al.	
/QN/		6,236,359	05/22/2001	Watters et al.	
/QN/		6,236,858	05/22/2001	Griffith	
/QN/		6,240,069	05/21/2001	Alperovich	
/QN/		6,246,376	06/12/2001	Bork et al.	
/QN/		6,246,861	06/12/2001	Messier et al.	
/QN/		~~6,256,543~~	06/26/2001	Camp	6,252,543
/QN/		6,256,498	07/03/2001	Ludwig	
/QN/		6,259,923	07/10/2001	Lim et al.	
/QN/		6,275,771	08/14/2001	Berstis et al.	
/QN/		6,311,060	10/30/2001	Evans et al.	
/QN/		6,314,365	11/06/2001	Smith	
/QN/		6,317,718	11/13/2001	Fano	
/QN/		6,321,092	11/20/2001	Fitch et al.	
/QN/		6,324,404	11/27/2001	Dennison et al.	
/QN/		6,330,452	12/11/2001	Fattouche et al.	
/QN/		6,360,101	03/19/2002	Irvin	
/QN/		6,360,102	03/2002	Havinis	
/QN/		6,360,167	03/19/2002	Millington et al.	
/QN/		6,374,306	04/16/2002	Tognazzini	102(e) 03/12/1999
/QN/		6,377,810	04/23/2002	Geiger et al.	102(e) 06/11/1999
/QN/		6,393,274	05/21/2002	Peltonen	102(e) 06/08/1999
/QN/		6,397,065	05/28/2002	Huusko et al.	102(e) 12/07/1999
/QN/		6,400,946	06/04/2002	Vazvan	102(e) 03/08/1996
/QN/		6,400,956	06/02/2002	Richton	102(e) 11/15/1999

Examiner Signature	/Quynh Nguyen/	Date Considered	11/19/2011

*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.
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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				***Complete if known***	
SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	11/387,384
				Filing Date	March 22, 2006
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
(use as many sheets as necessary)				**Examiner Name**	Quynh H. Nguyen
Sheet	1	of	1	**Attorney Docket Number**	JDM/002 CON

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
		6,144,336	11/2001 o	Preston et al.	
		6,603,977	08/2003	Walsh et al	
		6,662,014	12/2003	Walsh et al	

Change(s) applied to document, /T.W./ 1/15/2013

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]
		WO 01/001718	01/04/2001	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]
		WROLSTAD, JAY, "Sprint Claims First With E911-Capable Phone," newsfactor.com (as viewed at http://www.newsfactor.com/perl/story/13952.html on January 22, 2007), October 4, 2001)	
		WROLSTAD, JAY, "Sprint Rolls Out E911 Services," newsfactor.com (as viewed at http://www.newsfactor.com/perl/story/15506.html on January 22, 2007), December 26, 2001)	
		"Sprint PCS First Quarterly E911 Implementation Report," Before the Federal Communications Commission, In the Matter of Revision of the Commission's Rules To Ensure Compatibility With Enhanced 911 Emergency Calling Systems , CC Docket No. 944-102, February 1, 2002	
		"Who is Integrated Data Communications?," presented at the FCC E-911 Automatic Location Identification Round Table, June 28, 1999.	

Examiner Signature	/Quynh Nguyen/	Date Considered	09/20/2012

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /QN/

Substitute for form 1449A/PTO				Complete if known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	11/387,384
				Filing Date	March 22, 2006
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
(use as many sheets as necessary)				**Examiner Name**	Quynh H. Nguyen
Sheet	4	of	8	**Attorney Docket Number**	JDM/002 CON

/QN/		6,408.186	06/18/2002	Park et al.	102(e) 06/21/2000
/QN/		6,421,009	07/16/2002	Suprunov	102(e) 05/08/1998
/QN/		6,438,376	08/20/2002	Elliott et al.	102(e) 05/11/1999
/QN/		6,438,381	08/20/2002	Alberth, Jr. et al.	102(e) 06/08/2000
/QN/	6	6,446,118	09/03/2002	Gottlieb	102(e) 02/29/2000
/QN/		6,449,486	09/10/2002	Rao	102(e) 05/25/1999
/QN/		6,456,854	09/2002	Chern	
/QN/		6,466,788	10/2002	Carlsson	
/QN/		6,532,360	03/11/2003	Shaffer	102(e) 12/14/1999
/QN/		6,564,064	05/13/2003	Ciganer et al.	102(e) 12/01/1999
/QN/		6,580,914	06/17/2003	Smith	102(e) 08/17/1998
/QN/		6,580,918	06/17/2003	Leickel	102(e) 07/23/1998
/QN/		6,584,314	06/24/2003	Haumont	102(e) 06/09/2000
/QN/		6,587,691	07/2003	Granstam	
/QN/		6,603,969	08/05/2003	Vuoristo	102(e) 11/25/1998
/QN/		~~6,610,687~~ 6,611,687	08/26/2003	Clark	102(e) 11/15/1999
/QN/		6,618,593	09/09/2003	Drutman et al.	102(e) 09/08/2000
/QN/		6,618,671	09/09/2003	Dooley et al.	102(e) 09/20/2001
/QN/		6,622,020	09/16/2003	Seki	102(e) 07/12/1995
/QN/		6,628,938	09/30/2003	Rachabathuni et al.	102(e) 08/14/2000
/QN/		6,665,389	12/2003	Haste III	
/QN/		6,677,894	01/13/2004	Sheynblat	102(e) 11/30/1998
/QN/		6,714,791	03/30/2004	Friedman	102(e) 02/23/2001
/QN/		6,716,101	04/06/2004	Meadows et al.	102(e) 06/28/2000
/QN/		6,735,564	05/11/2004	Puhakainen	102(e) 11/09/2000
/QN/		6,778,837	08/17/2004	Bade et al.	102(e) 03/22/2001

Change(s) applied to document, /T.W./ 1/15/2013

Change(s) applied to document, /T.W./ 1/15/2013

Change(s) applied to document, /J.F./ 1/8/2013

Examiner Signature	/Quynh Nguyen/	Date Considered	11/19/2011

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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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Substitute for form 1449A/PTO **SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (use as many sheets as necessary) Sheet 1 of 1	***Complete if known***	
	Application Number	11/387,384
	Filing Date	March 22, 2006
	First Named Inventor	Jeffrey D. Mullen
	Art Unit	2614
	Examiner Name	Quynh H. Nguyen
	Attorney Docket Number	JDM/002 CON

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
/QN/		6,078,578	06/2000	Matsumoto	
/QN/		6,215,863	04/2001	Bennett et al.	
/QN/		6,647,257	11/2003	Owensby	
/QN/		7,130,630	10/2006	Enzmann	
/QN/		7,324,823	01/2008	Rosen	
/QN/		2002/0141434	10/2002	Grundvig	

Change(s) applied to document, /T.W./ 1/15/2013

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	/Quynh Nguyen/	Date Considered	05/20/2012

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Substitute for form 1449A/PTO				***Complete if known***	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	11/387,384
				Filing Date	March 22, 2006
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2614
(use as many sheets as necessary)				**Examiner Name**	Quynh H. Nguyen
Sheet	1	of	8	**Attorney Docket Number**	JDM/002 CON

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
/QN/		4,654,879	03/31/1987	Goldman et al.	
/QN/		5,043,736	08/27/1991	Darnell et. al	
/QN/		5,086,390	02/04/1992	Matthews	
/QN/		5,097,416	03/17/1992	Matthews	
/QN/		5,197,092	03/23/1993	Bamburak	
/QN/		5,305,201	04/19/1994	Matthews	
/QN/		5,327,144	07/05/1994	Stilp et al.	
/QN/		~~5,337,334~~	08/09/1994	Antero Alvesalo	5,337,344
/QN/		5,341,410	08/23/1994	Aron et al.	
/QN/		5,384,824	01/24/1995	Alvesalo	
/QN/		~~5,388,147~~	02/07/1995	Grimes	5,388,147
/QN/		5,442,805	08/15/1995	Sagars et al.	
/QN/		5,479,482	12/26/1995	Grimes	
/QN/		5,502,757	03/26/1996	Bales et al.	
/QN/		5,519,760	05/21/1996	Borkowski et al.	
/QN/		5,537,460	07/16/1996	Holliday, Jr. et al.	
/QN/		5,548,816	08/20/1996	DeVaney	
/QN/		5,551,058	08/27/1996	Hutcheson et al.	
/QN/		5,555,286	09/10/1996	Tendler	
/QN/		5,719,563	02/17/1998	Thompson	
/QN/		5,767,788	06/16/1998	Ness	
/QN/		5,778,315	07/07/1998	Proietti	
/QN/		5,796,634	08/18/1998	Craport et al.	

Change(s) applied to document, /J.F./ 1/8/2013

Change(s) applied to document, /T.W./ 1/15/2013

Examiner Signature	/Quynh Nguyen/	Date Considered	11/19/2011

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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/387,384	02/12/2013	8374575	JDM/002 CON	7999

32733 7590 01/23/2013

JEFFREY D. MULLEN
1310 Riverfront Drive
PITTSBURGH, PA 15238

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Jeffrey D. Mullen, New York, NY;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

Docket No.: JDM/002 CON
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Letters Patent of:
MULLEN

Examiner: Nguyen, Quyuh H.

Inventor: Jeffrey D. Mullen

Patent No.: 8,374,575

Art Unit: 2652

Issue Date: February 12, 2013

Conf. No. 7999

Serial No.: 11/387,384

Filed: March 22, 2006

For: Systems and Methods For Locating Cellular Phones and Security Measures for the Same

REQUEST FOR CERTIFICATE OF CORRECTION PURSUANT TO 37 C.F.R. § 1.322

Attention: Certificate of Correction Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Please issue a certificate of correction in accordance with the attached form.

One or more of the errors to be corrected were made by applicant. The fee of $160 is being paid with this request.

Apply any other necessary charges or credits to Deposit Account 50-3855, referencing the above attorney docket number.

Respectfully submitted,

Date: October 14, 2021

/Jeffrey D. Mullen/
Jeffrey D. Mullen
Applicant (Reg. No. 52,056)
Customer No. 32733
2212 Hassinger Lane
Glenshaw, PA 15116
Mobile No. 914 837-7741

PTO/SB/44 (09-07)
Approved for use through 01/31/2020. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO.	:	8,374,575 B2
APPLICATION NO.	:	11/387,384
ISSUE DATE	:	Feb. 12, 2013
INVENTOR(S)	:	Jeffrey D. Mullen

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Claim 30, Column 15, Line 32: "said first wireless telephone" should read --a first wireless telephone--.

MAILING ADDRESS OF SENDER (Please do not use Customer Number below):
Jeffrey D, Mullen
APPLICANT
2212 HASSINGER LANE
GLENSHAW, PA 15116

Electronic Patent Application Fee Transmittal

Application Number:	11387384
Filing Date:	22-Mar-2006
Title of Invention:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
First Named Inventor/Applicant Name:	Jeffrey D. Mullen
Filer:	Jeffrey David Mullen
Attorney Docket Number:	JDM/002 CON

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
CERTIFICATE OF CORRECTION	2811	1	160	160

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**160**

Electronic Acknowledgement Receipt	
EFS ID:	44036677
Application Number:	11387384
International Application Number:	
Confirmation Number:	7999
Title of Invention:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
First Named Inventor/Applicant Name:	Jeffrey D. Mullen
Customer Number:	32733
Filer:	Jeffrey David Mullen
Filer Authorized By:	
Attorney Docket Number:	JDM/002 CON
Receipt Date:	14-OCT-2021
Filing Date:	22-MAR-2006
Time Stamp:	22:54:43
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$160
RAM confirmation Number	E20210DM55252120
Deposit Account	503855
Authorized User	Jeffrey Mullen
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Certificate of Correction	JDM-002CON--RequestForCertificateOfCorrection.pdf	147323 d7d671a553d6998c052f3288393938e8508082ac	no	1
Warnings:					
Information:					
2	Request for Certificate of Correction	JDM-002CON--CertificateOfCorrectoin.pdf	208892 82098565c7165d6ed44ccabcf5d4c2074362e27b	no	1
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	37573 29e5cac3823252b17bb89452fae1baf60f5e6ed7	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	393788		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO.	: 8,374,575 B2
APPLICATION NO.	: 11/387384
DATED	: February 12, 2013
INVENTOR(S)	: Jeffrey D. Mullen

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Claim 30, Column 15, Line 32: “said first wireless telephone” should read --a first wireless telephone--.

Signed and Sealed this
Thirtieth Day of November, 2021

Drew Hirshfeld
Performing the Functions and Duties of the
Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office

AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Texas - Waco Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
6:22-cv-00145	2/9/2022	Western District of Texas - Waco Division

PLAINTIFF	DEFENDANT
Mullen Industries LLC	Apple Inc.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	8,374,575	2/12/2013	Mullen Industries LLC
2	9,204,283	12/1/2015	Mullen Industries LLC
3	9,635,540	4/25/2017	Mullen Industries LLC
4	11,096,039	8/17/2021	Mullen Industries LLC
5	11,109,218	8/31/2021	Mullen Industries LLC

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

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AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Texas - Waco Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
6:22-cv-00145	2/9/2022	Western District of Texas - Waco Division

PLAINTIFF	DEFENDANT
Mullen Industries LLC	Apple Inc.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	11,122,418	9/14/2021	Mullen Industries LLC
2	11,190,633	11/30/2021	Mullen Industries LLC
3	11,234,117	1/25/2022	Mullen Industries LLC
4	11,246,024	2/8/2022	Mullen Industries LLC
5			

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

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Trials@uspto.gov
571-272-7822

Paper 9
Date: May 9, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE, INC.,
Petitioner,

v.

MULLEN INDUSTRIES LLC,
Patent Owner.

IPR2023-00097
Patent 8,374,575 B2

Before BARBARA A. PARVIS, JAMES J. MAYBERRY, and NATHAN A. ENGELS, *Administrative Patent Judges.*

PARVIS, *Administrative Patent Judge.*

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Apple, Inc.("Petitioner") filed a Petition (Paper 1 ("Pet.")) requesting an *inter partes* review of claims 1–46 ("challenged claims") of U.S. Patent No. 8,374,575 B2 (Ex. 1004, "the '575 patent") pursuant to 35 U.S.C. §§ 311–319, along with the supporting Declaration of Mr. David H. Williams. (Ex. 1021). Mullen Industries LLC ("Patent Owner") filed a Preliminary Response. Paper 7 ("Prelim. Resp.").

We have authority to determine whether to institute review under 35 U.S.C. § 314 and 37 C.F.R. § 42.4.

Upon consideration of the contentions and the evidence of record at this juncture, we conclude Petitioner establishes a reasonable likelihood of prevailing in demonstrating the unpatentability of the challenged claims of the '575 patent. Accordingly, we grant Petitioner's request and institute an *inter partes* review of all challenged claims of the '575 patent and with respect to all grounds set forth in the Petition.

II. BACKGROUND

A. Real Parties-in-Interest

Petitioner identifies itself, Apple, Inc., as the real party-in-interest. Pet. 78–79. Patent Owner names itself, Mullen Industries LLC, as the real party-in-interest. Paper 3, 1.

B. Related Matters

Pursuant to 37 C.F.R. § 42.8(b)(2), the parties inform us that the '575 patent was asserted against Petitioner in the following district court case: *Mullen Industries LLC v. Apple Inc.*, C.A. No. 6:22-cv-00145-ADA (W.D. Tex., filed Feb. 9, 2022). Pet. 78; Paper 3, 1. Petitioner indicates this case was transferred and assigned Case No. 3:23-cv-00437 (NDCA, filed Jan. 31,

2023). Paper 6, 2. Patent Owner identifies several other Petitions of related patents pending: IPR2023-00087, IPR2023-00090, IPR2023-00091, IPR2023-00096, IPR2023-00098, IPR2023-00115, IPR2023-00116, IPR2023-00117, IPR2023-00148, and IPR2023-00149. Paper 3, 1–2; Prelim. Resp. 2.

C. The '575 Patent

The '575 patent is titled "Systems and Methods for Locating Cellular Phones and Security Measures for the Same." Ex. 1001, code (54). The '575 patent relates to remotely determining a device's location. *Id.* at 1:17–20.

The '575 patent describes that a deficiency in current systems is that the location of a device that is determined by GPS [Global Positioning System] signals is only minimally utilized. *Id.* at 1:29–31. The patent seeks "to provide systems and methods which better utilize the information about a device's location." *Id.* at 1:31–38. More specifically, the patent describes "systems and methods for allowing a user of a cellular phone (e.g., a requesting user or a requester) to locate the position of a different user's cellular phone (e.g., a requested user) based upon requestor-assigned access rights." *Id.* at 1:38–43.

According to the '575 patent, a process initiates when a user requests the location of another user's cell phone, and then the process evaluates if the user initiating the location request has the rights to access the location of the desired user. *Id.* at 4:50–53. If no access rights for the requesting user have been granted, the process informs the requesting user that he/she has not been given access to the requested location. *Id.* at 4:53–56. But, if access has been given by a particular user that allows for the requesting user to locate that particular user, the allowed location information is provided,

though the process may filter the information and only provide a portion of the available information. *Id.* at 4:62–67.

An example of a screen displaying location information is shown in Figure 6, reproduced below.

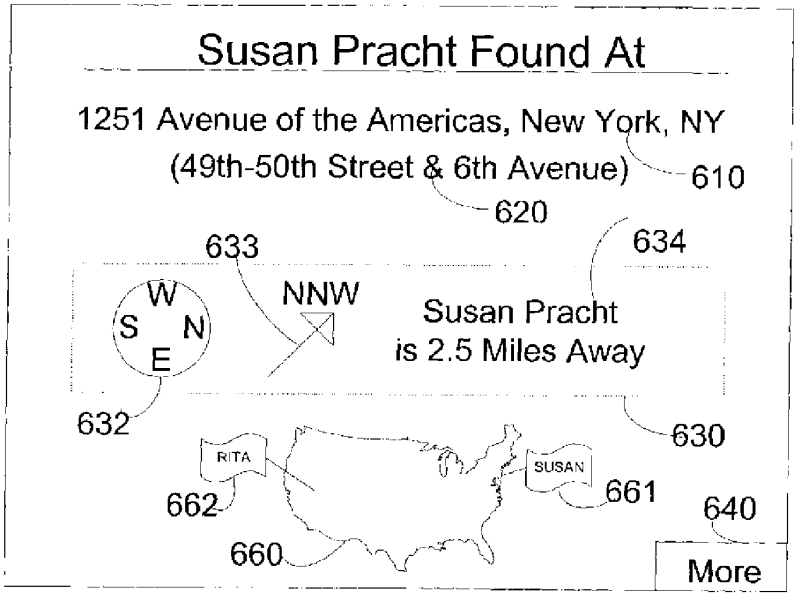


Figure 6, above, shows primary location information 610, as well as secondary location information 620 to supplement the requested user's exact location, directional information 630, distance information 634, map 660, and the location of other users Rita and Susan, at 661 and 662.

The '575 patent also describes a login feature in which a user profile is stored remotely. *Id.* at 9:39–43. In accordance with the '575 patent, a display screen is provided for a user to log into a device. *Id.* at 9:46–47. The '575 patent states that logging into a device also adds a level of security, especially when combined with a password. *Id.* at 9:47–49.

D. Illustrative Claim

Petitioner challenges claims 1–46 of the '575 patent. Pet. 1. Claims 1, 13–15, 30, and 38 are independent claims. Independent claim 1, reproduced below, is illustrative of the claimed subject matter.

1. A method comprising:
    obtaining a location of a first wireless telephone;
    transmitting said location from said first wireless telephone to a remote server;
    changing, at the direction of said first wireless telephone, a list of users on said remote server for a profile associated with said first wireless telephone that are allowed to access said location, wherein each user of said list of users is representative of one of a plurality of wireless telephones;
    transmitting said location from said remote server to at least one of said users of said list of users;
    determining a second location associated with one of said plurality of wireless telephones; and
    providing directional information to said one of said plurality of wireless telephones, wherein said directional information is representative of directions between said location and said second location.

Ex. 1001, 12:61–13:11.

E. Evidence

Petitioner relies on the patent document references summarized in the table below.

Name	Patent Document	Exhibit
Enzmann	US 7,130,630 B1, issued Oct. 31, 2006	1040
Sheha	US 7,333,820 B2, issued Feb. 19, 2008	1041
Maruyama	US 6,430,498 B1, issued Aug. 6, 2002	1052
Preston	US 6,236,652 B1, issued May 22, 2001	1056
Tanaka	US 6,819,919 B1, issued Nov. 16, 2004	1060

F. Asserted Grounds

Petitioner provides a summary table with the asserted statutory grounds of unpatentability for each of the challenged claims of the '575 patent (Pet. 2), which are set forth below:

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1–9, 11, 12, 30–37	102(e)[1]	Sheha[2]
1–46	103(a)	Sheha, Tanaka, Preston[3]
1–46	103(a)[4]	Enzmann, Maruyama, Tanaka, Preston[5]

[1] The '575 patent was filed March 22, 2006. Ex. 1001, code (22). The AIA versions of 35 U.S.C. §§ 102 and 103 do not apply. Our analysis would not change under the AIA versions of §§ 102, 103.

[2] Petitioner includes a table with a column header "35 U.S.C." and a table entry "§§102, 103." Pet. 3. In its element-by-element analysis, Petitioner argues "Sheha anticipates claim 1." Pet. 20. For independent claim 30, Petitioner relies on only its contentions for claim 1. *Id.* at 43–44. Petitioner also argues that Sheha discloses the further recitations of dependent claims 2–9, 11, 12, 31–37. *See, e.g.*, Pet. 25–36, 44–45. We, therefore, determine that Petitioner presents an anticipation challenge based on Sheha for claims 1–9, 11, 12, and 30–37.

[3] In its element-by-element analysis, Petitioner asserts unpatentability based on subsets of the prior art listed here. We refer to these grounds as the "Sheha obviousness grounds" herein. We refer to the anticipation and obviousness grounds collectively as the "Sheha grounds."

[4] Petitioner includes a table with a column header "35 U.S.C.," a corresponding table entry of "§§102, 103," and a list of references including "Enzmann, Maruyama, Tanaka, and Preston." Pet. 2–3. In its element-by-element analysis, Petitioner argues "Enzmann in view of Maruyama makes obvious claim 1." Pet. 47. We preliminarily find that Petitioner does not set forth with sufficient clarity an anticipation ground based on Enzmann. *Id.* at 47–72. We, therefore, do not include an anticipation ground in the summary table.

[5] In its element-by-element analysis, Petitioner asserts unpatentability based on subsets of the prior art listed here. We refer to these grounds as the "Enzmann obviousness grounds" or the "Enzmann grounds" herein.

III. ANALYSIS

A. Legal Standards

To establish anticipation, each and every element in a claim, arranged as recited in the claim, must be found in a single prior art reference. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008). "To anticipate a claim, a prior art reference must disclose every limitation of the claimed invention, either explicitly or inherently." *In re Schreiber*, 128 F.3d 1473, 1477 (Fed. Cir. 1997).

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter 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. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in evidence, objective evidence of nonobviousness, i.e., secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill in the art ("POSITA") the time of the invention

> would have had at least a bachelor of science degree in computer science, computer engineering, electrical engineering, or a similar degree with one or two years of experience with wireless networks and devices, such as cell phones and personal digital assistants ('PDAs') as well as wireless positioning technologies such as GPS or triangulation.

Pet. 7–8 (citing Ex. 1021 ¶ 43).[6] Petitioner also asserts "[a]dditional practical experience would substitute for lack of a formal degree." *Id.* (citing Ex. 1021 ¶ 44).

At this time, Patent Owner does not address the level of skill of the ordinary artisan. *See generally* Prelim. Resp.

We find that the phrase "at least" in Petitioner's proposed definition creates a vague, open-ended upper bound for the level of ordinary skill, and we therefore do not adopt that aspect of the proposal. With that exception, on the current record, we find Petitioner's proposal is consistent with the level of skill reflected in the '575 patent Specification and the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). We, therefore, adopt Petitioner's proposal, with the "at least" phrase omitted.

C. Claim Construction

We construe the challenged claims by applying the standard used in federal courts, in other words, "the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b)," which is articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b) (2020). Under this standard, the words of a claim generally are given their "ordinary and customary meaning," which is the meaning the term would have to a person

[6] In the related cases, Petitioner offers the same level of skill, with a slight exception that in certain cases Petitioner identifies one exemplary wireless positioning technology, i.e., GPS. *See, e.g.*, IPR2023-00096, Paper 1, 7–8. Based on the record before us at this juncture, we do not discern a substantive difference between Petitioner's proposals.

of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *Phillips*, 415 F.3d at 1312–13.

Petitioner asserts that "[n]one of the claim terms of the '575 Patent need be construed by the Board." Pet. 8. Patent Owner does not address claim construction at this early stage. *See generally* Prelim. Resp.

Based on the record before us, we do not discern a need to construe explicitly any claim terms because doing so would not change the outcome of the analysis below. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (stating that "we need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

D. Overview of the Asserted Art

1. Enzmann

Enzmann is titled "Location Query Service for Wireless Networks." Ex. 1040, code (54). Enzmann relates to wireless networks that track the location of wireless network devices. *Id.* at 1:7–9.

Figure 1, reproduced below, shows a diagram of a system for tracking locations of network users. *Id.* at 3:34–35, 3:53–55.

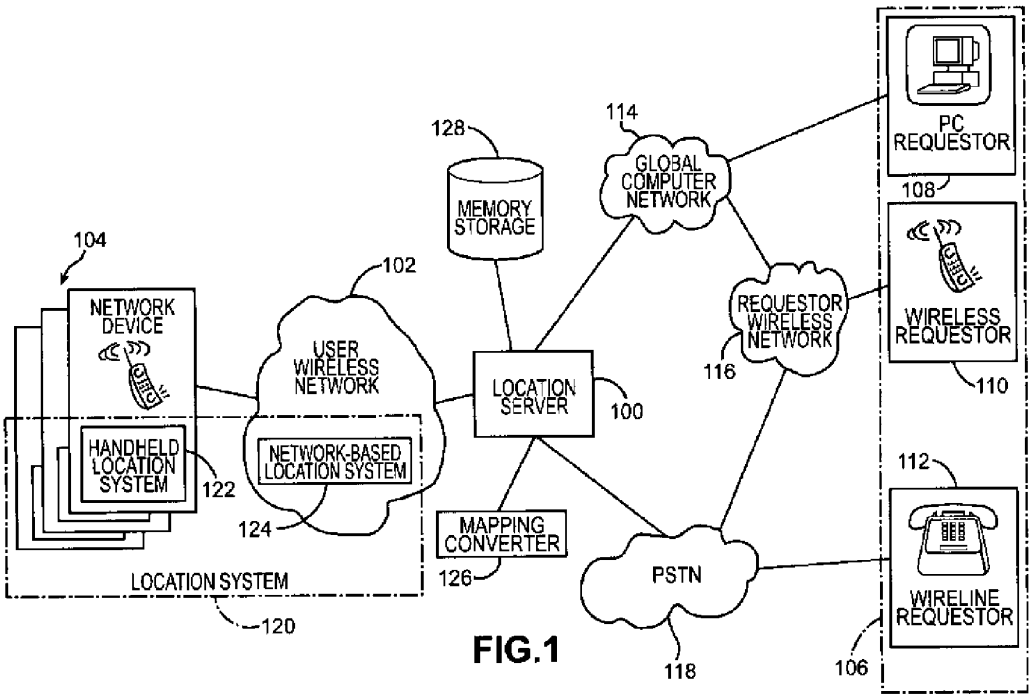


FIG.1

Figure 1 shows a schematic diagram of a system architecture including, among other things, location server 100, location system 120, user network devices 104, and requestors 108 and 110. *Id.* at 3:34–36, 3:62–4:4, 4:16–18.

Enzmann describes that location system 120 provides location information, such as position coordinates, of network device 104. *Id.* at 4:16–18, 4:24–26. Location server 100 executes service logic including receiving location queries from requestors 106, confirming the access levels of requestors 106, obtaining the location information of wireless network devices 104, and returning the location information to requestors 106. *Id.* at 5:3–8. Location server 100 is in communication with memory storage 128, which is a database that can record relationships between device identifications and network user identifications. *Id.* at 5:28–33. Memory storage 128 also contains authorized requestor lists for each device identification. *Id.* at 5:33–34.

A user submits a location query to location server 100 server, which includes an identification of the requestor and an identification of the network user about whom the requestor desires location information. *Id.* at 6:41–46. The query also may include a password. *Id.* at 6:41–48. The location server 100 determines if the requestor is authorized, and if so, user network 102 uses location system 120 to determine the location of the specified network device. *Id.* at 7:12–14, 7:51–65.

2. Sheha

Sheha is titled "System and Method for Providing Routing, Mapping, and Relative Position Information to Users of a Communication Network." Ex. 1041, code (54). Sheha states that it is directed to a system and method for providing real-time position information of one party to another party. *Id.* at code (57). Figure 3, reproduced below, illustrates telephone and computing devices for establishing a mobile-to-mobile connection. *Id.* at 6:45–47.

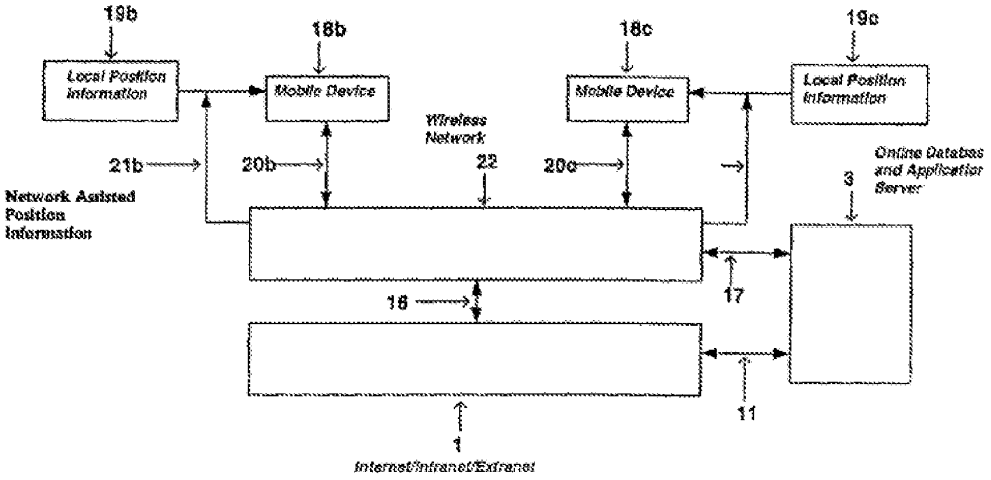


FIG. 3

Figure 3, above, illustrates mobile devices 18b, 18c, wireless network 22, and online database and application server (ODAS) 3 for establishing mobile-to-mobile connections. *Id.* at 10:66–11:15.

Mobile devices 18b, 18c include onboard position information devices 19b, 19c, respectively. *Id.* at 11:15–17. Information is transferred to wireless network 22 via wireless connections 20b, 20, respectively. *Id.* 11:10–15. ODAS 3 stores telephone and address information. *Id.* at 7:51–55. Telephone account users have a username and password for ODAS 3. *Id.* at 8:40–46. Prior to the destination mobile device 18c receiving the telephone call from the originating mobile device 18b, wireless network 22 sends the position information, obtained from the ODAS 3, in the form of a Map Caller-ID. *Id.* at 11:38–42.

3. Maruyama

Maruyama is titled "Portable Terminal with the Function of Walking Navigation." Ex. 1052, code (54). Maruyama "relates to a portable terminal provided with the function of walking navigation, which can supply location-related information to the walking user." *Id.* at 1:10–13.

Figure 5, reproduced below, shows a display aid for walking navigation.

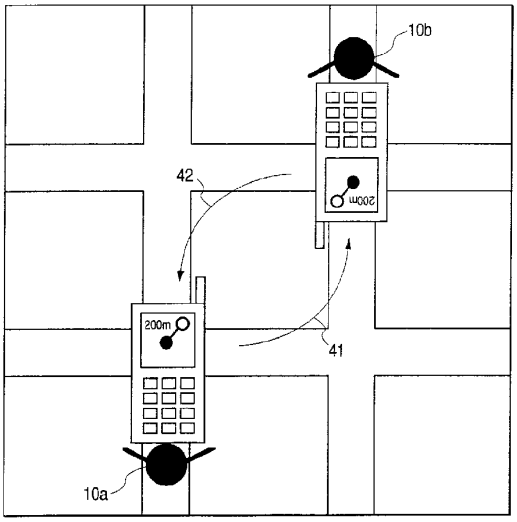


Figure 5, with mobile users 10a and 10b, and information flows 41 and 42.

The example of Figure 5 shows navigation information for two users who are scheduled to meet. *Id.* at 8:5–6. Information can be shared between the users, either directly or through a server, so confirm to each other their current locations. *Id.* at 8:6–11.

4. Preston

Preston is titled "Geo-Spacial Internet Protocol Addressing." Ex. 1056, code (54). Preston relates to a dynamic location-based (geo-spacial) Internet addressing scheme that is backward compatible with existing Internet protocols. *Id.* at 1:10–14. Preston describes using a global

position to generate a globally-unique, Internet protocol (IPv4, IPv6) compatible addressing scheme. *Id.* at 5:34–36. Preston describes a "Unresolved Dynamic IP" address that is a function of GPS latitude and longitude. *Id.* at 7:24–49.

5. Tanaka

Tanaka is titled "Method for Providing Matching and Introduction Services to Proximate Mobile Users and Service Providers." Ex. 1060, code (54). Tanaka relates to a "personal matching/meeting service that utilizes wireless, and/or Internet infrastructures coupled with real-time positional data," so that the system can "inform system users when they come within range of other users who meet search criteria." *Id.* at 1:15–21.

Tanaka describes a central database that stores user profiles and real-time locations of system users. *Id.* at code (57). Users' mobile devices determine their location, using any of "an integrated GPS receiver, cellular triangulation such as Time Difference of Arrival (TDOA)" or other position determining techniques. *Id.* at 2:59–3:3. Alternatively, the user could enter their position manually. *Id.* at 3:3–10. To use the system, a user submits a request to the server, including search parameters. *Id.* at 3:66–4:2. The server returns profiles of others matching users nearby. *Id.* at 4:2–8.

E. Motivation to Combine

Petitioner presents its reasoning to make proposed combinations and modification to the asserted art in a sub-section titled "Motivation to Combine Sheha and Enzmann with Tanaka, Preston, and Maruyama." Pet. 17–20. In that sub-section, Petitioner presents motivations for combining each of Sheha and Enzmann with the other art cited. *Id.* Petitioner also presents motivation to combine arguments in its element-by-element

analyses for each of the Sheha and Enzmann grounds. We address the parties' arguments relating to motivation to combine here, as well as further below in our discussion of the element-by-element analyses in the Petition.

With respect to the combination of Sheha and Enzmann with Tanaka, Petitioner argues the following:

> Regarding Tanaka, a POSITA would have found it desirable to incorporate Tanaka's user profile filtering and alert functionality into the Sheha and Enzmann systems, to enhance Sheha and Enzmann's's locationing services with notifications when one or more of the other wireless users is nearby, allowing users to obtain directions, locate nearby friends for a social visit, or find potential business, social, or romantic matches in the area. Ex. 1021 ¶¶ 203–206. In addition, a POSITA would have found it desirable to incorporate related user interface functionality described in Tanaka into Sheha and Enzmann to allow a user to provide an easy an intuitive way to send or receive location information, such as Tanaka's disclosure of tapping on a map or location to send a location update. *Id.* ¶ 207. A POSITA would have had a reasonable expectation of success in combining Sheha or Enzmann with Tanaka because Tanaka is related to shared location services like Sheha and Enzmann, wireless device location information for is already available to authorized requestors in the Sheha and Enzmann systems, and incorporating functionality from one such system into another similar system would have involved only ordinary software development efforts, which would have been within the capabilities of the POSITA. *Id.* ¶¶ 204–207.

Pet. 18–19.

Patent Owner argues that the Petition and the testimony of Mr. Williams do not provide allegations, supporting evidence, or technical reasoning in support of Petitioner's positions. Prelim. Resp. 35, 58. As set forth above, the Petition and Mr. Williams's testimony include detailed explanations and cite supporting evidence. We preliminarily find that the

Petition and Mr. Williams's testimony are not lacking in allegations, supporting evidence, or technical reasoning.

With respect to the combination of Enzmann and Maruyama, Petitioner argues a person having ordinary skill in the art "would have been motivated to incorporate its direction and navigation features with Enzmann's locating services because location systems like Enzmann were commonly used with navigation systems such as the system taught by Maruyama to obtain driving directions or route information." Pet. 19 (citing Ex. 1021 ¶¶ 184–185). Mr. Williams testifies that "[w]hile Enzmann focuses on a system to share locations, it does not discuss all of the obvious uses of location information." Ex. 1021 ¶ 184. Mr. Williams testifies "[u]sers of the Enzmann system would be interested in having the option to obtain directions to a received location." *Id.* Petitioner also argues that a person having ordinary skill in the art "would have had a reasonable expectation of success incorporating Maruyama's navigation functionality into Enzmann because it would have been straightforward to incorporate such basic navigation functionality into the Enzmann system, and required only routine software development efforts to integrate a navigation system to use the location information stored and available within the Enzmann system." Pet. 18–19 (citing Ex. 1021 ¶ 186).

Patent Owner argues Petitioner and Mr. Williams offer "no technical evidence" supporting "that navigation systems were 'commonly used,'" and provide "no technical discussion about such systems being used on wireless telephones." Prelim. Resp. 52. Patent Owner also argues "Mr. Williams' allegations for reasonable expectations of success are similarly high-level

and non-technical" and lack "supporting evidence" and "technical reasoning." *Id.* at 52–53.

Contrary to Patent Owner's arguments, we preliminarily find that Mr. Williams's testimony includes citations to disclosures in the asserted prior art that support his testimony. *See, e.g.*, Ex. 1021 ¶ 185 (citing Ex. 1052, 3:12–20, 6:44–51, 8:39–43, Fig. 5). Mr. Williams provides additional testimony with supporting citations that "providing navigational functionality from an initial location to a destination, as well as related navigational information" was known. *See, e.g.*, *id.* ¶ 155 (cited in Pet. 18). Some of the documents cited as supporting evidence have not been entered into the record by Petitioner. Mr. Williams provides further testimony that "[u]sers of the Enzmann system would be interested in having the option to obtain directions to a received location." Ex. 1021 ¶ 184. At this preliminary juncture, we find the Petition and Mr. Williams's testimony sufficient without the evidence not submitted.

At this juncture, we are persuaded that Petitioner has articulated sufficiently persuasive reasoning, based on the evidence of record, as to why one of ordinary skill in the art would have made Petitioner's proposed modifications. We find that Petitioner's reasoning is not undermined by Patent Owner's arguments based on the preliminary record before us at this early stage in the proceeding.

F. Sheha Grounds

Petitioner argues that claims 1–9, 11, 12, and 30–37 are under 35 U.S.C. § 102 as anticipated by Sheha. Pet. 3, 20–36, 44–45. Petitioner argues that claims 1–46 are unpatentable under 35 U.S.C. § 103(a) as obvious over Sheha, Tanaka, and Preston. Pet. 3, 20–47. Patent Owner

disputes Petitioner's showing for the independent claims. *See generally* Prelim. Resp.

For the reasons given below, we are persuaded by Petitioner's contentions and evidence discussed in its element-by-element analysis. Pet. 20–47. To the extent the challenge set forth on page 3 of the Petition includes the identification of art in addition to that discussed in Petitioner's element-by-element analysis, we need not make determinations regarding that additional art.

1. Independent claim 1

a) The Preamble and Elements 1a and 1b

The preamble and elements 1a and 1b in claim 1 recite the following "[a] method comprising: obtaining a location of a first wireless telephone; transmitting said location from said first wireless telephone to a remote server." Ex. 1001, 12:61–64. Petitioner argues that Figure 3 of Sheha illustrates a mobile-to-mobile configuration in which mobile devices 18 b, c communication with wireless network 22. Pet. 21 (citing Ex. 1041, 10:67–11:35, Fig. 3. Petitioner argues that cellular telephones are exemplary mobile devices 18 b, c. *Id.* (citing Ex. 1066-11:3). Petitioner argues that Sheha discloses that mobile devices 18b, c determine their own positions and, after a mobile device determines its position, the position is supplied to ODAS 3. *Id.* (citing Ex. 1041, 10:5–16, 11:3–8, 11:15–20, 11:44–51). Petitioner relies on the testimony of Mr. Williams as support for its positions. *Id.* at 20–21 (citing Ex. 1021-1 ¶¶ 12–14). Patent Owner does not dispute Petitioner's showing at this preliminary stage.

We preliminarily find that Petitioner's arguments are supported sufficiently by the cited portions of the asserted art. After consideration of

the contentions and the evidence of record at this early stage, we determine that Petitioner has shown sufficiently that Sheha teaches the preamble and elements 1a and 1b for purposes of institution.

b) Element 1c

Elements 1c in claim 1 recites the following:

> changing, at the direction of said first wireless telephone, a list of users on said remote server for a profile associated with said first wireless telephone that are allowed to access said location, wherein each user of said list of users is representative of one of a plurality of wireless telephones.

Ex. 1001, 12:65–13:3.

Petitioner argues that Sheha discloses that each mobile device "may have privacy settings stored at the server and changed at the direction of the first wireless device that 'allow the device to prevent or limit other calling devices from obtaining position information.'" Pet. 22 (citing Ex. 1041, 5:38–46, 11:63–12:4). Petitioner also argues that Sheha describes that a user of a mobile device has the authority to "define" a list of other users who are allowed to access to location information for the mobile device. *Id.* at 22–23 (citing Ex. 1041, 5:9–20, 5:38–46, 11:61–12:7). Petitioner relies on the testimony of Mr. Williams as support for its position. *Id.* at 22–23 (citing Ex. 1021-1 ¶¶ 16–17).

Patent Owner argues that Sheha's privacy settings "are not user-specific and do not identify individual users that are allowed to receive position information." Prelim. Resp. 26. Claim 1 does not recite "user-specific" or "individual" and neither party has offered a construction for any term of claim 1 that includes "user-specific" or "individual." Even if those terms were recited in claim 1, Sheha discloses that "users can define a group

of specific users" that have access to location information by using "a group database and authorization and authentication protocols to identify users" that are permitted to access location information. Ex. 1041, 11:63–12:1. Patent Owner argues that the aforementioned disclosure is "not relevant" because it "is found in the description of the 'landline-to-landline position request.'" Prelim. Resp. 29–30. Sheha, however, describes "a user can request the position of a mobile devices similarly to requesting the position of a landline device." Ex. 1041, 12:4–7.

Patent Owner also argues that Sheha does not describe "privacy settings stored at the server." Prelim. Resp. 28. Patent Owner also argues that "[t]here is no description in Sheha about changing, modifying or otherwise revising privacy settings, let alone "at the direction of said first wireless device." *Id.* Sheha describes "the calling local mobile device has privacy settings" and can choose not to reveal its position or enable position transfer "at anytime." Ex. 1041, 5:9–20. Sheha also describes that "users can define a group of specific users that have access" to position information "by utilizing a group database." *Id.* at 11:63–66.

We preliminarily find that Petitioner's arguments are supported sufficiently by the cited portions of the asserted art. We further preliminarily find that Patent Owner's arguments do not undermine Petitioner's showing based on the preliminary record at this juncture of the proceeding. After consideration of the contentions and the evidence of record at this early stage, we determine that Petitioner has shown sufficiently that Sheha teaches element 1c for purposes of institution.

c) Element 1d

Element 1d recites "transmitting said location from said remote server to at least one of said users of said list of users." Petitioner relies on its contentions for element 1a and further argues that "Sheha discloses that '[w]hen a mobile device's position information is requested, the system, based on privacy settings, responds with the appropriate position information to the requesting user's device.'" Pet. 23 (citing, e.g., Ex. 1041, 4:59–5:1–2, 12:1–7). Petitioner also relies on the testimony of Mr. Williams as support for its position. *Id.* at 23 (citing Ex. 1021-1 ¶ 19).

Patent Owner argues "[t]here is no 'requesting' recited" in claim 1. Prelim. Resp. 33. Patent Owner also argues Sheha does not disclose "transmitting location information." *Id.* We preliminarily find that Sheha's disclosure that "the system, based on privacy settings, *responds with the appropriate position information to the requesting user's device*" (Ex. 1041, 12:1–7 (emphasis added) is consistent with Petitioner's position.

We preliminarily find that Petitioner's arguments are supported sufficiently by the cited portions of the asserted art. We further preliminarily find that Patent Owner's arguments do not undermine Petitioner's showing based on the preliminary record at this juncture of the proceeding. After consideration of the contentions and the evidence of record at this early stage, we determine that Petitioner has shown sufficiently that Sheha teaches element 1d for purposes of institution.

d) Element 1e

Element 1e recites "determining a second location associated with one of said plurality of wireless telephones." Petitioner argues "[a]s discussed above regarding claim 1a, Sheha discloses a system where both the local and

remote devices determine their locations." Pet. 23 (citing Ex. 1041, 4:13–18, Fig. 3). Petitioner provides further details arguing that "Sheha discloses that mobile device 18b determines its position and updates its reported position in the ODAS prior to initiating a call with mobile device 18c." *Id.* (citing Ex. 1041, 10:66–11:9, 11:15–20).

Patent Owner argues mobile device 18b is not "one of said plurality of wireless telephones." Prelim. Resp. 38. Patent Owner argues "Petitioner makes no argument that the second location is determined for one of devices belonging to one of the users from the list of users." *Id.* at 39. Sheha describes "mobile-to-mobile systems," in which "either or both of the local and remote devices' position information" is determined. Ex. 1041, 4:13–18. Sheha describes that "[t]he ODAS 3 receives both the originating and destination telephone numbers, users' account information, and *position information for both mobile devices 18b and 18c*." *Id.* at 11:20–23 (emphasis added). Sheha also describes that "[t]he mobile devices 18b and 18c continually send their updated position information to the ODAS 3, when the position information has changed significantly." *Id.* at 11:44–47.

We preliminarily find that Petitioner's arguments are supported sufficiently by the cited portions of the asserted art. We further preliminarily find that Patent Owner's arguments do not undermine Petitioner's showing based on the preliminary record at this juncture of the proceeding. After consideration of the contentions and the evidence of record at this early stage, we determine that Petitioner has shown sufficiently that Sheha teaches element 1e for purposes of institution.

e) Element 1f

Element 1f recites "providing directional information to said one of said plurality of wireless telephones, wherein said directional information is representative of directions between said location and said second location." Petitioner argues "Sheha discloses using a remote mobile device's location 'to obtain driving directions to that device,' such that if both wireless telephones grant access to their respective position information, this 'can be used for real-time driving directions or collaboration purposes.'" Pet. 24 (citing Ex. 1041, 5:21–26, 5:32–34; Ex. 1021-1 ¶ 20). Petitioner argues "Sheha discloses that the server, ODAS, can calculate and provide this directional information" and points to "a 'Map Caller-ID' screen" illustrated in Figure 5. *Id.* (citing Ex. 1041, 9:23–28, 12:32–37, Fig. 3; Ex. 1021-1 ¶ 20). Petitioner relies on the testimony of Mr. Williams as support for its position. *Id.* (citing Ex. 1021-1 ¶ 20).

Patent Owner argues that Sheha lacks explanation and "does not teach sending 'directional information to' a wireless telephone." Prelim. Resp. 40. As explained with respect to element 1c, we preliminarily find that Sheha's disclosure that "the system, based on privacy settings, responds with the appropriate position information to the requesting user's device" (Ex. 1041, 12:1–7 (emphasis added) is consistent with Petitioner's position that position information is transmitted to "at least one of said users of said list of users." *See supra* § III.F.1.c.

Patent Owner also argues element 1f is not met because in Sheha the mobile device calculates the navigational information, not ODAS 3. Prelim. Resp. 40–41. Element 1f recites "providing directional information to said one of said plurality of wireless telephones," not "calculating." Sheha describes that ODAS 3 receives "position information for both mobile

devices 18b and 18c" and that "[t]he ODAS 3 periodically updates each mobile device with the other's position information, thus providing real-time driving directions and route information." Ex. 1041, 11:20–23, 11:49–51 (cited on Pet. 21).

We preliminarily find that Petitioner's arguments are supported sufficiently by the cited portions of the asserted art. We further preliminarily find that Patent Owner's arguments do not undermine Petitioner's showing based on the preliminary record at this juncture of the proceeding. After consideration of the contentions and the evidence of record at this early stage, we determine that Petitioner has shown sufficiently that Sheha teaches element 1f for purposes of institution.

f) Conclusion

After consideration of the arguments and the evidence of record at this early stage, we determine that Petitioner has shown sufficiently, for purposes of institution, that Sheha discloses all recitations in claim 1. Accordingly, we conclude that Petitioner has demonstrated a reasonable likelihood that it would prevail in showing that claim 1 is unpatentable under 35 U.S.C. § 102 as anticipated by Sheha. A disclosure that anticipates under 35 U.S.C. § 102 also renders the claim unpatentable under 35 U.S.C. § 103(a), because anticipation is the epitome of obviousness. *See In re McDaniel*, 293 F.3d 1379, 1385 (Fed. Cir. 2002) ("It is well settled that 'anticipation is the epitome of obviousness.'") (quoting *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983)).

2. Independent Claims 13, 14, 15, 30, and 38

Independent claims 13, 14, 15, 30, and 38 are similar to claim 1 and Petitioner accounts for all differences between claim 1 and the other

independent claims. Patent Owner relies on the same arguments it presented for claim 1.

Patent Owner also argues that Petitioner's motivation to combine Sheha and Tanaka is deficient for claims 13, 15, and 38. Patent Owner's arguments is discussed above with respect to Petitioner's motivation to combine. *See supra* § III.E.

Patent Owner further argues for claims 13, 15, and 38 that Tanaka is deficient in not disclosing an alert message that comprises location information and transmitting the alert message "to a user of a list of users." Prelim. Resp. 37. Patent Owner argues that Tanaka "is the inverse of Claim 1." *Id.* Patent Owner's argument is based on the teachings of Tanaka alone, but Petitioner relies on the combination of Tanaka and Sheha for the disputed recitation. Attacking references individually does not undermine Petitioner's showing of obviousness. *See In re Keller*, 642 F.2d 413, 426 (CCPA 1981) (nonobviousness cannot be established by attacking prior art teachings individually where the ground of unpatentability is based upon a combination of the prior art teachings). We preliminarily find that Patent Owner's arguments do not undermine Petitioner's showing for claims 13, 15, and 38.

In summary, after consideration of the arguments and the evidence of record at this early stage claims 13, 14, 15, 30, and 38, we preliminarily determine that Petitioner's showing is sufficient for purposes of institution and that Patent Owner's argument does not undermine Petitioner's showing for the reasons given herein. Accordingly, we conclude that Petitioner has demonstrated a reasonable likelihood that it would prevail in showing that claim 30 is unpatentable under 35 U.S.C. § 102 as anticipated by Sheha and

that claim 30 is unpatentable under 35 U.S.C. § 103(a) as obvious over Sheha. We also conclude that Petitioner has demonstrated a reasonable likelihood that it would prevail in showing that independent claims 13, 14, 15, and 38 are unpatentable under 35 U.S.C. § 103(a) as obvious over Sheha and Tanaka.

3. Dependent Claims 2–12, 16–29, 31–37, and 39–46

We have considered Petitioner's arguments and evidence for dependent claims 2–12, 16–29, 31–37, and 39–46 and preliminarily find that Petitioner has shown sufficiently that the asserted prior art combinations it relies on teach the further recitations in each of those dependent claims. After consideration of the contentions and the evidence of record at this juncture, we conclude that Petitioner has demonstrated a reasonable likelihood that it would prevail in showing that claims 2–9, 11, 12, and 31–37 are unpatentable under 35 U.S.C. § 102 as anticipated by Sheha. We also conclude that Petitioner has demonstrated that a reasonable likelihood that it would prevail in showing claims 2–12, 16–29, 31–37, and 39–46 are unpatentable under 35 U.S.C. § 103(a) as obvious in view of the asserted art identified in Petitioner's element-by-element analysis.

G. Enzmann Grounds

Petitioner argues that claims 1–46 are unpatentable as obvious over Enzmann, Maruyama, Tanaka, and Preston. Pet. 3, 47–72. Patent Owner disputes Petitioner's showing for the independent claims. *See generally* Prelim. Resp.

For the reasons given below, we are persuaded by Petitioner's contentions and evidence discussed in its element-by-element analysis. Pet. 47–72. To the extent the challenge set forth on page 3 of the Petition

includes the identification of art in addition to that discussed in Petitioner's element-by-element analysis, we need not make determinations regarding that additional art.

1. Independent claim 1

a) The Preamble and Elements 1a–1c

The preamble and elements 1[a]–1[c] in claim 1 recite the following:

> 1. A method comprising:
> obtaining a location of a first wireless telephone;
> transmitting said location from said first wireless telephone to a remote server;
> changing, at the direction of said first wireless telephone, a list of users on said remote server for a profile associated with said first wireless telephone that are allowed to access said location, wherein each user of said list of users is representative of one of a plurality of wireless telephones.

Ex. 1001, 12:61–13:3.

Petitioner argues that Enzmann describes a location query service that determines the locations of wireless devices using either location systems in the wireless devices or using a network-based location system. Pet. 48 (citing Ex. 1040, 2:6–8, 3:53–61, 5:2–7, 5:39–50, 7:51–57, Fig. 1). Petitioner argues that "after a mobile device determines its position, it transmits its position information to a location server 100." *Id.* at 49 (citing Ex. 1040, 5:2–7, 7:63–8:15). Petitioner argues that Enzmann's system allows users to control who is permitted to access their locations by providing a list of authorized requestors. *Id.* at 50 (citing Ex. 1040, 2:35–41, 5:28–34, 7:17–34). Petitioner also argues that Enzmann's system allows users to change the list "because Enzmann allows the user of the target device to grant or deny location access rights for requestors who are not on

the list of authorized requestors." *Id.* (citing Ex. 1040, 7:26–58). Petitioner relies on the testimony of Mr. Williams as support for its position. *Id.* at 47–50 (citing Ex. 1021-1 ¶¶ 101–105). Patent Owner does not dispute Petitioner's showing at this preliminary stage.

We preliminarily find that Petitioner's arguments are supported sufficiently by the cited portions of the asserted art. After consideration of the contentions and the evidence of record at this early stage, we determine that Petitioner has shown sufficiently that Enzmann teaches the preamble and elements 1a–1c for purposes of institution.

b) Element 1d

Element 1d recites "transmitting said location from said remote server to at least one of said users of said list of users." Petitioner refers to its contentions for element 1a and further argues "Enzmann discloses that if the request is authorized, the system transmits the target device location information to the requester." Pet. 51 (citing Ex. 1040, 2:39–41, 5:2–7, 8:65–67; Ex. 1021-1 ¶ 106). Patent Owner does not dispute Petitioner's showing at this preliminary stage.

We preliminarily find that Petitioner's arguments are supported sufficiently by the cited portions of the asserted art. After consideration of the contentions and the evidence of record at this early stage, we determine that Petitioner has shown sufficiently that Enzmann teaches element 1d for purposes of institution.

c) Element 1e

Element 1e recites "determining a second location associated with one of said plurality of wireless telephones." Petitioner refers to its contentions for element 1a and further argues "[b]ecause Enzmann discloses a system

with multiple wireless users on the same system, the system determines a second location whenever a second location request is received, such as if the target device requested—and was authorized to obtain— the location of the requesting device." Pet. 51 (citing Ex. 1040, 2:52–60). Petitioner relies on the testimony of Mr. Williams as support for its position. *Id.* (citing Ex. 1021-1 ¶ 107).

Patent Owner argues the following:

> Enzmann does *not* disclose the concept of a requestor sending its own location to a "network user" — such functionality would be entirely unnecessary and unrelated to the disclosed system. Simply put, Enzmann does not teach a two-way system of determining the location of a requestor that just received location information from a network device user. Accordingly, Enzmann does not teach "determining a second location associated with one of said plurality of wireless telephones" as recited in Claims 1 and 30, nor would skilled artisans have been motivated to modify Enzmann to have this functionality.

Prelim. Resp. 45.

Contrary to Patent Owner's argument, we preliminarily find that Petitioner does not rely on determining a location of a requestor. Petitioner, instead, argues that "Enzmann discloses a system with *multiple wireless users on the same system.*" Pet. 51 (emphasis added). We preliminarily find consistent with Petitioner's contentions at this early stage that Enzmann describes that "[t]he user wireless network is in communication with *a plurality of network devices operated by a plurality of network users*" and "[t]he user wireless network is also in communication with a location system for determining the location of *each network device*." Ex. 1040, 2:54–58 (emphases added); *see also id.* at Fig. 1 (illustrating a plurality of network devices 104).

We preliminarily find that Petitioner's arguments are supported sufficiently by the cited portions of the asserted art. We further preliminarily find that Patent Owner's arguments do not undermine Petitioner's showing based on the preliminary record at this juncture of the proceeding. After consideration of the contentions and the evidence of record at this early stage, we determine that Petitioner has shown sufficiently that Enzmann teaches element 1e for purposes of institution.

d) Element 1f

Element 1f recites "providing directional information to said one of said plurality of wireless telephones, wherein said directional information is representative of directions between said location and said second location."

Petitioner relies on the teachings of Enzmann discussed above and Maruyama for element 1f. Pet. 51. Petitioner argues that "Maruyama discloses displaying directional information representative of directions between the locations of two mobile devices." *Id.* at 52 (citing Ex. 1052, 3:12–20, 3:30–33, 6:44–51, 8:39–43, Fig. 5). Petitioner relies on the testimony of Mr. Williams as support for its position. *Id.* at 51–52 (citing Ex. 1021-1 ¶¶ 107–108).

Patent Owner argues "Maruyama disclosures cited by Petitioner describe providing the distance between two locations and presenting an arrow that shows the direction of the location of one user/device relative to another user/device—not directions instructing one user/device how to navigate to another user/device." Prelim. Resp. 52. Element 1f does not recite "how to navigate." Based on the preliminary record before us, neither party has argued that any term recited in claim 1 should be construed to mean "how to navigate."

Maruyama describes a "Meeting by Appointment Service" that is "used when meeting someone by appointment so as to notify the partner of his/her present place and/or confirm where the partner is now." Ex. 1052, 3:30–33; *see also id.* at 8:39–42 (describing that "the starting point (user's present place) of the arrow is represented by a black circle and the ending point (partner's present place of the arrow is represented by a white circle"). Maruyama describes that the "Meeting by Appointment Service" service is available "[w]hen using the portable terminal of the present invention with the function of walking navigation." *Id.* at 3:21–22, 3:30. Maruyama describes displaying "a direction of movement from [a] present place." *Id.* at 3:15–16. We preliminarily find that Maruyama's disclosures teach "representative of directions between said location and said second location."

Patent Owner also argues that Petitioner's motivation to combine is deficient. Prelim. Resp. 52–53. We discuss Patent Owner's arguments in that regard in connection with Petitioner's motivation to combine arguments. *See supra* § III.E.

We preliminarily find that Petitioner's arguments are supported sufficiently by the cited portions of the asserted art. We further preliminarily find that Patent Owner's arguments do not undermine Petitioner's showing based on the preliminary record at this juncture of the proceeding. After consideration of the contentions and the evidence of record at this early stage, we determine that Petitioner has shown sufficiently that the combination of Enzmann and Maruyama teaches element 1f for purposes of institution.

e) Conclusion

After consideration of the arguments and the evidence of record at this early stage, we determine that Petitioner has shown sufficiently, for purposes of institution, that the combination of Enzmann and Maruyama teaches all recitations in claim 1. Also, at this juncture, we are persuaded that Petitioner has articulated sufficiently persuasive reasoning, based on the evidence of record, as to why one of ordinary skill in the art would have made Petitioner's proposed modifications.

Accordingly, we conclude that Petitioner has demonstrated a reasonable likelihood that it would prevail in showing that claim 1 is unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Enzmann and Maruyama.

2. Independent Claims 13, 14, 15, 30, and 38

Independent claims 13, 14, 15, 30, and 38 are similar to claim 1 and Petitioner accounts for all differences between claim 1 and the other independent claims. Patent Owner relies on the same arguments it presented for claim 1 and the Sheha grounds. Patent Owner also argues Petitioner's motivation to combine Sheha and Tanaka is deficient, which we discuss with respect to Petitioner's motivation to combine arguments. *See supra* § III.E.

Patent Owner argues Petitioner's positions are deficient based on a number of characterizations of the asserted prior art, which are not persuasive. *See, e.g.*, Prelim. Resp. 54–58. For instance, Patent Owner argues that Enzmann would have been understood to describe "a user creating in the instant messaging service app a customized buddy list of friends that live in his city." *Id.* at 56. Enzmann, however, describes "[t]he present invention is a location query service for use with a wireless network

that tracks locations of network users." Ex. 1040, 3:53–55. Enzmann describes "suitable methods of determining location as a part of the wireless networks include Wireless Access Protocol (WAP) location services, Time Difference of Arrival (TDOA) location systems, Angle of Arrival (AOA) locations and other systems using triangulation across cell sites or cell sectors" and an "example of a suitable location system in the handheld devices is a GPS." *Id.* at 4:32–38. Enzmann describes that its location determining applies "to numerous situations in which a requestor wants to know the location of a network user" including that it could be implemented to have "an instant messaging service configured to display only the friends of that user who are in the same city as the user." Ex. 1040, 9:1–3, 9:17–19.

Patent Owner also argues Enzmann does not describe automatically and continuously tracking devices and continually calculating distances. Prelim. Resp. 34. The independent claims do not recite the terms "automatic," "continuous," or other similar terms.

After consideration of the arguments and the evidence of record at this early stage, we preliminarily determine that Petitioner's showing is sufficient for purposes of institution and that Patent Owner's argument does not undermine Petitioner's showing for the same reasons previously given. Accordingly, we conclude that Petitioner has demonstrated a reasonable likelihood that it would prevail in showing that independent claims 13, 14, 15, 30, and 38 are unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Enzmann and Maruyama.

3. Dependent Claims 2–12, 16–29, 31–37, and 39–46

We have considered Petitioner's arguments and evidence for dependent claims 2–12, 16–29, 31–37, and 39–46 and preliminarily find that

Petitioner has shown sufficiently that the asserted prior art combinations it relies on teach the further recitations in each of those dependent claims. After consideration of the contentions and the evidence of record at this juncture, we conclude that Petitioner has demonstrated a reasonable likelihood that it would prevail in showing that claims 2–12, 16–29, 31–37, and 39–46 are unpatentable under 35 U.S.C. § 103(a) as obvious over the asserted art identified in Petitioner's element-by-element analysis.

IV. CONCLUSION

For the foregoing reasons, we conclude that the information presented in the Petition establishes a reasonable likelihood that Petitioner would prevail in showing that claims 1–46 of the '575 patent are unpatentable.

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that *inter partes* review of claims 1–46 of the '575 patent is hereby instituted on all grounds stated in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial; the trial will commence on the entry date of this decision.

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Paper No. 17
Entered: November 7, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

MULLEN INDUSTRIES LLC,
Patent Owner.

IPR2022-01389 (Patent 11,190,633 B2)
IPR2023-00090 (Patent 11,122,418 B2)
IPR2023-00091 (Patent 9,204,283 B2)
IPR2023-00096 (Patent 11,096,039 B2)
IPR2023-00097 (Patent 8,374,575 B2)
IPR2023-00115 (Patent 11,234,117 B2)
IPR2023-00116 (Patent 11,234,117 B2)
IPR2023-00148 (Patent 11,246,024 B2)[1]

Before JEFFREY S. SMITH, BARBARA A. PARVIS, JAMES B. MAYBERRY, NATHAN A. ENGELS, and STEVEN M. AMUNDSON, *Administrative Patent Judges*.[2]

PER CURIAM.

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[1] This Order addresses issues that are the same in each of the identified proceedings. We exercise our discretion to issue one Order to be filed in each proceeding. The parties are not authorized to use this style heading in subsequent papers.

[2] This listing of Administrative Patent Judges does not reflect an expanded panel under SOP 1 § III.M. This order addresses multiple proceedings in which listed judges are paneled in various groups of three.

TERMINATION
Due to Settlement After Institution of Trial and
Granting Joint Motion to File Settlement Agreement
as Business Confidential Information
35 U.S.C. § 317; 37 C.F.R. § 42.74

I. INTRODUCTION

With the Board's authorization, Petitioner and Patent Owner (collectively, "the Parties") filed a joint motion to terminate in each of the above-captioned proceedings. Paper 18 ("Joint Motion").[3] Along with the Joint Motion, the Parties filed a copy of a Settlement Agreement (Ex. 1019, "Settlement Agreement"), as well as a joint motion requesting that the Settlement Agreement be treated as business confidential information and kept separate from the files of the patents involved in the above-captioned proceedings. Paper 19 ("Joint Request").

II. DISCUSSION

Under 35 U.S.C. § 317(a), "[a]n inter partes review instituted under this chapter shall be terminated with respect to any petitioner upon the joint request of the petitioner and the patent owner, unless the Office has decided the merits of the proceeding before the request for termination is filed." 35 U.S.C. § 317(a) also provides that if no petitioner remains in the *inter partes* review, the Office may terminate the review.

In the Joint Motion, the Parties represent that the Settlement Agreement resolves their disputes involving the patents at issue in the

[3] The relevant papers and exhibits filed in the above-captioned proceedings are substantively the same. We cite to the record in IPR2022-01389, unless otherwise indicated.

above-captioned proceedings. Joint Motion 2.[4] The Parties also "certify that there are no collateral agreements or understandings made in connection with, or in contemplation of, the termination of this proceeding, pursuant to 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(b)." *Id.* at 3.

We instituted trial for the above-identified *inter partes* review proceedings (*see* Paper 9), but we have not yet decided the merits of the proceedings, and final written decisions have not been entered. Notwithstanding that the proceedings have moved beyond the preliminary stage, the Parties have shown adequately that termination of the proceedings is appropriate. Under these circumstances, we determine that good cause exists to terminate the proceedings with respect to the Parties.

In the Joint Request, the Parties request that the Settlement Agreement be treated as business confidential information and kept separate from the files of the patents involved in the above-captioned proceedings. Joint Request 2.[5] After reviewing the Settlement Agreement, we find that it contains confidential business information regarding the terms of settlement. Thus, good cause exists to treat the Settlement Agreement as business confidential information pursuant to 37 C.F.R. § 42.74(c).

This Order does not constitute a final written decision pursuant to 35 U.S.C. § 318(a).

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[4] The Joint Motion (Paper 18) does not include page numbers. We consider the title page as page 1 and then proceed from there in numerical order.

[5] The Joint Request (Paper 19) does not include page numbers. We consider the title page as page 1 and then proceed from there in numerical order.

III. ORDER

Accordingly, it is:

ORDERED that the Joint Motions to Terminate (IPR2022-01389, Paper 18; IPR2023-00090, Paper 17; IPR2023-00091, Paper 15; IPR2023-00096, Paper 15; IPR2023-00097, Paper 15; IPR2023-00115, Paper 15; IPR2023-00116, Paper 15; IPR2023-00148, Paper 14) are *granted*, and IPR2022-01389, IPR2023-00090, IPR2023-00091, IPR2023-00096, IPR2023-00097, IPR2023-00115, IPR2023-00116, and IPR2023-00148 are *terminated* with respect to Petitioner and Patent Owner; and

FURTHER ORDERED that the Joint Requests to treat the Settlement Agreement as business confidential information (IPR2022-01389, Paper 19; IPR2023-00090, Paper 18; IPR2023-00091, Paper 16; IPR2023-00096, Paper 16; IPR2023-00097, Paper 16; IPR2023-00115, Paper 16; IPR2023-00116, Paper 16; IPR2023-00148, Paper 15) are *granted*, and the Settlement Agreement (IPR2022-01389, Ex. 1019; IPR2023-00090, Ex. 1061; IPR2023-00091, Ex. 1063; IPR2023-00096, Ex. 1062; IPR2023-00097, Ex. 1061; IPR2023-00115, Ex. 1062; IPR2023-00116, Ex. 1062; IPR2023-00148, Ex. 1056) shall be kept separate from the files of U.S. Patent Nos. 11,190,633 B2, 11,122,418 B2, 9,204,283 B2, 11,096,039 B2, 8,374,575 B2, 11,234,117 B2, and 11,246,024 B2, and made available only to Federal Government agencies on written request, or to any person on a showing of good cause, pursuant to 37 C.F.R. § 42.74(c).

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