INTERNATIONAL SEARCH REPORT

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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)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, 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.

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Date of the actual completion of the international search	Date of mailing of the international search report
6 December 2000	12/12/2000

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 99 51051 A (NOKIA TELECOMMUNICATIONS OY ;AHMAVAARA KALLE (FI)) 7 October 1999 (1999-10-07) page 3, line 4 - line 17 page 4, line 14 -page 6, line 20 claims 1,14 -----	1-3,5-7, 9,11-28

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

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Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0898438 A	24-02-1999	FI 973425 A	21-02-1999
		AU 7045198 A	08-03-1999
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		FI 990988 A	30-04-1999
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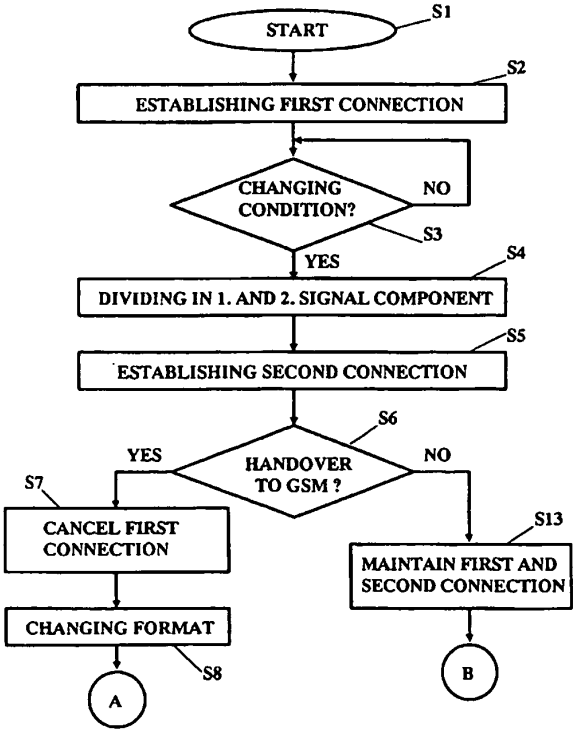
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[Continued on next page]

(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.

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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

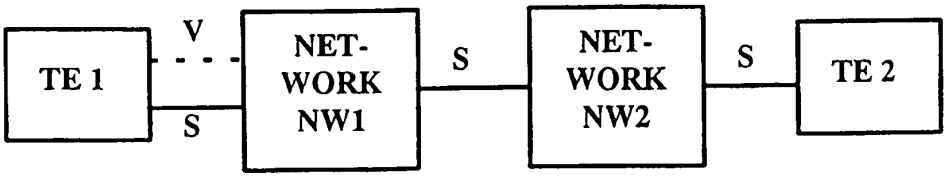


FIG. 1C

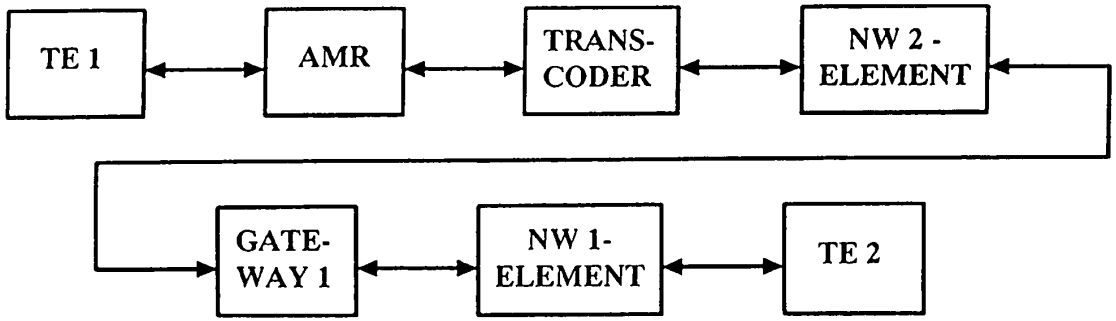

TE 1
AMR
TRANS-
CODER
NW 2 -
ELEMENT
GATE-
WAY 1
NW 1-
ELEMENT
TE 2

FIG. 2A

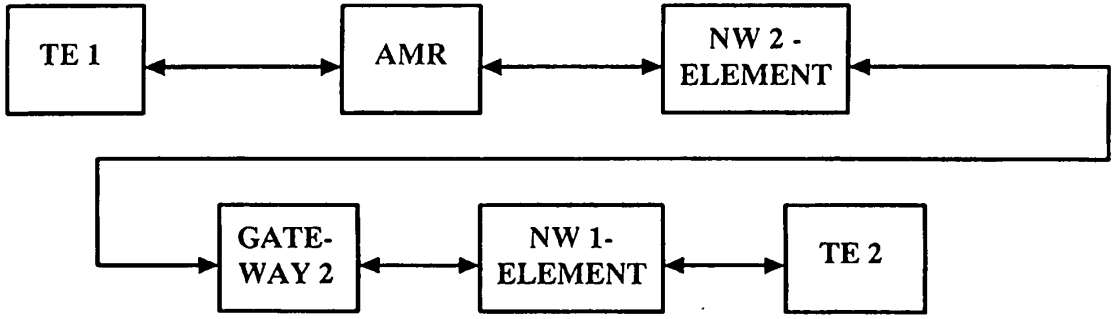

TE 1
AMR
NW 2 -
ELEMENT
GATE-
WAY 2
NW 1-
ELEMENT
TE 2

FIG. 2B

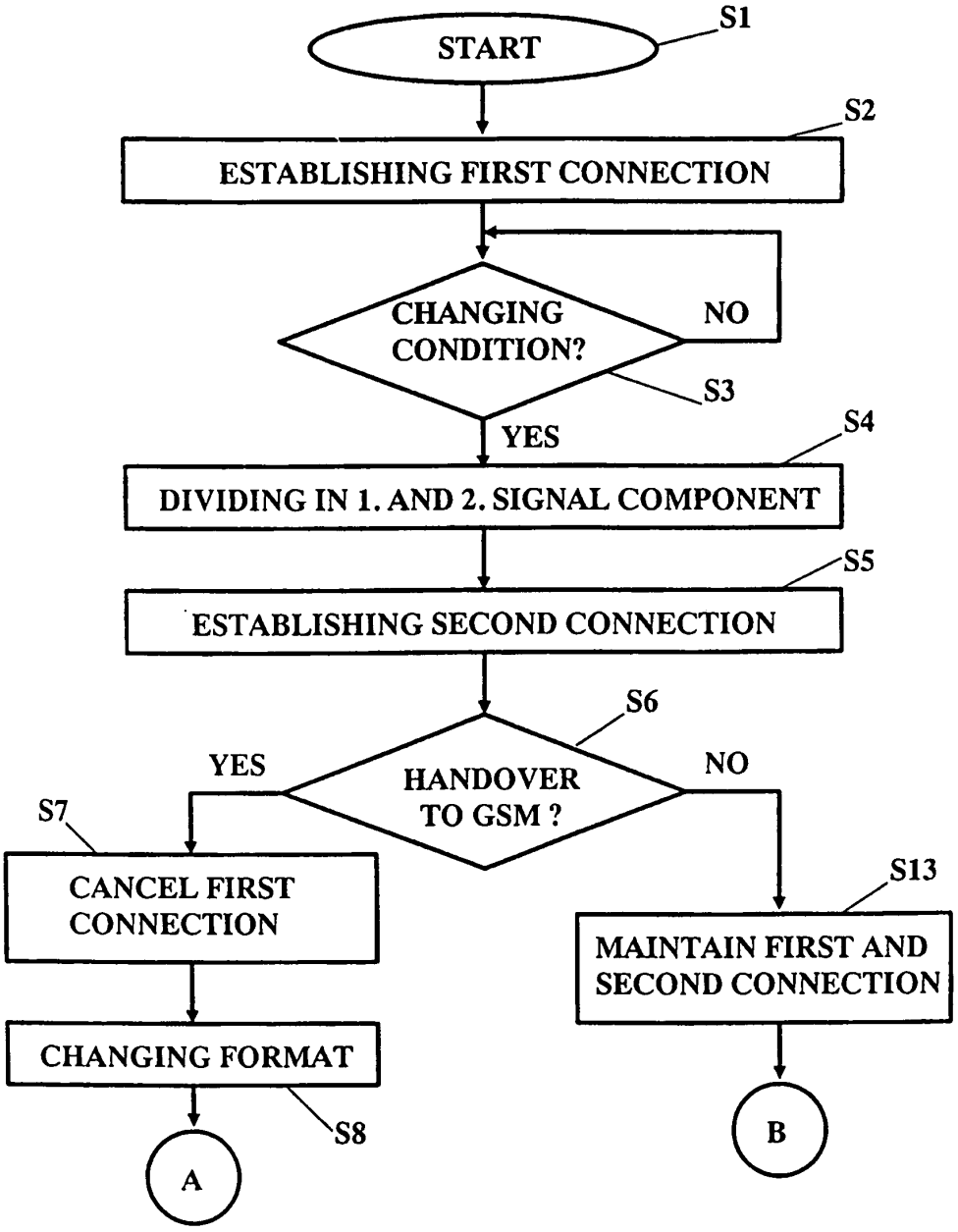

START
S1
ESTABLISHING FIRST CONNECTION
S2
CHANGING CONDITION?
NO
S3
YES
S4
DIVIDING IN 1. AND 2. SIGNAL COMPONENT
S5
ESTABLISHING SECOND CONNECTION
S6
HANDOVER TO GSM ?
YES
NO
S7
CANCEL FIRST CONNECTION
CHANGING FORMAT
S8
A
S13
MAINTAIN FIRST AND SECOND CONNECTION
B

FIG.3

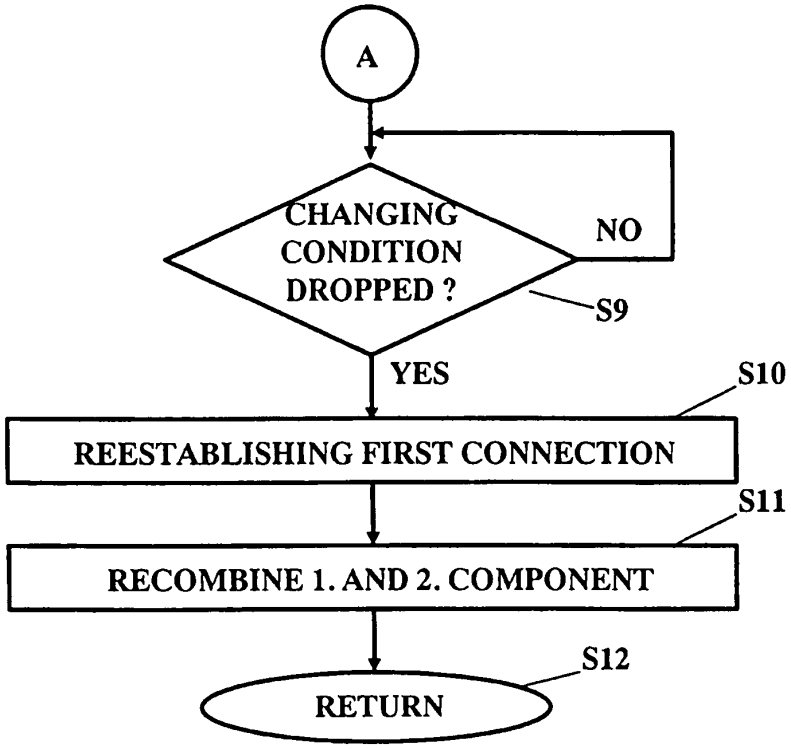

A
CHANGING CONDITION DROPPED ?
NO
S9
YES
S10
REESTABLISHING FIRST CONNECTION
S11
RECOMBINE 1. AND 2. COMPONENT
S12
RETURN

FIG.4

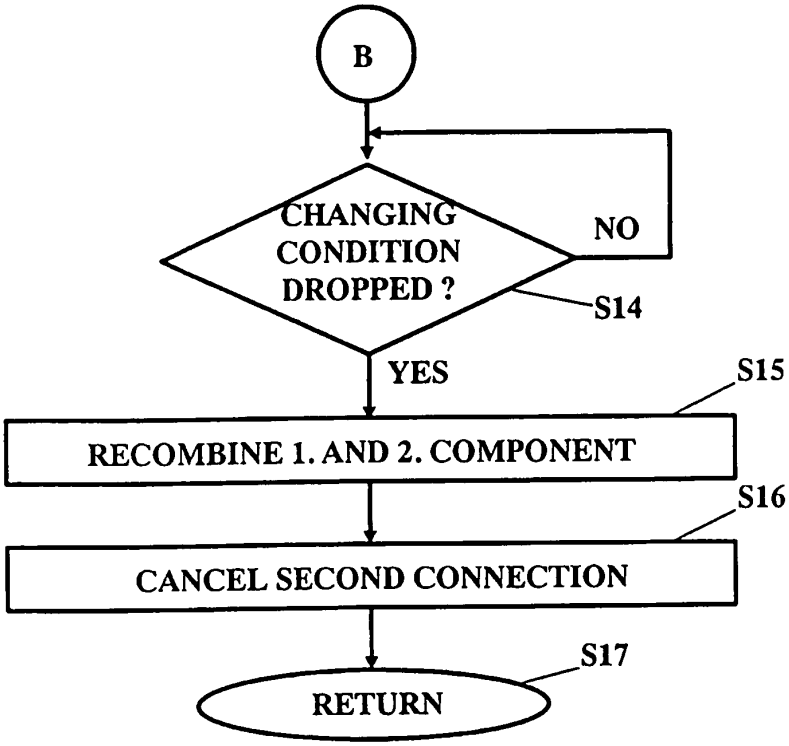

B
CHANGING CONDITION DROPPED ?
NO
S14
YES
S15
RECOMBINE 1. AND 2. COMPONENT
S16
CANCEL SECOND CONNECTION
S17
RETURN

FIG.5

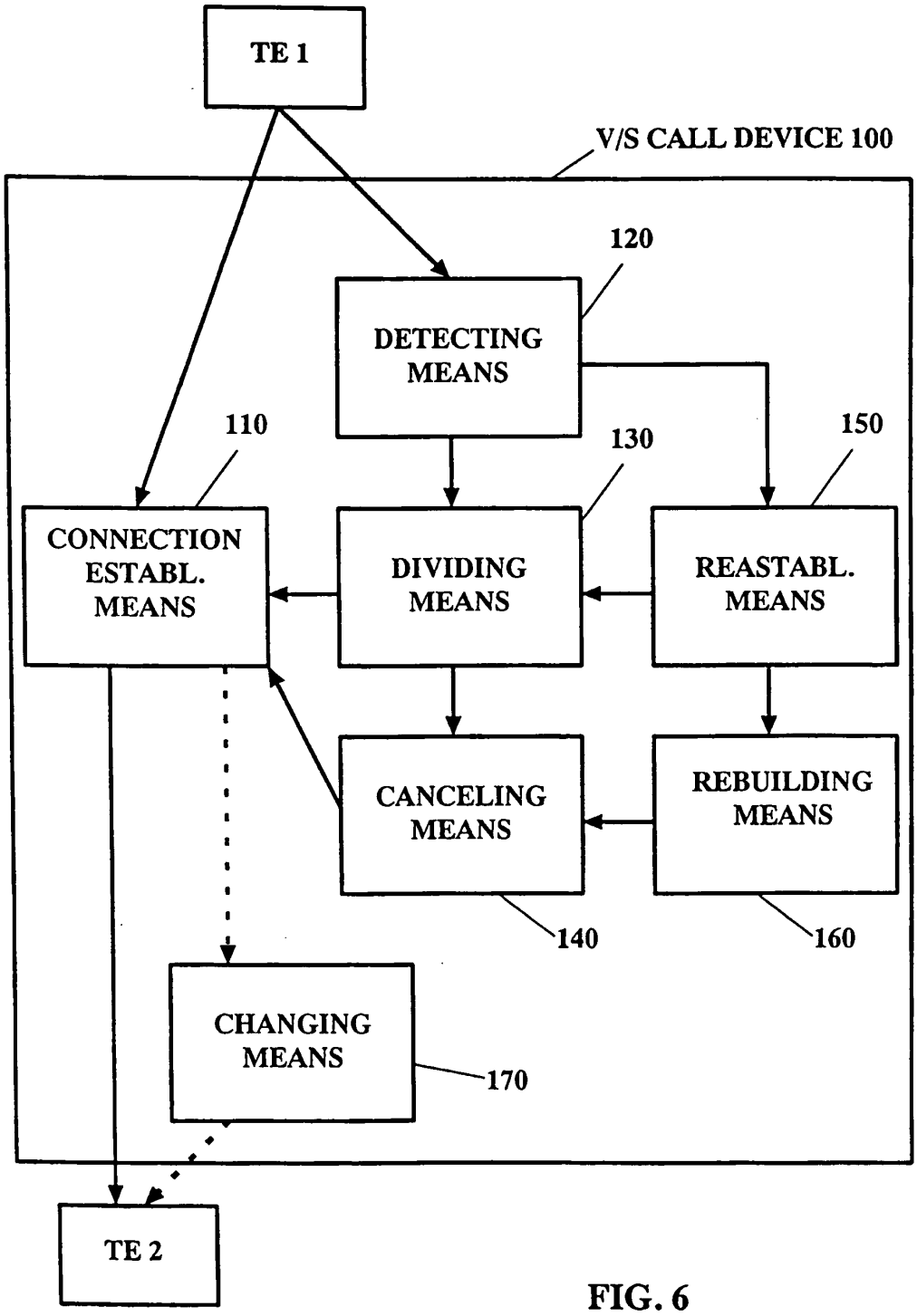

TE 1
V/S CALL DEVICE 100
120
DETECTING MEANS
110
130
150
CONNECTION ESTABL. MEANS
DIVIDING MEANS
REASTABL. MEANS
CANCELING MEANS
REBUILDING MEANS
140
160
CHANGING MEANS
170
TE 2

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.

* Special categories of cited documents :

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

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

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

"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
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

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0841763 A	13-05-1998	FI 964308 A	26-04-1998
		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

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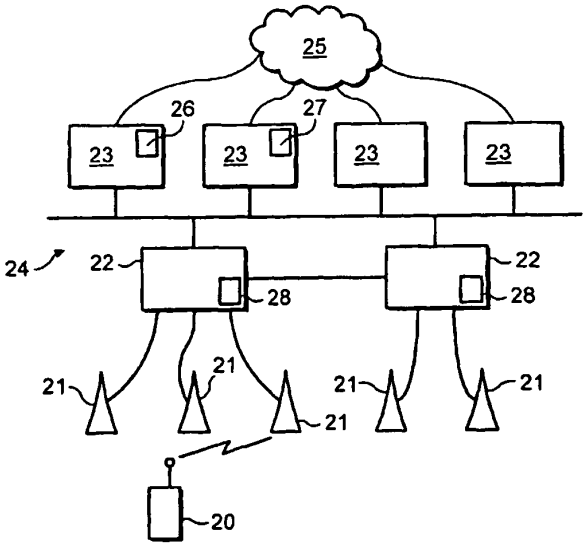
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(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.

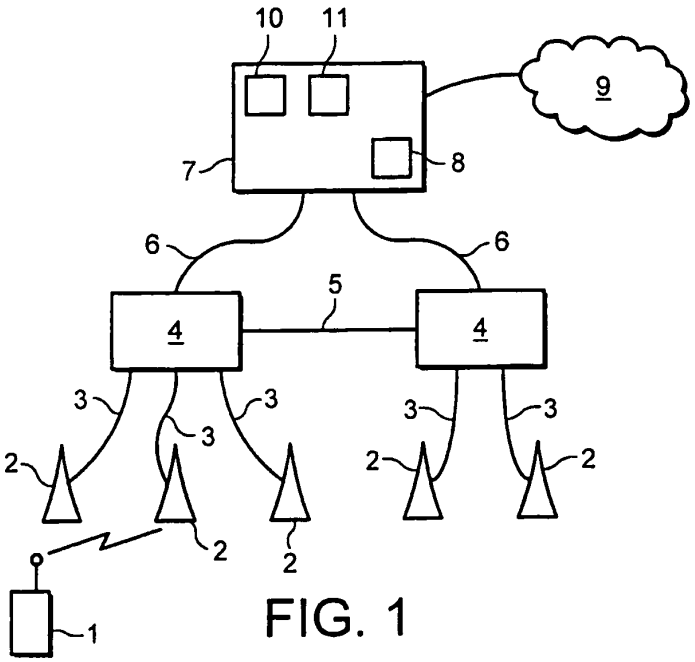

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FIG. 1

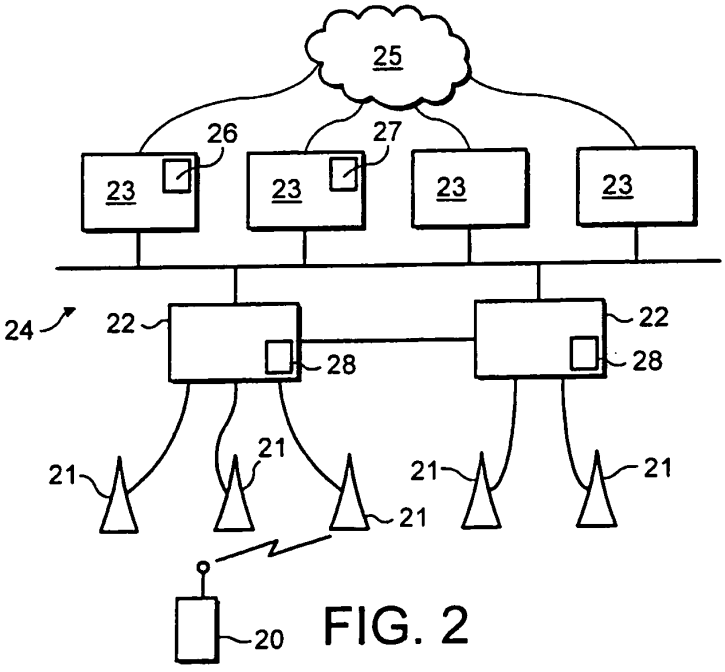

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FIG. 2

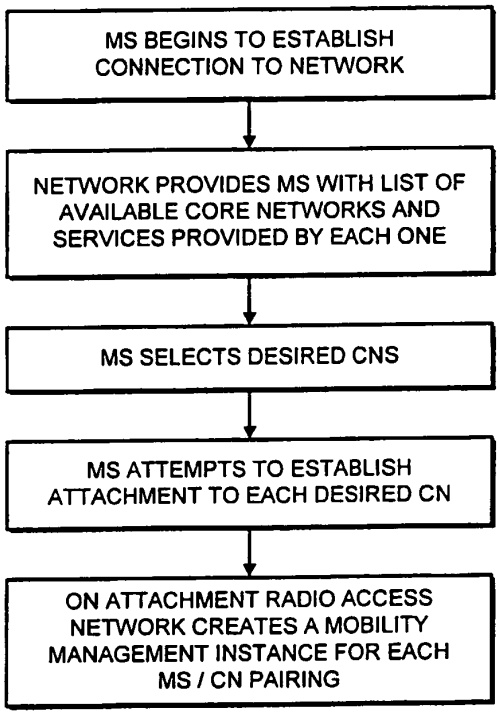

MS BEGINS TO ESTABLISH CONNECTION TO NETWORK
NETWORK PROVIDES MS WITH LIST OF AVAILABLE CORE NETWORKS AND SERVICES PROVIDED BY EACH ONE
MS SELECTS DESIRED CNS
MS ATTEMPTS TO ESTABLISH ATTACHMENT TO EACH DESIRED CN
ON ATTACHMENT RADIO ACCESS NETWORK CREATES A MOBILITY MANAGEMENT INSTANCE FOR EACH MS /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

[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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"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

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

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
		AU 3980095 A	31-05-1996
		CN 1141111 A	22-01-1997
		DE 19581443 T	27-02-1997
		WO 9614719 A	17-05-1996
		FI 962789 A	03-09-1996
		JP 9507986 T	12-08-1997

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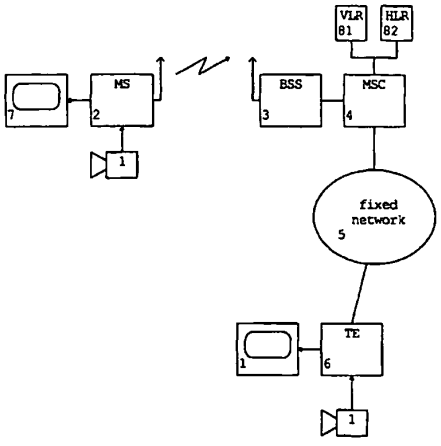
(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR,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

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Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD AND SYSTEM FOR PROVIDING A CALLER PICTURE



(57) Abstract: 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 a 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.

WO 01/03406 A1

Method and System for Providing a Caller Picture

FIELD OF THE INVENTION

The present invention relates to a method and system for providing a caller picture via a telecommunication network to a called party.

BACKGROUND OF THE INVENTION

Conventionally, multi-media communication apparatuses capable of performing speech and image communication via a communication line are known.

Document US 5,414,457, for example, discloses a communication apparatus, wherein, in a reception state, an image of a calling party and a selection signal for a telephone number are registered in a volatile memory in correspondence with each other, and the registered image is displayed on an image display section. When a calling operation is performed to a party corresponding to the registered image, an operator need only designate the image of the party to be called from displayed images, and a CPU automatically outputs a selection signal for a telephone number corresponding to the designated image. Therefore, the image of a party to be called can be visually recognized before calling. Thus, since calling can be made after confirmation of an image such as a face of a party to be called, a dialing error can be prevented. However, a subscriber B may only store an image information transmitted from a subscriber A and to be used when the subscriber B is about to make a call to the subscriber A. Thus, the subscriber B does not receive a caller picture

from the subscriber A, before answering to the phone, if the subscriber A has not phoned him up before.

Furthermore, document US 5,761,279 discloses a system for displaying a graphic information such as a facial representation on a communication's terminal. The facial representation is digitized, compressed and stored in a memory at an appropriate control center of a communication network. Upon receipt of a display command, the digitized data is retrieved from a memory and transmitted to the called party's display terminal using a modem technology. However, the user has to provide a photo to the service provider in advance, who digitizes it. Thus, the caller pictures are not real-time pictures and their quality is not very high.

Thus, a drawback of the above prior art ist that the caller picture is determined in advance and cannot be changed according to the actual needs of the calling party.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a method and system for providing a caller picture to a called party in a more flexible manner.

This object is achieved by a method for providing a caller picture via a telecommunication network to a called party, comprising the steps of:

generating the caller picture at a terminal of a calling party;

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

storing the caller picture at a network element of the telecommunication network; and

transmitting the caller picture from the network element to a terminal of the called party.

Furthermore, the above object is achieved by a system for providing a caller picture to a called party via a telecommunication network, having a plurality of terminals and at least one network element for routing calls,

wherein said plurality of terminals comprise camera means for generating the caller picture, display means for displaying the caller picture, and transmitting means for transmitting the caller picture to the at least one network element at the beginning of a call; and

wherein the network element comprises receiving means for receiving the caller picture, storing means for storing the caller picture, and transmitting means for transmitting the caller picture to a terminal of the called party.

Accordingly, a camera function is provided at the terminal of a calling party, such that the terminal both digitizes a caller picture and transmits it to the network element of the telecommunication network. Then, the network element which may be a switching means, stores the picture. Thereby, a much better quality of the caller picture can be achieved, and not only a facial representation, but anything just like post cards can be transmitted in real-time to the called party. Therefore, the picture is up-to-date and a selection function for selecting one of a plurality of centrally stored caller pictures based on the calling person is not required.

Preferably, the transmission of the caller picture to the network element, the storing of the caller picture at the

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.

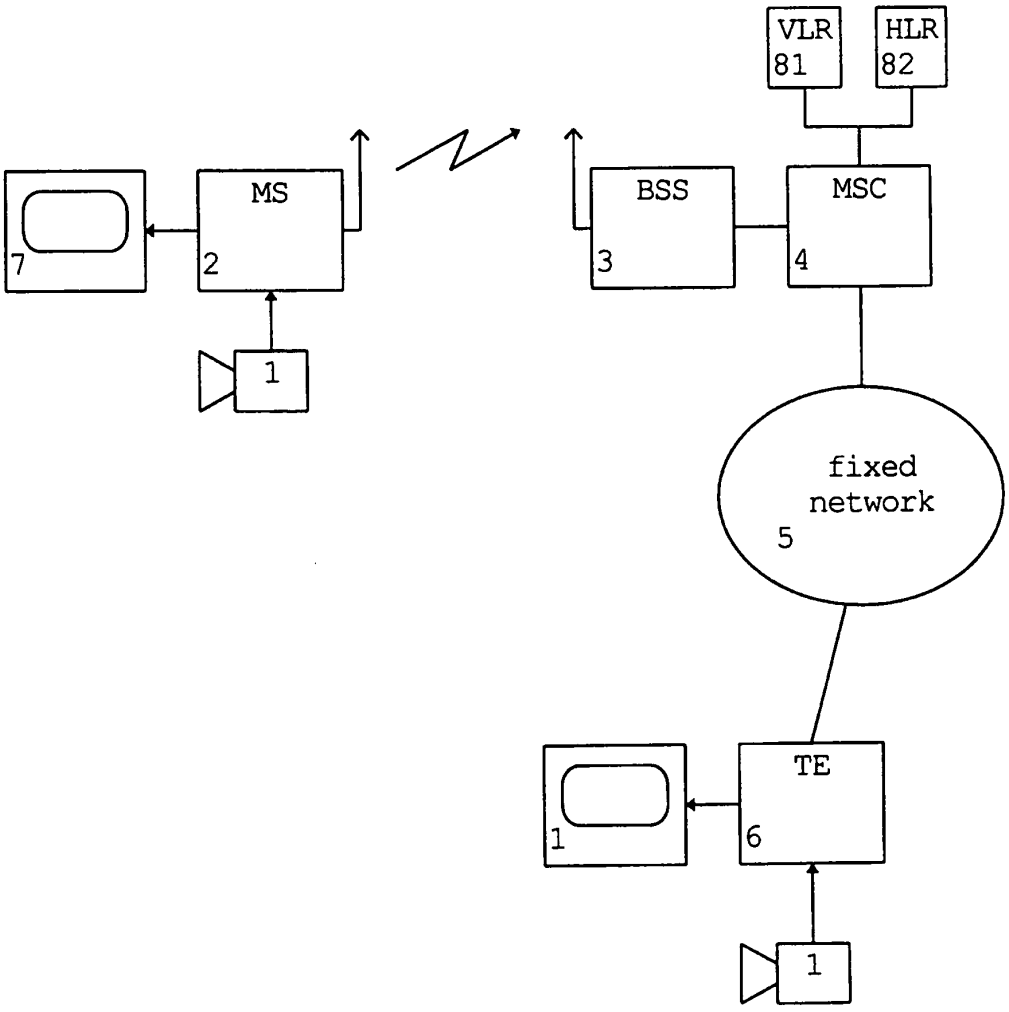


Fig. 1

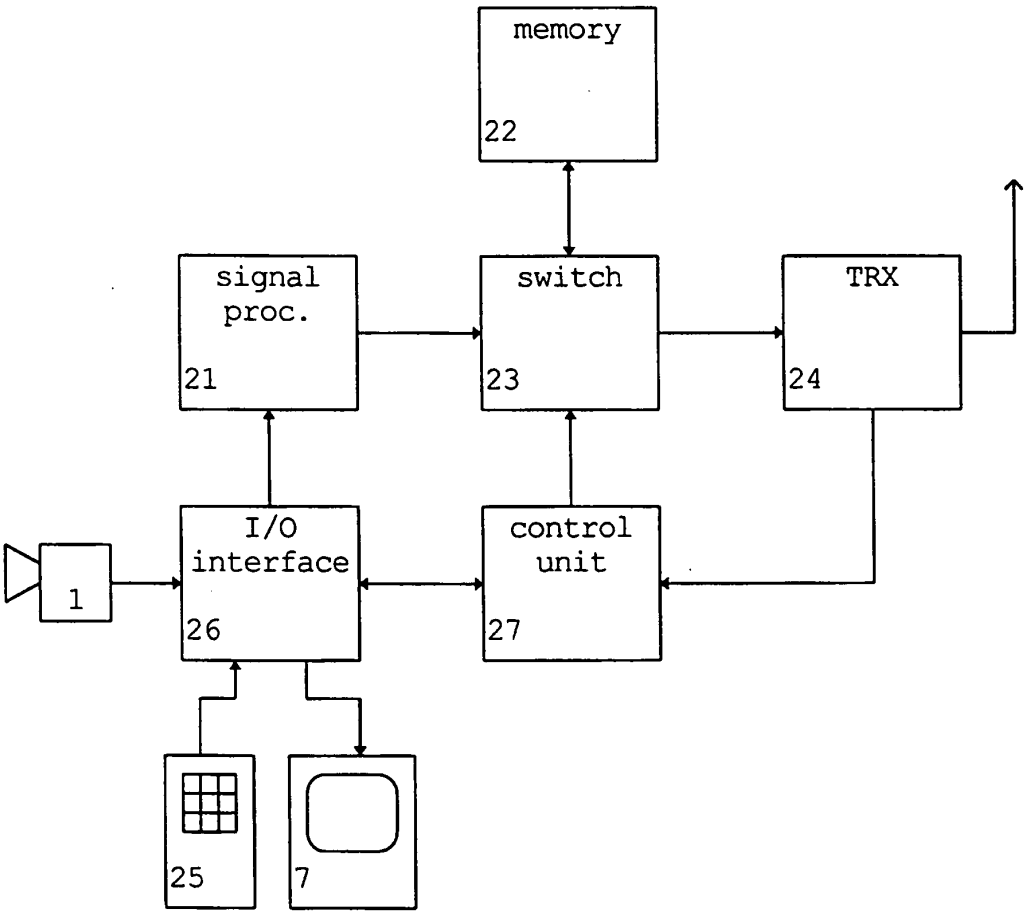

memory
22
signal proc.
21
switch
23
TRX
24
I/O interface
26
control unit
27
1
25
7

Fig. 2

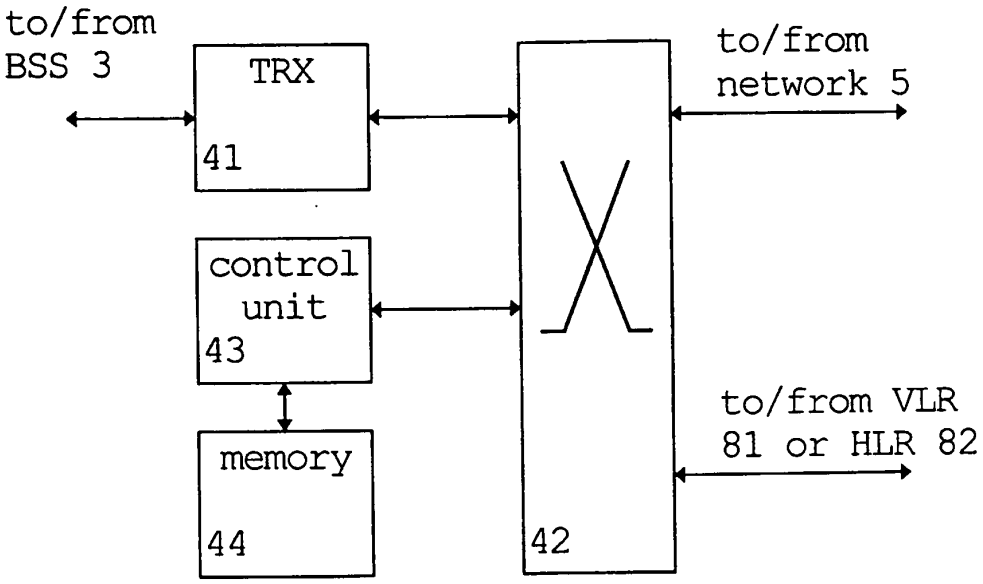

to/from
BSS 3
TRX
41
control
unit
43
memory
44
42
to/from
network 5
to/from VLR
81 or HLR 82

Fig. 3

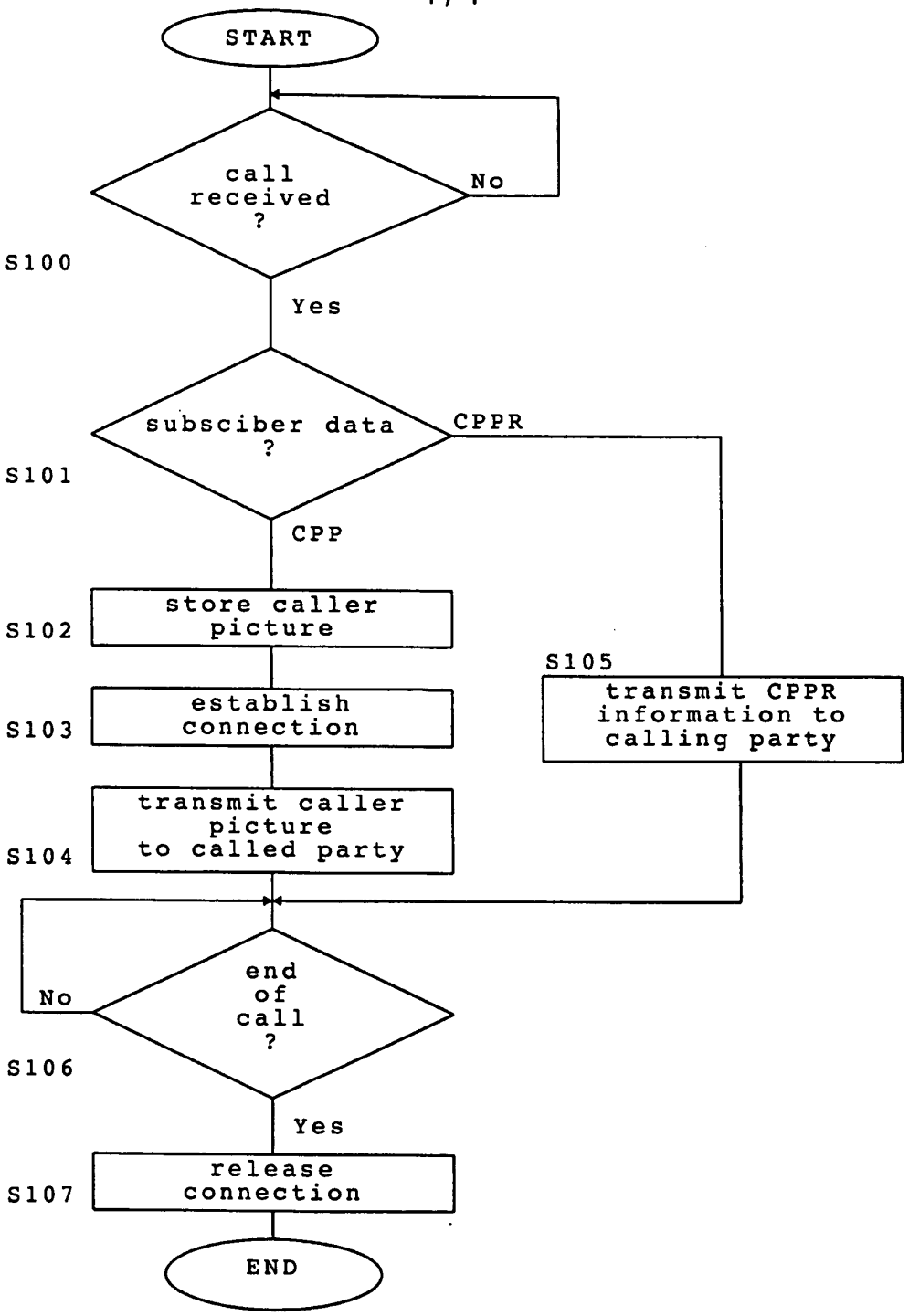

START
call received ?
No
S100
Yes
subsciber data ?
CPPR
S101
CPP
store caller picture
S102
S105
transmit CPPR information to calling party
establish connection
S103
transmit caller picture to called party
S104
end of call ?
No
S106
Yes
release connection
S107
END

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.

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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... onal 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.
A	JARNO KNUUTILA, JARI HAMALAINEN: "Migration towards multimedia capability in GSM high speed data terminals" IEEE,1998, pages 89-94, XP002133553 Tampere, Finland page 93, left-hand column, line 15 -right-hand column, line 45	1-25
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 ... second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

information on patent family members

Inter nal Application No
PCT/EP 99/04519

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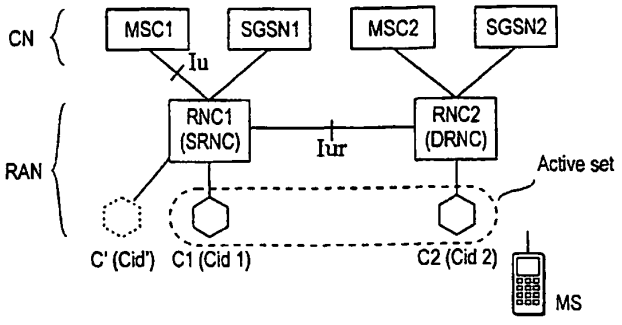
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Published:
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(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

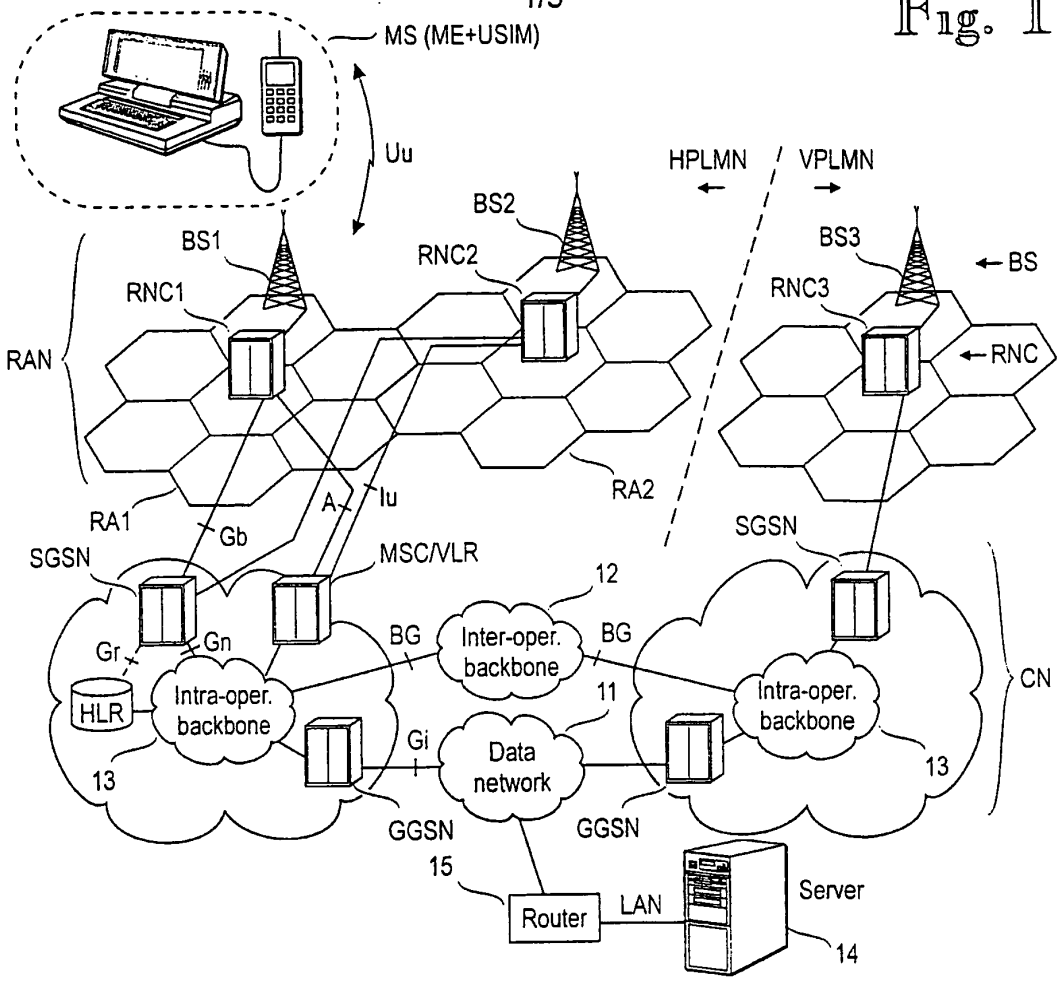
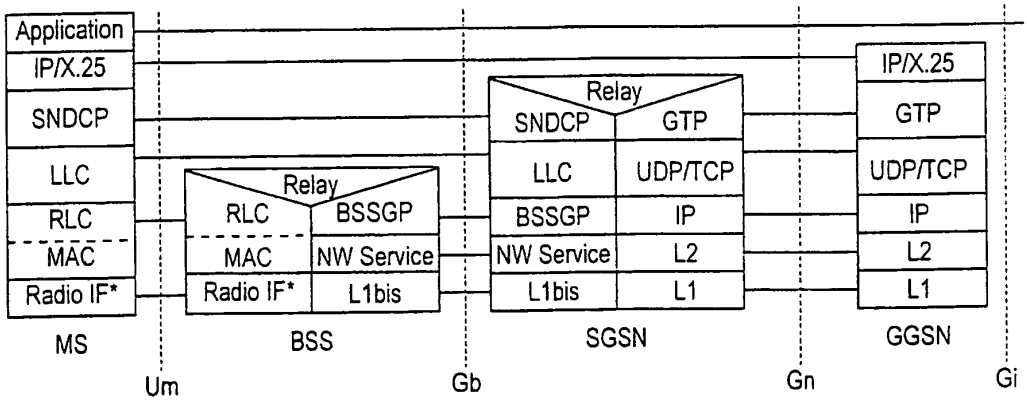


Fig. 2



*WCDMA in 3G

Fig. 3

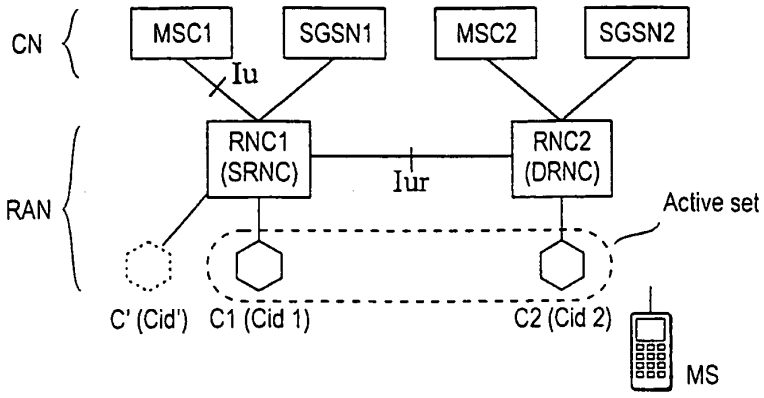

CN
MSC1
SGSN1
MSC2
SGSN2
Iu
RAN
RNC1
(SRNC)
Iur
RNC2
(DRNC)
Active set
C' (Cid')
C1 (Cid 1)
C2 (Cid 2)
MS

Fig. 4

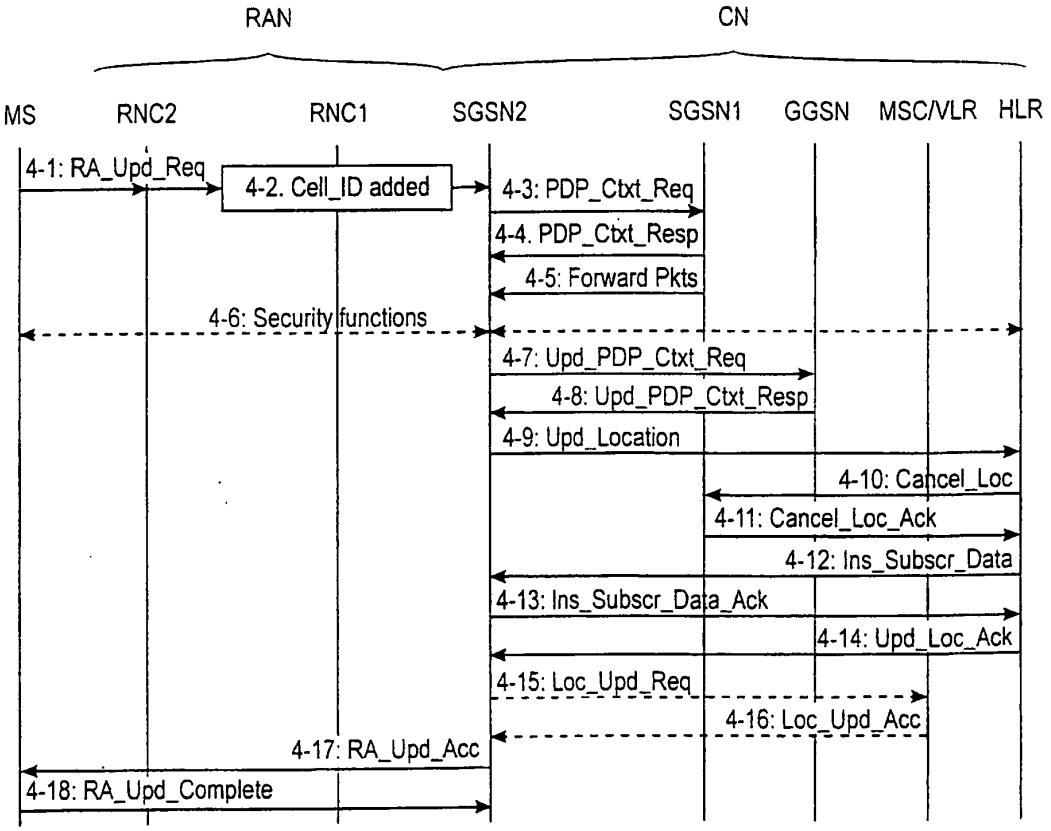
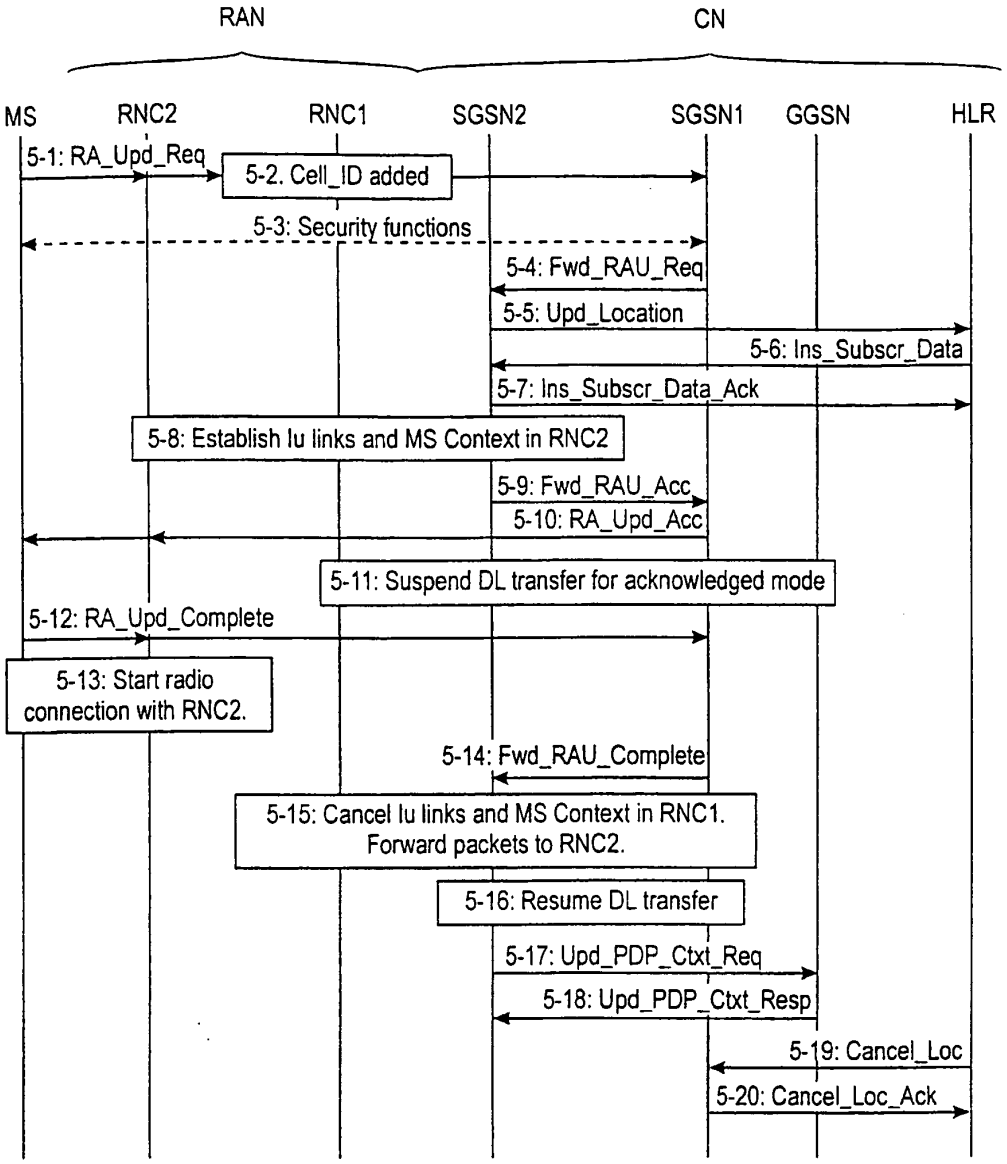

RAN
CN
MS
RNC2
RNC1
SGSN2
SGSN1
GGSN
MSC/VLR
HLR
4-1: RA_Upd_Req
4-2. Cell_ID added
4-3: PDP_Ctxt_Req
4-4. PDP_Ctxt_Resp
4-5: Forward Pkts
4-6: Security functions
4-7: Upd_PDP_Ctxt_Req
4-8: Upd_PDP_Ctxt_Resp
4-9: Upd_Location
4-10: Cancel_Loc
4-11: Cancel_Loc_Ack
4-12: Ins_Subscr_Data
4-13: Ins_Subscr_Data_Ack
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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"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

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INTERNATIONAL SEARCH REPORT
Information on patent family members

01/08/00

International application No.
PCT/FI 00/00357

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		AU 5900699 A	21/03/00
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		WO 0012593 A	09/03/00
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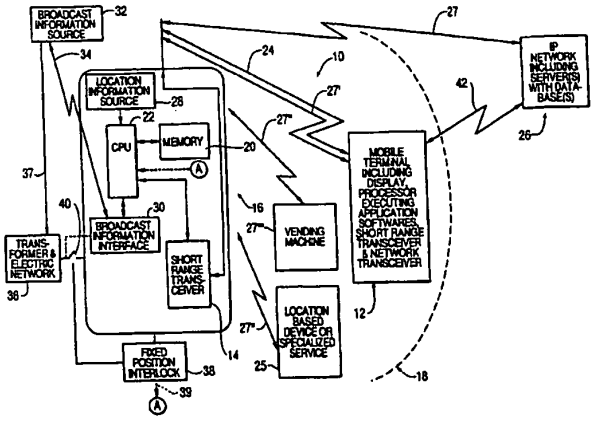
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(54) Title: METHOD AND SYSTEM FOR CONNECTING A MOBILE TERMINAL TO A DATABASE



(57) Abstract: The invention is a communication system (10) and a method of communication. The communication system includes an information source (20); a position transceiver (14) disposed at a broadcast location (16) and coupled to the information source, the position transceiver broadcasting information from the information source within a broadcast area (18) where the position transceiver is located, the information including identification information relating to the information source; a mobile terminal (12) within the broadcast area comprising first and second transceivers (44 and 46), the first transceiver communicating with the position transceiver; a network (42) communicating with the second transceiver; and a database (26), communicating with the network, storing information which is transmitted to the second transceiver associated with the identification information in response to the database receiving at least the identification information by transmission of the network from the mobile terminal to the database.

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METHOD AND SYSTEM FOR CONNECTING A MOBILE TERMINAL TO A DATABASE

BACKGROUND OF THE INVENTION

The invention relates to a system and method for transmitting information to a mobile terminal from an information source which transmitted information is transmitted by the mobile terminal to a database to fetch information associated with the transmitted information stored in the database for transmission back to the mobile terminal.

BACKGROUND ART

Advertisement media in publicly travelled places have the objective of obtaining the interest of a passerby. Typically, advertisements contain information which is directed to the consumer to obtain the consumers interest and further provide contact information, such as a telephone number or a fax number, where further information about the advertised goods or services may be obtained. Since the advent of IP networks (e.g., the internet), a uniform resource locator (URL) reference is also typically given in advertisements which enables the user to download information to a computer from an IP network about the advertisement to provide a more detailed consideration of the advertised goods or services.

Additionally, systems have been proposed in which the location of a user controls the accessing of an information source, such as a server based service. These systems may use a GPS receiver or a mobile telephone to provide the user's location to a system to control accessing of the information source which is particular to the users location.

Location services and location based services are becoming more important in telecommunication networks. It is possible to localize and indicate the position of a mobile telephone

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used, for example, for emergency calls. Many existing and new telecommunications services will benefit from knowing the position of the terminal being used. The drawback in current and planned telecommunications networks is that it is not possible to determine the position of the terminal being used or in an idle state accurately enough for all types of position dependent services in all circumstances. The achievable position determining accuracy is around 100m within a cellular network and around 10m with GPS. Not all mobile terminals will have GPS functionality.

Mobile terminals, which utilize cellular communications, are suitable for connecting a user to a website or other database to obtain information. The obtaining of information by a mobile terminal typically uses a linkage between a cellular telephone network to which the terminal subscribes and an IP network. However, the user of a mobile terminal, in order to access advertisement information or other sources of information, is required to write down from the advertisement the information for linking the mobile terminal to the website or other database, and use that information to connect the mobile terminal to an IP service provider to fetch information from the website or database. While it is possible to link an advertisement with a mobile terminal using cellular communications, such a cellular linkage has the disadvantage in highly crowded places, such as airports, of requiring substantial network capacity to link the advertisement to a large number of persons carrying mobile terminals which are passing by the advertisement.

Low power RF systems have been proposed, e.g. Bluetooth, for providing communications between a number of transceivers without or in a local area network by a short range radio link having a broadcast range of a few meters. Such systems will be commercially available in the near future and are designed to operate in open spectrum, e.g. 2.4 gigahertz.

Additionally, low power optical communication systems using an infrared carrier have been proposed which will provide

a linkage between a number of transceivers over a short range. These systems will perform functions similar to Bluetooth.

DISCLOSURE OF THE INVENTION

The present invention is a communication system and a method of communication which provides connectivity between at least one information source which provides information, such as information relating to location based services, at least one mobile terminal and at least one database. With the invention, at least one position transceiver is disposed at a broadcast location and is coupled to the information source. The information source provides information to the position transceiver which is broadcast to the at least one mobile terminal.

The position transceiver overcomes the location problems of the prior art by indicating and transmitting its own very exact predefined position to at least one mobile terminal within range and which is able to receive this information. The at least one mobile terminal can then communicate this position to a network and servers connected to the network to access information, such as information related to or part of position dependent services offered to the user of the mobile terminal.

In one preferred embodiment of the invention, the position transceiver is connected to a network server by fixed telephone lines or wireless connections. This connectivity enables the network server to update the information which is broadcasted by the position transceiver.

In another preferred embodiment of the invention, the information which is broadcasted is changed using a keyboard of the position transceiver or a PC connected to the position transmitter. The position transmitter only accepts appropriately authenticated changes.

The position transceiver can broadcast information to the mobile terminal continuously or on request of the user of the mobile terminal or only when the position transceiver

recognizes by any known mechanism that a mobile terminal or a mobile user of the mobile terminal is in the vicinity of the position transceiver.

The at least one position transceiver broadcasts information directed to the user of each mobile terminal to induce the user to communicate with the at least one database to retrieve information stored in each database over a network. The information broadcast by each position transceiver includes identification information which is related to and identifies the information source and which is transmitted by the mobile terminal over the network to the at least one database to address or identify the information in each database which is transmitted by the network back to the mobile terminal to enable the user thereof to use the retrieved information which is associated with the information source at the broadcast location. A display, which is part of each mobile terminal, enables the user to selectively review the information broadcast from a plurality of position transceivers and choose which information sources in each database from which the user wishes to obtain additional information associated with any of the identification information broadcast from the position transceivers. The broadcast information, may without limitation, be diverse types of information such as, but not limited to, advertising information and includes identification information relating to the source of the broadcast information.

Each mobile terminal is located within a broadcast area defined by the broadcast range of the at least one position transceiver located at a broadcast location. The at least one position transceiver preferably has a limited broadcast range so that the broadcast range is limited within the optical view of the users of the mobile terminals as they pass by the broadcast location.

Each mobile terminal is a multimode transceiver which operates in short range and cellular modes, and includes first and second transceivers. The first transceiver communicates

with at least one position transceiver and receives broadcasts therefrom which preferably are of limited range. While not limited thereto, the first transceiver may use a low power optical or RF broadcast communications to connect each position transceiver at the broadcast location to the first transceiver and the information source. A network communicates with the second transceiver which may be, without limitation, a cellular network connected to an IP network. Each database communicates with the network and stores information which is transmitted to the second transceiver of each mobile terminal associated with the identification information.

In a preferred operational mode of the present invention, the user of the mobile terminal passes within the broadcast area of at least one position transceiver disposed at a broadcast location. Each position transceiver either continually broadcasts information to the broadcast area, which permits each user of a mobile terminal to view with a display which is part of the mobile terminal information received by the first transceiver thereof which is being broadcast to the user, such as advertisement information and the identification information, which is used to fetch the information stored in each database by transmission from the second transceiver by the network to each database or broadcasts upon demand of the user of the mobile terminal to the mobile terminal.

Each mobile terminal includes a processor and associated memory. The associated memory stores the information received from each position transceiver by the first transceiver permitting the user of the mobile terminal at the time of reception or at a later time to utilize the second transceiver to connect to addressable areas in each database using the identification information transmitted to the first transceiver.

The identification information which is used to retrieve information for transmission to the second transceiver may be of many different types. For example, the identification information may be a function of a geographic position of the

broadcast location at which each information transceiver is located and may comprise one or more of geographical coordinates, the elevation of the broadcast location, an address of the broadcast location, including street address, or a pointer, or a uniform resource locator, which is an address or provides an identification of the information stored in the database associated with the identification information. While the invention is not limited thereto, the network in a preferred embodiment includes a cellular telephone network which is connected to an IP network which facilitates transmission by the transmission control protocol/internet protocol (TCP/IP).

In a preferred embodiment of the present invention, the broadcast location includes a plurality of information sources and a plurality of position transceivers disposed at the broadcast location respectively coupled to a different one of the plurality of information sources. Each position transceiver broadcasts information including identification information relating to one of the information sources from the broadcast location. The broadcast location includes a display which displays information relating to the information which is broadcast including the identification information broadcasted by each of the plurality of position transceivers. Each database stores information which is transmitted to the second transceiver associated with the identification information of the plurality of position transceivers in response to each database receiving at least the identification information by transmission by the network from the mobile terminal to each database.

A billboard type display may be utilized to display advertisement information or other information from a plurality of information sources which are viewed from a public place, such as an airport, through which multiple users of mobile terminals pass to attract their attention in a classic advertising manner. The billboard may continuously broadcast via the plurality of position transceivers over a limited range

(low power) RF or optical transmission medium information which is directed to the passersby with mobile terminals from each of the information sources. An activation switch may be associated with each of the information sources to permit the passers by to selectively activate the position transceiver associated with the information source to which the passerby is attracted by display of information on the billboard type display. Finally, the broadcast may be activated by detecting the presence of the passersby by a known mechanism, such as a motion detector, to activate the position transceivers to broadcast the information.

There are numerous applications for the position transceiver besides transmitting advertisement information. These additional applications are: emergency calls; navigational services in which the user of the mobile terminal is provided information how to travel from point A to point B; calibration of the location of the mobile terminal in a cellular network and calibration of the cellular network to determine location of mobile terminals; location based services, e.g. printing a document at the closest available printer; informing the user of the mobile terminal of special services available only at the broadcast location of the position transmitters, such as special telecommunications services; transmission of price information about goods and services and payment information, the user of the mobile terminal in response thereto sends the requested payment as a short message service (SMS) to a network server, and the position transceiver in response thereto receives payment acknowledgment from the network server receiving the payment and transmits the payment acknowledgment to the user of the mobile terminal and provides a transmission permitting the user of the mobile terminal to have access to the purchased goods or services.

A method of transmitting data in a communications system including an information source, a position transceiver coupled to the information source and disposed at a broadcast location,

a mobile terminal within a broadcast area, the mobile terminal comprising first and second transceivers with the first transceiver communicating with the position transceiver, a network communicating with the second transceiver and at least one database, communicating with the network and storing information associated with the identification information includes broadcasting information including identification information relating to the information source with the position transceiver to the first transceiver within the broadcast area; transmitting at least the identification information from the second transceiver with the network to the database; and in response to the database receiving at least the identification information, transmitting from the database the stored information associated with the identification information to the second transceiver. The identification information comprises information which is a function of a geographic position of the broadcast location which may be one or more of geographical coordinates, elevation of the broadcast location, an address of the broadcast location, which may be a street address, and further, a location within the street address, or a pointer, or a uniform resource locator which is an address of or identifies the information associated with the identification information in the database.

In a preferred embodiment of the method, the broadcast location comprises a plurality of information sources; a plurality of position transceivers disposed at the broadcast location respectively coupled to a different one of the plurality of information sources, each position transceiver broadcasting information including identification information relating to one of the information sources from the broadcast location; and a display which displays information relating to the information broadcasted by each of the plurality of position transceivers. Information which is stored in the database is transmitted to the second transceiver associated with the identification information of the plurality of position transceivers in response to the database receiving at

least the identification information by transmission by the network from the second transceiver of the mobile terminal to the database. The information which is broadcasted from each of the plurality of position transceivers may include a webpage or application software which is executed by a processor in the mobile terminal which controls the first and second transceivers. The application software may comprise without limitation a program for opening a window or a web browser for searching the information stored in the database identified by the identification information.

The broadcasted information may be encrypted. The position information transmitted from the second transceiver to the database may be signed by the user of the mobile terminal of when the information was transmitted from the information transceiver to the mobile terminal to indicate the user's current location to permit database verification that the user is where the user should be; and the database checks validity of the signature, decrypts the information which is received from the network and checks validity of the time stamp and if the time stamp and signature are valid, the database transmits the stored information associated with the identification information with the network to the second transceiver.

The plurality of position transceivers of the broadcast location may cease to broadcast the information when the plurality of information transceivers are moved. A device may be provided at the broadcast location which senses when the plurality of position transceivers are moved and which disables transmission of the information when movement is sensed. The device for sensing movement may be of diverse designs and may be a mechanical connection between the information transceivers and a physical location at which the information transceivers are located which, when opened, disables their normal function, e.g. by disconnecting electrical power. As an alternative, the position transceiver can start transmitting an error indication if the position transceiver is moved.

In a preferred embodiment of the method, each position transceiver broadcasts the information with a limited range RF carrier or a limited range infrared carrier and the network comprises a cellular telephone network and an IP network.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates a system diagram of an embodiment of the present invention.

Fig. 2 illustrates a schematic diagram of a mobile terminal in accordance with the present invention.

Fig. 3 illustrates a preferred embodiment of the broadcast location at which a plurality of position transceivers are located which are designed to communicate with multiple users of terminals in a public place which pass within broadcast range of the plurality of information transceivers.

Fig. 4 illustrates a memory map of a preferred embodiment of the database of the system of Fig. 1.

Like reference numerals identify like parts throughout the drawings.

BEST MODE FOR CARRYING OUT THE INVENTION

Fig. 1 illustrates a communication system 10 in accordance with the present invention. The communication system 10 provides a mechanism by which a user of a mobile terminal 12 receives information broadcast by a position transceiver 14 which without limitation has a short (limited) range and which is part of a broadcast location 16 which broadcasts information within a broadcast area 18. Only one position transceiver 14 is illustrated, but it should be understood that in a preferred embodiment of the present invention, a plurality of position transceivers are part of the broadcast location as described below in conjunction with Fig. 3. The position transceiver 14 broadcasts information, which is stored in memory 20, under the control of CPU 22, by means of a low power RF or infrared link 24. In a preferred form of the present invention, the link 24 may be in accordance with the Bluetooth specification

which has been proposed in unregulated spectrum, such as 2.4 GHz or known or proposed infrared communication links. In a preferred embodiment of the specification as illustrated in Fig. 2, a plurality of information transceivers 14, simultaneously, on demand or upon detection of a user of the mobile terminal 12 by any known mechanism within broadcast area 18, broadcast information via the low power RF or infrared link 24 to one or more mobile terminals 12 located within the broadcast area.

The information which is broadcast via the link 24 is diverse in nature and includes identification information. The information which is broadcast by at least one position transceiver 14 includes without limitation advertisements, information relating to making emergency calls, information relating to providing navigation services to enable a user of the mobile terminal 12 to move from a first position to a second position, information for calibrating a position of the mobile terminal 12 within a cellular network providing connection to the network transceiver therein or for calibrating the network positioning determination function, information relating to location and location based devices or services 25 which are proximate to the broadcast location and the mobile terminal from which the user of the mobile terminal receives goods or services after communication of the mobile terminal with a database within IP network including servers with database 26, such as printing a document by a closest available printer, information informing a user of the special services, such as telecommunications available only at the location of the position transceiver with the advertisement information including a price of goods or services and a requested form of payment indication with the user sending with the mobile terminal the requested form of payment to the database using a short message system (SMS) format and the network transmitting acknowledgment of payment 27 from the database to the position transmitter 14 and the position transmitter transmitting the acknowledgment 27' of payment to

the user of the mobile terminal and access 27'' location based device or specialized service 25 or to machine 27''' providing the purchased goods or receiver.

Broadcast advertising information may be diverse in nature. Advertising information may be a webpage and identification information which provides the mobile terminal 12 with the ability to access an IP network, including server(s), with database 26 and specifically, information stored in the database associated with the identification information transmitted from the position transceiver 14 to the mobile terminal 12 via link 24. The identification information provides an address of the server, database, or a portion of the database at which the information associated with the identification information is stored.

The broadcast location 16 further includes a location information source 28, which may be a GPS receiver which informs the CPU 22 of the physical location of the position transceiver 14, to provide the CPU with one possible form of the identification information which is a function of the geographic position of the broadcast location, e.g. geographical coordinates, and the elevation of the broadcast location. Alternatively, the physical location may be programmed into the memory 20 at the time of setup of the system and entered by keyboard and a PC. The identification information may be a physical address of the broadcast location, such as the street address, and further information defining the location of the broadcast location 16 within the street address, such as floor and room number at which at least one position transceiver is located which is stored in the memory 20 as a consequence of this information being readily programmable. Furthermore, the identification information may be a pointer, which may be numerically based or a uniform resource locator (URL).

The function of the identification information, regardless of its content as described above, is to provide a linkage between the user of the mobile terminal 12, the information

source of the information transmitted by at least one position transceiver 14 and the information which is transmitted from the database within the IP network including servers with database 26 to the mobile terminal which is associated with the identification information broadcast from the at least one position transceiver 14 by the link 24 to the mobile terminal 12.

The broadcast location 16 facilitates the diverse applications discussed above, including marketing and advertising. The broadcast location obtains the initial interest of the user of the mobile terminal 12 by the displays 50 of information associated with the broadcast location 16 as described below in association with Fig. 3, or from a display 49' in Fig. 2 associated with the mobile terminal indicating the nature of the information being transmitted from the at least one position transceiver 14 to the mobile terminal 12, e.g. a webpage, etc. The user of the terminal 12 is then induced by the initial visual contact with the displays 49' and/or 50 to contact the database within the IP network, including server(s) with database, to obtain more information associated with the identification information.

The broadcast location 16 further includes a broadcast information interface 30. The broadcast information interface 30 is coupled to the CPU 22 and associated memory 20. The memory 20 functions as the source of broadcast information after it is inputted through the broadcast information interface 30. A broadcast information source 32, which may be a server in a network, is coupled to the broadcast information interface 20 by wireline (not illustrated), RF link 34, which may be cellular or other RF communications, or through modulation of information transmitted over the electric mains 37 to transformer and electric network 36. The broadcast information source 32 may be proximate to the broadcast location 16 or remote therefrom and provides the broadcast location with the capability of having the information which is broadcast updated. Alternatively, the broadcast information

source 32 may be eliminated by use of a keyboard or local PC at the location 16 to directly provide the information including identification to the memory 20 which is broadcast by the at least one position transceiver 14. A fixed position interlock 38 may be used to disable the application of electrical power from the transformer and electrical network 36 to the broadcast location 16 by opening switch 40 when the broadcast location 16 is physically moved or to cause an error message to be broadcast in response to signal 39 generated by the fixed position interlock. The fixed position interlock 38 may be, for example without limitation, a mechanical lock, hidden seals, a movement detector or magnetic sensor which, upon movement, causes switch 40 to open to disconnect electric power from the broadcast location 16 or to generate the signal 39 to cause the error message to be broadcast.

The mobile terminal 12 includes first and second transceivers which respectively are a transceiver which is connected to the broadcast location 16 via links 24 and 27 and a network transceiver, which is preferably a cellular transceiver, that is connected by RF link 42 to the IP network, including servers with database 26. However, it should be understood that the present invention is not limited to the use of a cellular network connected to an IP network including server(s) with database 26. Alternatively, the cellular network or other communication network may link the second transceiver directly to a database with or without a server.

Fig. 2 illustrates a block diagram of one form of a mobile terminal 12 which may be used to practice the invention. The mobile terminal 12 is a multimode receiver including a first transceiver 44 which communicates with the position transceiver 14 and may operate as a short range device without limitation in accordance with the Bluetooth RF specification or a limited range infrared specification and a second transceiver which operates as a network transceiver 46 which without limitation may be a cellular transceiver over which the user of the terminal 12 receives voice, PCS, etc.,

communications. The mobile terminal 12 has a main CPU 48 and associated memory 49 which stores the information which is transmitted and received by the first and second transceivers 44 and 46. The main CPU 48 executes software which transfer the information received by the first transceiver 44 to the second transceiver 46 and drives the display 49' which displays the information received from the at least one position transceiver 14 including, but not limited to, the identification information and other information for the above-identified diverse applications including advertising, such as a web page, browser, etc.

As has been described above, identification information, which is transmitted by the link 24, performs the function of addressing or identifying particular blocks of data within the database of the IP network, including servers with database 26, which are transmitted by link 42 to the network transceiver 46 within the mobile terminal 12. The information which is received from the database 26 by the network transceiver 46 enables the user of the mobile terminal 12 to obtain more detailed information about the information which is broadcast by the link 24 including display on display 49'. This function enhances the diverse applications discussed above, including an advertising function, by providing a complete linkage to the detailed source of information associated with the identification information broadcast by the broadcast location 16 stored within the database within the IP network including server(s) with database 26.

In normal operation, each mobile terminal 12, when it is within the broadcast area 18, displays on the display 49' information regarding the information being broadcast from the broadcast location 16. This enables the user of each mobile terminal 12, when multiple short range position transceivers 14 are used, to pick and choose from the information which is most interesting which is being broadcast from a plurality of information sources at the broadcast location 16. This information, which is displayed on the display 49' of the

mobile terminal 12, has associated with it the identification information which is transmitted via links 24 and 42 to the database within the IP network, including server(s) with database 26, to fetch the more detailed information stored in the database which is associated with the identification information for transmission back to the users of each mobile terminal 12 to enable the users to learn of more information regarding the source of the broadcast information from the location 16. This functionality facilitates advertisement and the other applications discussed above by obtaining the attention of users of mobile terminals 12 while at the same time not having to rely upon calls being made to cellular transceivers within the broadcast area 18. With the present invention, the information that is broadcast to each mobile terminal 12 when the users are within the broadcast area 18 contains sufficient information to obtain the attention of the users and to enable the users to obtain complete access to information stored in the remote databases, such as manufacturer's information to induce a sale, which is associated with the information, which is broadcast and/or displayed at the broadcast location 16, as described below in conjunction with Fig. 3.

The CPU 48 within the mobile terminal 12, which controls overall operation thereof, coordinates the transmission of information between the broadcast location 16 and the IP network, including server(s) with database 26. The CPU 48 processes the identification information which is received by the first short range transceiver 44 from the broadcast location 16 and is transmitted by the second network cellular transceiver 46 to the IP network including server(s) with database 26. The CPU 48 provides accessability to the memory 49 therein to both of the first and second transceivers 44 and 46 so as to facilitate transmission of information between the transceivers to provide the requisite information flow.

While the invention is not limited thereto, the identification information sent by the location position 16, may contain added information for security reasons. The information which is transmitted from the broadcast location 16 by link 24 to the mobile terminal 12 may include unencrypted information and encrypted information. The encrypted information may include as part of its identifying information, a time stamp with all of the encrypted information being encrypted by a MLC public key which may be encrypted, for example, with RSA public key cryptography. The encrypted message may be signed by the user with secret key. The server in the IP network, including server(s) with database 26, checks the signature, decrpyts the transmission of information from the mobile terminal 12, and determines if the time stamp is valid. If all of this information is verified, the server within the IP network including server(s) with database 26 may conclude with a high probability that the user of the mobile terminal 12 is in fact an authorized user and provide the user of the mobile terminal 12 with access thereto.

Fig. 3 illustrates a preferred embodiment of the broadcast location 16. The location source 16 includes a plurality of information sources 50 which are N in number. Each information source 50 provides a display of information and has an associated display driver including processor which is designed to attract the attention of the users of the mobile terminal 12 to induce the users to communicate with the databases within the IP network, including server(s) with database 26, to obtain more detailed information associated with the identification information which is transmitted by the communication link 24. Each information source 50 is associated with a particular position transceiver 14 so that the visual impression produced by the display thereof is related to the information which is transmitted to the mobile terminals 12 and displayed on the display 49' thereof and is related to the identification information which performs the function of addressing or identifying particular information stored in the database of

the IP network, including server(s) with database 26. The stored information, which is identified by the identification information, is transmitted by link 42 back to the second transceiver 46, as described below in association with Fig. 4 or via link 27 to the broadcast location 16. Each information transceiver 14 may include an on/off switch 52 which is associated with a correspondingly identified display 50 and which, upon activation by the user of the mobile terminal 12 within the broadcast area 18, causes the information, including identification information, to be transmitted by the link 24 to the user's terminal 12.

The displays 50 are a form of billboard and may contain diverse information but in environments where marketing is to be performed, the information is directed to soliciting the attention of the users of the mobile terminals 12 to obtain more information about the goods or services available for purchase which are described in the display. The particular displays 50 are not limited to any particular configuration and the overall broadcast location 16 of Fig. 3 may be located at a table with each of the individual transceivers 14 being located on the table.

Fig. 4 illustrates a memory map 100 of an individual server in the IP network including server(s) with database 26. The database 102 includes a plurality of bodies of information which are N in number which correspond to the N information sources of the broadcast location 16. Each information source 104 is addressed or identified by the identification information broadcasted over the link 24 to the mobile terminal 12 and transmitted by the network over link 42 to the server including the database 102. The server associated with the database 102, in response to the identification information, fetches a particular block of information 104 associated with the identification information. The fetched information is transmitted over communication link 42 to the mobile terminal 12 to enable the user thereof to learn more about the goods or services or other information associated

with the individual information sources 50 of the broadcast locations of Fig. 2.

While the invention has been described in terms of its preferred embodiments, it should be understood that numerous modifications may be made thereto without departing from the spirit and scope of the invention as defined in the appended claims. It is intended that all such modifications fall within the scope of the appended claims.

CLAIMS

1. A communication system comprising:

an information source;

a position transceiver disposed at a broadcast location and coupled to the information source, the position transceiver broadcasting information from the information source within a broadcast area where the position transceiver is located, the broadcasted information including identification information relating to the information source;

a mobile terminal within the broadcast area comprising first and second transceivers, the first transceiver communicating with the position transceiver;

a network communicating with the second transceiver; and

a database, communicating with the network, storing information which is transmitted to the second transceiver associated with the identification information in response to the database receiving at least the identification information by transmission of the network from the mobile terminal to the database.

2. A communication system in accordance with claim 1 wherein:

the identification information comprises information which is a function of a geographic position of the broadcast location.

3. A communication system in accordance with claim 2 wherein:

the identification information comprises geographical coordinates.

4. A communication system in accordance with claim 3 wherein:

the identification information further comprises elevation of the broadcast location.

5. A communication system in accordance with claim 2 wherein:
the identification information comprises an address of the broadcast location.

6. A communication system in accordance with claim 5 wherein:
the address is a street address.

7. A communication system in accordance with claim 6 wherein:
the identification information further defines a location within the street address.

8. A communication system in accordance with claim 1 wherein:
the identification information is a pointer which identifies a location of the position transceiver associated with corresponding data of the database where the information which is transmitted to the second transceiver is stored.

9. A communication system in accordance with claim 1 wherein:
the identification information, which is broadcasted from the position transceiver, includes a uniform resource locator which is an address of the information associated with the identification information in the database in the network.

10. A communication system in accordance with claim 1 wherein the broadcast location comprises:
a plurality of information sources;
a plurality of position transceivers disposed at the broadcast location respectively coupled to a different one of

the plurality of information sources, each position transceiver broadcasting information including identification information relating to one of the information sources from the broadcast location; and

a display which displays information relating to the information broadcasted by each of the plurality of position transceivers; and wherein

the database stores information which is transmitted to the second transceiver associated with the identification information of the plurality of position transceivers in response to the database receiving at least the identification information by transmission of the network from the mobile terminal to the database.

11. A communication system in accordance with claim 10 wherein:

the identification information, which is broadcasted from each of the plurality of position transceivers, includes a uniform resource locator which is an address of the information associated with the identification information in the database in the network.

12. A communication system in accordance with claim 10 wherein:

the information, which is broadcasted from each of the plurality of position transceivers, includes a web page.

13. A communication system in accordance with claim 10 wherein:

the information, which is broadcasted from each of the plurality of position transceivers, includes application software which is executed by a processor in the mobile terminal.

14. A communication system in accordance with claim 13 wherein:

the application software comprises an application program for opening a window.

15. A communication system in accordance with claim 13 wherein:

the application software comprises a web browser for searching the information stored in the database identified by the identifying information.

16. A communication system in accordance with claim 1 wherein:

the information is encrypted.

17. A communication system in accordance with claim 16 wherein:

the transmission of the information from the mobile terminal to the database is signed by a user of the mobile terminal with a time stamp of when the information was transmitted from the position transceiver to the mobile terminal to indicate the user's current location to permit database verification that the user is where the user should be; and

the database checks validity of the signature, decrypts the encrypted information which is received from the network and checks validity of the time stamp and if the time stamp and signature are valid, the database transmits the stored information associated with the identification information via the network to the second transceiver.

18. A communication system in accordance with claim 10 wherein:

the plurality of position transceivers of the broadcast location cease to broadcast the information when the plurality of position transceivers are moved.

19. A communication system in accordance with claim 18 wherein:

the broadcast location includes a device which senses when the plurality of position transceivers are moved and which disables transmission of the information when movement of the plurality of position transceivers is sensed.

20. A communication system in accordance with claim 1 wherein:

the position transceiver broadcasts the information with a limited range RF carrier.

21. A communication system in accordance with claim 1 wherein:

the position transceiver broadcasts the information with an infrared carrier.

22. A communication system in accordance with claim 10 wherein:

the broadcast location includes a device which senses when the plurality of position transmitters are moved; and

the plurality of position transceivers transmit an error indication when the device senses the plurality of information transceivers are moved.

23. A communication system in accordance with claim 1 wherein:

the broadcasted information includes an advertisement.

24. A communication system in accordance with claim 1 wherein:

the broadcasted information includes an emergency call.

25. A communication system in accordance with claim 1 wherein:

the broadcasted information includes information providing a service to enable a user of the mobile terminal to move from a first location to a second location.

26. A communication system in accordance with claim 1 wherein:

the broadcasted information provides calibration of where the mobile terminal is located in the network.

27. A communication system in accordance with claim 1 wherein:

the broadcasted information provides position calibration of the network.

28. A communication system in accordance with claim 1 wherein:

the broadcasted information relates to services which are available to a user of the mobile terminal when the user is in a vicinity of the broadcast location.

29. A communication system in accordance with claim 1 wherein:

the broadcasted information relates to communication services which are available to a user of the mobile terminal only when the user is in a vicinity of the broadcast location.

30. A communication system in accordance with claim 1 wherein:

the broadcasted information relates to a price for goods or services and an indication where payment may be transmitted if a user of the mobile terminal wishes to purchase the goods or services; and

the mobile terminal transmits payment for purchasing the goods or services to the database.

31. A communication system in accordance with claim 30 wherein:

acknowledgment of the payment is transmitted to the position transmitter and;

the position transceiver transmits the payment acknowledgment to the mobile terminal.

32. A communication system in accordance with claim 31 wherein:

the transmission of the payment acknowledgment to the mobile terminal also permits the user of the mobile terminal to have access to the purchased goods or services.

33. A method of transmitting data in a communication system including an information source, a position transceiver coupled to the information source and disposed at a broadcast location, a mobile terminal within a broadcast area comprising first and second transceivers with the first transceiver communicating with the position transceiver, a network communicating with the second transceiver and a database, communicating with the network, storing information associated with the identification information comprising:

broadcasting with the position transceiver information including identification information relating to the information source to the first transceiver within the broadcast area;

transmitting at least the identification information from the second transceiver with the network to the database; and

in response to the database receiving at least the identification information, transmitting from the database the stored information associated with the identification information to the second transceiver.

34. A method in accordance with claim 33 wherein:

the identification information comprises geographical coordinates.

35. A method in accordance with claim 34 wherein:
the identification information further comprises an elevation of the broadcast location.

36. A method in accordance with claim 35 wherein:
the identification information comprises an address of the broadcast location.

37. A method in accordance with claim 36 wherein:
the identification information further defines a location within a street address.

38. A method in accordance with claim 33 wherein:
the identifying information is a pointer which identifies a location of the position transceiver associated with corresponding data of the database where the information which is transmitted to the second transceiver is stored.

39. A method in accordance with claim 33 wherein:
the broadcast location comprises a plurality of information sources, a plurality of position transceivers disposed at the broadcast location respectively coupled to a different one of the plurality of information sources, each position transceiver broadcasting information including identification information relating to one of the information sources from the broadcast location;
a display which displays information relating to the information broadcasted by each of the plurality of position transceivers; and
information, stored in the database associated with the identification information of the plurality of position transceivers, is transmitted to the second transceiver in response to the database receiving at least the identification

information by transmission by the network from the mobile terminal to the database.

40. A method in accordance with claim 33 wherein:
the identification information, which is broadcasted from the position transceiver, includes a uniform resource locator which is an address of the information associated with the identification information in the database in the network.

41. A method in accordance with claim 39 wherein:
the identification information, which is broadcasted from each of the plurality of position transceivers, includes a uniform resource locator which is an address of the information associated with the identification information in the database in the network.

42. A method in accordance with claim 39 wherein:
the information, which is broadcasted from each of the plurality of position transceivers, includes a web page.

43. A method in accordance with claim 39 wherein:
the information, which is broadcasted from each of the plurality of position transceivers, includes application software which is executed by a processor in the mobile terminal.

44. A method in accordance with claim 43 wherein:
the application software comprises an application program for opening a window.

45. A method in accordance with claim 43 wherein:
the application software comprises a web browser for searching the information stored in the database identified by the identifying information.

46. A method in accordance with claim 33 wherein:
the information is encrypted.

47. A method in accordance with claim 46 wherein:
the transmission of the information from the second transceiver to the database is signed by a user of the mobile terminal with a secret key and includes a time stamp of when the information was transmitted from the position transceiver to the mobile terminal; and
the database checks validity of the signature, decrypts the information which is received from the network and checks validity of the time stamp and if the time stamp and signature are valid, the database transmits the stored information associated with the identification information via the network to the second transceiver.

48. A method in accordance with claim 39 wherein:
the plurality of position transceivers of the broadcast location cease to broadcast the information when the plurality of information transceivers are moved.

49. A method in accordance with claim 48 wherein:
the broadcast location includes a device which senses when the plurality of position transceivers are moved and which disables transmission of the information when movement is sensed.

50. A method in accordance with claim 33 wherein:
the position transceiver broadcasts the information with a limited range RF carrier.

51. A method in accordance with claim 33 wherein:
the position transceiver broadcasts the information with a limited range infrared carrier.

52. A method in accordance with claim 33 wherein

the network comprises a cellular telephone network and an IP network.

53. A method in accordance with claim 33 wherein:
the broadcast location includes a device which senses when the plurality of position transmitters are moved; and
the plurality of position transceivers transmit an error indication when the device senses the plurality of information transceivers are moved.

54. A method in accordance with claim 33 wherein:
the broadcasted information includes an advertisement.

55. A method in accordance with claim 33 wherein:
the broadcasted information includes an emergency call.

56. A method in accordance with claim 33 wherein:
the broadcasted information includes information providing a service to move from a first location to a second location.

57. A method in accordance with claim 33 wherein:
the broadcasted information provides calibration of where the mobile terminal is located in the network.

58. A method in accordance with claim 33 wherein:
the broadcasted information provides calibration of the network.

59. A method in accordance with claim 33 wherein:
the broadcasted information provides calibration of position determination by the network.

60. A method in accordance with claim 33 wherein:

the broadcasted information relates to services which are available to a user of the mobile terminal when the user is in a vicinity of the broadcast location.

61. A method in accordance with claim 33 wherein:
the broadcasted information relates to communication services which are available to a user of the mobile terminal only when the user is in a vicinity of the broadcast location.

62. A method in accordance with claim 33 wherein:
the broadcasted information relates to a price for goods or services and an indication where payment may be transmitted if a user of the mobile terminal wishes to purchase the goods or services; and
the mobile terminal transmits payment for purchasing the goods or services to the database.

63. A method in accordance with claim 62 wherein:
acknowledgment of the payment is transmitted to the position transmitter and;
the transceiver transmits the payment acknowledgment to the mobile terminal.

64. A method in accordance with claim 63 wherein:
the transmission of the payment acknowledgment to the mobile terminal also permits the user of the mobile terminal to have access to the purchased goods or services.

65. A method in accordance with claim 33 wherein:
the information broadcasted with the position transceiver is continuously broadcast.

66. A method in accordance with claim 33 wherein:
the information broadcasted with the position transceiver is broadcasted upon activation of the position transmitter by the user of the mobile terminal.

67. A method in accordance with claim 33 wherein:

the information broadcasted with the position transceiver detection is broadcasted when presence of a user of the mobile terminal in a vicinity of the position transmitter is detected.

FIG. 1

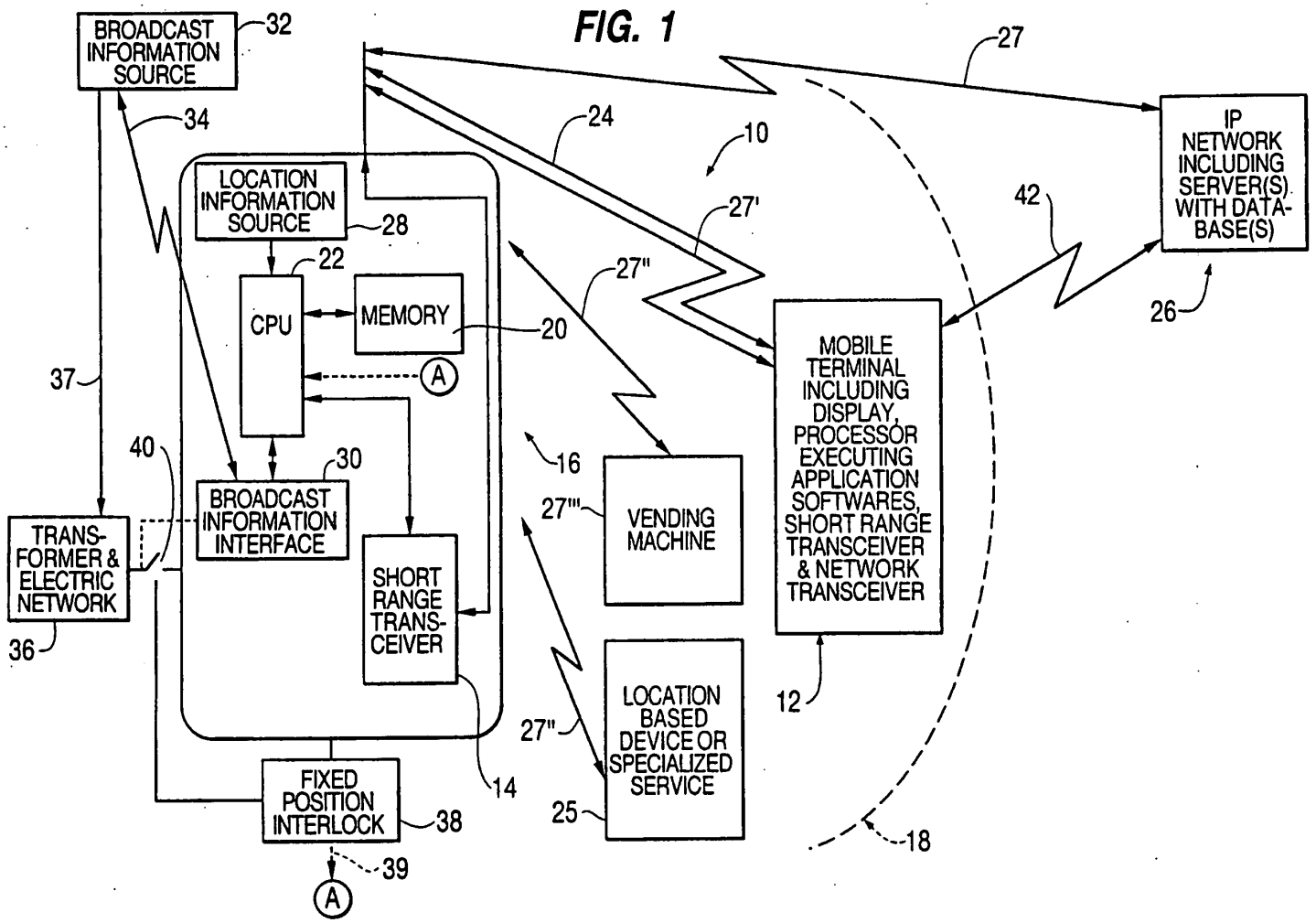

BROADCAST INFORMATION SOURCE
32
34
LOCATION INFORMATION SOURCE
28
22
CPU
MEMORY
20
A
37
40
30
BROADCAST INFORMATION INTERFACE
TRANS-FORMER & ELECTRIC NETWORK
36
SHORT RANGE TRANS-CEIVER
14
FIXED POSITION INTERLOCK
38
39
A
24
10
27
27'
27"
IP NETWORK INCLUDING SERVER(S) WITH DATA-BASE(S)
42
26
MOBILE TERMINAL INCLUDING DISPLAY, PROCESSOR EXECUTING APPLICATION SOFTWARES, SHORT RANGE TRANSCEIVER & NETWORK TRANSCEIVER
12
16
27'''
VENDING MACHINE
27"
LOCATION BASED DEVICE OR SPECIALIZED SERVICE
25
18

FIG. 2

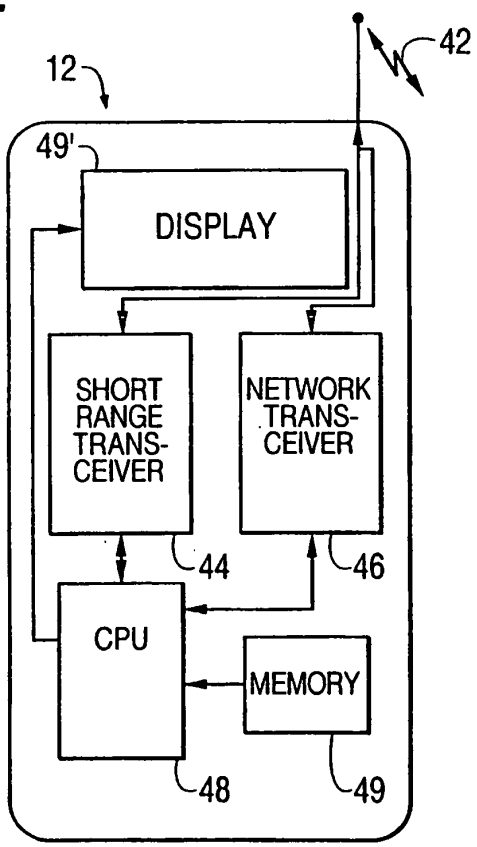

12
42
49'
DISPLAY
SHORT RANGE TRANS-CEIVER
NETWORK TRANS-CEIVER
44
46
CPU
MEMORY
48
49

FIG. 3

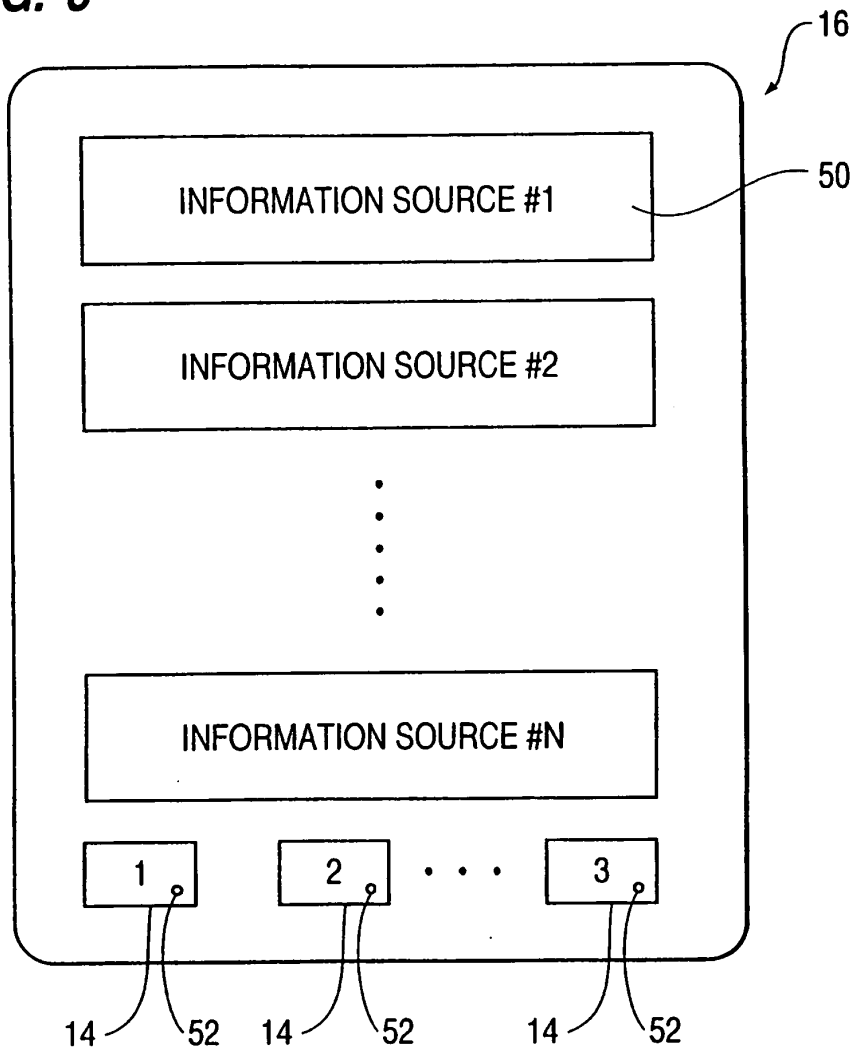
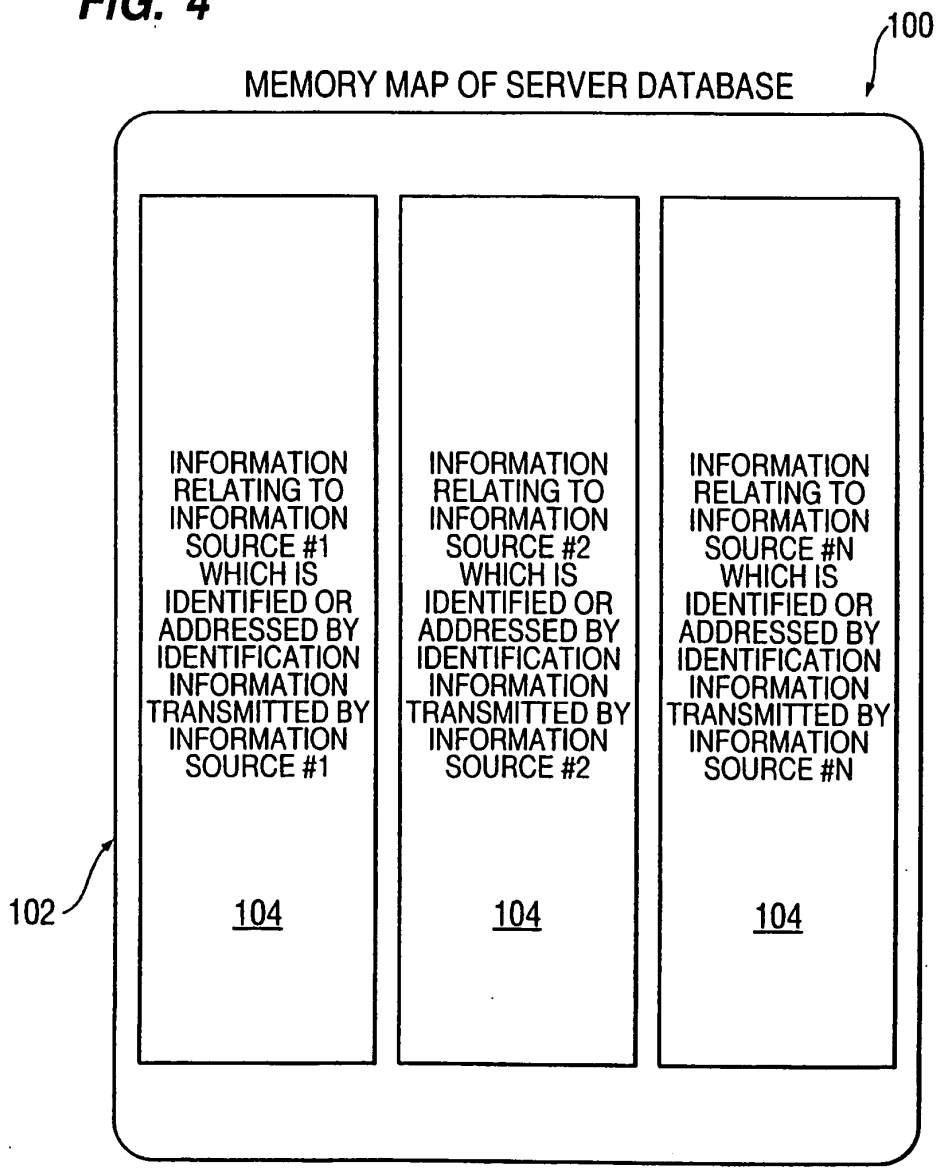

16
50
INFORMATION SOURCE #1
INFORMATION SOURCE #2
INFORMATION SOURCE #N
1
2
3
14
52
14
52
14
52

FIG. 4


100
MEMORY MAP OF SERVER DATABASE
INFORMATION RELATING TO INFORMATION SOURCE #1 WHICH IS IDENTIFIED OR ADDRESSED BY IDENTIFICATION INFORMATION TRANSMITTED BY INFORMATION SOURCE #1
104
INFORMATION RELATING TO INFORMATION SOURCE #2 WHICH IS IDENTIFIED OR ADDRESSED BY IDENTIFICATION INFORMATION TRANSMITTED BY INFORMATION SOURCE #2
104
INFORMATION RELATING TO INFORMATION SOURCE #N WHICH IS IDENTIFIED OR ADDRESSED BY IDENTIFICATION INFORMATION TRANSMITTED BY INFORMATION SOURCE #N
104
102

INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/IB 00/00770

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 G01S 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)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 796 351 A (YABUKI TSUTOMU) 18 August 1998 (1998-08-18) column 1, line 57 -column 2, line 54 figure 1 --- -/--	1-9,16, 20,21, 23, 26-30, 33-38, 40,46, 50-52, 54, 57-62, 65-67

[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)

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"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

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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
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3

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INTERNATIONAL SEARCH REPORT

Int. ional Application No
PCT/IB 00/00770

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 848 564 A (BOSCH GMBH ROBERT) 17 June 1998 (1998-06-17) column 2, line 24 - line 57 column 4, line 18 - line 24 figure 1	1-9,16, 20,21, 23, 26-30, 33-38, 40,46, 50-52, 54, 57-62,65
A	EP 0 697 670 A (AT & T CORP) 21 February 1996 (1996-02-21) column 2, line 33 -column 4, line 32 figures 1-3	1,30-33, 62-64
A	EP 0 785 535 A (MITSUBISHI ELECTRIC CORP) 23 July 1997 (1997-07-23) column 4, line 15 -column 5, line 50 column 7, line 31 -column 8, line 16 claims 1,4,6,7,9 figures 2,3,8-10	1-3, 9-15,33, 34,40-44
A	WO 98 47116 A (ERICSSON TELEFON AB L M) 22 October 1998 (1998-10-22) page 3, line 24 -page 4, line 6 page 23, line 24 -page 24, line 1 figure 1	1,16,17, 33,46,62

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

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte onal Application No
PCT/IB 00/00770

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		EP 0976116 A	02-02-2000
		NO 995031 A	16-12-1999

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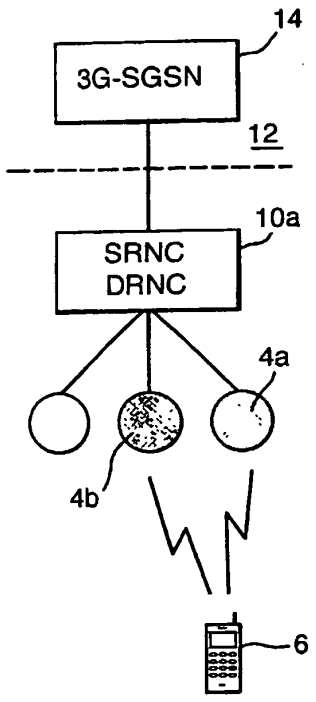
(74) Agents: STYLE, Kelda, Camilla, Karen et al.; Page White & Farrer, 54 Doughty Street, London WC1N 2LS (GB).

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[Continued on next page]

(54) Title: RELEASING A CONNECTION IN A WIRELESS COMMUNICATION NETWORK



(57) Abstract: A network element (10a), such as a radio network controller, for use in a communication network (e.g. UMTS), said network element (10a) being arranged between an end station (6) and an end element (14), for example an SGSN, wherein connections are established between said end station (6) and said end element (14) via said network element (10a), said network element (10a) comprising means for determining if the connection between said end element (14) and said end station (6) is to be released.

WO 00/76243 A1



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.

RELEASING A CONNECTION IN A WIRELESS COMMUNICATION NETWORK

Field of the Invention

The present invention relates to a network element for use in a communications network. In particular, but not exclusively, the network element is a radio network controller in a code division multiple access wireless cellular communications network.

Background of the Invention

The use of code division multiple access (CDMA) is being proposed for the next generation of cellular telecommunication networks. Additionally, code division multiple access is also being used in the IS-95 standard in the USA. CDMA is a direct sequence spread spectrum technique. In a wireless cellular network using CDMA, the mobile stations in one cell associated with a first base station will use the same frequency as mobile stations in an adjacent cell associated with the second base station. The different mobile stations can be distinguished by the respective base stations as each mobile station will be using a different spreading code.

In one of the new CDMA standards which is currently being proposed, connections are made between a mobile station to a base station, from the base station to a radio network controller and from the radio network controller to a core network. The core network is arranged to control the establishment and release of connections between the mobile station and the core network. With "bursty" traffic which consists of packets of data which are sent irregularly, the

core network is unable to predict the traffic which is to be transmitted between the core network and the mobile station and vice versa.

It has been proposed that a timer mechanism be used by the core network in order to control the release of the connection. For example, if a packet of data has not been received for X seconds, then the connection is released.

This method has the problem that the core network may not release this connection at an appropriate time. This is because the core network is not aware of parameters of the radio network controller or the mobile station which might indicate that an earlier break in the connection was appropriate. This may result in connections being maintained longer than required. This unnecessarily uses up resources within the network, which may reduce the amount of traffic which can be supported.

Summary of the Invention

It is an aim of embodiments of the present invention to address this problem.

According to one aspect of the present invention, there is provided a network element for use in a communications network, said network element being arranged between an end station and an end element, wherein connections are established between said end station and said end element via said network element, said network element comprising means for determining if the connection between said end element and said end station is to be released.

Brief Description of the Drawings

For 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 to the accompanying drawings in which:-

Figure 1 shows a cellular telecommunication network in which embodiments of the present invention can be incorporated;

Figure 2A shows a mobile station in communication with two base stations under the control of a single radio network controller;

Figure 2B shows a mobile station in communication with two base stations, each of which is connected to a different radio network controller;

Figure 3A shows the connection before the serving radio network controller is changed;

Figure 3B shows the connections after the serving radio network controller has been changed;

Figure 4 shows the various radio resource control modes;

Figure 5 shows a first embodiment of the present invention; and

Figure 6 shows a second embodiment of the present invention.

Detailed Description of Embodiments of the Present Invention

Reference will first be made to Figure 1 in which three cells 2 of the cellular telecommunications network are shown. Each cell 2 is served by a respective base transceiver station (BTS) 4. The base station is sometimes called node B in CDMA systems. Each base transceiver station is arranged to transmit signals to and receive signals from the mobile stations 6 located in the cell

associated with the given base transceiver station 4. Likewise, each mobile station 6 is able to transmit signals to and receive signals from the respective base transceiver station 4.

The cellular telecommunications network shown in Figure 1 uses a code division multiple access technique.

With the proposed new CDMA standard, macro diversity is possible. This means that a mobile station can be connected to more than one radio network controller RNC at the same time. However, as far as the core network is concerned, these connections are controlled by one radio network controller which is defined as the serving radio network controller SRNC. This serving radio network controller SRNC communicates with a third generation serving GPRS support node 3G-SGSN. This serving GPRS support node is analogous to that of the GPRS standard used in conjunction with the GSM standard but has been modified so as to be usable with the CDMA standard.

Reference is made to Figure 2A. In Figure 2A, a mobile station 6 is in communication with two base stations 4a and 4b. Each of these base stations 4a and 4b is connected to the same radio network controller RNC 10a. The common radio network controller 10a is thus the serving radio network controller and is connected to the core network 12. This core network 12 is represented by the dashed line and is the part of the network upstream of the serving radio network controller. The serving radio network controller 10a is in fact connected to the third generation serving GPRS support node 3G-SGSN 14 of the core network 12.

Reference is now made to Figure 2B which shows the mobile station 6 connected to two base stations 4c and 4d. However, unlike in Figure 2A, one base station 4c is connected to one radio network controller 10c whilst the other base station 4d is connected to a second radio network controller 10b. One of these radio network controllers acts as the serving radio network controller SRNC 10b. In the embodiment shown in Figure 2B, the second radio network controller 10b acts as the serving radio network controller. The other radio network controller 10c is defined as being a drift radio network controller DRNC. The drift radio network controller 10c is connected to the serving radio network controller 10b. The serving radio network controller 10b is, as in the arrangement shown in Figure 2A, connected to the SGSN 14. In the arrangement shown in Figure 2A, the drift radio network controller and the serving radio network controller are the same radio network controller.

The serving radio network controller 10a or b is able to combine information received from the mobile station 6 via the two different base stations 4a-d, regardless of whether or not the base stations are connected to the same radio network controller or different radio network controllers. In the latter situation, the drift radio network controller 10c would forward information from the respective base station 4c to the serving radio network controller 10b. The serving radio network controller 10b also copies information which is intended for a given mobile station 6 to the relevant drift radio network controller 10c so that the base station 4c connected to the serving radio network controller 10b as well as the base station connected to the drift radio

network controller 10c can be transmit the same information, where appropriate, to the mobile station 6.

The serving radio network controller SRNC is arranged to control the information transfer and request for radio resources from the appropriate drift radio network controllers DRNC. The drift radio network controllers only relay information between the mobile station and the serving radio network controller SRNC.

It is preferred that the same serving radio network controller SRNC be used for packet switched traffic (i.e. data transmitted in packet form) and circuit switched traffic i.e. speech.

When a mobile station moves, the base station or base stations with which the mobile station is in communication needs to change. This may mean that a different serving radio network controller may be required. This is described in relation to Figures 3A and 3B. In the arrangement shown in Figure 3A, the mobile station 6 is in communication with a single base station 4. This base station 4 is connected to the drift radio network controller 10c. The drift radio network controller is connected to the serving radio network controller 10b, as shown in Figure 2B. The serving radio network controller is connected to the current SGSN 14 which is in turn connected to the gateway GPRS serving node 16. Accordingly, signals to and from the mobile station follow the following path: mobile station 6 to the base station 4c connected to the drift RNC 10c, to the drift RNC 10c, from the drift RNC 10c to the serving RNC 10b, from the serving RNC 10b to the current SGSN 14 and from the current SGSN 14

to the GGSN 16. The same path is used for signals from the GGSN 16 to the mobile station 6, but in reverse.

The SGSN 14 also has a connection to a home location register 18. Each radio network controller 10b and 10c is connected to respective 3G mobile services switching centres 20a and 20b. The drift radio network controller 10c is connected to a different serving GPRS support node 22, which is not in use in this mode. There is also a connection between the home location register 18 and the third generation mobile services switching center 20a connected to the serving radio network controller 10b.

Reference is now made to Figure 3B which shows the connections which are established once the serving radio network controller has changed. In this arrangement, the drift radio network controller 10c becomes the serving radio network controller. The serving radio network controller 10b may become a drift radio network controller or may not be involved in communications with the mobile station 6. The mobile station continues to send and receive signals from the base station 4c connected to the new serving radio network controller 10c. The new serving radio network controller 10c has established a connection with the SGSN 22 to which it is connected. Signals from the serving GPRS node 22 connected to the new serving radio network controller 10c are passed to the GGSN 16. A connection is established between the home location register HLR 18 and the mobile services switching centre 20b connected to the new serving radio network controller 10c. A connection is also established between the home location register 18 and the SGSN 22 connected to the new serving radio network controller 10c.

This relocation procedure takes place when the target radio network controller (i.e. a drift radio network controller) is controlling all of the communications to and from the mobile station. In other words, the serving radio network controller does not communicate with the mobile station 6 with any of the base stations which it controls.

The connection between the mobile station 6 and the GGSN 16 is now via the base station 4c, the new serving radio network controller 10c, and the new SGSN 22.

Radio resource control provides the common control and signalling between the radio network controller and the mobile station. The same radio resource control connection is used both by speech and packet data traffic. The radio resource control (RRC) modes are illustrated schematically in Figure 4. In the RRC-idle mode 30, there is no connection established between the mobile station and the universal mobile telecommunications system terrestrial radio access network (UTRAN). UTRAN is the combination of RNC(s) and BTS(s). If the user equipment is attached to the network, but in RRC-idle mode (which implies that the mobile is not in active communication), the location is tracked by the SGSN. In this mode, there is no signalling between the UTRAN and the mobile station except for system information that is sent from the network downlink on a broadcast channel to the user equipment. The user equipment can also receive paging messages in this mode. No information on the mobile station is stored in the UTRAN in this state.

In the connected mode 32, the main states are the cell connected state 34 and the UTRAN Registration Area (URA)

connected state 36. One radio network controller will be acting as the serving radio network controller and a radio resource control connection is established between the mobile station and the serving radio network controller. When the position of the mobile station is known on the cell level, the mobile station is in the cell connected state. The radio resource control connection mobility is handled by hand over procedures. In this state, the radio link may be use different channels:-

1. Dedicated Channel (DCH). In this channel, a spreading code is allocated to the mobile station and is solely used by that mobile station.

2. Dedicated Shared Channel (DSCH). In this channel, a spreading code is shared amongst a number of mobile stations. The radio channel is optimised for packet traffic.

3. Common Channel on the downlink and Random Access Channel on the uplink. These are common channels and are suitable for use with short packets.

When the mobile position is known only on the URA level, i.e. which group of cells it is in, the mobile station is in the URA connected state. The URA comprises a set of cells of the network. In other words, the mobile station is in one of a plurality of cells which together define the URA. The URA updating procedures provide the mobility functioning. Paging is performed for downlink packet transfer.

A radio access bearer represents the connection between the SGSN and the mobile station. The radio access bearer comprises two branches. The first branch is the GTP (GPRS tunnelling protocol) tunnel between the radio network controller and the SGSN. The second branch is between the mobile station and the radio network controller. Between one mobile station and the SGSN, there are as many radio access bearers as there are PDP (packet data protocol) context activated when a radio access bearer is established. A radio resource control connection is established between the mobile station and the radio network controller, for signalling. However, no radio access bearer may be established. A radio access bearer is established only when the connection between the radio network controller and the SGSN is also established.

Reference is now made to Figure 5. In this arrangement inside the radio network controller 50, a process determines that the RRC connection of a particular mobile station should be released to optimise the use of resources. By releasing the connection which otherwise uses unnecessary signalling, the radio resources of the network are conserved, thus improving capacity and/or quality. The radio network controller 50 therefore sends an Iu release request 54 to the SGSN 52. Iu is the interface between the radio network controller and the SGSN 52. The request sent to the SGSN 52 indicates the reason why the bearer should be released. In the embodiments of the invention, the connection may be broken in order to optimise resources. This will be described in more detail hereinafter.

It is known to release the connection if the operation and maintenance controller of the network has intervened and

wants the connection to be broken or if there is equipment failure at some point between the mobile station and the SGSN 52.

The SGSN 52 decides whether or not to confirm the request for the release of the radio bearer. If the SGSN 52 agrees that the connection should be broken, a release command 56 is sent to the radio network controller 50 via the Iu interface.

If the radio resource connection between the radio network controller 50 and the mobile station 58 has not already been released, the radio network controller sends a radio resource control connection release message 60 to the mobile station. The mobile station releases the connection and sends a radio resource control connection released message 62 to the radio network controller 50. The radio network controller 50 then sends a confirmation 59 that the connection has been released to the SGSN 52 on the Iu interface.

Reference is now made to Figure 6 which shows an alternative embodiment to that shown in Figure 5. In the embodiment shown in Figure 6, the radio network controller 50 does not send a release request to the SGSN 52. Instead, the RNC 50 sends a release radio connection message 64 to the mobile station 58. The mobile station sends an acknowledgement message 66 to the radio network controller 50 and the connection therebetween is broken. The radio network controller 50 then advises the SGSN 52 via the Iu interface that the connection has been released. The SGSN 52 then releases all of the Iu connections. This alternative signalling is applicable particularly if there is no need of

confirmation from the SGSN. The RNC process which triggers the signalling procedure shown in Figure 5 or 6, should make the decision to release the RRC connection of a particular mobile station based (among other things) on the quality of service profile of the radio access bearer established. The process may only release the RRC connection, if the quality of service profile indicates that this bearer(s) are used for bursty traffic between the SGSN 52 and the mobile station 58. This type of traffic is indicated by the traffic class parameter.

One class of traffic is referred to background traffic whilst the other type of traffic is interactive traffic. Background traffic is, for example message traffic which is not time sensitive whilst interactive traffic is, for example traffic resulting in web browsing. With both of these types of traffic, the SGSN is unable to predict when and what traffic is to be forwarded to the mobile station and likewise when and what traffic is going to be received from the mobile station. The radio network controller carries out a process to control the release of the bearer for one or more of the following reasons:

1. The radio network controller has a timer which measures the time since the last packet was transferred to or received from the mobile station. If a given time lapses without a packet being transferred, then the radio network controller releases the connection. Different times may be used depending on the quality of services profile, in particular whether or not the traffic is interactive or background traffic. A shorter time may be provided for background traffic.

2. The radio network controller can take into account the radio state of the mobile station. For example, the RNC may release the RRC connection only in the URA connected mode.

3. The connection may be kept when another radio bearer is established, for example from the mobile switching centre to the mobile station via the radio network controller. The reason is that the RNC has to keep this mobile RRC-connected for this circuit switched connection, so that it can maintain the radio access bearer for a packet connection without using additional resources.

4. The radio network controller can take into account the movement of the mobile station. If the mobile station is moving above a given speed, the bearer connection may be released. A fast moving mobile station uses up a relatively large amount of radio resources for updates (e.g. URA updates). The radio network controller could set a maximum number of URA updates, for example 10 and if no user data traffic has been received within that time, the connection could be released. This is an elegant way to take into account the mobile movement.

5. The radio network controller may release the connection if the mobile station enters an area controlled by a different radio network controller. In this regard, reference is made to Figures 3a and 3b.

As mentioned hereinbefore, a combination of these methods may be used for determining if a radio network controller should release the bearer. For example, if a mobile station, which is in the URA update state enters a new radio network controller area, the serving radio network

controller can be arranged to release the radio bearer. This may in turn trigger a routing area update from the mobile station. The routing area update is used by mobile to inform the SGSN of its location in RRC-idle mode.

If the bearer is released the internal resources of the radio network controller can be conserved. For example, each time a connection is established, the radio network controller requires some buffer resource to be allocated thereto If a connection is not being used, the buffer resource may be wasted.

In another example, if a mobile station has a circuit switch connection i.e. speech connection, the radio network controller could keep the packet bearer established longer than otherwise. This is because a user is more likely to transfer data during or after a call and the radio network controller would merely have to re-establish that bearer otherwise.

In one modification of the embodiments described hereinbefore, the SGSN could be arranged to give an indication in the bearer set up procedure to the radio network controller whether or not the radio network controller is permitted to suggest the release of the bearer. Rules associated with this may also be transferred from the SGSN to the radio network controller. Those rules may take any suitable form. The indication in the bearer set up may be implicitly derived by the radio network controller from quality of service parameters provided by the SGSN to the radio network controller.

The SGSN could indicate the timer value, or indicate not to release RRC connection if a bearer with particular quality

of service profile is established. The SGSN can thus instruct the RNC as to how it should interpret the rules which it has for determining when to release a connection.

Whilst the present invention has referred to mobile stations, it should be appreciated that embodiments of the present invention are applicable to other types of user equipment, for example computer terminals. These computer terminals may be fixed or mobile.

Embodiments of the present invention have been described in the context of a code division multiple access system. It should be appreciated that embodiments of the present invention can be used with any other suitable spread spectrum access technique, frequency division multiple access techniques, time division multiple access technique or hybrids thereof.

CLAIMS:

1. A network element for use in a communication network, said network element being arranged between an end station and an end element, wherein connections are established between said end station and said end element via said network element, said network element comprising means for determining if the connection between said end element and said end station is to be released.

2. A network element as claimed in claim 1, wherein said network element is arranged to release said connection when the determining means determines that the connection is to be released.

3. A network element is claimed in claim 2, wherein said network element is arranged to release the connection between the network element and said end station.

4. A network element as claimed in claim 2 or 3, wherein said network element is arranged to send a message to the end element indicating that said connection has been released.

5. A network element as claimed in claim 1, wherein said network element is arranged to send a request for the connection to be released to said end station.

6. A network element as claimed in claim 5, wherein the end element sends a connection release command to said network element in response to the release request received by said network element, said network element controlling the release of said connection.

7. A network element as claimed in claim 6, wherein said network element is arranged to send a release request to said end station in response to the release command received from said end element.

8. A network element as claimed in claim 7, wherein said network element is arranged to send a message to said end element advising that the connection has been released.

9. A network element as claimed in any preceding claim, wherein said determining means determines that the connection is to be released if the connection has not been used for a predetermined time.

10. A network element as claimed in claim 9, wherein the predetermined time depends on the type of traffic for which the connection is intended.

11. A network element as claimed in claim 9, wherein the predetermined time depends on the quality of service profile of the traffic for which the connection is intended.

12. A network element as claimed in any preceding claim, wherein said determining means is arranged to determine if the connection is to be released based on the state of the end station.

13. A network element as claimed in any preceding claim, wherein said determining means is arranged to determine if the connection should be released based on the movement of the end station.

14. A network element as claimed in claim 13, wherein the amount of updating information received in a given time from the end station is used as a measure of the movement of the end station.

15. A network element as claimed in claim 14, wherein said updating information comprises URA updates.

16. A network element as claimed in any preceding claim, wherein said determining means is arranged to determine if the connection should be released based on the location of said end station.

17. A network element as claimed in claim 16, wherein said determining means determines that the connection should be released if the end station is associated with a different network element.

18. A network element as claimed in any preceding claim, wherein said network element is a radio network controller.

19. A network comprising a network element as claimed in any preceding claim, an end station and an end element.

20. A network as claimed in claim 19, wherein said end station is a mobile station.

21. A network element as claimed in claims 19 or 20, wherein said end element is a SGSN.

22. A network as claimed in claims 19, 20 or 21 wherein said network operates in accordance with the UMTS Standard.

Fig.1.

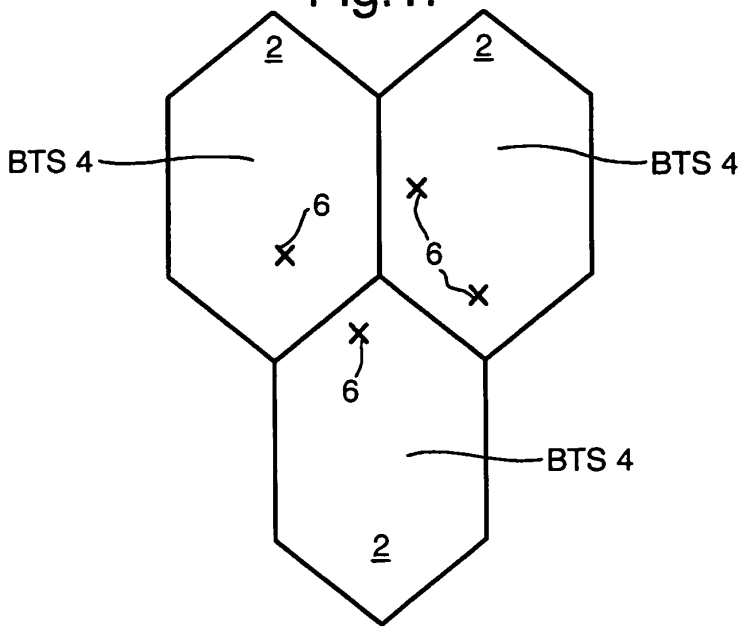


Fig.2A.

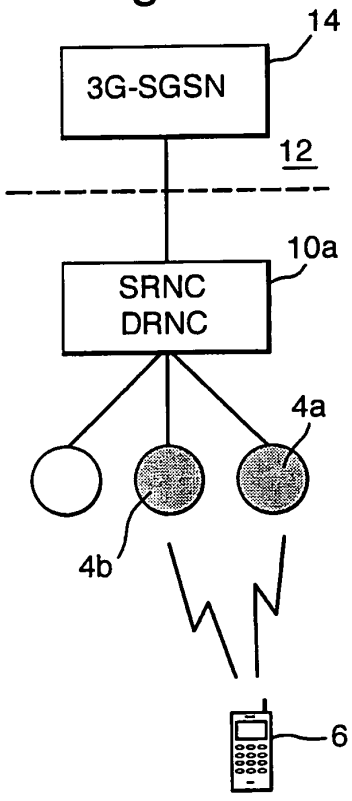


Fig.2B.

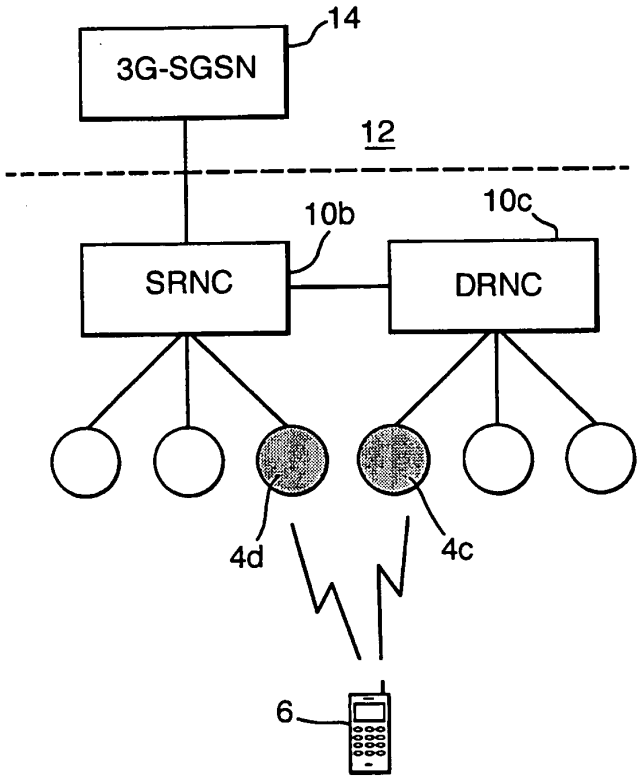


Fig.3A.

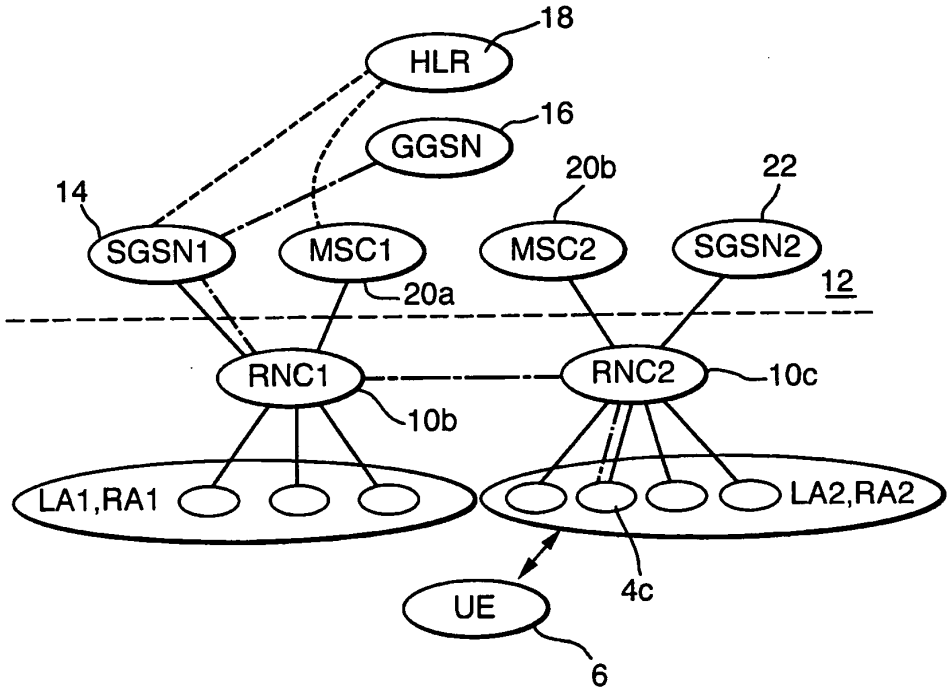

18
HLR
16
GGSN
14
20b
22
SGSN1
MSC1
MSC2
SGSN2
20a
12
RNC1
RNC2
10c
10b
LA1,RA1
LA2,RA2
4c
UE
6

Fig.3B.

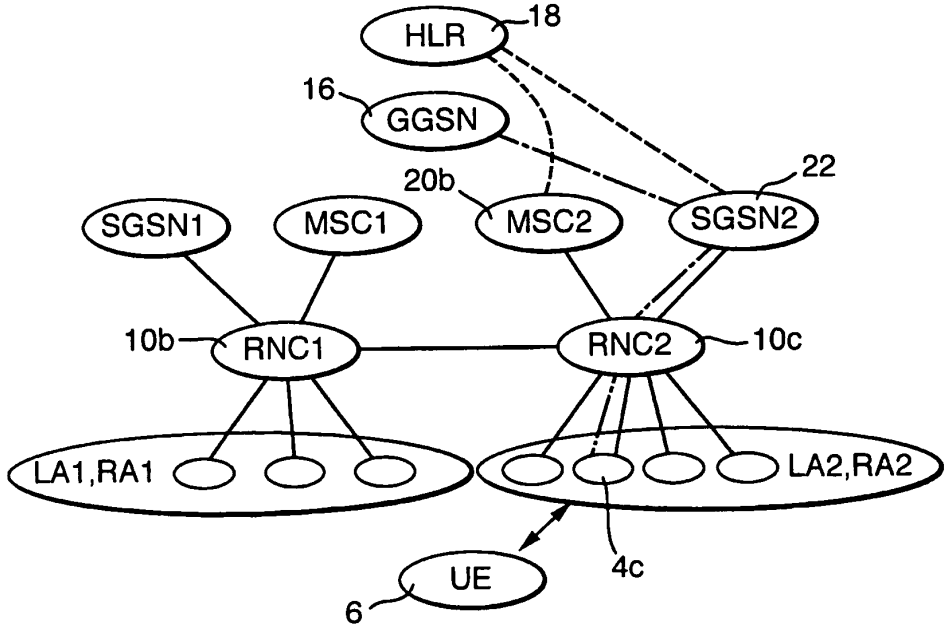

18
HLR
16
GGSN
22
20b
SGSN1
MSC1
MSC2
SGSN2
10b
RNC1
RNC2
10c
LA1,RA1
LA2,RA2
4c
UE
6

Fig.4.

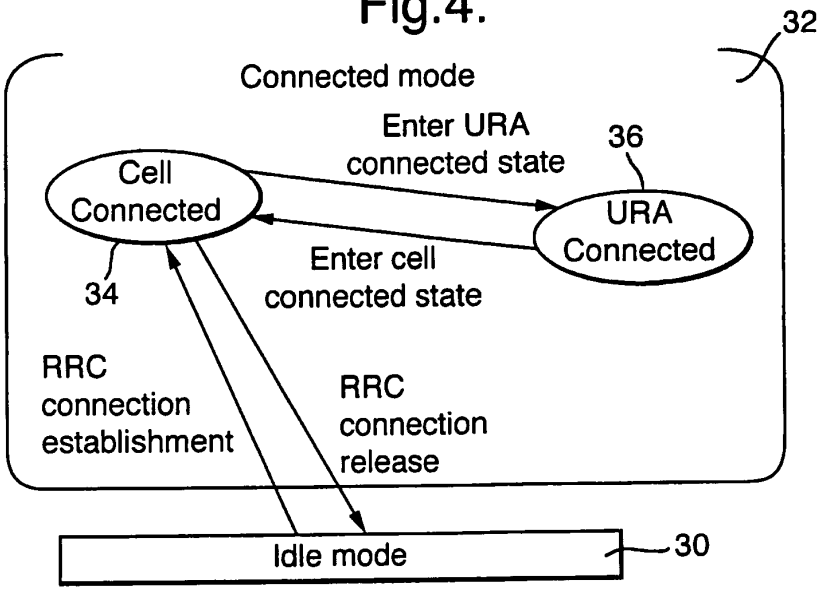


Fig.5.

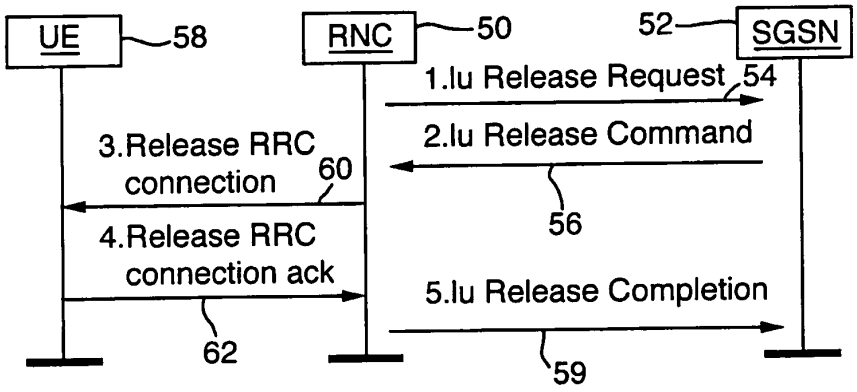
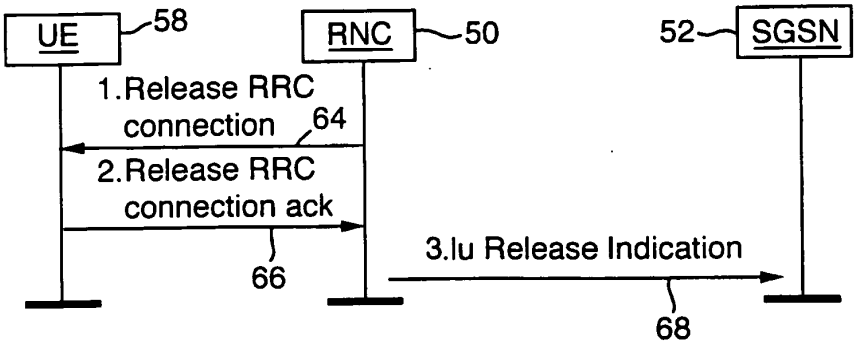


Fig.6.



INTERNATIONAL SEARCH REPORT

Inte onal Application No
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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	EP 0 888 022 A (LUCENT TECHNOLOGIES INC) 30 December 1998 (1998-12-30) column 8, line 52 -column 9, line 58	4
A	WO 95 08898 A (NOKIA TELECOMMUNICATIONS OY ;MUSZYNSKI PETER (FI)) 30 March 1995 (1995-03-30) page 15, line 5 - line 35	1-4,16, 17,19,20

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

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
15 August 2000	22/08/2000

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

Inter ...nal Application No
PCT/EP 00/04231

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter nal Application No
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(72) Inventors; and

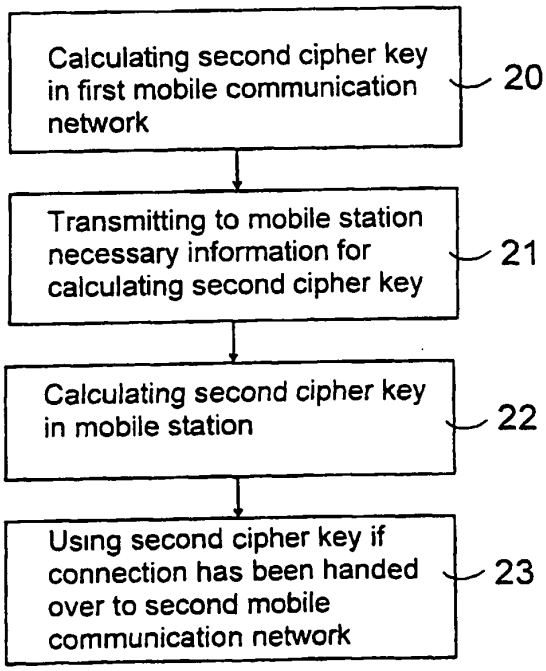
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(74) Agent: **KOLSTER OY AB**; Iso Roobertinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).

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[Continued on next page]

(54) Title: ARRANGING AUTHENTICATION AND CIPHERING IN MOBILE COMMUNICATION SYSTEM



(57) Abstract: A method of arranging authentication and ciphering in a telecommunication system comprising two different mobile communication networks, a mobile station communicating with a first one of the mobile communication networks. In the first mobile communication network, a cipher key according to a second mobile communication network is calculated and information necessary for calculating the cipher key is transmitted to the mobile station, at which the cipher key according to the second mobile communication network is also calculated. After the connection has been handed over to the second mobile communication network, traffic is ciphered by using said precalculated cipher key.

WO 00/76194 A1

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, MZ, 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.

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ARRANGING AUTHENTICATION AND CIPHERING IN MOBILE COMMUNICATION SYSTEM

BACKGROUND OF THE INVENTION

The invention relates to a method and an arrangement for arranging data protection disclosed in the preambles of the independent claims.

In mobile communication systems, at least one part of a transmission path is comprised of a wireless section, whereby data transmission takes place via a radio path. A radio path is a physically open resource, which puts security at risk. Various solutions have been developed in digital mobile communication systems to arrange data protection, including ciphering methods and methods for identifying, i.e. authenticating, a user or a subscriber.

In mobile communications systems, a mobile network typically carries out subscriber authentication in order to make sure that only correct parties have an access right. For example, a mobile station in a digital GSM system comprises a subscriber identity module SIM application comprising means for authenticating the subscriber. The SIM application further uses a personal identity number PIN check, whereby only the person who knows the PIN code can use the SIM application. In authentication, the mobile station transmits to the GSM network identification information, and the SIM and thus also the subscriber are authenticated on the basis of this information. The SIM comprises mobile-operator-specific information, including an SIM-specific international mobile subscriber identity IMSI of a mobile services subscriber. Typically, the SIM also comprises a temporary mobile subscriber identity TMSI within a location area, which can be used to avoid transferring the IMSI over a radio path.

A mobile switching centre MSC, which typically also comprises a visitor location register VLR, transmits an authentication request to an authentication centre AuC. The authentication centre AuC is typically located as a part of a home location register HLR of the subscriber. Subscriber authentication information and authentication algorithms are stored in the authentication centre. On the basis of the IMSI comprised in the authentication request, the authentication centre AuC selects a subscriber-specific authentication key Ki. In addition, a random-number generator generates a number of random-number parameters RAND, which, together with the key Ki, are used to provide each RAND parameter with a checking parameter SRES by applying authentication algorithm A3. The authentication centre AuC typically transmits

these RAND/SRES parameters simultaneously with a calculated cipher key Kc to the visitor location register VLR to be stored.

When the VLR wishes to authenticate a subscriber, it selects a RAND value for the parameter from a RAND/SRES table corresponding to the present subscriber and transmits the RAND value to the mobile station and further to the SIM application. The SIM comprises the same authentication key Ki and authentication algorithm A3 as those used at the authentication centre AuC. The SIM calculates the SRES parameter, which is the authentication response, by means of the received RAND parameter and the key Ki by applying algorithm A3. The mobile station returns the SRES parameter to the visitor location register VLR. The VLR compares the SRES value transmitted by the mobile station with a stored SRES value, and if they are the same, the authentication has succeeded. In principle, the GSM network can request authentication at any stage when a mobile station is registered in the network. Authentication can be carried out particularly when a mobile station registers in a network.

Ciphering is used in many telecommunication systems to prevent data to be transmitted from becoming subject to unauthorised access. For example, it is possible in the GSM system to use ciphering of data transmission which is difficult to crack, whereby speech and data converted into digital form are ciphered at the mobile station to be transmitted over the radio path. Similarly, received ciphered data in the GSM network is deciphered into plain speech and data. In connection with the present application, ciphering can refer either to ciphering or deciphering of traffic. Ciphering and user authentication utilise cipher keys and ciphering algorithms accessible to the particular transmission and reception equipment only.

When in the GSM system the mobile switching centre MSC/VLR has authenticated the user, ciphering of the traffic to be transmitted can be initiated. The cipher key Kc is calculated in connection with authentication by means of the secret key Ki and the random number RAND by applying algorithm A8 both at the authentication centre AuC and the SIM. Algorithms A3 and A8 are typically implemented such that both the SRES parameter and the cipher key Kc are calculated simultaneously. In the authentication parameters the authentication centre transmits the cipher key Kc with the RAND and SRES parameters to the visitor location register VLR, whereby these three parameters form a "triplet". The cipher key Kc is stored in the visitor location

register VLR. The visitor location register VLR transmits the random number RAND to the SIM application for authentication and cipher key calculation. The SIM calculates the cipher key Kc typically in connection with calculating the SRES parameter on the basis of the RAND parameter and the secret key Ki by applying algorithm A8. Consequently, calculating the cipher key Kc is a part of the GSM authentication. The cipher key Kc is stored in the SIM application. According to the GSM standard, the Kc is 64 bits at most.

When the mobile switching centre MSC/VLR commands ciphering to be initiated, the cipher key Kc is transmitted from the visitor location register VLR to a base station. Furthermore, a command is transmitted to the mobile station, which starts using the Kc calculated at the SIM. The GSM network selects the ciphering algorithm on the basis of the identifier of the ciphering algorithm comprised in a "classmark" identifier transmitted by the mobile station. The base station and the mobile station carry out traffic ciphering and deciphering, depending on the direction of the traffic, by means of the cipher key Kc and the number of the traffic frame by applying algorithm A5. *The GSM System for Mobile Communications* by M. Mouly and M. Pautet, Palaiseau, France, 1992, ISBN: 2-9507190-0-7, for example, discloses a more detailed description of the GSM system.

Third generation mobile communication systems have been developed throughout the world. 3rd generation partnership project 3GPP standardizes a third generation mobile communication system which is based on the GSM system and called a universal mobile telecommunications systems UMTS, which comprises a new radio interface, for example. The UMTS radio interface will be based on the wideband code division multiple access WCDMA technique. The GSM core network will be utilised in the UMTS system, whereby connection management and mobility management will mainly remain the same. The UMTS system will provide circuit-switched services and packet-switched services. The packet-switched services will probably be based on the general packet radio service GPRS in the GSM.

An essential requirement in the UMTS system is the handover requirement between the GSM and the UMTS. In connection with the present application, handover refers to changing a radio traffic connection and radio traffic responsibility from a source system to a target system without the data transfer connection provided for a user service being substantially disconnected. In the GSM/UMTS handover, the connection is thus handed over from

the UMTS system to the GSM system, or vice versa. In the GSM/UMTS handover, the connection provided for the user remains similarly uninterrupted to one in the existing internal handover in the GSM system. This enables the UMTS system to be rapidly introduced since particularly in the beginning, the GSM system with its extensive coverage area can be used as backup. For this purpose, it is probable that devices called dual-mode mobile stations supporting both the GSM system and the UMTS system will appear on the market.

In the UMTS standardization work, it is likely that a solution with mainly similar principles to the GSM procedures will be selected as far as the security architecture is concerned. In such a case, as high compatibility with the GSM architecture as possible can be achieved. Both the UMTS network and a user service identity module USIM application of the SIM identity application kind in the GSM comprise a secret key which is required for carrying out authentication. Changes will primarily relate to key lengths and algorithms used; document TR S3.03 version 0.1.2 "3G Security: Security Architecture" in the 3GPP discusses security requirements in the UMTS system. Particularly the cipher key to be used will probably be longer than in the GSM system.

In order to support the GSM system, a UMTS IC card UICC comprising the USIM application may also comprise the SIM application of the GSM system. The UMTS system further requires that services may be provided to mobile stations with only a smart card comprising a GSM identity SIM application. Furthermore, at the early stage the GSM/UMTS core network may be the same, so the core network of the UMTS system can also support authentication and ciphering according to the GSM system as well.

In the GSM system, in a handover situation, ciphering parameters used in handover between mobile switching centres, such as the cipher key, are transmitted from the source network to the target network. Hence, when a connection is handed over from the GSM network to the UMTS network, the cipher key Kc according to the GSM can be used while the traffic remains ciphered all the time. It is naturally required that the UMTS network supports the ciphering according to the GSM system. It is also possible to carry out authentication according to the UMTS system and start using a UMTS cipher key after handover.

When the mobile station is in the UMTS network, a cipher key according to the UMTS system is available for its use. When handover from the UMTS system to the GSM system is carried out, the problem is the ciphering

since a base station sub-system BSS according to the GSM system is not necessarily able to carry out the ciphering by the UMTS parameters. Consequently, the UMTS cipher key cannot be used as such after handover, according to the GSM principles. According to the prior art, when a change to the GSM system takes place, authentication according to the GSM system can be carried out after handover. In such a case, GSM ciphering can be initiated only after the cipher key Kc has been calculated. This, however, is time-consuming, and some of the traffic will be transferred over the GSM radio interface unciphered.

BRIEF DESCRIPTION OF THE INVENTION

An object of the invention is thus to provide a method and an apparatus implementing the method so as to enable the above-mentioned problems to be alleviated. The objects of the invention are achieved by a method and a system which are characterized by what is disclosed in the independent claims. Preferred embodiments of the invention are disclosed in the dependent claims.

The invention is based on the idea that a cipher key of a "second" mobile communication network according to a mobile communication system, such as a GSM system, is determined in a first mobile communication network typically according to a different mobile communication system, such as a UMTS system, when a mobile station operates in the first mobile communication network. In such a case, a "second" cipher key according to the second mobile communication network can be determined which can preferably be stored both in the mobile station and in the first mobile communication network usually using a "first" cipher key for ciphering traffic. The advantage achieved is that the second cipher key according to the second mobile communication network, such as the GSM network, is already available before a potential handover situation.

In a handover situation, the second cipher key can, according to a preferred embodiment of the invention, be transmitted from the first mobile communication network to a network element performing ciphering, such as a base station, in the second mobile communication network. Furthermore, the second cipher key stored in the subscriber identification application, such as the SIM application, is preferably transmitted to a means in the mobile station which carries out ciphering in the mobile station. Hence, as soon as the logical connection has been handed over to the base station system of the second

mobile communication network, it is possible to start to use ciphering according to the network concerned both at the mobile station and at the network element in the second mobile communication network that carries out the ciphering. The advantage then achieved is that, with the exception of the first signalling messages, no traffic is transferred unciphered over the air interface after handover, as is the case in an internal handover situation in the GSM system.

According to a solution of the invention, a mobile communication network and a mobile station can use several different and alternative methods of ciphering or authentication by using different algorithms or keys. If the mobile communication network and the mobile station support more than one ciphering or authentication method, it is thus possible to e.g. change the cipher key used, if necessary.

According to a preferred embodiment of the invention, a first mobile communication network examines, by means of an IMSI and/or classmark identifier, for example, whether a mobile station supports a second mobile communication network. In such a case, the cipher key according to a second mobile communication network is preferably calculated only if the mobile station supports the second mobile communication network. Furthermore, according to a preferred embodiment of the invention, the second cipher key can be calculated simultaneously with authentication according to the first mobile communication system. In such a case, one message is preferably used for requesting of the authentication centre and further, the mobile station, calculation of a cipher key according to two different systems and, possibly, of an authentication response.

On the other hand, according to another preferred embodiment of the invention, a request can be specified for calculating explicitly a second cipher key according to the second mobile communication system. This can be necessary when, for example, it is detected that handover is necessary to a second mobile communication network. In such a case, calculation of the cipher key according to the second mobile communication network only can be requested preferably in connection with authentication. According to an embodiment of the invention, the second cipher key can be calculated only when necessary, in other words when a decision is made about handover to the second mobile communication network.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is now described in closer detail in connection with the preferred embodiments with reference to the accompanying drawings, in which

Figure 1 shows, by way of example, a UMTS system with a GSM base station sub-system also connected thereto;

Figure 2 shows a method according to a preferred embodiment of the invention in a simplified manner and by means of flow diagram;

Figure 3 shows an authentication implementation according to a preferred embodiment of the invention by means of a signalling diagram;

Figure 4 shows, by way of example and by means of a signalling diagram, a handover function from a UMTS system to a GSM system.

DETAILED DESCRIPTION OF THE INVENTION

In principle, the invention can be applied to any mobile communication system. It is particularly well suited for a UMTS system, which will largely be based on the GSM system. In the following, a preferred embodiment of the invention will be described by using an example wherein GSM authentication functions, calculation of a cipher key in particular, are carried out in a UMTS network before a handover function from the UMTS network to a GSM network (Figures 1 and 3) and a handover function which utilizes, according to the invention, a precalculated cipher key (Figure 4). Figure 2 describes in a simplified manner a method according to a preferred embodiment of the invention independently of the mobile communication system used.

Figure 1 shows, by way of example, a mobile communication network according to the UMTS system, a core network CN of the mobile communication network also being able to control a GSM base station sub-system. A UMTS mobile station MS comprises mobile equipment ME and a UICC smart card. A UMTS radio access network RAN comprises one or more base stations BS, and radio frequencies available to the base stations are controlled by a radio network controller RNC.

For circuit-switched services, the radio network controllers RNC are connected to a mobile switching centre MSC, which is responsible for connection establishment of the circuit-switched services and routing them to correct addresses. Two databases are utilized herein which comprise information on mobile subscribers: a home location register HLR and a visitor location register

VLR. Similarly, a serving GPRS support node SGSN utilizing the home location register HLR is used for packet-switched services. Both the MSC and the SGSN communicate with an authentication centre AuC, typically via the home location register HLR.

The mobile switching centre MSC is via an interworking function IWF connected to other telecommunication networks, such as a public switched telephone network PSTN or an integrated services digital network ISDN. A GPRS gateway support node GGSN communicates with packet data networks PDN.

A base station sub-system BSS according to the GSM system is also connected to the core network CN, the base station sub-system BSS comprising at least one base transceiver station BTS and a base station controller BSC.

A home environment HE specified in the UMTS documents of the 3GPP enters a contract with a subscriber for service provision and provides a USIM application. In such a case, the home location register HLR is located in the home environment HE. A serving network SN refers to a network in the area of which the mobile station is currently located. In roaming situations or in situations in which service provision and network operation are separated from each other, separate home environment HE and serving network SN can be discerned. In Figure 1, the home environment HE and the serving network SN are not separated.

In functions described later, the visitor location register VLR may be located in the serving network SN and the authentication centre AuC may be located in the home environment HE of a different operator or they may belong to a network controlled by the same operator. In connection with the present application, networks elements in the core network CN of Figure 1 are named as in the GSM system; the essential feature is that the network elements are capable of carrying out the functions according to the UMTS system.

The security architecture in the UMTS system will be mainly similar to that in the GSM system. Hence, the procedure described earlier according to the GSM will also be implemented in the UMTS; probable differences will be discussed in the following. Table 1 shows UMTS parameters corresponding to GSM parameters that have been discussed in 3GPP document TR S3.03 version 0.1.2 "3G Security: Security Architecture".

Table 1.

DESCRIPTION	GSM	UMTS
random number parameter	RAND	RANDu
authentication checking parameter to be compared (authentication response)	SRES	XRES
cipher key	Kc	CK
integrity key	-	IK
authentication token	-	AUTN

In authentication according to the UMTS system, the authentication centre AuC produces five parameters in accordance with Table 1 and transmits them to the visitor location register VLR. In the GSM system, three parameters are produced, i.e. a triplet. The random number parameter RANDu corresponds to the RAND parameter in the GSM system, but may vary in length. An authentication checking parameter XRES (Expected Response) and a cipher key CK in particular may also vary in length compared to the GSM parameters SRES and Kc. The GSM lacks an authentication token AUTN; it can be transmitted to the USIM application in the same message as the RANDu parameter. By means of the AUTN token, the USIM application can check whether the serving network has the right to serve UMTS services. As distinct from the GSM system, the USIM generates an XRES parameter and calculates a cipher key CK only if the AUTN parameter is acceptable. As in the GSM system, the USIM transmits the calculated XRES parameter to the network to the visitor location register VLR, which compares it with the authentication checking parameter received from the authentication centre. The authentication has succeeded if the XRES calculated in the network and the XRES parameter calculated in the USIM application correspond to each other.

The GSM system lacks an integrity key IK; in the UMTS system, it will be used for protecting certain signalling messages, such as information on features of a mobile station, for example. The IK is calculated both in the USIM application and in the UMTS network. Since UMTS standardization work is still underway, algorithms necessary for producing the parameters shown in Table 1 have not been determined precisely. They will probably differ from GSM al-

gorithms A3, A5 and A8. The key corresponding to the secret key Ki in the GSM is K in the UMTS, K being used in calculating authentication parameters both in the USIM application and the authentication centre.

In principle, the GSM or the UMTS network can request authentication of a mobile station at any time. Authentication can be carried out e.g. in connection with location update or while providing a paging response when a mobile station receives a call. The invention can be applied to authentication at any time.

In the example according to the invention, the mobile station MS is capable of establishing a connection both to the GSM and the UMTS networks, i.e. it is a so-called dual-mode mobile station. The MS thus comprises functions both according to the GSM system and the UMTS system, and further, functions of the SIM application and the USIM application. The SIM/USIM functions are preferably located on a smart card UICC and they can preferably be provided from the same operator, i.e. home environment HE, as one application. It is assumed that the subscriber identifier, preferably the IMSI, is the same both for the GSM and the UMTS system. Hence, the IMSI identifier identifies both the SIM application and the USIM application. On the basis of the IMSI identifier, the UMTS network can preferably also detect whether a subscriber that has the right to access both GSM and UMTS services is at issue. Even though the IMSI identifier were the same, authentication (comprising calculation of cipher keys) can be carried out in the solution according to a preferred embodiment of the invention for both the SIM application and the USIM application separately.

In the following, a method according to a preferred embodiment of the invention will be described in a simplified manner by means of Figure 2, without being restricted to any certain mobile communication system. In Figure 2, the most important steps of the invention are simplified, not all embodiments being shown. Later, by means of Figures 3 and 4, different steps and embodiments will be described in closer detail, applied to the UMTS and the GSM systems.

When a mobile station operates in a first mobile communication network, traffic being transferred over the air interface is ciphered mainly by using a first cipher key. According to the invention, a second cipher key according to a second mobile communication network is calculated in the first mobile communication network (20). This can take place after the first mobile

communication network has detected a need for handover of the active connection to the second mobile communication network, for example, or in connection with authentication according to the first mobile communication network.

After calculating the second cipher key, the first mobile communication network transmits information necessary for calculating the cipher key to the mobile station (21). The mobile station detects that calculation of the second cipher key according to the second mobile communication network is at issue and carries out calculation of the second cipher key (22). Next, the second cipher key is available both in the first mobile communication network and at the mobile station. If the logical connection provided for the mobile station is handed over to the second mobile communication network, the second cipher key is used both at the mobile station and in the second mobile communication network after the handover (23). The first mobile communication network has then preferably transmitted the second key to the network element carrying out the ciphering in the second mobile communication network before handover. Hence, the traffic between the mobile station and the second mobile communication network can be ciphered immediately after handover.

In the following, a solution according to a preferred embodiment of the invention when applied to circuit-switched connections in the UMTS and GSM networks will be described in closer detail by means of Figure 3. Figure 3 shows an exemplary signalling pattern of an authentication process, i.e. production of a cipher key, production and checking of authentication parameters, only including steps that are essential to the invention. When the mobile station is within the area of the UMTS network, it is further assumed that the traffic between the mobile station and the mobile communication network is ciphered using the UMTS cipher key.

In Figure 3, the mobile station MS transmits a location update request message, for example, in order to request location update (identity, arrow 30). The essential point is that the message (identity, arrow 30) comprises a UMTS subscriber identifier, either a TMSI or an IMSI identifier, for a similar purpose to the one in the GSM system, i.e. for identifying a subscriber. In some UMTS specifications, a temporary mobile user identity TMUI corresponds to the TMSI identifier, and an international mobile user identity IMUI to the IMSI identifier.

The UMTS network may also transmit a request to the mobile station to transmit a subscriber identifier, and the mobile station responds by transmitting the requested subscriber identifier (identity, arrow 30).

It is further possible that in the UMTS system, the IMSI identifier is ciphered over the radio path in order to prevent misuse. If the IMSI identifier is ciphered, the visitor location register VLR has to transmit the ciphered IMSI identifier to the home location register HLR, which transmits the unciphered IMSI identifier back to the visitor location register (not shown).

The visitor location register VLR transmits the request for authentication and the IMSI identifier to the home location register HLR and further to the authentication centre AuC (send authentication info, arrow 31).In the network, the VLR and the HLR communicate using the MAP signalling protocol. In the UMTS system, it is possible to use a different MAP version than in the GSM since, compared to the GSM, the above-described UMTS authentication functions require changes in the MAP protocol. Consequently, the home environment HE and further, the authentication centre AuC in connection with the home location register can infer from, for example, the MAP version that the request (send authentication info, arrow 31) has been received from a network capable of the UMTS.

On the basis of the IMSI identifier the home environment HE, preferably the home location register HLR, can detect that the subscriber has the right to access both the GSM and the UMTS network. According to a preferred embodiment of the invention, the authentication centre AuC calculates both the authentication parameters of the UMTS and the authentication parameters of the GSM (triplet) substantially simultaneously and transmits them to the visitor location register VLR. If the serving network SN is not according to the UMTS (an MAP version according to the GSM system, for example), or on the basis of the IMSI identifier only the SIM application can be used, the authentication centre AuC calculates preferably the GSM authentication parameters only. Furthermore, characteristics of the mobile station MS may also set requirements for the calculation of the GSM parameters, i.e. whether the mobile station supports the GSM system. Then, correspondingly, when the mobile station only supports the UMTS system or when, on the basis of the IMSI identifier, only the USIM application can be used, the AUC can calculate the authentication parameters of the UMTS only.

Alternatively, it is possible for the visitor location register VLR to request authentication information according to a desired system or systems in connection with a (send authentication info, arrow 31) message. This can be implemented, for example, by adding bits indicating the type of authentication requested to the authentication information request (send authentication info, arrow 31).

In order to avoid unnecessary processing power consumption, GSM authentication is carried out in the UMTS network only if the mobile station comprises the SIM application and the GSM functionality (dual-mode mobile station). The UMTS network can discern from the classmark identifier, for example, whether the mobile station supports the GSM system. In such a case, the visitor location register can, the classmark identifier and/or the IMSI identifier having indicated that the mobile station supports the GSM system, request authentication both according to the GSM system and the UMTS system of the authentication centre AuC in connection with the (send authentication info, arrow 31) message.

The authentication centre AuC transmits the calculated authentication information to the visitor location register VLR (authentication info, arrow 32), wherein the information is stored. Since the authentication centre has calculated the GSM authentication parameters, a cipher key Kc according to the GSM network is available in the serving network SN for later use. After this step, the idea of the invention can be applied at least in two different ways: by implicit or explicit GSM authentication, which will be described next.

An implicit GSM authentication according to a preferred embodiment of the invention will be discussed in the following. In this case, the UMTS random-number parameter RANDu received from the authentication centre AuC is equal in length to the GSM random-number parameter RAND (preferably 128 bits). The VLR transmits to the mobile station an authentication request (authentication request, arrow 33) comprising the random-number parameter RANDu of the length of the RAND parameter in the GSM system. Since the authentication at issue is authentication according to the UMTS system, an authentication token AUTN is also preferably transmitted to the USIM application of the mobile station.

According to a preferred embodiment of the invention, the mobile station MS transmits the random-number parameter RANDu both to the SIM and the USIM applications even though the authentication request

(authentication request, arrow 33) were according to the UMTS system. The mobile station may comprise, for example, means for checking the random-number parameter, in which case, when the random-number parameter is according to the GSM system, it is also transmitted to the SIM application. Then, according to a preferred embodiment of the invention, the SIM application calculates the cipher key Kc by using the secret key Ki and the RANDu parameter by applying A8 algorithm. The SIM application does not, however, have to produce the authentication checking parameter SRES. The SIM application stores the Kc for later use preferably in the memory of the smart card UICC.

The USIM application receives the RANDu parameter, and, if the authentication token AUTN is acceptable, carries out the calculation of the authentication checking parameter XRES. Then, by means of the secret key K and the RANDu parameter and the authentication algorithm of the UMTS, the USIM produces the XRES parameter. The cipher key CK of the UMTS can be calculated simultaneously by means of the secret key K and the calculation algorithm of the cipher key. The authentication checking parameter XRES is transmitted from the USIM application to the visitor location register VLR (authentication response, arrow 34), which compares it with the checking parameter received from the authentication centre AuC. If they match, authentication according to the UMTS has succeeded.

According to a preferred embodiment of the invention, in the implicit GSM authentication it is further assumed that the GSM authentication has been carried out when the UMTS authentication has succeeded. Furthermore, the cipher key according to the GSM system exists both in the UMTS network and in the USIM application for potential handover from the UMTS network to the GSM network. When authentication has been carried out, the UMTS network can transmit an approval, i.e. acknowledgement of the authentication to the mobile station MS (acknowledgement, arrow 35). Necessary procedures at a given time can then be continued according to the prior art; for example, the UMTS network may give the mobile station MS a command to initiate ciphering.

Since in the implicit GSM authentication it is only necessary to calculate the cipher key Kc, the authentication centre AuC does not necessarily have to calculate and transmit all authentication parameters of the visitor location register VLR. Only the cipher key Kc has to be calculated and transmitted

to the visitor location register, preferably applying the same random-number parameter as in calculating the cipher key CK of the UMTS.

According to a preferred embodiment of the invention, so-called explicit GSM authentication can also be carried out. In such a case, the RANDu parameter can be of a different length than the RAND parameter of the GSM. The UMTS network then transmits, preferably in the authentication request (authentication request, arrow 33), information on which authentication is desired, the GSM authentication, the UMTS authentication, or possibly both.

The authentication request (authentication request, arrow 33) comprises, for example, a GSM bit and a UMTS bit. When the GSM bit has a value 1, the mobile station detects that it is the GSM authentication that is requested. Similarly, if the UMTS bit is 1, authentication according to the UMTS system will be carried out. If both bits are 1, authentication according to both systems can be carried out. The MS can detect the desired authentication also from the length of the random-number parameter RAND or RANDu. Furthermore, the mobile station MS can discern that it is the UMTS authentication that is desired if the authentication request (authentication request, arrow 33) comprises the authentication token AUTN.

If the serving network SN has requested GSM authentication, the RAND random-number parameter is transmitted to the SIM application and calculation according to the GSM system of the authentication response SRES and the cipher key Kc is carried out. The authentication response SRES is transmitted to the visitor location register VLR to be checked (authentication response, arrow 34) and the cipher key Kc is stored in the SIM application for potential later use.

If the serving network SN has requested UMTS authentication, the RANDu random-number parameter is transmitted to the USIM application and authentication according to the UMTS system is carried out in a manner described earlier. If the UMTS authentication succeeds, nothing, however, is assumed concerning the GSM authentication on the basis thereof, but the GSM authentication has to be carried out separately if the serving network SN so desires.

If the serving network SN requests authentication according both to the GSM and the UMTS systems, it preferably transmits both the RANDu and the RAND parameters in the authentication request (authentication request, arrow 33). When the mobile station has detected from, for example, the two

different random-number parameters that both the UMTS authentication and the GSM authentication are requested, it transmits the RAND parameter to the SIM application and the RANDu parameter to the USIM application. The SIM and the USIM calculate the authentication responses SRES and XRES and the cipher keys Kc and CK. The mobile station MS transmits the SRES parameter transmitted by the SIM application and the XRES parameter transmitted by the USIM application to the visitor location register VLR (authentication response, arrow 34) possibly in different messages. The visitor location register VLR compares the authentication responses received from the mobile station MS with the ones received from the authentication centre AuC, and if they match, the authentications have succeeded.

The explicit method described above can generally be applied to a mobile communication system which supports several authentication methods. For example, it is possible that a new, alternative authentication and/or ciphering method will be developed for the UMTS system. The network element (e.g. the AuC) which carries out authentication and calculation of the cipher key and the means (e.g. the USIM) which carries out the corresponding functions in the mobile station comprise the same algorithms. If the serving mobile communication network and particularly the network element carrying out the functions of the visitor location register VLR know how to apply the parameters according to the alternative authentication method, the explicit method may be used. Hence, the serving mobile communication system can transmit to the authentication centre AuC an identifier of the authentication algorithm or algorithms used, for example.

On the other hand, it is also possible that the AuC is aware of the characteristics of the mobile station and further, the serving mobile communication network. In such a case, on the basis of the characteristics, it can also transmit the parameters according to the alternative method to the serving mobile communication network, to the visitor location register VLR, for example. Furthermore, the serving mobile communication network can preferably transmit to the mobile station information on the authentication method used in connection with the authentication request. This enables, for example, the cipher method used to be flexibly changed by calculating the cipher key according to the new authentication both at the authentication centre and the subscriber application. The cipher method used can, if necessary, be changed by transmitting the new cipher key to the means responsible for ciphering both

in the mobile communication network and at the mobile station. Preferably, the authentication centre AuC is also informed that the cipher method has been changed successfully.

The great advantage achieved by the above-described GSM authentication according to the implicit or explicit method is that the cipher key Kc according to the GSM system is ready for potential handover from the UMTS system to the GSM system. The cipher key Kc is stored both in the UMTS network, preferably in the visitor location register VLR, and in the mobile station, preferably in the SIM application.

The calculation of the cipher key Kc according to the GSM system can be carried out if the serving network SN so desires. It can be carried out, for example, always in connection with the UMTS authentication.

The calculation of the cipher key Kc can, according to a preferred embodiment of the invention, also be carried out when it is detected from the local radio cells that a need exists to carry out handover to the base station sub-system BSS according to the GSM system. Furthermore, the cipher key Kc can be calculated while handover is being carried out, which, however, may cause delay in carrying out the handover.

The cipher key Kc according to the GSM system can also be determined by separating it from the cipher key CK of the UMTS when, for example, the connection is being handed over to the GSM base station. The CK will probably be longer than the Kc. Then, the mobile station MS and the UMTS network, preferably the VLR, make the CK key as short as the Kc key and preferably store it in memory for later use. Hence, the Kc key according to the GSM system is available for a potential handover situation. It is then unnecessary to calculate the GSM parameters at the authentication centre or in the SIM application.

In the following, by means of Figure 4, a handover process will be described in a circuit-switched connection by way of example, only taking into account parts relevant to the invention. The mobile station MS carries out measurements of base stations located in the neighboring area, measuring also base stations of the GSM system when the UMTS network has preferably so requested. The mobile station MS transmits the measurement information to a serving radio network controller RNC (measurement, arrow 40).

The RNC makes a decision about inter-system handover on the basis of, for example, whether a handover threshold has been exceeded as far

as the signal strength is concerned. The RNC transmits an announcement about the necessity of the handover to an anchor mobile switching centre AMSC of the serving UMTS network SN (handover required, arrow 41). In handover, the AMSC is a so-called source mobile switching centre. The AMSC preferably comprises interworking function IWF, which enables a handover request according the GSM system to be produced. If the cipher key Kc is not yet precalculated, the AMSC can request that it be calculated after, for example, the AMSC has received the handover request (handover required, arrow 41). Before the handover request is transmitted to the GSM network, the cipher key Kc is calculated, for example, in the explicit manner described above.

The AMSC retrieves the precalculated cipher key Kc preferably from the visitor location register VLR. The AMSC transmits the cipher key Kc in the handover request to a relay mobile switching centre RMSC according to the GSM system together with other information according to the GSM system and necessary in the handover, such as the classmark information of the mobile station (prepare ho request, arrow 42). It is possible that the UMTS base station sub-system and the GSM base station sub-system to which handover is to be performed are connected to the same core network, as illustrated in Figure 1. In such a case, both the GSM and the UMTS base station sub-systems can be controlled by the same mobile switching centre MSC, which transmits the handover request to the GSM base station sub-system according to the GSM system.

The RMSC transmits the handover request, which also comprises the cipher key Kc, to a base station controller BSC (handover request, arrow 43). The BSC allocates the necessary resources according to the handover request and transmits the reply to the RMSC (ho request ack, arrow 44). The RMSC transmits the reply to the handover request to the AMSC (prepare ho response, arrow 45). The AMSC transmits a command according to the UMTS system to carry out the handover to the radio network controller RNC (handover command, arrow 46).

The RNC transmits to the mobile station MS the handover command between the UMTS and the GSM systems (inter-system ho command, arrow 47). This message comprises all necessary information on, for example, the radio channel for the mobile station to be able to carry out handover according to the GSM system. The mobile station MS recognizes that the han-

dover is to the GSM system, and it activates the GSM functions. Furthermore, the mobile station preferably detects that a cipher key according to the GSM system is needed, whereby the cipher key Kc according to the GSM system is requested of the SIM application. The SIM application transmits the cipher key Kc to the means of the mobile station which carries out ciphering according to the GSM system.

The mobile station MS transmits a handover access message on a GSM channel allocated thereto as in a typical GSM system (handover access, arrow 48). The mobile station MS typically transmits one or more unciphered [HANDOVER ACCESS] messages determined in the GSM specifications. Next, the connection is handed over be served by the GSM base station subsystem according to the GSM system which is known per se and which needs not be described in closer detail here. Traffic to be transmitted can, according to a preferred embodiment of the invention, be ciphered by using the precalculated cipher key Kc and the ciphering algorithm A5 preferably immediately after the (handover access, arrow 48) message. The GSM network can possibly also carry out the authentication although the traffic can already be ciphered.

The great advantage achieved from the solution of a preferred embodiment of the invention is that the traffic between the mobile station and the mobile communication network can be ciphered immediately after handover by means of the cipher key Kc according to the GSM system. If no cipher key Kc for ciphering were available in the mobile station and the GSM base station, it would be necessary to carry out authentication and calculation of the cipher key after handover in the GSM network. In such a case, some of the traffic to be transmitted would remain unciphered and time would be wasted.

In order to implement a preferred embodiment of the invention compared to the prior art implementation, such as the GSM system, changes are mainly required in the functions of the mobile switching centre MSC/VLR, the visitor location register VLR and the mobile station MS. The functions required by the solution of the invention can be implemented by software.

The above-described authentication, calculation of the cipher key and handover implementation describe by way of example the application of the invention to the UMTS and the GSM systems. The invention can also readily be applied to other mobile communication systems, such as wireless local area networks.

It is obvious to one skilled in the art that as technology advances, the basic idea of the invention can be implemented in several different ways. The invention and its embodiments are thus not restricted to the above-described examples but they can vary within the scope of the claims.

CLAIMS

1. A method of arranging data protection in a telecommunication system comprising a first mobile communication network wherein a first cipher key is used for ciphering traffic between a mobile station and a mobile communication network, a second mobile communication network wherein a second cipher key is used for ciphering traffic between a mobile station and a mobile communication network, and a mobile station supporting said mobile communication networks, **characterized** by

calculating said second cipher key in the first mobile communication network when the mobile station operates in the first mobile communication network,

transmitting information necessary for calculating said second cipher key from the first mobile communication network to the mobile station when the mobile station operates in the first mobile communication network, and

calculating said second cipher key at the mobile station.

2. A method as claimed in claim 1, **characterized** by

using said second cipher key for ciphering the traffic between the mobile station and the second mobile communication network if the mobile station is handed over from the first mobile communication network to the second mobile communication network during an active connection.

3. A method as claimed in claim 1 or 2, **characterized** by

transmitting said second cipher key from the first mobile communication network to the second mobile communication network,

transmitting said second cipher key calculated at the mobile station to a ciphering means of the mobile station in response to the fact that the first mobile communication network transmits a request to the mobile station for handover to the second mobile communication network, and

using said second cipher key in ciphering traffic after the handover in the mobile station and in the second mobile communication network.

4. A method as claimed in any one of the preceding claims, **characterized** by

checking, in the first mobile communication network, whether the mobile station supports the second mobile communication network,

calculating said second cipher key in the first mobile communication network in response to the fact that the mobile station supports the second mobile communication network,

transmitting a request for calculation of said second cipher key from the first mobile communication network to the mobile station, and

calculating at the mobile station said second cipher key in response to said request.

5. A method as claimed in claim 4, **characterized** by

calculating said second cipher key in the first mobile communication network in response to the fact that an identifier transmitted by the mobile station, such as an IMSI subscriber identifier, and/or a classmark identifier indicate that the mobile station supports the second mobile communication network.

6. A method as claimed in any one of the preceding claims, **characterized** by

calculating said second cipher key at a network element in the first mobile communication network, such as an authentication centre, in response to the fact that a network element of the first mobile communication network, such as a visitor location register or a home location register, comprising identifiers transmitted by the mobile station requests calculation of said second cipher key, and

transmitting said second cipher key from said network element calculating the cipher key to said network element comprising the identifiers transmitted by the mobile station.

7. A method as claimed in any one of the preceding claims, **characterized** by

the mobile station comprising a subscriber identification application, such as a USIM application, to the first mobile communication network and a subscriber identification application, such as an SIM application, to the second mobile communication network,

transmitting the information necessary for calculating said second cipher key received by the mobile station to the identification application according to the second mobile communication network.

8. A method as claimed in any one of the preceding claims, **characterized** by

calculating said second cipher key in the first mobile communication network in connection with calculating an authentication response according to the first mobile communication network and the first cipher key,

transmitting the information necessary for calculating the first cipher key and said second cipher key, such as a random-number parameter, from the first mobile communication network to the mobile station,

transmitting the necessary information at the mobile station for calculating said first and second cipher keys to the identification applications according to the first and the second mobile communication networks,

calculating said second cipher key in the identification application according to the second mobile communication network and the authentication response in the identification application according to the first mobile communication network,

transmitting said authentication response according to the first mobile communication network from the mobile station to the first mobile communication network, and

acknowledging the authentication of the mobile station to be performed for the second mobile communication network in response to the fact that the first mobile communication network accepts the authentication response transmitted by the mobile station.

9. A method as claimed in any one of claims 1 to 7, **characterized** by

determining a random-number parameter and calculating the authentication response according to the second mobile communication network in connection with calculating said second cipher key in the first mobile communication network,

transmitting a request to the mobile station for calculation of an authentication response according to the second mobile communication network,

transmitting the information necessary at the mobile station for calculating said second cipher key to the identification application according to the second mobile communication network,

calculating, in the identification application according to the second mobile communication network, the authentication response according to the second mobile communication network in connection with calculating said second cipher key,

transmitting the authentication response according to the second mobile communication network calculated at the mobile station to the first mobile communication network, and

checking said authentication response according to the second mobile communication network transmitted by the mobile station in the first mobile communication network.

10. A method as claimed in any one of claims 1 to 7, **characterized** by

calculating said second cipher key by shortening the first cipher key in the first mobile communication network and at the mobile station before the handover to the second mobile communication network takes place.

11. A method as claimed in any one of the preceding claims, **characterized** by

calculating said second cipher key in response to the fact that a decision has been made in the first mobile communication network to carry out handover to the second mobile communication network.

12. A telecommunication system comprising at least a first mobile communication network arranged to use a first cipher key for ciphering traffic between a mobile station and a mobile communication network, a second mobile communication network arranged to use a second cipher key for ciphering traffic between a mobile station and a mobile communication network, and a mobile station arranged to support said different first and second mobile communication networks, **characterized** in that

the first mobile communication network is arranged to calculate said second cipher key when the mobile station operates in the first mobile communication network,

the first mobile communication network is arranged to transmit information necessary for calculating said second cipher key from the first mobile communication network to the mobile station when the mobile station operates in the first mobile communication network, and

the mobile station is arranged to calculate said second cipher key.

13. A telecommunication system as claimed in claim 12, **characterized** in that

the mobile station and the second mobile communication network are arranged to cipher the traffic between the mobile station and the second mobile communication network by using said second cipher key if the mobile

station is handed over from the first mobile communication network to the second mobile communication network during an active connection.

14. A telecommunication system as claimed in claim 12 or 13, **characterized** in that

the first mobile communication network is arranged to transmit said second cipher key to the second mobile communication network before the handover to the second mobile communication network,

the mobile station is arranged to transmit said second cipher key calculated at the mobile station to a ciphering means of the mobile station in response to the fact that the first mobile communication network transmits a request to the mobile station for handover to the second mobile communication network, and

the mobile station and the second mobile communication network are arranged to use said second cipher key in ciphering traffic after the handover.

15. A telecommunication system as claimed in any one of claims 12 to 14, **characterized** in that

the first mobile communication network is arranged to check whether the mobile station supports the second mobile communication network on the basis of an identifier transmitted by the mobile station, such as an IMSI and/or a classmark identifier,

the first mobile communication network is arranged to calculate said second cipher key in response to the fact that the mobile station supports the second mobile communication network,

the first mobile communication network is arranged to transmit a request to the mobile station for calculation of said second cipher key, and

the mobile station is arranged to calculate said second cipher key on the basis of said request.

16. A telecommunication system as claimed in any one of claims 12 to 15, **characterized** in that

a network element comprising identifiers transmitted by the mobile station of the first mobile communication network, such as a visitor location register or a home location register, is arranged to transmit the request for calculation of said second cipher key to a network element of the first mobile communication network, such as an authentication centre,

the network element of the first mobile communication network, such as the authentication centre, is arranged to calculate said second cipher key in response to the fact that the network element comprising the identifiers transmitted by the mobile station requests calculation of said second cipher key, and

said network element calculating said second cipher key is arranged to transmit the calculated second cipher key to said network element comprising the identifiers transmitted by the mobile station.

17. A telecommunication system as claimed in any one of claims 12 to 16, **characterized** in that

the first mobile communication network is arranged to calculate said second cipher key in connection with calculation of an authentication response according to the first mobile communication network and the first cipher key,

the first mobile communication network is arranged to transmit to the mobile station information necessary for calculating the first cipher key and said second cipher key, such as a random-number parameter,

the mobile station comprises an identification application according to the first mobile communication network, such as a USIM application, and an identification application according to the second mobile communication network, such as an SIM application,

the mobile station is arranged to transmit said information necessary for calculating the first cipher key and said second cipher key to the identification applications according to the first and the second mobile communication networks,

said identification application according to the second mobile communication network is arranged to calculate said second cipher key and said identification application according to the first mobile communication network is arranged to calculate the authentication response according to the first mobile communication network, and

the mobile station is arranged to transmit the authentication response according to the first mobile communication network to the first mobile communication network.

18. A telecommunication system as claimed in any one of claims 12 to 16, **characterized** in that

the first mobile communication network is arranged to determine a random-number parameter according to the second mobile communication

network and to calculate the authentication response in connection with calculating said second cipher key,

the first mobile communication network is arranged to transmit a request to the mobile station for calculating the authentication response according to the second mobile communication network,

the mobile station comprises an identification application according to the first mobile communication network, such as a USIM application, and an identification application according to the second mobile communication network, such as an SIM application,

the mobile station is arranged to transmit the information necessary for calculating said second cipher key to the identification application according to the second mobile communication network,

the identification application according to the second mobile communication network is arranged to calculate said second cipher key and the authentication response according to the second mobile communication network substantially simultaneously,

the mobile station is arranged to transmit the authentication response according to the second mobile communication network to the first mobile communication network, and

the second mobile communication network is arranged to check the authentication response according to the second mobile communication network.

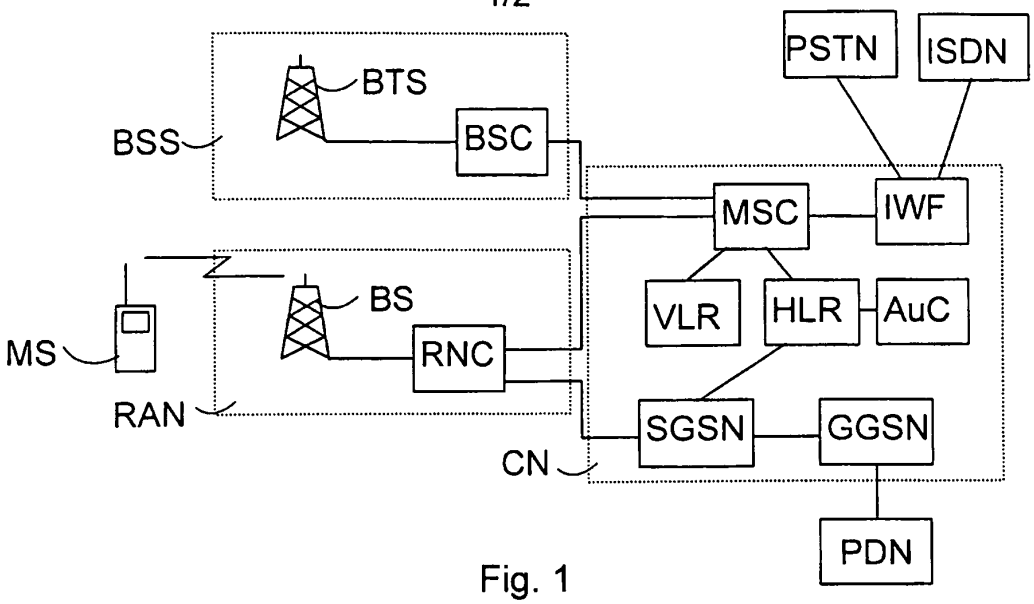

PSTN
ISDN
BTS
BSS
BSC
MSC
IWF
BS
VLR
HLR
AuC
MS
RNC
RAN
SGSN
GGSN
CN
PDN

Fig. 1

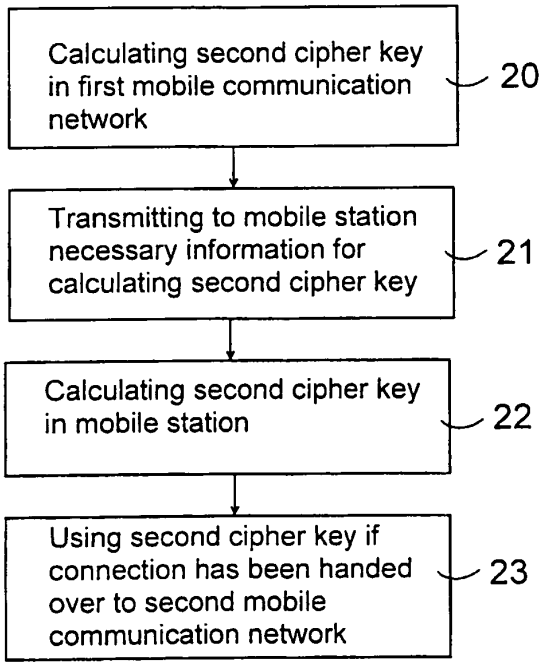

Calculating second cipher key in first mobile communication network
20
Transmitting to mobile station necessary information for calculating second cipher key
21
Calculating second cipher key in mobile station
22
Using second cipher key if connection has been handed over to second mobile communication network
23

Fig. 2

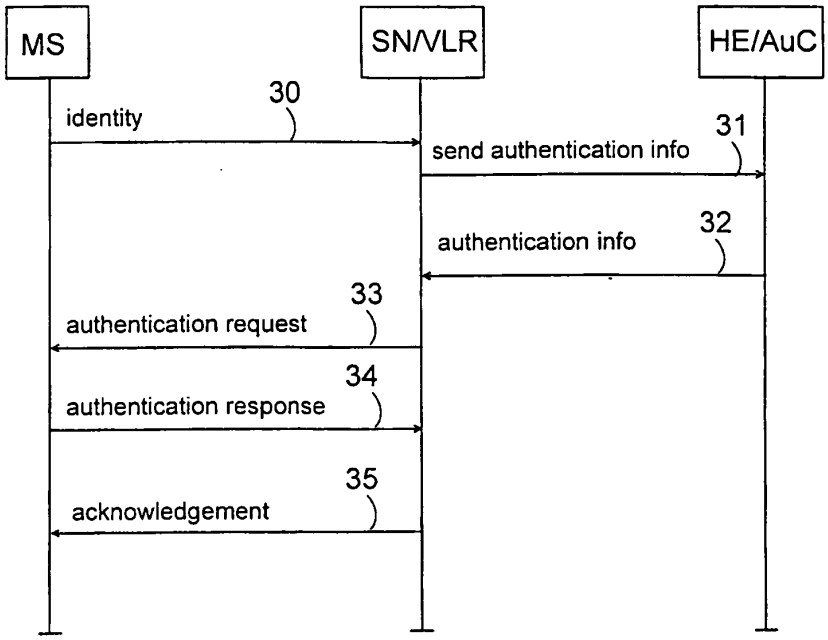

MS
SN/VLR
HE/AuC
30
identity
31
send authentication info
32
authentication info
33
authentication request
34
authentication response
35
acknowledgement

Fig. 3

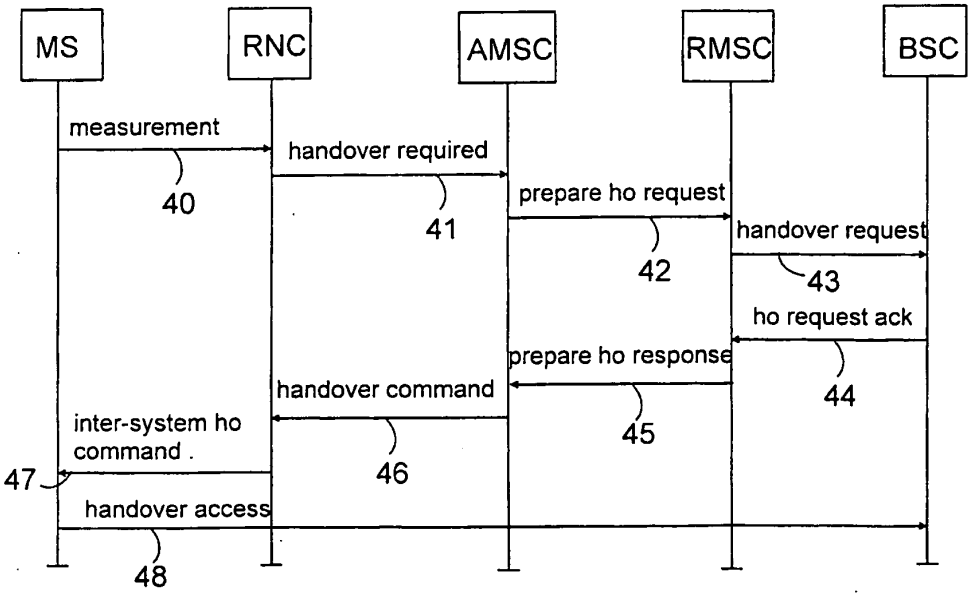

MS
RNC
AMSC
RMSC
BSC
measurement
40
handover required
41
prepare ho request
42
handover request
43
ho request ack
44
prepare ho response
45
handover command
46
inter-system ho command .
47
handover access
48

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00495

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04M 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: H04M

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 9859513 A1 (NOKIA MOBILE PHONES LTD.), 30 December 1998 (30.12.98), page 1, line 3 - page 2, line 24 ---	1-18
P,A	PUTZ, S.; SCHMITZ, R. "Secure interoperation between 2G and 3G mobile radio networks". In: First International Conference on 3G Mobile Communication Technologies, 2000. (Conf. Publ. No. 471), 27-29 March 2000, pages 28-32. ISBN 0-85296-726-8 --- --------	1-18

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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13 November 2000	16 -11- 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 Tomas Erlandsson /OGU Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT
Information on patent family members

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WO	9859513	A1	30/12/98	AU	7656498 A	04/01/99
				EP	0992170 A	12/04/00
				FI	105309 B	00/00/00
				FI	972722 A	25/12/98

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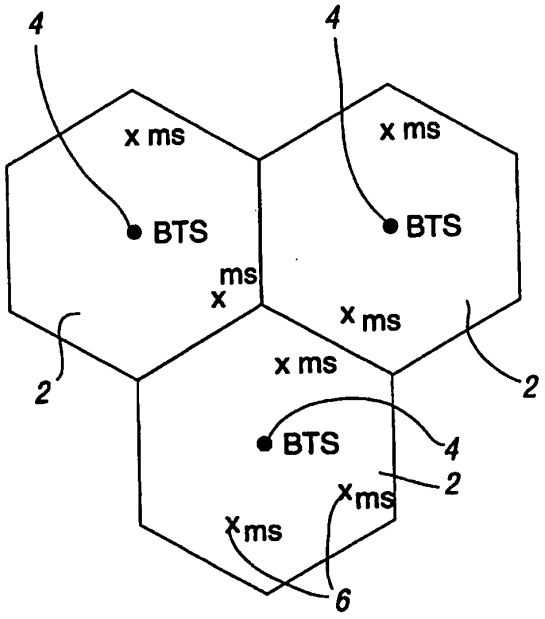
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Published
With international search report.

(54) Title: DISCONTINUOUS TRANSMISSION CDMA SYSTEM

(57) Abstract

A method of transmitting from a first node to a second node, said method comprising the steps of transmitting in a first mode at least one data frame from said first node to said second node; and determining if there is no data to be transmitted and if there is no data to be transmitted transmitting at least one empty frame in the first mode; and switching to a second mode in which no transmission is made in the absence of data to be transmitted at least some of the time.



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DISCONTINUOUS TRANSMISSION CDMA SYSTEM

Field of the invention

The present invention relates to a method of transmitting and in particular but not exclusively to a method of transmitting in a wireless telecommunications network.

Background of the invention

The use of code division multiple access (CDMA) is being proposed for the next generation of cellular telecommunication networks. Additionally, code division multiple access is also being used in the IS-95 Standard in the USA. CDMA is a direct sequence spread spectrum technique. In a wireless cellular network using CDMA, the mobile terminals in one cell associated with a first base station will use the same frequency as mobile stations in an adjacent cell associated with a second base station. The different mobile stations can be distinguished by the respective base stations as each mobile station will be using a different spreading code.

In US-A-5101501 a CDMA system is described which uses "soft" handoff. With soft handoff, a mobile station is capable of communicating with more than one base station at the same time. This will typically occur when the mobile station is close to the boundary defined between two cells. The signals sent by the mobile stations will be received and processed by both of the base stations. Likewise, the mobile station will receive the same signal from the two base stations. The signals from the two base stations may be combined. The combined signal may provide better quality than the any of the individual signals received by the mobile station.

Thus, one mobile station can listen to two or more base stations simultaneously. It is therefore important that the information received by the mobile stations from the different base station

be identical. If different information is received from the different base stations, the mobile station will have no way of determining which is the correct information and which information can be ignored. Additionally it will not be possible to combine the signals from the different base stations to provide a meaningful combined signal.

Generally, different information will be received by the mobile station because an error in transmission has occurred and one of the expected transmissions from one or more of the base stations is not transmitted by the base station. The base station may not receive any information to be transmitted to the mobile station for two reasons. Firstly there has been an error in the information received by the base station. Secondly, there is in fact no information to be received. The lack of information may be due to, for example a pause in conversation or because the transmission is a discontinuous transmission. It is therefore necessary to determine whether the lack of received information is intentional or whether it is due to an error.

It has been suggested by the inventor that empty frames of data can be sent to the base station in two different ways. These two ways do not constitute prior art. Firstly, the transmission is suspended. In other words, the base station will be sent nothing. This has the advantage that the processing resources at the base station are saved as well as in other network elements. The load at the interface between the base station and the network controller, which is sending the information to the base station, is reduced. However this method has the disadvantage that it is not possible to distinguish between a transmission error and the fact that there is no data. This leads to two problems.

Firstly, failures in the interface between the base station and the network controller are not detected by the base station in the case of information being sent from the network controller to the base station or by the network controller in the case of information being sent from the base station to the network

controller.

Secondly, if a data frame is not received, due to an error, by a base station, that data frame cannot be transmitted by the base station to the mobile station. If the mobile station is in soft handoff, that is communicating with more than one base station at a time, the mobile station will receive different data streams from the base stations due to the error. This may lead to errors in the mobile station when it attempts to combine the different data streams.

The second method for dealing with empty frames of data is for the base station to be sent empty frames of data. This makes it possible to distinguish between errors and the fact that there is no information. However, this method does have the disadvantage that additional processing capacity is required at the base station and other network elements. Additionally, the load at the interface between the base station and the network controller is increased.

Similar problems can also occur in the uplink directions.

Summary of the invention

It is an aim of embodiments of the present invention to provide a method of dealing with the absence of information or data which addresses the disadvantages of the known methods.

According to one aspect of the present invention, there is provided a method of transmitting from a first node to a second node, said method comprising the steps of transmitting in a first mode at least one data frame from said first node to said second node; and determining if there is no data to be transmitted and if there is no data to be transmitted transmitting at least one empty frame in the first mode; and switching to a second mode in which no transmission is made in the absence of data to be transmitted at least some of the time.

The first and second nodes may be any suitable elements in a telecommunications network.

According to a second aspect of the present invention there is provided a method of receiving transmissions from a first node at a second node, said transmission have a first mode in which if there is no data to be transmitted, empty frames are transmitted and a second mode in which if there is no data to be transmitted nothing is transmitted, said method comprising the steps of: receiving transmissions from said first node, wherein if the transmissions have a first mode and a frame is not received and error is determined to have occurred.

According to a third aspect of the present invention there is provided a first node for transmitting data to a second node, wherein said first node comprises transmitting means for transmitting data to said second node, said transmitting means have a first mode of operation in which data is transmitted in data frames and if there is no data to be transmitted empty frames are transmitted and a second mode of operation in which if there is no data no frames are transmitted.

According to a fourth aspect of the present invention, there is provided a second node for receiving transmissions from a first node at a second node, said transmissions have a first mode in which if there is no data to be transmitted, empty frames are transmitted and a second mode in which if there is no data to be transmitted nothing is transmitted, said second node comprising means for receiving transmissions from said first node, and determining means for determining that if the transmissions have a first mode and a frame is not received, an error has occurred

Brief description of the 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 to the accompanying drawings in which:
Figure 1 shows a schematic diagram of part of a cellular telecommunications network incorporating base transceiver stations and mobile stations;
Figure 2 shows part of the network of Figure 1 in more detail; and
Figure 3 illustrates the normal and silent modes used by the base stations of Figure 1.

Detailed description of embodiments of the invention

Reference will first be made to Figure 1 in which three cells 2 of a cellular telecommunications network are shown. Each cell 2 is served by a respective base transceiver station (BTS) 4. Each base transceiver station 4 is arranged to transmit signals to and receive signals from the mobile stations 6 located in the cell associated with the given base transceiver station 4. Likewise, each mobile station 6 is able to transmit signals to and receive signals from the respective base transceiver station 4.

The cellular telecommunications network shown in Figure 1 uses a code division multiple access technique. Accordingly, at least some of the mobile stations will be in communication with more than one base station at the same time. This, however, will be described in more detail hereinafter.

Reference is now made to Figure 2. As can be seen from this figure, the base stations are connected to a SRNC (serving radio network controller) 20. Data blocks are transmitted between the SRNC 20 and the base stations 28 and 30 using a frame protocol FP. A data frame contains data which is to be transmitted in one interleaving period and a transport format indicator TFI. The interleaving period is the period over which data is interleaved. The transport format indicator TFI provides information as to the format of the data frame such as the size of the data block, the interleaving period and the like.

Each UE (user equipment for example mobile stations or the like) has an independent transport connection which means that each frame contains the data and current transport format indicator TFI of one bearer only. Typically a call will have more than one bearer, for example a signalling bearer and a data or voice bearer. For downlink communications (from the SRNC 20 to the base station direction), all the data blocks of users having the same user equipment are multiplexed onto a single radio link. The manner in which the multiplexing is done will depend on the transport format indicator TFI of each frame which indicates the amount of data in each frame for the bearers. A transport format combination information TFCI field of the radio frame provided in a dedicated physical control channel DPCCH will indicate the manner in which the multiplexing is carried out. The transport format combination information TFCI field will indicate the transport format indicator TFI for each of the bearers whose data is multiplexed in the radio frame or frames in the dedicated physical data channel DPDCH. In the case of soft handoff where a mobile station is in communication with more than one mobile station at a time, the dedicated physical data channels DPDCH from each of the bases stations communicating with the mobile station in question will be the same as will the rate information RI fields in all the radio links.

The format described hereinbefore is part of the currently proposed UMTS (universal mobile telephone service) standard. It should be appreciated that any other standard can alternatively be used.

In the following, it is assumed for simplicity that there is only one bearer per transport channel and the SRNC does not carry out any multiplexing. The transport format information can have a particular value which indicates that the frame does not contain any data. For simplicity it is assumed that the particular value is zero although the particular value can be any other value.

The SRNC 20 shown in Figure 2 has first and second medium access

controllers MAC 24 which receive the data from respective bearers. For simplicity, the medium access controllers 24 are each shown as receiving information from one bearer only. The medium access controllers can receive information from more than one bearer and carry out the multiplexing function described hereinbefore.

The medium access controller 24 receives an input from a first bearer Bearer 1 and a second bearer, Bearer 2 and outputs a first transport channel 1 and a second transport channel 2. The input from Bearer 1 maps to the first transport channel 1 and the input from Bearer 2 maps to the second transport channel 2. The transport channels are input to respective macrodiversity combiners 26. The macrodiversity combiners 26 output the transport channels to each base station which is in communication with the mobile station for which the transport channel is intended. In the example shown in Figure 2, the first transport channel 1 is output to first and second base stations 28 and 30 as is the second transport channel 2. Thus the first and second base stations are each arranged to transmit the same channels to a single mobile station.

The mode of operation for transmission of information between the SRNC 20 and base stations will now be described with reference to Figure 3. Two modes are defined. The first mode is the normal mode and the second mode is the silent mode. The data which is to be sent to the mobile station is interspersed with periods where there is no data. This may occur during pauses in a conversation between two parties. Alternatively, in the case of non speech data, the data may be discontinuous.

In the normal mode A of operation, on the transmit side, the SRNC 20 transmits a frame F for every interleaving period. As shown in Figure 2, frames F1 and F2 contain data. If no data is present, frames F3, F4 and F5 which are empty frames E are sent. After N consecutively received empty frames E, the frame protocol connection is switched to the silent mode S. N can have any

suitable value such as 1, 2 or 3 or any other suitable value.

In the silent mode S, on the transmit side, the SRNC 20 is prevented from transmitting any frame if there is no data in the frame. The SRNC may transmit K empty frames F6 at the beginning of the silent mode S to ensure that the base station has switched to the silent mode; also if up to K of the N empty frames previously sent have been lost during the transmission. After M consecutive frames F7 and F8 including data are transmitted, the frame protocol connection is switched to the normal mode A again. K may be 0 or 1 or any other suitable number. M can be 1, 2, 3 or any other suitable number.

In the normal mode A, on the receive side, if a frame is not received in an interleaving period, the base station generates an interface failure alarm and decides whether to transmit the radio frame without the data or to not transmit the frame at all. After the base station has received N empty frames, the frame protocol connection is switched to the silent mode S.

In the silent mode S, on the receive side, if a frame is not received in one interleaving period, the base station considers the bearer to be in an inactive state and sets the transport format indicator TFI to zero. After M consecutive data frames with data have been received, the frame control layer connection is switched to the normal mode A.

The parameters M, N and K may be:

1. predetermined, for example fixed in a standard used by the network;
2. Iub/Iur (Iub is the interface between the SRNC and the base station while Iur is the interface between two radio network controllers) interface protocol configurable parameters, that is the parameters can be set at each interface as required; and
3. signalled from the SRNC to base stations every time a new branch or bearer is set. The parameters may be reconfigurable as required.

Control frames which do not contain data but instead contain control information such as power control and synchronisation information are sent in both the normal mode and the silent mode. Control frames may not be present in either or both of these modes.

Reference will now be made to a second embodiment of the present invention which uses explicit signalling in order to switch from the normal mode to the silent mode. In this second embodiment, the base station will not automatically switch to the silent mode when a predetermined number of consecutive empty frames have been received. However, the transmission of a predetermined number of empty frames when in the normal mode can be used as an indication that the silent mode should be used. Of course, any other suitable measure can be used to determine that a switch should be made between the normal and the silent mode.

Once a determination has been made that the base station should stop using the normal mode and start using the silent mode, the radio network controller will include in the next frame sent to the base station a mode bit indicative of this. This mode bit may have a given value for the silent mode and the other value for the normal mode. Alternatively, one value of the bit indicates that the mode should change either from the normal to the silent mode or from the silent mode to the normal mode. The other value of the bit would indicate that the mode is not to be changed.

When the base station receives the frame transmitted by the radio network controller, it checks the mode bit. If this bit indicates that the mode is to change from the normal mode to the silent mode, the base station changes its mode and sends an acknowledgement confirming that the base station has understood that the mode is changed. Once the radio network controller has received the acknowledgement from the base station, the radio network controller will use the silent mode.

Changes from the silent mode to the normal mode can be achieved

in the same way as in the first embodiment. However, it is also possible to alter the mode from the silent to normal mode in the following. When it is determined that the base station is to receive using the normal mode, the radio network controller will alter the mode bit in the next frame sent to the base station, to indicate that the mode should change to the normal mode. If a data frame is being sent to the base station, the mode bit will be altered in that frame. If no data frame is being sent to the base station due to an absence of data, the radio network controller will send an empty frame with the mode bit set accordingly.

The base station will send an acknowledgement indicating that it has received the frame and has noted that the mode is changed to the normal mode. When the radio network controller receives the acknowledgement, the radio network controller will then use the normal mode.

It is possible to use this second method to notify the base station by sending in advance information that the mode will change after a predetermined number of frames or the like.

The method used by the first embodiment has the advantage that the frame structure does not need to be altered. A second advantage of the first method is that two way communication does not have to be set up if one party, for example, the radio network controller is sending data to the base station and the base station is not sending any data to the radio network controller. The second method is advantageous in that both parties are certain as to which mode of operation is being used.

The acknowledgement sent by the base station to the radio network controller may use a mode bit in the frame, as described hereinbefore in relation to the frames sent from the radio network controller to the base station. Thus the acknowledgement may comprise the mode bit in the frame sent by the base station to the radio network changing to reflect the new mode. Either of

the options for the mode bit described hereinbefore may be used.

It should be appreciated that although the transmissions from the SRNC to the base station are described as using the normal and silent mode of operation, this mode of operation can alternatively or additionally be used for transmissions from the base station to the SRNC. The values of the parameters used in the downlink and uplink directions may differ. Embodiments of the present invention may be applied to the communications between any two nodes of a telecommunications network, wired or wireless.

It should be appreciated that although embodiments of the present invention are particularly advantageous when used in a soft handoff or similar context, that is when a mobile station is in communication with more than one base station at the same time, embodiments of the present invention can also advantageously be used where the mobile station is in communication with one base station at a time. In an alternative embodiment of the present invention, the normal and silent mode of operation may only be used when the mobile station is in communication with more than one base station at a time. A different mode of operation may be used when the mobile station is in communication with only one base station. The different mode of operation may be one which incorporates one of the previously known methods for dealing with empty frames.

Whilst preferred embodiments have been described in the context of a code division multiple access system, embodiments of the present invention can be used with any other spread spectrum technique or any other suitable access technique such as time division multiple access, frequency division multiple and space division multiple access as well as hybrids thereof.

CLAIMS:

1. A method of transmitting from a first node to a second node, said method comprising the steps of:

transmitting in a first mode at least one data frame from said first node to said second node; and

determining if there is no data to be transmitted and if there is no data to be transmitted transmitting at least one empty frame in the first mode; and

switching to a second mode in which no transmission is made in the absence of data to be transmitted at least some of the time.

2. A method as claimed in claim 1, wherein said second mode is used if a predetermined number of empty frames are transmitted consecutively.

3. A method as claimed in claim 2, wherein the first station, if using the first mode, switches automatically to the second mode if the predetermined number of empty frames are transmitted consecutively.

4. A method as claimed in claim 1 or 2, comprising the step of the first node sending information to the second node advising that the mode is to change from the first mode to the second mode.

5. A method as claimed in claim 4, wherein the second node is arranged to confirm receipt of said information and when the first node has received the confirmation from the second node, said first node is arranged to use said second mode.

6. A method as claimed in claim 4 or 5, wherein said information is in a frame transmitted from the first node to the second node.

7. A method as claimed in any of claims 4 to 6, wherein said information is sent in advance of the change of mode.

8. A method as claimed in any preceding claim, wherein in said second mode, data to be transmitted is transmitted in data frames and if a predetermined number of data frames are transmitted, the first mode is used.

9. A method as claimed in claim 8, wherein if the predetermined number of data frames is received in said second mode, the first mode is automatically used.

10. A method as claimed in any of claims 1 to 8, wherein when the first node is using the second mode and the mode is to be switched to the first mode, the first node is arranged to transmit information that the mode is to be switched to said second mode.

11. A method as claimed in claim 10, wherein the second node is arranged to confirm receipt of said information that the mode is to be switched from said second mode to the first mode and the first node is arranged to use the first mode when the confirmation has been received by the first node.

12. A method as claimed in claim 2 or any claim appended thereto, wherein said predetermined number of data frames are consecutive data frames.

13. A method as claimed in any one of the preceding claims wherein if no data is to be transmitted at the beginning of the second mode, a predetermined number of empty frames are first transmitted and then no transmission is made in the absence of data to be transmitted.

14. A method as claimed in any one of the preceding claims, wherein said first node is arranged to transmit the same data to a plurality of second nodes, said plurality of second nodes

transmitting the same data to a third node.

15. A method of receiving transmissions from a first node at a second node, said transmission have a first mode in which if there is no data to be transmitted, empty frames are transmitted and a second mode in which if there is no data to be transmitted nothing is transmitted, said method comprising the steps of:

receiving transmissions from said first node, wherein if the transmissions have a first mode and a frame is not received and error is determined to have occurred.

16. A method as claimed in claim 15, wherein if an error is determined to have occurred, said second node transmits an empty frame to a third node.

17. A method as claimed in claim 15, wherein if an error is determined to have occurred, said second node transmits nothing to a third node.

18. A method as claimed in any of claims 15 to 17, wherein after a predetermined number of empty frames are received in said first mode, determining that the second mode is used by the first node.

19. A method as claimed in claim any of claims 6 to 9, wherein when a predetermined number of frames of data are received in said second mode, determining that the first mode is used by the first node.

20. A method as claimed in any of claims 15 to 20, wherein a change in operation of said first node is determined from information received by the second node from the first node.

21. A method as claimed in claim 20, wherein said information is in at least one frame transmitted from the first node to the second node.

22. A method as claimed in claim 16 or any claim appended

thereto, wherein said third node is a mobile station.

23. A method as claimed in any preceding claim, wherein said first node is a base station or a radio network controller in a wireless cellular telecommunications network.

24. A method as claimed in any preceding claim, wherein said second node is a base station or a radio network controller in a wireless cellular telecommunications network.

25. A first node for transmitting data to a second node, wherein said first node comprises transmitting means for transmitting data to said second node, said transmitting means have a first mode of operation in which data is transmitted in data frames and if there is no data to be transmitted empty frames are transmitted and a second mode of operation in which if there is no data no frames are transmitted at least some of the time.

26. A second node for receiving transmissions from a first node at a second node, said transmissions have a first mode in which if there is no data to be transmitted, empty frames are transmitted and a second mode in which if there is no data to be transmitted nothing is transmitted, said second node comprising means for receiving transmissions from said first node, and determining means for determining that if the transmissions have a first mode and a frame is not received, an error has occurred.

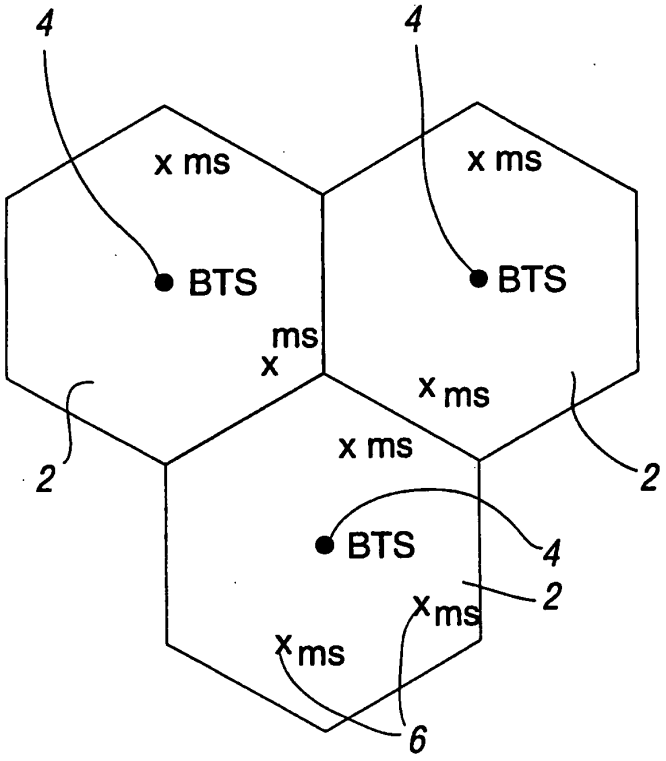


FIG. 1

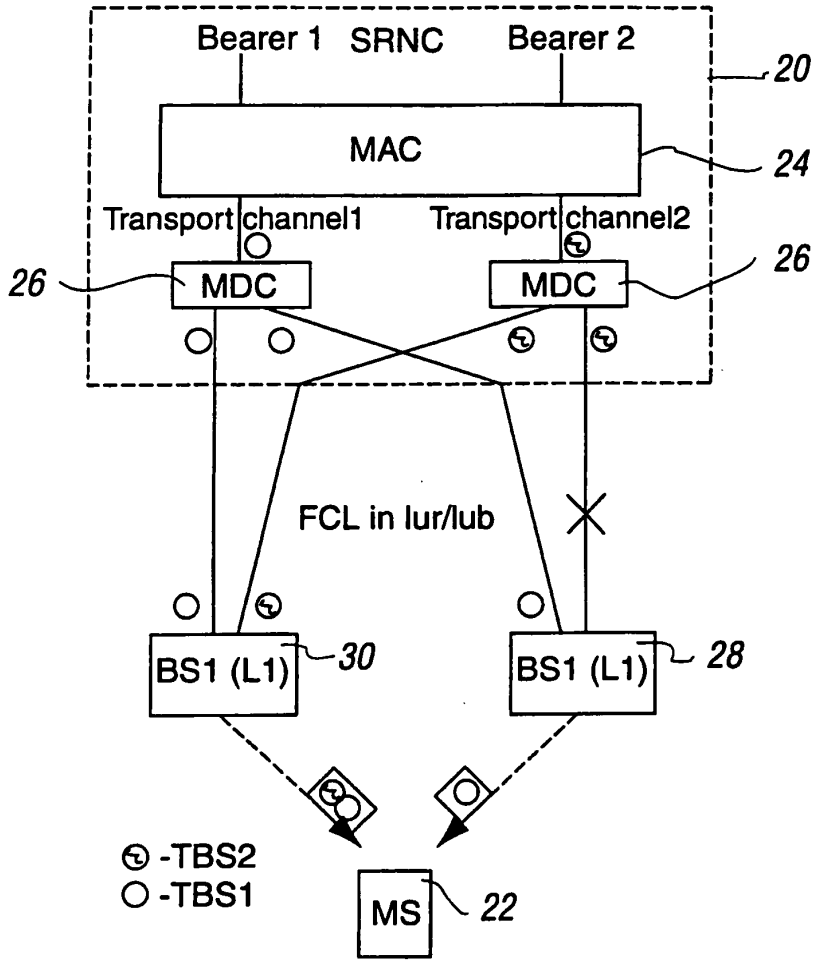

Bearer 1
SRNC
Bearer 2
20
MAC
24
Transport channel1
Transport channel2
26
MDC
MDC
26
FCL in Iur/Iub
BS1 (L1)
30
BS1 (L1)
28
-TBS2
-TBS1
MS
22

FIG. 2

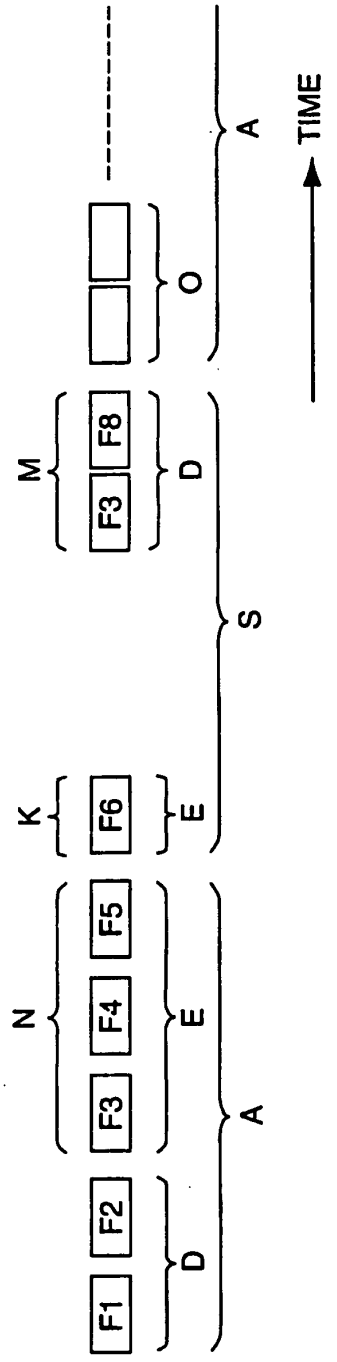


FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B7/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04B

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

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A	column 3, line 40 -column 4, line 47 claims 1,2	2-24,26
X	WO 97 02561 A (NOKIA MOBILE PHONES LTD ;KAPANEN PEKKA (FI)) 23 January 1997 (1997-01-23) abstract claim 1; figures 2,4,5	1,25

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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	Lazaridis, P

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Interna[illegible]onal Application No
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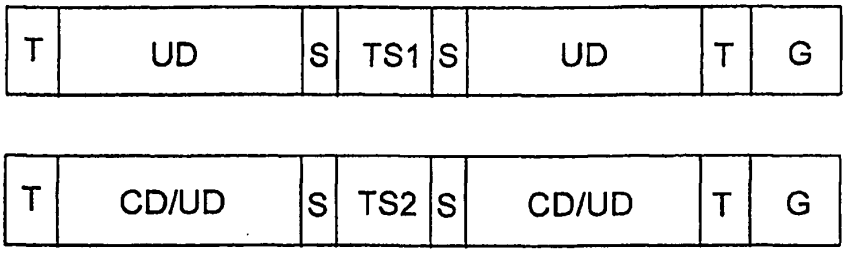
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(57) Abstract

A signaling method in a wireless digital telecommunication system between a base station and a terminal, where the signals between the base station and the terminal are generated from bursts comprising symbols, the bursts comprising a known training sequence. The symbols are used for generating a second training sequence of the same length as the known training sequence and a burst comprising said training sequence to be used for transmitting signalling messages. The number of training sequences used can be restricted to two, whereby conventional user data is sent in the burst comprising the known training sequence and information deviating from the conventional user data is sent by the burst comprising the second training sequence, and the stealing symbols in the burst can be used for specifying a signalling message to be transmitted.

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SIGNALLING METHOD AND TELECOMMUNICATION SYSTEM

The invention relates to a signalling method in a wireless digital telecommunication system between a base station and a terminal, where the signals between the base station and the terminal are generated from bursts comprising symbols, the bursts comprising a known training sequence.

The invention further relates to a wireless digital telecommunication system for signalling between a base station and a terminal, where the signals to be transmitted over a radio connection between the base station and the terminal comprise bursts generated from symbols, the bursts comprising a known training sequence, and the system comprising at least one transmitter and at least one receiver, whereof the transmitter comprises means for generating said training sequence and the receiver comprises means for identifying said training sequence.

In digital radio systems, call-related signalling between a base station and a terminal occurs simultaneously with a call to be transferred on a traffic channel. The GSM system, for example, employs two signalling channels for conducting call-related signalling, a SACCH (Slow Associated Control Channel) and a FACCH (Fast Associated Control Channel). The SACCH is a separate low-rate signalling channel associated with each traffic channel. Due to its low rate the channel can be used for non-urgent signalling only. The FACCH is fast signalling within the traffic channel, and can be used for time-critical signalling. However, a part of the traffic channel capacity is then lost.

In digital radio systems, such as the GSM system, data transmission occurs in bursts, and a specific burst structure is determined for each purpose, like data and signalling transmission, synchronization or equalization. A normal burst used for data and signalling transmission comprises in the middle a training sequence including a set of predetermined symbols that the receiver identifies. When comparing the received training sequence with a known training sequence the receiver may create information on the distortion caused by an un-ideal radio path to the received signal. On the basis of this information the receiver can demodulate the received signal more efficiently. The applicant's previous patent application PCT/FI97/00465 describes a signalling method, in which a training sequence is used for signalling, that speeds up the signalling and leaves the entire traffic channel to be used by the payload.

The problem with the above system is the number of different training sequences required for transmitting versatile signals. One training sequence can describe one signalling message only, and if, for example, power control signalling including eight steps is to be performed, eight different training sequences are required. If the aim is to perform several signalling events with the above method, the number of training sequences easily increases significantly. This increases the receiver load and complicates the implementation of the receiver, since the received training sequence must be separately compared with each known training sequence. Particularly distinguishing training sequences from one another becomes more difficult when the reception conditions are poor. Furthermore, when higher data transmission rates are aimed at, the use of a training sequence no longer necessarily guarantees fast enough signalling owing to the above and since the duration of the training sequence is relatively long bearing in mind that the training sequence is capable of transmitting one message only. Due to these drawbacks said method has not been widely employed and the GSM system, for example, still uses signalling channels.

A significant drawback with prior art signalling is that it matches poorly with packet-switched data transmission. In present packet-switched wireless telecommunication systems, such as the GPRS system (General Packet Radio Service) designed on the basis of the GSM system, data transmission from a terminal to a base station (uplink) and vice versa (downlink) takes place irrespective of one another. In said systems a channel is formed between the terminal and the base station only, when either party has data packets to send. In other words, there is no need to maintain a continuous return channel for transmitting signalling or acknowledgement messages in said systems. To utilize such asymmetrical data transmission optimally would require transmission of signalling and acknowledgement messages when the channel capacity is used for other purposes as well.

It is thus an object of the invention to provide a method and an apparatus implementing the method so as to solve the above problems. The objects of the invention are achieved with a method, characterized by

generating from symbols a second training sequence of the same length as the known training sequence,

generating a burst comprising said second training sequence and by

using the burst comprising said second training sequence for transmitting various signalling messages.

The wireless digital telecommunication system of the invention is characterized in that

the transmitter comprises means for generating a second training sequence of the same length as the known training sequence and means for generating a burst comprising said second training sequence and for coding a signalling message into said burst and in that

the receiver comprises means for receiving the burst comprising said second training sequence, means for identifying said second training sequence and means for decoding the coded signalling message in said burst.

According to a preferred embodiment of the invention the number of training sequences to be used is restricted to two. According to another preferred embodiment of the invention the stealing symbols in the burst comprising said second training sequence are used for specifying the signalling message to be transmitted.

The invention is based on the idea that various training sequences are used in the burst structure to indicate the contents of the burst. The recipient then interprets the received burst on the basis of the training sequence. A particular training sequence can preferably be employed in the burst structure to indicate that signalling data in particular is transmitted using the burst. The type of the signalling data to be transmitted can also be indicated in more detail by means of the stealing symbols in the burst. Stealing symbols have typically been used in a normal burst to indicate whether the data bits in a burst are allocated to be used on a traffic channel or stolen to be used on the FACCH. However, in the method of the invention the stealing symbols in the normal burst to be utilized for transmitting user data can also be allocated to transmit user data.

The method and system of the invention provide an advantage that enables transmission of signalling and acknowledgement messages particularly when the channel between the terminal and the base station is also employed for transferring user data. This is particularly advantageous in packet-switched wireless data transmission, as in this case the channel between the terminal and the base station does not have to be separately opened for signalling. Another advantage of the invention is that the data transmission capacity of a normal burst to be used for transmitting user data is not used for

the signalling of the invention. A further advantage of the invention is that it alleviates the implementation of the detection in the receiver, as the received training sequence is compared with the two known training sequences only, thus reducing the receiver load. Still another advantage of the invention is that the data transmission capacity of a normal burst increases, since the stealing symbols in the normal burst can also be utilized for transmitting user data.

In the following the invention will be described in greater detail in connection with the preferred embodiments, with reference to the accompanying drawings, in which

Figure 1 schematically shows a normal burst according to the GSM system;

Figure 2 schematically shows a known normal burst and a burst according to a preferred embodiment of the invention;

Figure 3a shows a burst structure according to a preferred embodiment of the invention;

Figure 3b shows a burst structure according to a second preferred embodiment of the invention;

Figure 3c shows a burst structure according to a third preferred embodiment of the invention;

Figure 3d shows a burst structure according to a fourth preferred embodiment of the invention;

Figure 4 is a block diagram showing a transmitter according to a preferred embodiment of the invention;

Figure 5 is a block diagram showing a receiver according to a preferred embodiment of the invention, and

Figure 6 is a flow chart showing parameter adjustment according to a preferred embodiment of the invention.

In the following the invention will be described by way of example on the basis of a TDMA-based (Time Division Multiple Access) GSM system and the further improvement thereof. It is obvious for those skilled in the art that the invention can be used in any corresponding telecommunication system.

Figure 1 shows the structure of a normal burst according to the GSM system, the length of the normal burst being 156,25 and the duration 0,577 ms. The normal burst comprises one time slot of a TDMA frame comprising eight time slots. The normal burst comprises in the middle a training

sequence (TS) that includes 26 symbols and that is used for correcting the received signal as described above. Stealing symbols (S), which are one symbol in length and located on both sides of the training sequence TS, are used for indicating the possible use of even and/or odd data symbols (DS) for FACCH signalling. The data symbols DS intended to transfer user and signalling data are divided into two sequences of 57 symbols which are located before the first stealing symbol and after the second stealing symbol. Tail symbol sequences (T), which are three symbols in length, are located at the beginning and in the end of a burst, and within the duration of the tail symbols the transmitter is correspondingly switched on and off between the bursts. After the burst, there is a guard period (G) of 8,25 symbols that prevents adjacent time slots from overlapping in base station reception.

According to a preferred embodiment of the invention a new burst type is introduced that deviates from the burst structure described above only in that the training sequence of the burst is different. Here the known training sequence in a normal burst is referred to as TS1 and the training sequence of the invention is referred to as TS2 in accordance with Figure 2. According to a preferred embodiment of the invention the burst according to the invention is employed in particular for transmitting control data (CD), whereby the known normal burst can, if necessary, be allocated to transfer user data (UD) only. User data can also be transmitted using the burst of the invention in situations where the transfer of user data also requires exceptional signalling. Then, in the reception the type of information in the burst can be deduced on the basis of the training sequence. Particularly when a burst comprising the training sequence TS2 is received, the receiver knows that the burst may comprise specific signalling data.

According to another preferred embodiment of the invention the number of various training sequences is restricted to said two training sequences TS1 and TS2. This alleviates the implementation of the detection in the receiver, as the received training sequence is compared with the two known training sequences only, thus reducing the receiver load. Particularly distinguishing training sequences from one another becomes easier in poor reception conditions compared with prior art, since the symbol constellations of the two training sequences can easily be determined to differ greatly from one another, and a large number of symbol errors in the received training sequences cannot either prevent the detection of the training sequence.

According to a preferred embodiment of the invention the stealing symbols in the burst of the invention are used to specify the information in the burst. Then, the stealing symbols of the known normal burst can also, if needed, be utilized when transferring user data. The use of the stealing symbols of the invention is explained in the following in greater detail with reference to the examples in Figures 3a-3d. In order to simplify the description, it is assumed in the following examples that the stealing symbols of the burst structure both comprise one bit. The invention can naturally also be implemented in systems where several bits are modulated into one symbol, in which case the amount of information to be specified using the stealing symbols is multiplied.

Figure 3a shows the burst structure of the invention, where the data symbols DS are allocated to the user data UD, the training sequence is the training sequence TS2 of the invention and both the stealing symbols are 0-bits. On the basis of the indicated training sequence TS2 the receiver knows that the burst comprises some signalling data and checks the specified information indicated by the stealing symbols. This burst may indicate, for example, the last time slot from the user data flow to be transferred on a particular channel. The transmission of a specific end sign is thus avoided in an additional burst.

Figure 3b describes the burst structure of the invention intended for fast signalling in particular. In this burst the data symbols DS are entirely or partly allocated to the signalling data, the training sequence is the training sequence TS2 of the invention and the first of the stealing symbols is preferably a 0-bit and the second a 1-bit. The spreading figure shown in Figure 3b describes in greater detail the signalling and user data fields CD/UD in the data symbols DS. There is a field in the beginning of the data symbols determining the field length of the signalling data (ctrl field length). A signalling discriminator (ctrl discriminator) defines the signalling message in question which is added after the signalling discriminator. Several signalling messages (ctrl field) can preferably also be transferred in the same burst. When the receiver knows, on the basis of the signalling discriminator, which signalling fields are concerned, it can distinguish the transmitted messages from the burst. If all messages to be transmitted and the lengths thereof are predetermined, i.e. standardized messages are concerned, then the field determining the total length of the signalling data is not needed, as the receiver is aware of the

length of the messages. However, it is preferable to keep the field determining the total length of the signalling data as an optional alternative and thereby alleviate the introduction of new signalling messages. If all data symbols are not needed for the signalling message, the unused symbols can be employed for transmitting user data. The burst according to Figure 3b can preferably be used to replace the FACCH signalling according to the GSM system.

Figure 3c describes the burst structure of the invention intended for slow signalling in particular, that is for replacing the SACCH signalling according to the GSM system, for example. A field of a specific length is allocated in the beginning of the data symbol field to the signalling data CD, and the rest of the data symbols can be employed for transmitting user data UD. The training sequence is the training sequence TS2 of the invention and the first of the stealing symbols is preferably a 1-bit and the second a 0-bit. This burst structure provides the advantage that if a known short signalling message is to be transmitted in one burst or if a longer, non-urgent signalling message is interleaved into several bursts, it is not necessary to attach the field determining the total length of the signalling data to the signalling data field.

Figure 3d describes the burst structure of the invention that can be used in applications that enable restricted retransmission of a burst. Such cases include real time speech or video image transmission, in which a sensible use of the application enables retransmission of a burst that is poorly received in the following TDMA frame only. In the burst the data symbols DS are allocated to the user data UD, the training sequence is the training sequence TS2 of the invention and both stealing symbols are 1-bits. Said burst can be employed in situations where the received normal burst is of poor quality and it is requested to be resent in the following time slot allocated to the channel. If the transmitter is able to receive the retransmission request in time, the data symbols of the previous burst are sent in the burst according to Figure 3d. Then, on the basis of the training sequence TS2 and the 1-bit stealing symbols the receiver can deduce that retransmission is concerned. If stealing symbols have been used for transmitting user data in the original normal burst, these have to be punctured before connecting the original burst to the retransmitted burst and attached to the original position in the burst structure when connecting the bursts. If the transmitter cannot receive a retransmission request, then the bursts are continued to be normally transmitted.

The burst of the invention can therefore, if needed, also be used for

transmitting user data. However, the training sequence TS2 in the burst indicates that the information in the burst is somehow exceptional as regards the normal burst.

The following describes the essential parts of the transmitter in the telecommunication system of the invention by means of the block diagram in Figure 4. The transmitter comprises means 100 that include the information to be sent, for example, the information about the last burst in the data flow according to Figure 3a. This information is coded in accordance with the invention into a combination of a determined training sequence and a stealing symbol combination in coding means 101, from where the coded information is applied to means 102 to be connected with the signal to be transmitted and the stealing symbols thereof. Next, the signal is modulated by processing means 103 and applied to conversion means 104 where the signal is converted from digital to analogue mode. The analogue signal is transferred to radio frequency parts 105 where the signal is converted to the transmission frequency. Then the signal is sent by an antenna 106 through the radio path to the receiver.

The essential parts of the receiver in the telecommunication system of the invention are described in the block diagram according to Figure 5. The receiver comprises an antenna 200 for receiving the signal sent through the radio path and wherefrom the signal is applied to radio frequency parts 201 in which the signal is converted to an intermediate frequency. The signal is then transferred to conversion means 202 where the signal is reconverted from analogue to digital mode. The digital signal propagates to processing means 203 where the signal may be filtered and demodulated, the channel impulse response and the energy thereof can be estimated, and the signal distorted on the channel can be restored into its original form. The restored signal is applied to separation means 204 where the identified training sequence and the stealing symbols are separated from the signal. Decoding means 205 decode the received training sequence and the stealing symbols in accordance with the method presented in the invention, and means 206 start the operations according to the preferred embodiments that correspond with the message in the transmitted signalling data.

The above operations in the transmitter and the receiver can be implemented, for example, using general or signal processors or separate logic. To implement single operations is known for those skilled in the art and the

description thereof is not needed in this context.

In the following the application of the invention is explained in greater detail by means of an example describing on-demand adjustment of a parameter to be performed in packet-switched wireless data transmission. Such an adjustment is based on the idea that only those parameters are adjusted that need to be adjusted at a particular time, in which case a separate signalling channel, for example, does not have to be maintained for this purpose.

The uplink and downlik data transmission can be totally independent of one another in packet-switched wireless data transmission. In short-delay real time data transmission, the uplink and downlink traffic channels are maintained only for the time the data packets are sent in either direction. Sending signalling messages and acknowledgement messages becomes more difficult in the opposite direction, as a continuously maintained channel for this purpose does not exist. It is therefore preferable if any maintained channel can be used for transmitting acknowledgement messages. The terminal may simultaneously comprise several active data transmission connections which are determined and restricted in different ways. A terminal may for instance comprise, in addition to a normal telephone connection, a simultaneous packet-switched connection with an outside telephone number service. Then, the signalling between the terminal and the network or the acknowledgement thereof can be selected to be performed through the best available data transmission connection. If, for example, the counterpart speaks on the telephone connection of the terminal, when the uplink speech connection of the terminal is not in use, the signalling messages can be multiplexed to said packet-switched data connection. If, in turn, the downlink signalling takes place through an active call connection and the call is disconnected midst signalling, then the signalling can be transferred to a possible data connection. If no data connections exist, the downlink signalling can preferably be arranged as a broadcast message to all terminals within the cell area. Naturally only the terminals for whom the message is indicated tend to operate as the message requires. However, in this way the frequency band is used more efficiently as compared with opening a separate channel for signalling.

Figure 6 is a flow chart describing the adjustment of an on-demand adaptive parameter where the signalling of the invention can be utilized. The adjustable parameter concerned can, for example, be the transmission power

of a terminal. The adjustment process is started by checking if the time t_{last} that has elapsed from the previous adjustment is sufficient for providing a new adjustment which is determined on the basis of the adjustment frequency *afr*. Next a parameter value *par* is measured and the value is compared with the optimal value par_t of the parameter. If the difference between the parameter value *par* and the optimal value par_t of the parameter exceeds the error threshold e_{th}, then the parameter is adjusted and the value of the adjustment frequency *afr* is increased by a predetermined change afr_{step}. If the error threshold is not exceeded, the parameter does not need to be adjusted either, but the value of the adjustment frequency *afr* is reduced by a predetermined change afr_{step}. In both cases it is confirmed that the value of the adjustment frequency *afr* remain between the predetermined maximum value afr_{max} and minimum value afr_{min}.

Even though the invention has above been described by way of example in connection with power control signalling, the invention is not restricted thereto but the signalling of the invention can be used for any similar purposes, particularly in packet-switched data transmission. One example is the change of the used coding method in connection with link adaptation. However, it should be noted that digital wireless telecommunication systems, particularly TDMA systems, also comprise other types of bursts than the normal burst described in this context and the embodiment of the invention thereof. The burst structure of the invention cannot necessarily be used for sending the signalling data transmitted by these bursts.

Furthermore, even though the invention has above been described by way of example according to the preferred embodiment of the invention in which two training sequences are used, the number of training sequences is not restricted to two, but the invention can also be implemented using several training sequences. Then, the implementation of the receiver becomes more complicated, but the number of signalling messages to be indicated increases when the possible combinations of training sequences and stealing symbols increase.

It is obvious for those skilled in the art that as technology progresses the basic idea of the invention can be implemented in a number of ways. The invention and the embodiments thereof are thus not restricted to the above examples but may vary within the scope of the claims.

CLAIMS

1. A signalling method in a wireless digital telecommunication system between a base station and a terminal, where the signals between the base station and the terminal are generated from bursts comprising symbols, the bursts comprising a known training sequence, **characterized** by

generating from symbols a second training sequence of the same length as the known training sequence,

generating a burst comprising said second training sequence and by

using the burst comprising said second training sequence for transmitting at least one signalling message.

2. A method as claimed in claim 1, **characterized** by indicating the existence of said signalling message, in response to the received burst comprising said second training sequence.

3. A method as claimed in claim 2, **characterized** by restricting the number of the training sequences to be used to two.

4. A method as claimed in claim 3, **characterized** by

sending user data in the burst comprising said known training sequence and

sending signalling data and/or user data in the burst comprising said second training sequence.

5. A method as claimed in any one of the preceding claims, **characterized** by using the stealing symbols in the burst comprising said second training sequence for specifying the signalling message to be transmitted.

6. A method as claimed in any one of the preceding claims, **characterized** by using the burst comprising said second training sequence for transmitting FACCH signalling according to the GSM system.

7. A method as claimed in any one of the preceding claims, **characterized** by using the burst comprising said second training sequence for transmitting SACCH signalling according to the GSM system.

8. A method as claimed in any one of claims 1 to 5, **characterized** by using the method in a packet-switched wireless telecommunication system.

9. A method as claimed in any one of the preceding claims, **characterized** by using the method for adjusting the transmission

power of the mobile station and the base station.

10. A wireless digital telecommunication system for signalling between a base station and a terminal, where the signals to be transmitted over a radio connection between the base station and the terminal comprise bursts generated from symbols, the bursts comprising a known training sequence, the system comprising at least one transmitter and at least one receiver, whereof the transmitter comprises means for generating said training sequence and the receiver comprises means for identifying said training sequence, **characterized** in that

the transmitter comprises means for generating a second training sequence of the same length as the known training sequence and means for generating a burst comprising said second training sequence and for coding a signalling message into said burst and in that

the receiver comprises means for receiving the burst comprising said second training sequence, means for identifying said second training sequence and means for decoding the coded signalling message in said burst.

11. A telecommunication system as claimed in claim 10, **characterized** in that the receiver is arranged to indicate the existence of said signalling message, in response to the received burst comprising said second training sequence.

12. A telecommunication system as claimed in claim 11, **characterized** in that the number of the training sequences to be used in the system is restricted to two.

13. A telecommunication system as claimed in claim 12, **characterized** in that

said burst comprising the known training sequence is arranged to transmit user data and

said burst comprising the second training sequence is arranged to transmit signalling data and/or user data.

14. A telecommunication system as claimed in any one of claims 10 to 13, **characterized** in that at least one stealing symbol in the burst comprising said second training sequence is arranged to specify the contents in the signalling message to be transmitted.

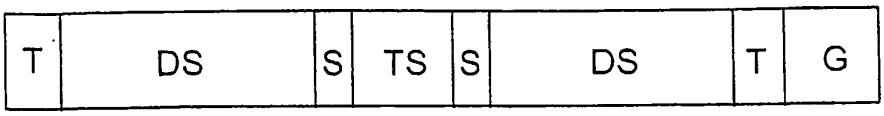


FIG. 1

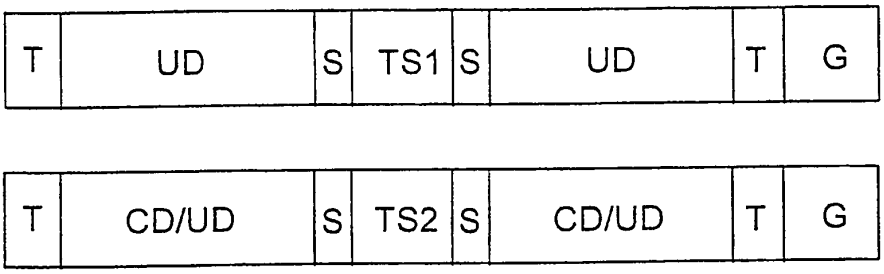


FIG. 2

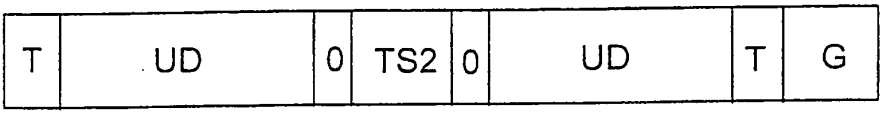


FIG. 3a

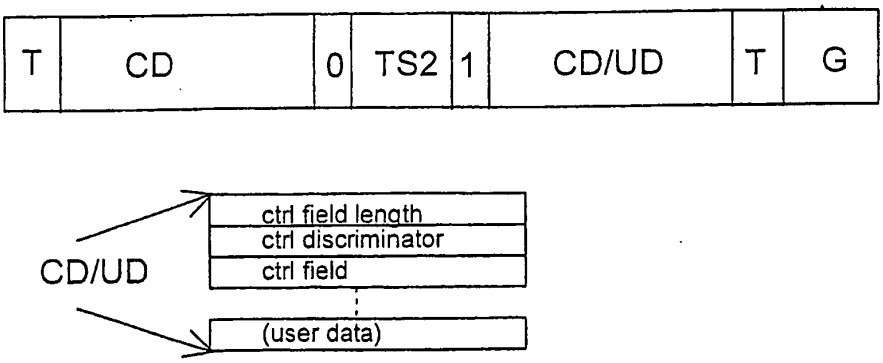


FIG. 3b

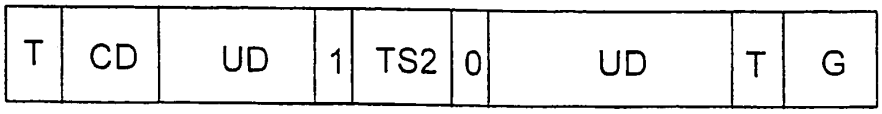


FIG. 3c

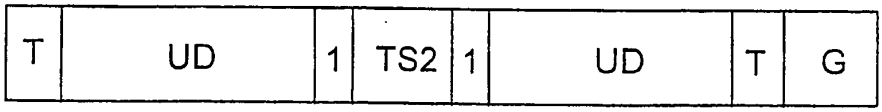


FIG. 3d

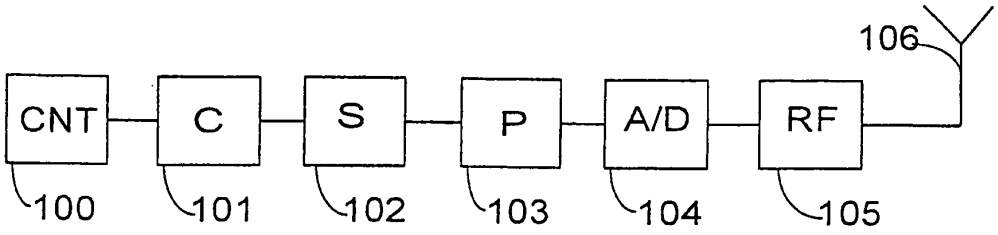


FIG. 4

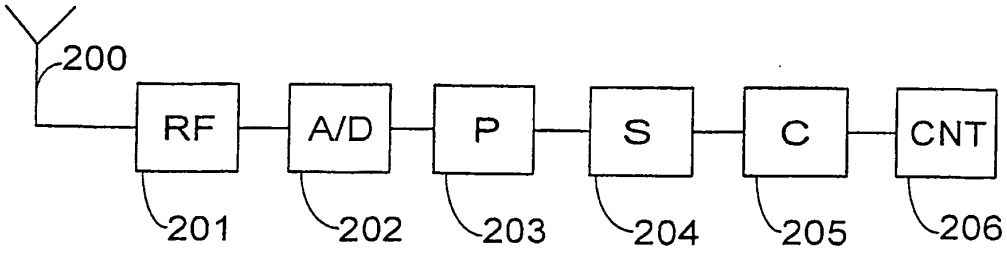


FIG. 5

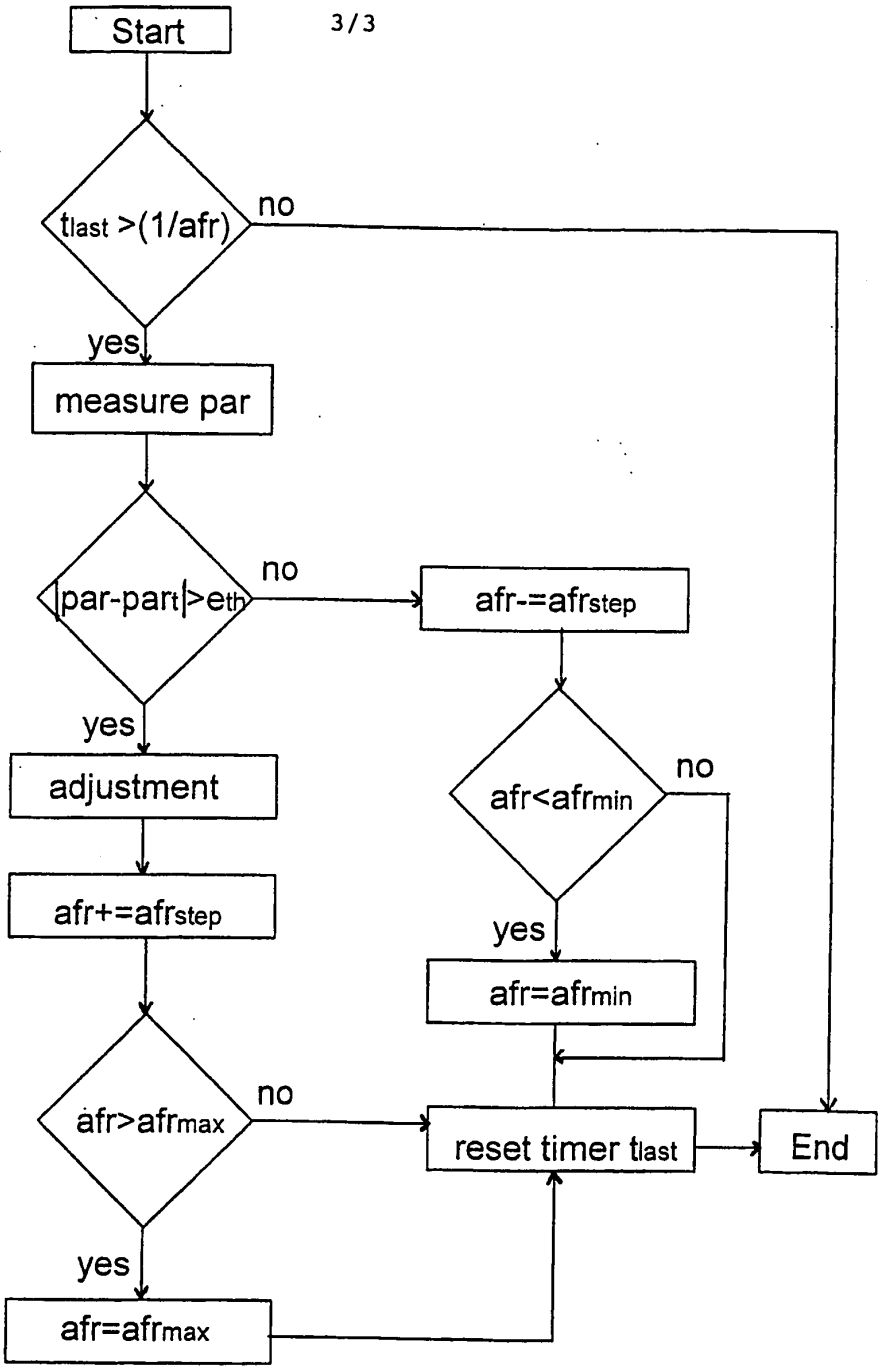

Start
tlast >(1/afr)
no
yes
measure par
par-part>eth
no
afr-=afrstep
yes
adjustment
afr<afrmin
no
afr+=afrstep
yes
afr=afrmin
afr>afrmax
no
reset timer tlast
End
yes
afr=afrmax

FIG. 6

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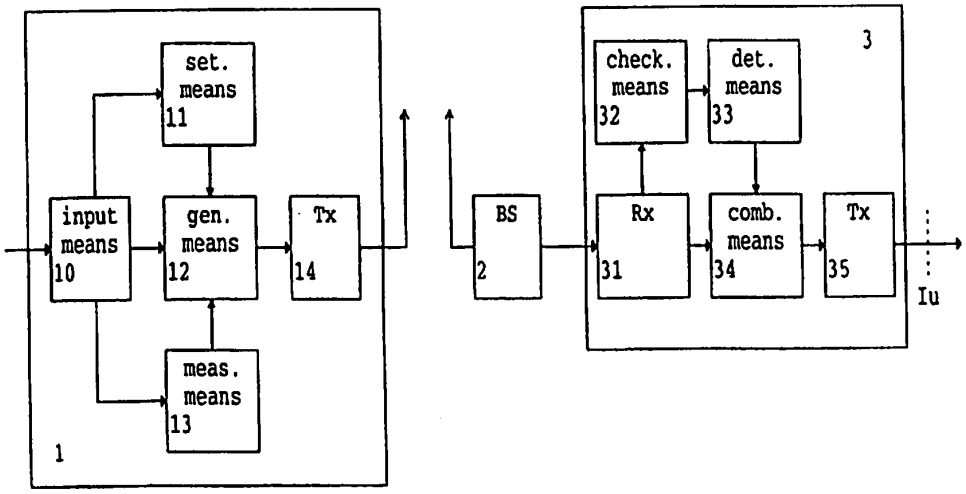
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(57) Abstract

A method and system for transmitting a position information from a mobile terminal of a mobile communication network via a network element (3) to a network node, wherein a control information indicating the requirement of a position information of the mobile terminal (1) at the network node is set in the radio interface message. This control information is checked at the network element as to whether a position information has to be forwarded or not. The position information is determined at the network element (3) and may be combined with a higher layer information so as to generate a complete higher layer information to be forwarded to the network node. Thereby, a position information can be supplied to the network node without substantially increasing overhead and processing power required for the radio interface message.

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Method and system for transmitting a position information

FIELD OF THE INVENTION

The present invention relates to a method and system for transmitting a position information from a mobile terminal of a mobile communication network such as a UTRAN (UMTS Radio Access Network) via a network element to a network node such as an SGSN (Serving GPRS Support Node) of the GPRS (General Packet Radio Service) or an MSC (Mobile Switching Center) of the GSM (Global System for Mobile Communications) or their equivalents in the UMTS (Universal Mobile Telecommunications System).

BACKGROUND OF THE INVENTION

Third generation mobile telecommunications systems aim at providing end-users, apart from terminal and personal mobility, with enhanced services. Compared to second generation systems, enhancement that will cover features all the way between the end-user and core network elements are required, i.e. from mobile terminals to radio access and fixed networks.

Fig. 1 shows a mobile communication system such as a UMTS system, wherein a UTRAN system is connected to a GPRS-based core network and to a GSM-based core network. According to Fig. 1, a mobile station (MS) 1 is radio-connected to at least one base station (BS) 2 which is connected to a Radio Network Controller (RNC) 3 of the UTRAN. In Code Division Multiple Access (CDMA) based systems, the MS 1 can be

connected to several BS 2 simultaneously due to macrodiversity.

The RNC 3 is connected to a mobile switching center (MSC) 5 of the UMTS or GSM core network which provides access to a circuit-switched network such as a Public Switched Telephone Network (PSTN) 8 or to a packet-switched network such as the Internet 9.

Additionally, the RNC 3 is connected to an SGSN 6 of the UMTS or GPRS core network. The SGSN 6 is connected to a Gateway GPRS Support Node (GGSN) which provides access to the Internet 9.

Thus, the RNC 3 is connected to two non-coordinated core network nodes which may both establish an active connection with the MS 1.

In the GSM system, a cell information field in the A-interface between a Mobile Switching Center (MSC) and a Base Station Controller (BSC) is bound to certain radio interface messages, called initial layer 3 messages. However, these radio interface messages do not comprise any position information relating to the position of the MS 1.

In the UMTS, the MS 1 may be connected via the RNC 3 of the UTRAN 4 to an independent core network node (CN node) such as the MSC 5 or the SGSN 6. In this case, new services of the CN node may require a position information of the MS 1 for an individual setup of the service.

Moreover, it is possible to use one RRC (Radio Resource Control) connection to two independent higher layer connections (connections at Mobility Management (MM) level or connections at Connection Management (CM) level) of

corresponding CN nodes. However, if another service is already provided to the MS 1, the UTRAN 4 does not automatically insert a position information when forwarding the service setup to the CN node, when existing GSM methods are used.

Thus, a mechanism is required to indicate to the RNC 3 that a higher layer protocol data unit (PDU) received from the MS 1 is an initial layer 3 message that should be sent as a complete layer 3 message including an additionally required MS position information to the CN node even if an active connection to the other CN node exists. In addition, the same mechanism can be used for non-initial layer 3 messages if the MS position information needs to be included therein, e.g. in case of a setup of an additional service.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a method and system for transmitting a position information from a mobile terminal of a mobile communication network via a network element to a network node requiring the position information of the mobile terminal.

This object is achieved by a method for transmitting a position information of a mobile terminal of a mobile communication network to a network node using an intermediate network element, comprising the steps of:
setting a control information in a radio interface message, which indicates the requirement of the position information of the mobile station at the network node,
transmitting the radio interface message to the network element,
checking the control information at the network element, and

determining and forwarding the position information to the network node in response to the result of the checking step.

Furthermore the above object is achieved by a system for transmitting a position information of a mobile terminal of a mobile communication network to a network node using an intermediate network element,
wherein said mobile terminal comprises:
setting means for setting a control information in a radio interface message, which indicates the requirement of a position information of the mobile station at the network node, and
transmitting means for transmitting the radio interface message to the network element, and
wherein the network element comprises:
checking means for checking the control information; and
determining means for determining the position information in response to the checking result of the checking means.

Accordingly, since a control information is added to the radio interface message, this parameter can be used at the RNC 3 to determine whether a position information should be forwarded to the core network through the corresponding Iu interface.

Thereby, the protocol amendments and additionally required information at the RRC level can be kept short so as to minimize message overhead transmitted via the radio interface.

An additional advantage arises when the position of the MS 1 can be detected more accurately than the cell level at the RNC 3 and new services need such an accurate position information. Then, only a short control information has to be transmitted via the radio interface to the RMC 3 in order to

indicate that the position information must be added before forwarding the message to the CN.

A higher layer information may be incorporated into the radio interface message at the mobile terminal, wherein the position information is combined with the higher layer information at the network element in response to the checking result. Thereby, a complete higher layer message including an additionally required MS position information can be forwarded to the network node.

Preferably the control information is provided in a control field used for signaling the requirement of the position information. This control field may have a length of one bit. Accordingly, the required additional overhead of a radio interface message can be restricted to only one bit.

Alternatively, the length of this control field may be more than one bit, if e.g. several accuracy levels of the MS position are possible.

Furthermore, a position measurement information can be incorporated at the MS1 into the radio interface message before transmission, wherein the position information may be determined at the RNC 3 on the basis of the position measurement information.

The position measurement information may also be sent from the MS to the network element, i.e. UTRAN, if no higher layer message is included. This position measurement reporting can be started either by an explicit request from the network element or it can be part of a default measurement started without explicit request from the network element.

In case no position information is required, the higher layer information can be transmitted in a transparent mode to the network node. Thus, the determination of the MS position at the RNC 3 is restricted to those cases, where it is actually required. Thereby, processing capacity is saved and unnecessary delay can be prevented.

Preferably, the network element is a radio network controller of the mobile communication network such as a radio access network of the UMTS, and the network node is a mobile switching center or a serving GPRS support node.

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 communication network connected to two independent core networks,

Fig. 2 shows an RRC Direct Transfer message according to the preferred embodiment of the present invention,

Fig. 3 shows a block diagram of a radio access network according to the preferred embodiment of the present invention, and

Fig. 4 shows a flow diagram of a transmission control procedure 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 communication system such as the UMTS system shown in Fig. 1.

In case a connection is established between the MS 1 and one of the CN nodes MSC 5 or SGSN 6, an RRC connection is used to send a corresponding higher layer PDU via the UTRAN 4. Such a higher layer message could be an MM (Mobility Management) layer message or a CM (Connection Management) layer message and is carried over the radio interface piggypacked into a radio interface message, i.e. an RRC message such as RRC Direct Transfer. Since the MS 1 knows based on the MM layer or the RRC layer, whether the present higher layer message is to be carried to the CN with a position information or not, a position information control field may be provided in the RRC message.

Fig. 2 shows an RRC Direct Transfer message according to the preferred embodiment, which is transmitted by the MS 1 to the RNC 3. The position information control field may consist of one bit which notifies whether a position information is required at the CN, or not. Alternatively, the position information control field may consist of more than one bit, if e.g. several accuracy levels are provided for the position information. In case the MS 1 derives from the MM or RRC layer information that the CN supplying the requested service requires a position information, it sets the position information control bit in the RRC Direct Transfer message to "0". If no position information is required, the position information control bit remains "1". Of course, an opposite setting control of the position information control bit is possible as well.

In addition thereto, a position measurement report can be added to the RRC Direct Transfer message so as to be used by the RNC 3 to calculate the MS position. Alternatively, the position measurement report can be a separate procedure between the MS 1 and the UTRAN 4, independent from the transmitting of the RRC Direct Transfer message.

Other contents of the RRC Direct Transfer message are a message type information used to indicate the type of the RRC message, a CN identifier used as a routing information for routing the higher layer information from the MS 1 to the correct Iu interface connection, and the higher layer information, i.e. higher layer PDU, to be transmitted to the CN.

Thus, upon receiving the above described RRC Direct Transfer message, the RNC 3 can calculate the MS position and generate a corresponding Iu interface message as a complete layer 3 information.

In case the one bit position information control field is set to "1", the RNC 3 detects that no position information is needed at the CN and transmits the higher layer information in a transparent manner over the Iu interface. In this case, a Direct Transfer Application Part (DTAP) of the layer 3 protocol at the RNC 3 is used.

Fig. 3 shows a block diagram of a radio access network such as the UTRAN 4 according to the preferred embodiment of the present invention.

According to Fig. 3, the MS 1 comprises an input means 10 for inputting a higher layer message to be transmitted via the radio interface of the UTRAN 4 and the Iu interface to an

independent CN node such as the MSC 5. Such a higher layer message could be a setup request for a service provided by the MSC 5.

Furthermore, a setting means 11 is provided to which an information derived from the higher layer message is supplied from the input means 10 as to whether the connected CN node requires a position information, or not. In response to this information, the setting means 11 supplies an instruction to a message generating means 12 so as to correspondingly set the position information control field of the RRC message generated by the message generating means 12 on the basis of the higher layer message or PDU supplied from the input means 10.

Optionally, a measurement means 13 may be provided for supplying a position measurement report to a generating means 12, wherein the position measurement report is incorporated at a corresponding field in the RRC message, if the position information is required.

Finally a transmitter Tx 14 is connected to the message generating means 12 so as to transmit the generated RRC message via the radio interface.

The transmitted RRC message is received by the BS 2 of the UTRAN 4 and supplied to the RNC 3, as previously described in connection with Fig. 1.

In the following, the operation of the RNC 3 shown in Fig. 3 is described with reference to the flow diagram shown in Fig. 4, wherein an RRC Direct Transfer message including a higher layer PDU is transmitted to the RNC 3.

The RRC Direct Transfer message including the higher layer PDU for the CN node is received by a receiver Rx 31 of the RNC 3 (step S101). Thereafter, the position information control field of the RRC message is checked by a checking means 32 connected to the Rx 31 (S102). Then, the received RRC message is supplied to a combining means 34. If the checking performed in the checking means 32 reveals in step S103 that no position information is required, the higher layer message (higher layer PDU) is supplied to a transmitter Tx 35 and sent to the desired CN node via the Iu interface in a transparent manner using the DTAP protocol (S104).

Otherwise, if the checking means 32 determines that a position information is required at the CN node, a corresponding information is supplied by the checking means 32 to a determining means 33 which is arranged to determine the position information.

Subsequently, the determining means 33 calculates the position of the transmitting MS 1 using the position measurement report included in the RRC message (step S105). Alternatively, the position information may be calculated or determined based on a corresponding position information of the MS 1 provided in the RNC 3.

Thereafter, the determining means 33 supplies the determined position information to the combining means 34, where the position information is combined with or added to the higher layer message so as to generate a Iu interface message (step S106). Thus, the Iu interface message corresponds to a complete layer 3 information.

Finally, the generated Iu interface message is sent by the Tx 35 to the desired CN node (S107).

Accordingly, a position information can be transmitted via the UTRAN 4 of the UMTS without requiring major changes of the radio interface messages, i.e. the RRC messages. Essentially, only one bit has to be added as a new parameter to each RRC message carrying a higher layer PDU on the radio interface. Alternatively, the position information control field may consist of more than one bit, if e.g. several accuracy levels are provided for the position information.

It is to be pointed out, that the transmission method and system described in the preferred embodiment is not restricted to the UTRAN of a UMTS, but can be used in connection with any mobile communication network where a higher layer message is to be carried on a radio interface message which does not include any position information. 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 vary within the scope of the attached claims.

In summary, a method and system for transmitting a position information from a mobile terminal of a mobile communication network via a network element to a network node is described, wherein a control information indicating the requirement of a position information of the mobile terminal at the network node is set in the radio interface message. This control information is checked at the network element as to whether a position information has to be forwarded or not. The position information is determined at the network element and may be combined with a higher layer information so as to generate a complete higher layer information to be forwarded to the network node. Thereby, the position information can be supplied to the network node without substantially increasing overhead and processing power required for the radio interface message.

Claims

1. A method for transmitting a position information of a mobile terminal **(1)** of a mobile communication network to a network node **(5, 6)** using an intermediate network element **(3)**, comprising the steps of:
a) setting a control information in a radio interface message, which indicates the requirement of said position information of said mobile terminal at said network node;
b) transmitting said radio interface message to said network element;
c) checking said control information at said network element; and
d) determining and forwarding said position information to said network node in response to the result of said checking step.

2. A method according to claim 1, further comprising the step of incorporating a higher layer information into said radio interface massage, and forwarding said position information together with said higher layer information to said network node.

3. A method according to claim 1 or 2, wherein said control information is provided in a control field used for signaling the requirement of said position information.

4. A method according to claim 3, wherein said control field has a length of one bit.

5. A method according to claim 3, wherein said control field has a length of more than one bit, each value of said control field referring to an accuracy level of said position information.

6. A method according to any one of claims 1 to 5, further comprising the steps of incorporating a position measurement information into said radio interface message before said transmission step, and determining said position information on the basis of said position measurement information.

7. A method according to any one of claims 2 to 6, wherein said higher layer information is transmitted in a transparent mode to said network node, when said checking step reveals that no position information is required.

8. A method according to any one of the preceding claims, wherein said network element is a radio network controller **(3)** of said mobile communication network, and wherein said setting step is performed in said mobile terminal.

9. A method according to any one of the preceding claims, wherein said mobile communication network is a radio access network of the UMTS, and wherein said network node is a mobile switching center **(5)** or a serving GPRS support node **(6)**.

10. A system for transmitting a position information of a mobile terminal **(1)** of a mobile communication network to a network node **(5, 6)** using an intermediate network element **(3)**,

a) wherein said mobile terminal **(1)** comprises:

setting means **(11)** for setting a control information in a radio interface message, which indicates the requirement of said position information of said mobile terminal **(1)** at said network node **(5, 6)**; and

transmitting means **(14)** for transmitting said radio interface message to said network element **(3)**; and

b) wherein said network element **(3)** comprises:
checking means **(32)** for checking said control information;
determining means **(33)** for determining said position information in response to the checking result of said checking means **(32)**.

11. A system according to claim 10, wherein said mobile terminal **(1)** comprises a message generating means **(12)** for incorporating a higher layer information into said radio interface message; and wherein said network element **(3)** comprises combining means **(34)** for combining said position information with said higher layer information in response to said checking result.

12. A system according to claim 11, wherein said message generating means **(12)** is arranged to incorporate a position measurement information into said radio interface message, and wherein said determining means **(33)** is arranged to determine said position information on the basis of said position measurement information.

13. A system according to any one of claims 10 or 12, wherein said network element is a radio network controller **(3)** of said mobile communication network **(4)**.

14. A system according to any one of claims 10 to 13, wherein said mobile communication network is a radio access network **(4)** of the UMTS, and wherein said network node is a mobile switching center **(5)** or a serving GPRS support node **(6)**.

15. A mobile terminal for transmitting a radio interface message via a network element **(3)** to a network node **(5, 6)**, comprising:

a) setting means **(11)** for setting a control information in said radio interface message, which indicates the requirement of a position information of said mobile terminal **(1)** at said network node **(5, 6)**; and

b) a transmitting means **(14)** for transmitting said radio interface message to said network element **(3)**.

16. A mobile terminal according to claim 15, further comprising message generating means **(12)** for incorporating a higher layer information into said radio interface message.

17. A mobile terminal according to claim 16, wherein said message generating means **(12)** is arranged to incorporate a position measurement information into said radio interface message.

18. A network element for forwarding a position information of a mobile terminal **(1)** to a network node **(5, 6)**, comprising:

a) checking means **(32)** for checking a control information provided in a radio interface message received from said mobile terminal **(1)**; and

b) determining means **(33)** for determining said position information in response to the checking result of said checking means **(32)**.

19. A network element according to claim 18, further comprising combining means **(34)** for combining said position information of said mobile terminal **(1)** with a higher layer information, to be forwarded to said network node **(5, 6)**, in response to said checking result.

20. A network element according to claim 18 or 19, wherein said determining means **(33)** determines said position

information on the basis of a position measurement information included in said received radio interface message.

21. A network element according to any one of claims 18 to 20, wherein said network element is a radio network controller **(3)** of a radio access network of the UMTS, and wherein said network node is a mobile switching center **(5)** or a serving GPRS support node **(6)**.

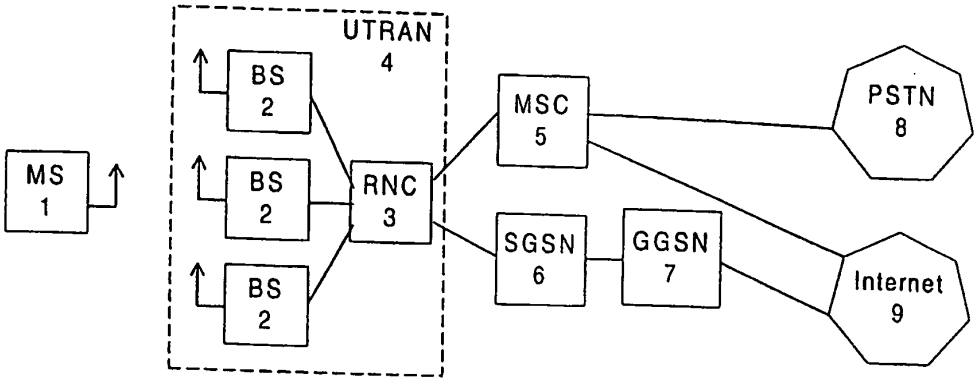

UTRAN
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BS
2
BS
2
BS
2
MS
1
RNC
3
MSC
5
SGSN
6
GGSN
7
PSTN
8
Internet
9

Fig. 1

RRC Direct Transfer message

Message type	CN id	Pos. info control field	Position measurement report	PDU

Fig. 2

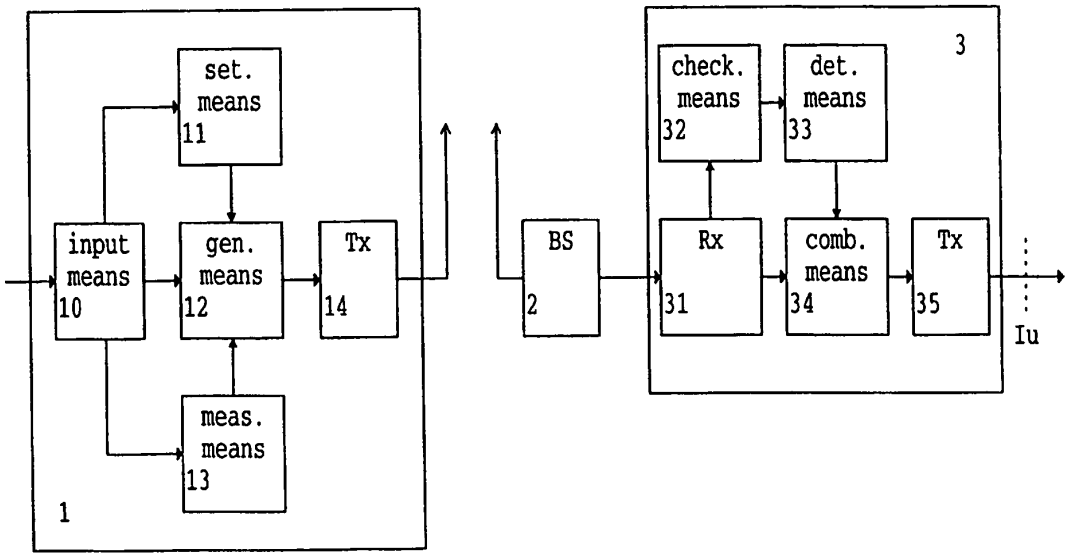


Fig. 3

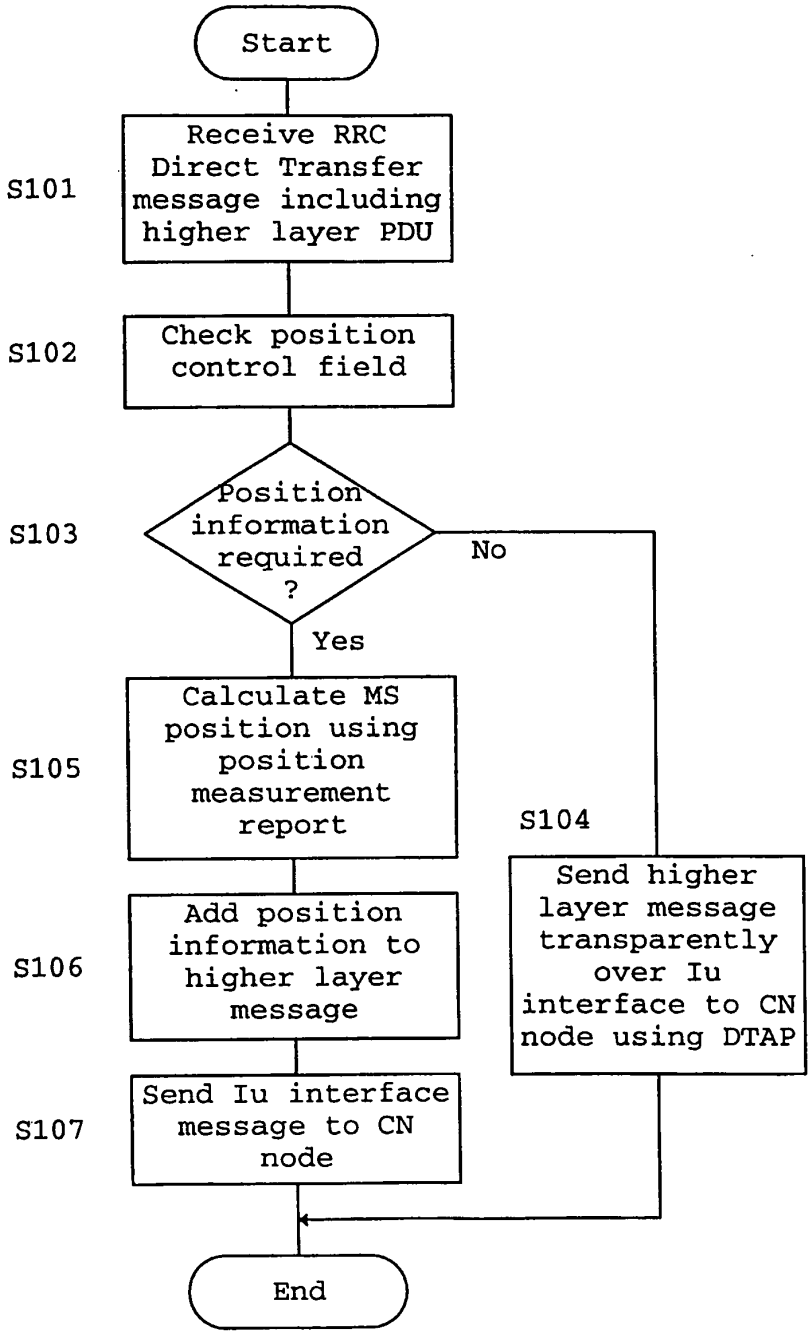

Start
Receive RRC Direct Transfer message including higher layer PDU
S101
Check position control field
S102
Position information required ?
S103
No
Yes
Calculate MS position using position measurement report
S105
S104
Send higher layer message transparently over Iu interface to CN node using DTAP
Add position information to higher layer message
S106
Send Iu interface message to CN node
S107
End

Fig. 4

INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/EP 98/08065

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.
A	US 5 754 955 A (EKBATANI MEHRDAD) 19 May 1998 (1998-05-19) column 6, line 42 - line 54; claim 4	1,10,15, 18
A	EP 0 805 609 A (HEWLETT PACKARD CO) 5 November 1997 (1997-11-05) column 13, line 19 - column 15, line 4	1,10,15, 18
A	EP 0 546 758 A (MOTOROLA INC) 16 June 1993 (1993-06-16) column 4, line 16 - line 31 column 7, line 33 - line 44 column 9, line 6 - line 24; figure 7	1,10,15, 18

☐ Further documents are listed in the continuation of box C.

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10 August 1999	18/08/1999

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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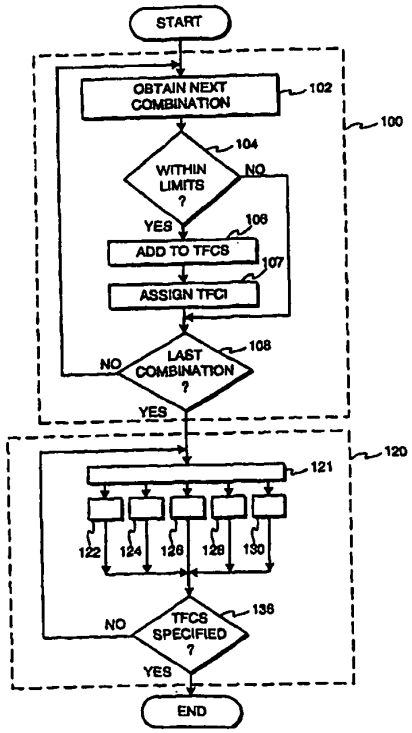
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(54) Title: METHOD FOR CONTROLLING BEARER PROPERTIES

(57) Abstract

The invention concerns the control of connections in cellular telecommunication systems. According to the invention, the available radio resources are controlled by allowing only certain conbinations of transport formats to be used by a single user. The inventive method restricts the combinations of bearer bit rates which can be used, without strictly limiting some bearers from using highest bit rates. This inventive approach allows flexible overall control of radio resources, while retaining the possibility of bearers to select between different bit rates.



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Method for controlling bearer properties

TECHNICAL FIELD OF THE INVENTION

The invention concerns the control of connections in cellular telecommunication systems.

BACKGROUND OF THE INVENTION

In cellular telecommunication systems a single speech connection or data connection through the cellular telecommunication network is called a bearer. Generally, a bearer is associated with a set of parameters pertaining to data communication between a certain terminal equipment and a network element, such as a base station or an interworking unit (IWU) connecting the cellular network to another telecommunications network. The set of parameters associated with a bearer comprises typically for example data transmission speed, allowed delays, allowed bit error rate (BER), and the minimum and maximum values for these parameters. A bearer may further be a packet transmission bearer or a circuit switched bearer and support for example transparent or non-transparent connections. A bearer can be thought of as a data transmission path having the specified parameters connecting a certain mobile terminal and a certain network element for transmission of payload information. One bearer always connects only one mobile terminal to one network element. However, a bearer can pass through a number of network elements. One mobile communication means (ME, Mobile Equipment) may in some cellular telecommunication systems support one bearer only, in some other systems also more than one simultaneous bearers.

In the new cellular telecommunication systems such as the UMTS system (Universal Mobile Telecommunication System) under development, variable bit rate bearers will be in much more widespread use than in the present systems. Multiple simultaneous bearers with multiple bit rate options will result in high amount of combinations to be supported. It is desirable that also the air interface part of the communications system supports this kind of bearer combinations efficiently, i.e. without excessive use of radio resources. Since the bit rates of bearers may change from frame to frame, the bit rates need to be indicated in the frames. Assuming that all possible combinations of instantaneous bit rates of different bearers shall be supported, the amount of bits required for identification of the transmission rate of a

radio frame may become excessive. On the other hand, fixed allocation of radio resources according to the maximum possible total bit rate is not feasible. Maximum bit rates of the bearers may be rarely used and if the resources allocated for a user are dimensioned based on the worst case combination i.e. all bearers using the highest possible bit rate, scarce radio resources will be wasted.

SUMMARY OF THE INVENTION

An object of the invention is to realize a method for controlling the bearers, which allows the control of maximum total bit rate of all bearers of a user, while aiming to avoid as much as possible restrictions of use of the highest data rates by a bearer. A further object of the invention is to realize a method, which reduces the amount of data transmission needed for communicating the bit rates of bearers from a transmitting entity to a receiving entity.

The objects are reached by restricting the allowed bit rate combinations, associating an identifier with each allowed combination, and identifying the instantaneous transmission rate using the identifier associated with the particular combination.

The method according to the invention is characterized by that, which is specified in the characterizing part of the independent method claim. The system for controlling bearers in a cellular telecommunication system according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a system for controlling bearers in a cellular telecommunication system. The dependent claims describe further advantageous embodiments of the invention.

According to the invention, the available radio resources are controlled by allowing only certain combinations of transport formats to be used by a single user. The inventive method restricts the combinations of bearer bit rates which can be used, without strictly limiting some bearers from using highest bit rates. Consequently, depending on the available resources, one bearer may well use its highest data rate, possibly even more bearers than one, although the total resource usage of all bearers of the user may be restricted. This inventive approach allows flexible overall control of radio resources, while retaining the possibility for bearers to select between different bit rates.

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 method according to an advantageous embodiment of the invention,

Figure 2 illustrates another method according to an advantageous embodiment of the invention,

Figure 3 illustrates a system according to an advantageous embodiment of the invention, and

Figure 4 illustrates a further method according to an advantageous embodiment of the invention.

Same reference numerals are used for similar entities in the figures.

DETAILED DESCRIPTION

In the following discussion, the term bit rate refers to the bit rate after channel coding, i.e. the bit rate actually transmitted over the air interface, and not the payload data bit rate unless otherwise specified.

According to the present invention, transmission of a single mobile communication means is controlled by controlling the allowed bit rate combinations of the bearers of the mobile communication means. The allowed combinations of bearer bit rates are restricted in such a way, which does not refuse the possibility of using the highest bit rates for some bearers.

To aid in the description of the invention, certain terms are defined in the following.

A transport format (TF) is a set of parameters, which correspond to a single way of preparing a payload data stream for transmission over the air interface. The set of parameters indicate for example payload data rate, the error control coding method used, interleaving method used, and other processing methods used in the particular cellular telecommunications network, i.e. describe the physical layer processing

applied to the data to be transmitted. Consequently, each TF corresponds to a specific instantaneous bearer bit rate. Further, each bearer has at least one transport format. In the case of a bearer supporting for example multiple bit rates, a bearer can have more than one corresponding TF.

Each transport format has a corresponding transport format identifier (TFID). The TFIDs can be assigned to TFs in many ways, for example in ascending order starting from the lowest bit rate, or according to some other predefined rule.

The combination of transport formats of the active bearers is a Transport Format Combination (TFC). The set of all possible transport format combinations form a Transport Format Combination Set (TFCS). Each TFC has a corresponding transport format combination identifier (TFCI), i.e. each TFCI corresponds to a definite group of transport formats. The TFCI is used to inform the current combination of transport formats to the receiver. The TFCI:s are preferably integer numbers.

A. Determination of allowed combinations

The determination about which combinations can be used and which cannot can be made on the basis of many different requirements according to the needs of the particular embodiment of the invention. Some examples of such requirements are given in the following.

A.1. An example of a limit: size of TFCI word

In order to further reduce the amount of data transmission needed for transmission of transport format information over the air interface to the receiver, the size of the TFCI word can be changed. If the TFCI word has m bits, the maximum number N of combinations that can be represented is $N = 2^m$. Consequently, the length of the TFCI word simply limits the number of allowed combinations. The length of the TFCI word can be adjusted to give a suitable compromise between use of transmission resources for transmitting the TFCI word and the variety of transport format combinations available. In an advantageous embodiment of the invention, the length of the TFCI word can be changed during a connection.

A.2. An example of a limit: maximum bit rate for the user

In a further advantageous embodiment of the invention, maximum allowed bit rate of a user is used in the determination of allowed transport format combinations. In such an embodiment, the allowed combinations include all transport combinations, whose total bit rate is less than or equal to the maximum bit rate for a user.

In various embodiments of the invention, the maximum bit rate may be user-dependent, some users having a different maximum limit from that of others. This provides one way of priorization of users, for example to provide high-paying users and otherwise prioritized users such as rescue workers a better service than to the rest of users.

A.3. Other grounds for combination decisions

In addition to the previously mentioned limits, other information can be used in making decisions about allowed transport format combinations. This kind of information may for example comprise priorities of the bearers, measured throughputs for each bearer as well as the aggregate throughput for the user in question, current load in the cell and interference levels.

B. Construction of TFCS

The construction of the transport format combination set and the assigning of transport format combination identifiers to the various combinations can be performed in many different ways. Some examples of these ways are presented in the following.

B.1 A first example

Preferably, a table of the allowed transport format combinations is constructed, whereby the table index can be used as the TFCI. Thereafter, only the table index i.e. the TFCI needs to be communicated between the transmitter and the receiver. However, the invention is not limited to using tables, since other means such as linked lists or other data structures can be used for associating a transport format combination and a TFCI.

B.2 A second example

Further, a predefined algorithm or rule can be used to generate the TFCI corresponding to a TFC, whereafter the TFCI found in this way can be used as the index to a table for storing the different allowed combinations. The TFCI of a TFC can be determined for example according to the following algorithm:

1. *factor = L(K)*
2. *TFCI = TFID(K)*
3. step through all values of *j* from *K*-1 to 1, repeating 3a and 3b:
   - 3a. *TFCI = TFCI + TFID(j) * factor*
   - 3b. *factor = factor * L(j)*

where

factor	is a temporary variable used in the algorithm,
L(j)	is number of TF:s for bearer *j*,
TFID(j)	is TFID of the TF of bearer *j*, and
K	is the number of active bearers.

This algorithm assumes that TFIDs are assigned to TFs in ascending order starting from the lowest bit rate, the first TFID being zero.

B.3 A third example

In a further advantageous embodiment of the invention, the TFCI values are assigned simply by iterating through all combinations of all transport formats of the bearers, checking for each combination whether the combination is allowed or not. If the combination is allowed, the next free TFCI value is assigned to the combination. For example, the allowed combination can be entered into the next free position in a table containing the TFCS, the index of the position then being the assigned TFCI.

B.4 A fourth example

In a still further advantageous embodiment of the invention, TFCI values are classified into two categories: active and inactive values. Active values are those values which are in use, and inactive values those that are not in use. In such an embodiment, new services can be taken into use by specifying the corresponding TFCI values to be active. If some transport format combinations are removed from use, the corresponding TFCI values are simply specified to be inactive. Such an embodiment has the advantage, that the timing of the changes in the TFCS and TFCI values is not very critical, since other active TFCI values remain unchanged. It is enough from the viewpoint of timing, that any new TFCI values are not used before the receiver has had enough time to receive the message specifying the new values and to change the TFCS and TFCI configuration. In such an embodiment, the message specifying that a TFCI value is now active may for example comprise also the specification of the TFC corresponding to the TFCI. In further embodiments of the invention, the TFC corresponding to a TFCI specified to be active may be previously known by the receiver, or may be deduced from the TFCI by the receiver according to a predefined rule. For example, all possible combinations of transport formats of the bearers can be stored in a table whose index values correspond to the TFCI values, and only those TFCI values are used, which are specified to be active.

B.5 A fifth example

In a further advantageous embodiment, the transport format combinations and the corresponding TFCI values are ordered according to the total bit rate of the TFC or some other desired criteria. In such an embodiment, the allowed transport format combinations are indicated simply by indicating the highest allowed TFCI. In such an embodiment, when a new TFC is allowed, the new TFC is inserted in the corresponding location in the ordered sequence of transport format combinations and given the TFCI value corresponding to that position in the sequence. The TFCI values are updated accordingly, i.e. the higher TFCI values are incremented by one. In a similar way, when a TFC is removed from use, it is removed from the ordered sequence, and the TFCI values are updated accordingly.

Preferably, the TFCI of the TFC with lowest bit rate is 0, the TFCI of the TFC with the next lowest bit rate is 1, and so on. However, this numbering scheme is not the only possible method that can be used in various embodiments according to the

section B.5 of this specification. Preferably, the TFCI values form a sequence of consecutive integer numbers.

The ordering of transport format combinations and the corresponding TFCI values may take into account also other parameters than the total bit rate of a TFC. For example, if more than one transport format combination has the same total bit rate, these combinations can be ordered according to their relative priority.

In this embodiment, a mobile station can request more resources simply by indicating a new desired highest allowed TFCI in the resource request, to which the network can reply by allocating more resources if possible, and returning a possibly new highest allowed TFCI limit.

C. Changing of the set of allowed transport formats

The transport format combination set (TFCS) needs to be known both to transmitter and receiver. Each time new variable rate bearer requires establishment of a connection or an old connection is released the TFCS is changed. Further, it may be desirable to restrict the use of certain combinations for some other reasons. To ensure that the transport format combination sets in the transmitter and in the receiver correspond to each other, the set or any changes to the set may need to be signalled from the transmitter to the receiver. Some ways to signal the TFCS according to various advantageous embodiments of the invention are described in the following.

C.1 Signalling of TFCS by explicit recitation

In an advantageous embodiment of the invention, the TFCS is signalled from a first end of a connection to a second end of the connection by explicitly reciting all allowed combinations. This embodiment is advantageous, if the number of allowed combinations is relatively small compared to the total number of combinations. In this embodiment, the first end sends one or more messages to the second end, which messages specify at least all allowed combinations, and for each combination specify one TFID at least for each bearer having more than one transport format.

In a further advantageous embodiment of the invention, the TFCS is signalled from a first end of a connection to a second end of the connection by explicitly reciting all those combinations, which are not allowed. This embodiment is advantageous, if

the number of non-allowed combinations is smaller than the number of allowed combinations. In this embodiment, the first end sends one or more messages to the second end, which messages specify at least all non-allowed combinations, and for each combination specify one TFID at least for each bearer having more than one transport format.

In a further advantageous embodiment of the invention, the message or messages specifying the allowed or non-allowed combinations, also specify whether the recited combinations are allowed or not. This allows the use of the same message type for specifying allowed and non-allowed combinations.

C.2 Signalling of the TFCS by indicating construction limits

In another advantageous embodiment of the invention, the end of the connection deciding about the allowed combinations informs the other end of the connection only about which limits and other information are to be used in construction of the TFCS. Such a limit may be for example the maximum total bit rate of a single user, and such other information may be for example the priorities of the bearers. Thereafter, the other end constructs the TFCS independently following the specified limits. Since the same limits are used at both ends, the resulting TFCS will be the same. The construction of the TFCS may proceed for example by going through all possible transport format combinations, and checking for each one whether the combination is allowed or not.

C.3 Signalling of the TFCS by indicating specific transport formats

If the restriction of the combinations is to be done in such a way that some transport formats of some bearers are not used in any of the allowed combinations, the TFCS can be specified with bearer specific messages restricting the use of one or more transport formats of a specific bearer.

In a further advantageous embodiment of the invention, the TFCS is specified with bearer specific messages indicating, which transport formats can be used.

C.4 Further methods

The previous methods have given examples of methods, in which the TFCS is constructed from scratch by indicating allowed or non-allowed transport formats or

combinations of transport formats. However, a new TFCS may also be defined by specifying the changes in the allowed transport format combinations and transport formats relative to the previous TFCS. The messages may specify whether the item being specified is to be allowed or restricted. The item being specified in a message may be for example a TFC, a bearer, or a single transport format of a bearer. For example, the new TFCS may be specified by a message, which restricts the use of one or more transport formats of a specific bearer.

After specifying the changes in the allowed combinations, transport formats and/or bearers, the TFCS is preferably reconstructed so that the TFCS contains only allowed combinations, and the TFCI values updated to correspond to the new TFCS.

The previously described ways of specifying the TFCS to a receiver are examples only and do not limit the invention in any way. Many other ways of specifying a set of combinations or for example different combinations of the previously described ways can as well be used in various embodiments of the invention.

D. Time of validity

In the previous examples of specifying the TFCS, the message or messages carrying the specifying information of TFCS may also comprise an indication of the starting time, after which the new TFCS is valid. However, the starting time of validity may also be defined implicitly, e.g. the new TFCS may be valid from the time the specifying message arrives or in the case of more than one message being used to specify the TFCS, from the receiving time of the last of these messages.

E. Examples of admission control methods according to the invention

The cellular telecommunications network can use for example the previously described TFCS construction limits at least partly as the admission condition in an admission control method. For example, the system can determine how many TFCI bits would be required to represent all combinations in the TFCS based on the size of the TFCS and the transport formats of all the bearers. If the amount of TFCI bits is less than equal to a maximum TFCI word length, the network can then refuse the bearer request, or for example in the case of a high priority request, refuse the service from other already established bearers. As another example, the maximum

bit rate limit may be considered. In such an example, the bearer is advantageously admitted, if at least some of its transport formats result in an allowed combination. Consequently, a multi-bit-rate bearer may be only partially admitted, i.e. admitted with a restricted selection of bit rates.

If the requested bearer has higher priority than some other bearers, the cellular network preferably allocates resources for the higher priority bearer first and restricts the bit rates of the other bearers to such values, that the resulting TF combination is an allowed combination. This may result in the adjustment of transport format for a bearer having a lower priority, or even refusing the service for a bearer having a lower priority.

Each bearer requiring establishment of a connection preferably indicates the variability of the user bit rate in a predefined way, e.g. using a predefined signalling procedure. The network then determines transport formats for the requested bearer and updates the TFCS accordingly, if the network can provide service for the bearer or for at least some of its transport formats.

Figure 1 shows the flow diagram of an advantageous embodiment of the invention. Figure 1 illustrates one example of the use of the inventive method in admission control. In step 135, a bearer request is received. As a response to the request, a TFCS is constructed in step 100. The step 100 of construction of a TFCS may also take into account the priority of the requested bearer as described previously. After the TFCS is constructed, it is checked in the following step 140 if the bearer belongs to any allowed combination. If the bearer is not a part of any allowed combination, the bearer is refused at step 150, after which the method is ended without taking the newly constructed TFCS into use. If the bearer is found to be a part of at least one TFC, the bearer is admitted in step 145. At the next step 120, the new TFCS is communicated to the receiver, after which the communicated TFCS is taken into use at step 155, after which the method is ended.

In further advantageous embodiments of the invention, the admission requirement may be different from the example of step 140 of Figure 1. For example, the bearer may be allowed only, if at least one transport format of the bearer is allowed in all combinations. Further, the bearer may also be allowed, if at least one transport format of the bearer is allowed in at least a predefined part of all combinations. In a further advantageous embodiment of the invention, a real time bearer is allowed only, if the highest transport format of the bearer is allowed in at least one TFC.

F. An example of a method

In the following, an example of a method according to an advantageous embodiment of the invention is presented. The method is described with reference to Figure 2, which illustrates as a flow diagram the construction 100 of a transport format combination set and the communication 120 of information to the receiver for construction of the same set at the receiver.

In this example, the step of construction 100 of a TFCS comprises the following steps 102, 104, 106, 107, and 108. All combinations are examined one by one, starting with step 102, in which the next, or at the first time after start of the method, the first combination is taken into consideration. In step 104 it is checked, whether the combination is within the predefined limits, such as within a predefined maximum total bit rate limit. If the combination is within the limits, the combination is added to the TFCS at step 106, and a TFCI is assigned to the combination in step 107. If the combination is not within the limits, the method is continued directly at step 108. In either case, in step 108 it is checked if the combination is the last one to be considered. If the combination is not the last one, it is returned back to step 102. If the combination is the last one, the method is continued at step 120.

In this example, the step of communication 120 of information to the receiver for construction of the set at the receiver comprises the following steps 121, 122, 124, 126, 128, 130, and 136. At step 121, the way of communicating the TFCS to the receiver is chosen. In this example, the steps 122, 124, 126, 128, 130, and 136 represent different ways of communicating the TFCS. At step 122, each allowed transport format combination is communicated to the receiver. At step 124, each non-allowed transport format combination is communicated to the receiver. At step 126, predefined limits for construction of the TFCS are communicated to the receiver. At step 128, information specifying at least one transport format of at least one bearer, which at least one transport format of at least one bearer is not a part of any allowed transport format combination is communicated to the receiver. At step 130, differences between the TFCS being communicated and a previous TFCS are communicated to the receiver.

The steps 122, 124, 126, 128, and 130 may comprise communication of all necessary information at one method step, or communication of only part of all necessary information. Therefore, at step 136 it is checked if the whole TFCS has been specified. If the whole TFCS has not been specified, it is returned back to step

121 for continuing the communication of the TFCS to the receiver. If the whole TFCS has been specified, the method is ended.

In the step 107 of assigning a TFCI to a combination, the assignment may be performed simply by assigning the next free TFCI value for the combination. Any other method or predefined rule of assigning TFCI values can be used, for example any of those described in the previous section B in this specification.

G. An example of a system

Figure 3 illustrates an example of a system according to an advantageous embodiment of the invention. Figure 3 shows mobile communication means 505, base stations 510, a network element 520 and the rest of a cellular telecommunications network 550. The network element 520 may be for example a radio network controller (RNC) of the UMTS cellular telecommunications network. The network element further comprises a processing unit 521 such as a microprocessor and a memory element 522 for storing programs for the processing unit and one or more transport format combination sets.

Further, according to this example the system comprises means 521 for construction of a set of allowed transport format combinations in a network element of the cellular telecommunication system, and means 521, 510 for communication of a constructed set of allowed transport format combinations to a mobile communication means 505.

During construction of a TFCS, the processor unit 521 performs the previously described checking whether a single transport format combination is within the predetermined limits. The processor unit 521 can perform this task by executing a program 523 stored in the memory means 522, which program directs the processor unit to perform the task. If a transport format combination is found to be within the limits, the processor unit 521 adds the combination to the set of allowed transport format combinations 529 stored in the memory means 522. Preferably, the processor unit also assigns a transport format combination identifier (TFCI) to each transport format combination. The transport format combination identifiers can also be stored in the memory means 522.

The processor unit 521 can also take care of the communication of the constructed TFCS to the receiver, in this case the mobile communication means 505 with the

help of other components of the cellular telecommunications network such as base stations 510. The previously described method steps, such as for example determining non-allowed transport format combinations or searching the differences between a transport format combination set and said previously stored second set of allowed transport format combinations can be realized using a program 524 stored in the memory means 522, which program directs the processing unit 521 to perform the method step. Further, the system may store more than one TFCS in the memory means, such as a previously constructed TFCS 529b, which can be used for example in determining the differences between a newly created TFCS and a previously created and communicated TFCS, after which a new TFCS can be communicated to the receiver simply by communicating the differences between the old and new TFCS. The receivers 505 store the communicated TFCS 506 in a memory means in the receiver, whereafter they are able to determine the current transport format combination on the basis of a received TFCI.

Preferably, the system also comprises means for assigning a transport format combination identifier to each transport format combination stored in said memory element. These means may comprise for example the processing unit 521, which can assign TFCI values to transport format combinations for example according to any of the embodiments of the invention described previously.

Preferably, the system also comprises means for sending a transport format combination identifier for identifying the transport formats used in a transmission. These means may comprise for example the processing unit 521, which can add the TFCI of the currently used TFC into the data transmitted to a receiver.

In an advantageous embodiment of the invnetion, also a mobile communication means 505 can comprise the means 521, 522, 523, 524, 525, 529, and 529b, or other means providing similar functionality. Although conventionally it is the network which decides about radio resource usage, the mobile communication means preferably has the capability and functionality needed for construction of a TFCS for example, according to the embodiments of the invention described in section C.2 in this specification, or according to other rules and limits set by the network.

H. A further example of a method

The TFCI values can be used to indicate, which transport formats are used in a transmission. For example, a TFCI value can be transmitted in each transmission

frame to describe the transmission format or transmission formats used in the frame. In another exemplary embodiment, a TFCI value can be transmitted each time, when the transport format combination is changed. Figure 4 illustrates one example of signalling according to an advantageous embodiment of the invention. Figure 4 illustrates events during communication between a transmitting party and a receiving party, such as, respectively, a mobile communication means and a base station of a cellular telecommunications network. First, a TFCI is sent from the transmitter to the receiver in step 610 for indicating, which transport formats are used in the next unit of transmission. In the next step 615, data is transmitted from the transmitter to the receiver, using the transport formats specified by the TFCI value transmitted in the previous step. In various embodiments of the invention, the order of sending of the TFCI value and the data which the TFCI value refers to, does not necessarily need to be that shown in figure 4. For example, in such systems in which data is transmitted in frames, such as in the GSM system, the TFCI value can be sent in the same transmission frame as the data which the TFCI value refers to, in which case the exact order of the data and the TFCI value is not important and can be set according to the requirements of the particular application.

I. Further considerations

In some advantageous embodiments of the invention, the TFCS used for transmission by a party and the TFCS used for reception by the same party do not need to be the same. This is advantageous for example when the amount of radio resources reserved for uplink communication is different from the amount of radio resources reserved for downlink communication. Such a situation is possible for example in the HSCSD (High Speed Circuit Switched Data) mode in GSM networks. Such an arrangement is advantageous for example in data terminal use when browsing information databases or the Internet, where only short requests are transmitted from the mobile communication means, but large amounts of information are returned from the data networks. In such embodiments of the invention, a communicating party preferably has at least two transport format control sets, one of which is used for reception and one for transmission.

In a further advantageous embodiment of the invention, multiple transport format combination sets are used to further reduce transport format signalling between a receiver and a transmitter. In such an embodiment, a plurality of transport format combination sets is constructed and communicated to the receiver, after which the current TFCS to be used is selected simply by sending a TFCS identifier to the

receiver. Such an embodiment reduces signalling over the air interface in such a case, in which some transport format combination sets are used relatively often. The plurality of transport format combination sets preferably comprises such sets, which are constructed as a result of most common bearer sets and limits, such as the maximum total bit rate for a user.

In such a case, when the allowed transport format combinations are limited by certain limits, which allow straightforward determination of allowability for a TFC, and the TFCI values are constructed according to a certain rule, explicit construction of a TFCS is not necessary for both parties of the connection. For example, the transmitting party may simply check if a new TFC is allowable according to the limits, and if the TFC is allowed, use the TFC in transmission, generating the TFCI on the fly. The receiving party can then use the TFCI as an index to a table containing the TFCS or, if the transport formats can be deduced from the specified TFCI using an inverse of the rule used for generating the TFCI, determine the used transport formats directly from the TFCI. Therefore, the existence of an explicit TFCS is not necessary in all embodiments of the invention.

In some circumstances, as a result of some kind of an error situation, it may be possible that the receiver and the transmitter have assigned the same TFCI to different transport format combinations. If such an error situation occurs, data transmission does not succeed, since the receiver attempts to interpret the received data stream in a different way than the data stream was constructed. Recovery from such an error situation can proceed in many ways in various embodiments of the invention. For example, according to one advantageous embodiment of the invention, the party which detects the error, informs the other end about the error, whereafter both ends reconstruct their TFCI values for example according to some of the previously described examples, such as those described in sections B.2 or B.3, after which the meaning TFCI values should be the same at both ends. According to another embodiment, the party detecting the error communicates its TFCS and TFCI values to the other party, which takes the communicated values into use. According to a third embodiment, if a mobile communication means detects the error, it requests the network to send the TFCS and the TFCI values used by the network and if the network detects the error, it sends the TFCS and the TFCI values used by the network preferably without waiting for the mobile communication means to request for the information.

In various examples of embodiments described in this specification, the transport formats have been classified as allowed or non-allowed. However, in some embodiments of the invention, a bearer having no allowed transport formats in a TFC can be assigned a null transport format, i.e. a transport format having a zero bit rate. Therefore, a null transport format corresponds to a non-allowed transport format. Therefore, in this specification and the accompanied claims the term allowed transport format refers to a non-null transport format, i.e. a transport format with an essentially nonzero bit rate, which can be used in the TFCS.

The present invention reduces the use of radio resources, while retaining flexibility in the use of different transport formats. The present invention allows restriction of the use of radio resources without making it impossible for some bearers to use high data rates. The flexibility of the inventive method allows such overall control of radio resources, while providing a way to specifically restrict certain specific services as well.

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 controlling bearers in a cellular telecommunication system, **characterized** in that the method comprises steps, in which
- a set of allowed transport format combinations is constructed, and
- information for construction of said set at a receiver is communicated to the receiver.

2. A method according to claim 1, **characterized** in that said set of allowed transport format combinations is constructed by checking for each transport format combination, whether the combination is within predefined limits.

3. A method according to claim 1, **characterized** in that a transport format combination identifier is assigned to each combination of said set of allowed transport format combinations.

4. A method according to claim 3, **characterized** in that said assigning of transport format combination identifiers is performed according to a predefined rule.

5. A method according to claim 4, **characterized** in that said set of allowed transport format combinations is ordered according to at least the total bit rate of the transport format combinations, and said transport format combination identifiers are assigned so that the identifiers form a sequence of consecutive integer numbers.

6. A method according to claim 1, **characterized** in that said step of communicating information for construction of said set comprises the step of communicating of each allowed transport format combination to said receiver.

7. A method according to claim 1, **characterized** in that said step of communicating information for construction of said set comprises the step of communicating of each non-allowed transport format combination to said receiver.

8. A method according to claim 1, **characterized** in that
said step of communicating information for construction of said set comprises the step of communicating at least one limit for construction of said set to said receiver.

9. A method according to claim 1, **characterized** in that
said step of communicating information for construction of said set comprises the step of communicating information specifying at least one transport format of at least one bearer, which at least one transport format of at least one bearer is not a part of any allowed transport format combination.

10. A method according to claim 1, **characterized** in that
said step of communicating information for construction of said set comprises the step of specifying the differences between said set to a previous set of transport format combinations.

11. A method according to claim 1, **characterized** in that
a bearer request is admitted, if at least one of the transport formats of the requested bearer is a part of an allowed transport format combination.

12. A method according to claim 3, **characterized** in that
transport formats used in a transmission between a receiver and a transmitter are identified by sending a transport format combination identifier from the transmitter to the receiver.

13. A method according to claim 3, **characterized** in that
if either party of the connection detects that the transport format combination identifiers of the receiver do not correspond to the transport format combination identifiers of the transmitter, the transport format combination identifiers are reconstructed at at least one party of the connection.

14. A method according to claim 13, **characterized** in that
said step of reconstruction comprises the reconstruction of transport format combination identifiers at both parties of the connection according to a predefined rule.

15. A method according to claim 13, **characterized** in that
in said step of reconstruction, one of the parties of the connection communicates its

transport format combination identifiers to the other party, which takes the communicated identifiers into use.

16. System for controlling bearers in a cellular telecommunication system **characterized** in that the system comprises
- means for construction of a set of allowed transport format combinations in a network element of the cellular telecommunication system, and
- means for communication of a constructed set of allowed transport format combinations to a mobile communication means.

17. A system according to claim 16, **characterized** in that
said means for construction of a set of allowed transport format combinations comprises
- a memory element for storing a set of allowed transport format combinations,
- means for checking whether a single transport format combination is within predetermined limits, and
- means for adding a single transport format combination to said set of allowed transport format combinations stored in said memory element.

18. A system according to claim 16, **characterized** in that
said means for communication of a constructed set of allowed transport format combinations to a mobile communication means comprises
means for determining non-allowed transport format combinations.

19. A system according to claim 16, **characterized** in that the system further comprises means for storing a previously constructed second set of allowed transport format combinations,
and said means for communication of a constructed set of allowed transport format combinations to a mobile communication means comprises
means for searching the differences between a transport format combination set and said previously stored second set of allowed transport format combinations.

20. A system according to claim 16, **characterized** in that the system further comprises means for assigning a transport format combination identifier to each transport format combination stored in said memory element.

21. A system according to claim 16, **characterized** in that the system further comprises means for sending a transport format combination identifier for identifying the transport formats used in a transmission.

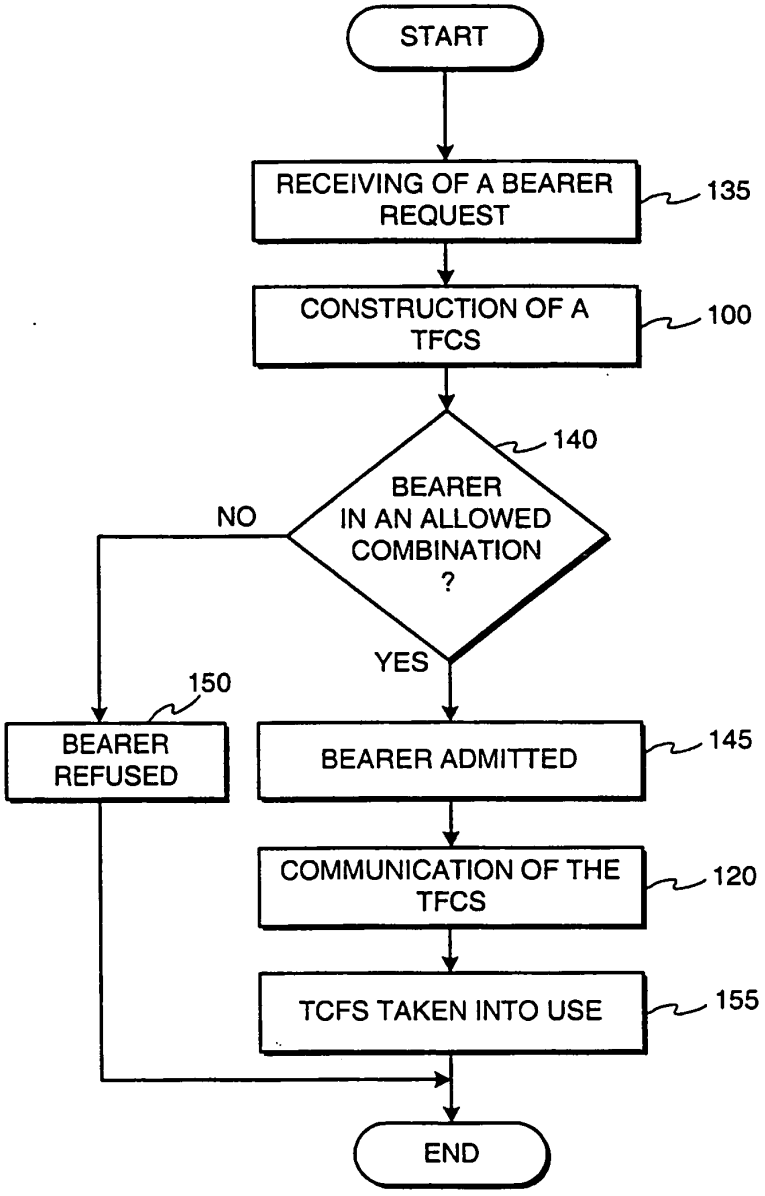

START
RECEIVING OF A BEARER REQUEST
135
CONSTRUCTION OF A TFCS
100
140
BEARER IN AN ALLOWED COMBINATION ?
NO
YES
150
BEARER REFUSED
BEARER ADMITTED
145
COMMUNICATION OF THE TFCS
120
TCFS TAKEN INTO USE
155
END

Fig. 1

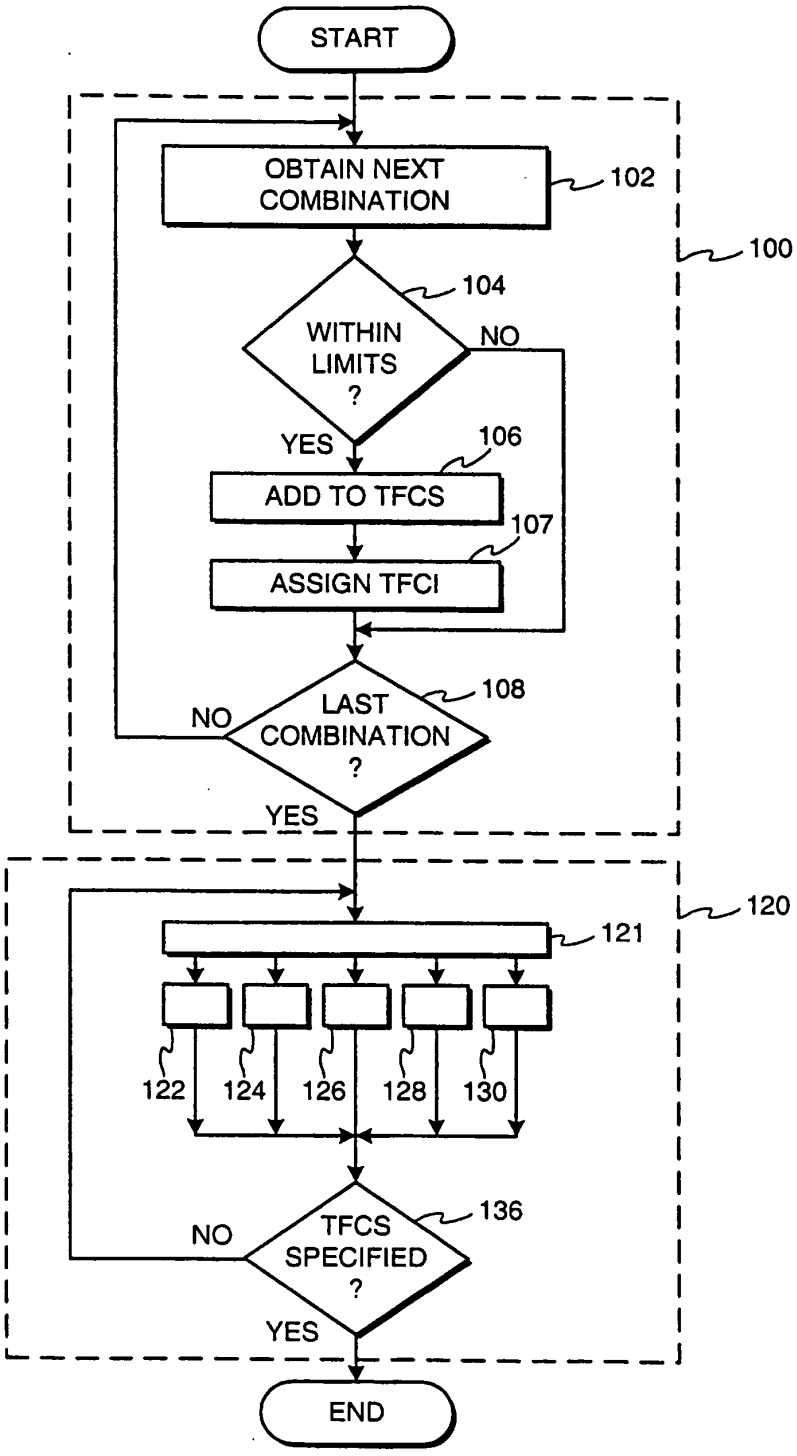

START
OBTAIN NEXT COMBINATION
102
100
104
WITHIN LIMITS ?
NO
YES
106
ADD TO TFCS
107
ASSIGN TFCI
108
LAST COMBINATION ?
NO
YES
120
121
122
124
126
128
130
136
TFCS SPECIFIED ?
NO
YES
END

Fig. 2

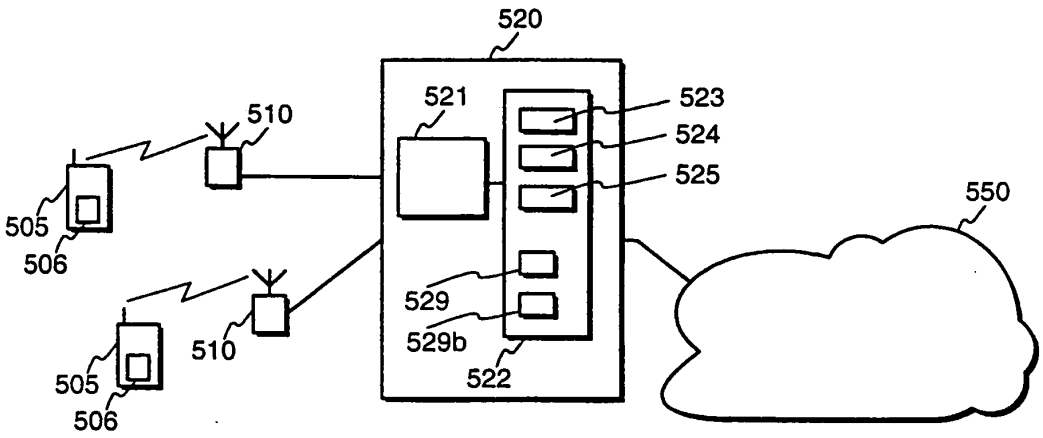

520
521
523
524
525
510
505
506
550
529
529b
522
510
505
506

Fig. 3

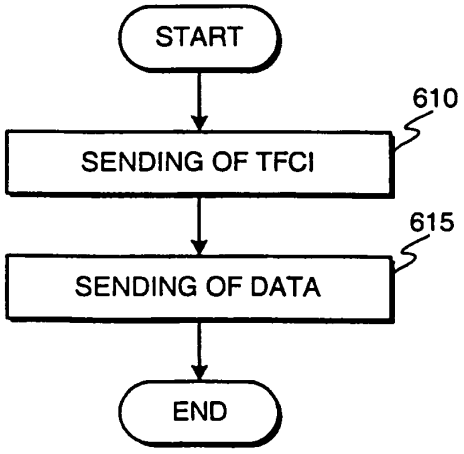

START
610
SENDING OF TFCI
615
SENDING OF DATA
END

Fig. 4

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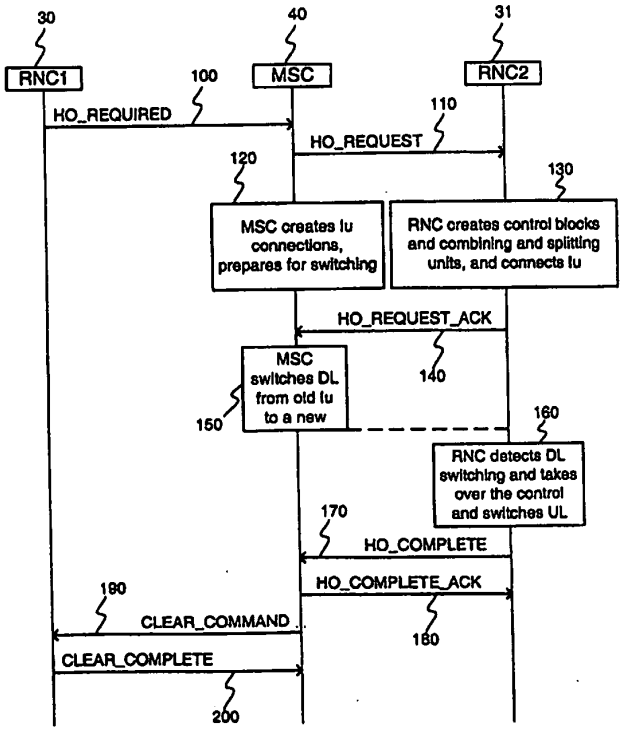
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(57) Abstract

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.

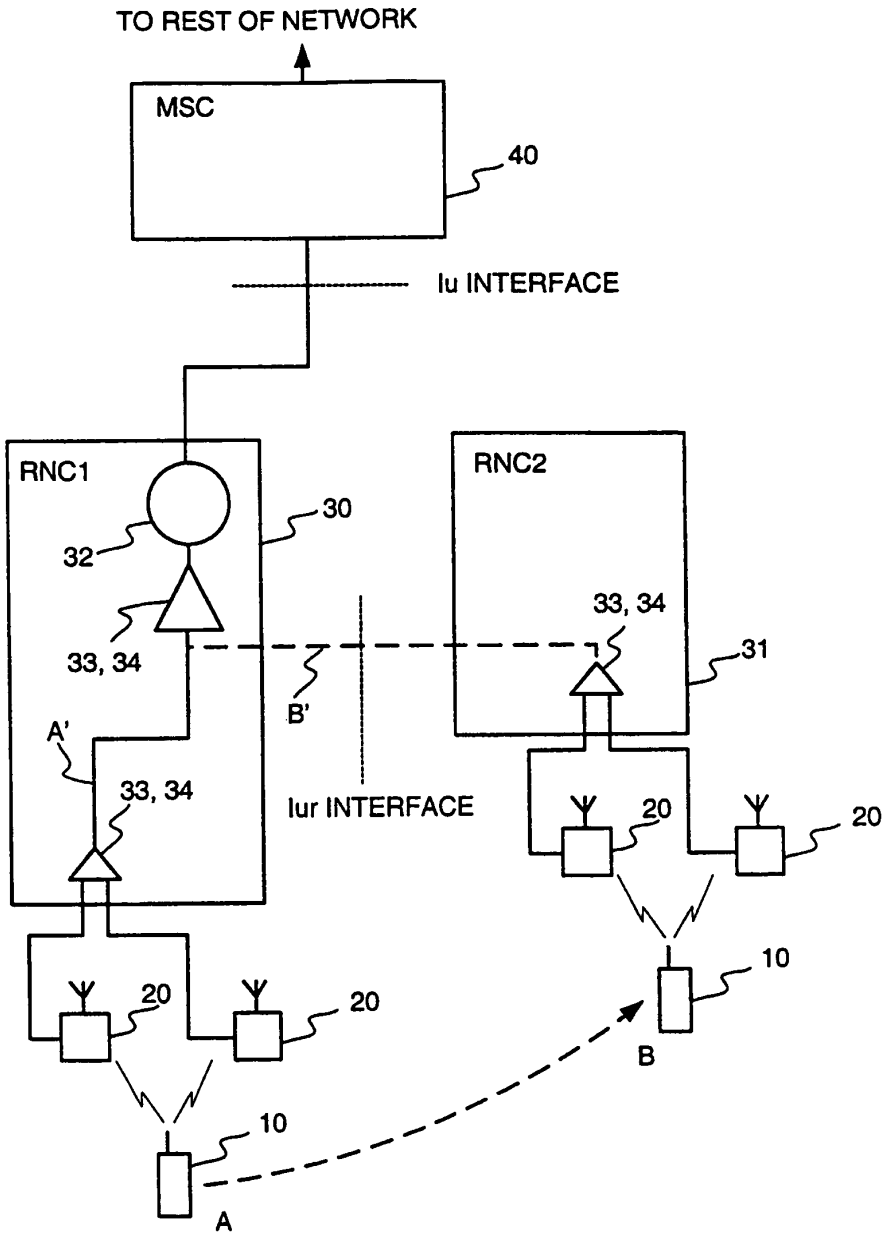


Fig. 1
PRIOR ART

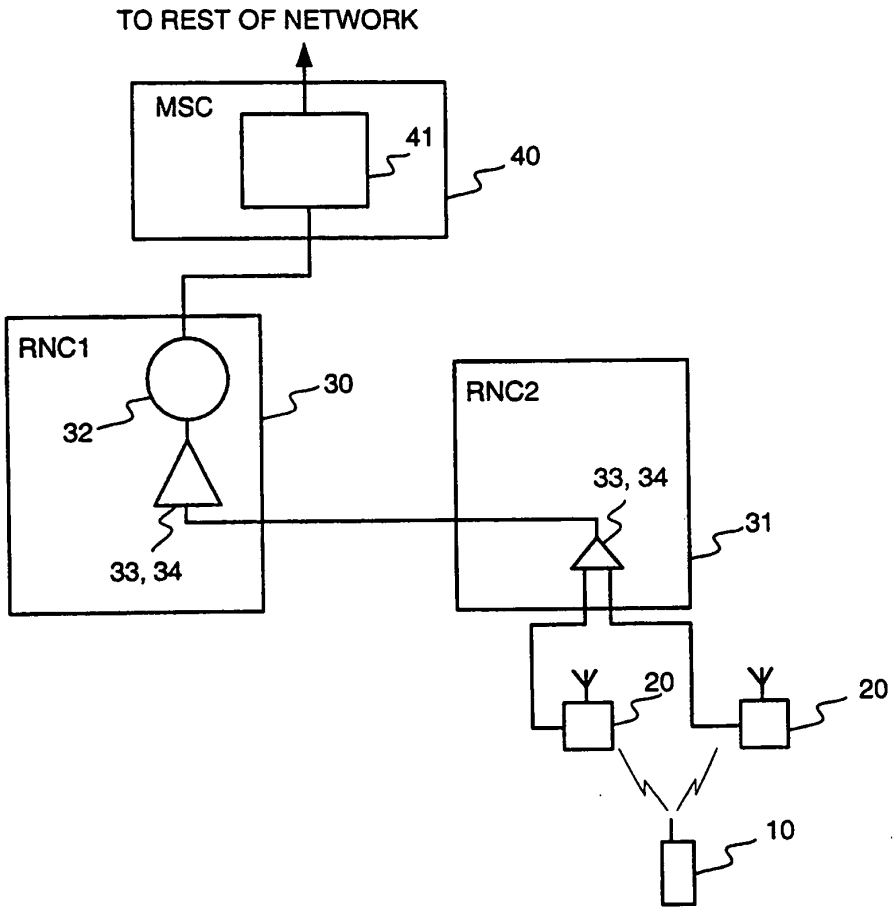

TO REST OF NETWORK
MSC
41
40
RNC1
30
32
33, 34
RNC2
33, 34
31
20
20
10

Fig. 2

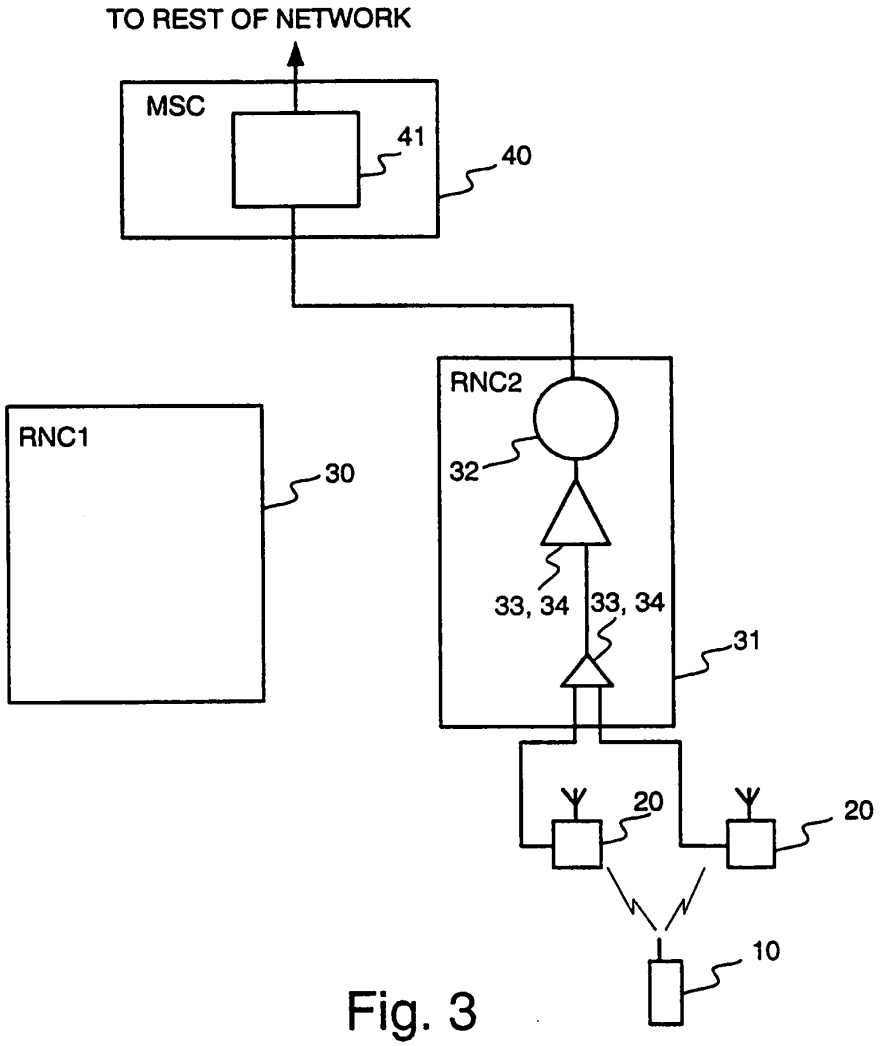

TO REST OF NETWORK
MSC
41
40
RNC2
RNC1
30
32
33, 34
33, 34
31
20
20
10

Fig. 3

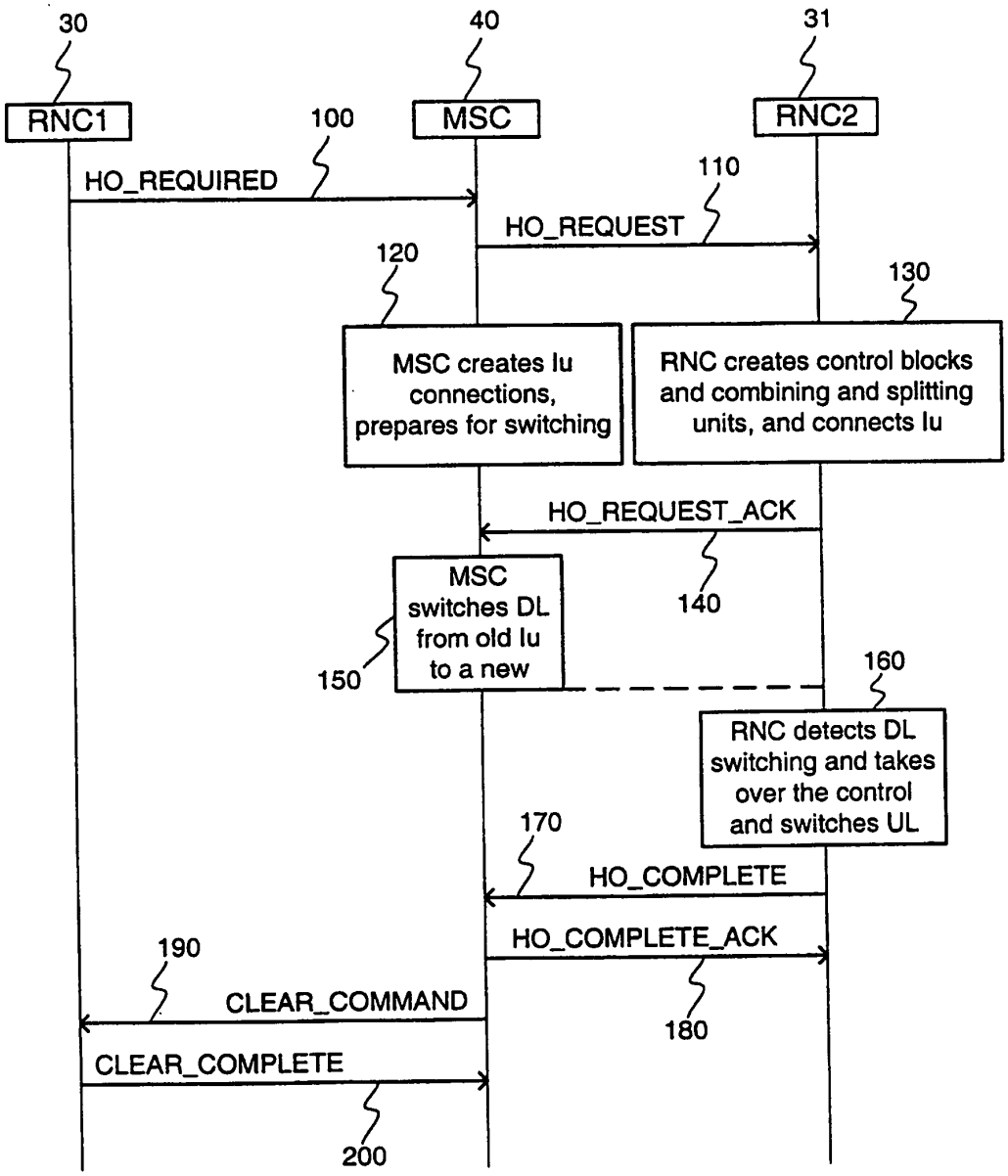

30
40
31
RNC1
MSC
RNC2
100
HO_REQUIRED
110
HO_REQUEST
120
130
MSC creates Iu connections, prepares for switching
RNC creates control blocks and combining and splitting units, and connects Iu
HO_REQUEST_ACK
140
MSC switches DL from old Iu to a new
150
160
RNC detects DL switching and takes over the control and switches UL
170
HO_COMPLETE
HO_COMPLETE_ACK
180
190
CLEAR_COMMAND
CLEAR_COMPLETE
200

Fig. 4

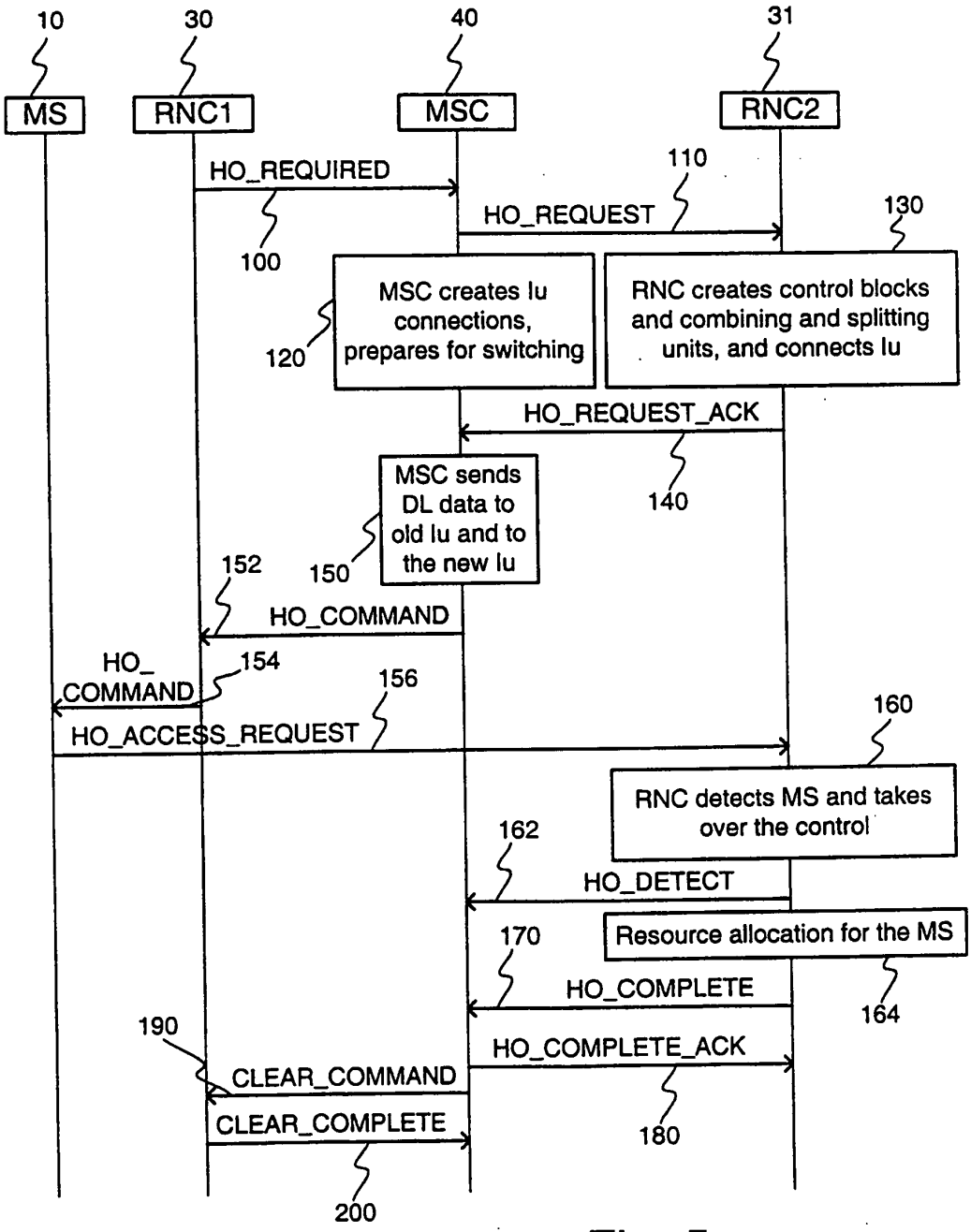

10
30
40
31
MS
RNC1
MSC
RNC2
HO_REQUIRED
110
HO_REQUEST
130
100
MSC creates Iu connections, prepares for switching
120
RNC creates control blocks and combining and splitting units, and connects Iu
HO_REQUEST_ACK
140
MSC sends DL data to old Iu and to the new Iu
150
152
HO_COMMAND
HO_ COMMAND
154
156
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

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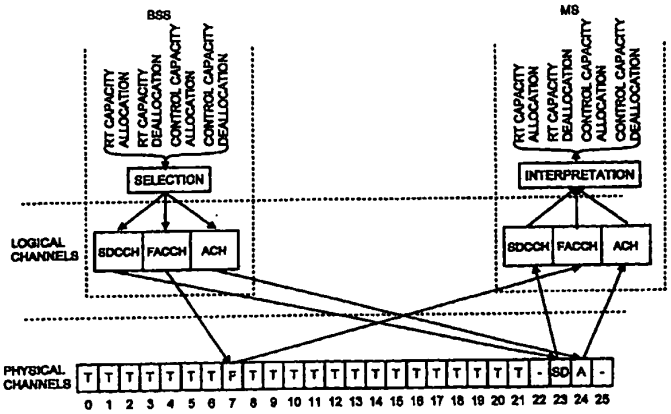
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(57) Abstract

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.

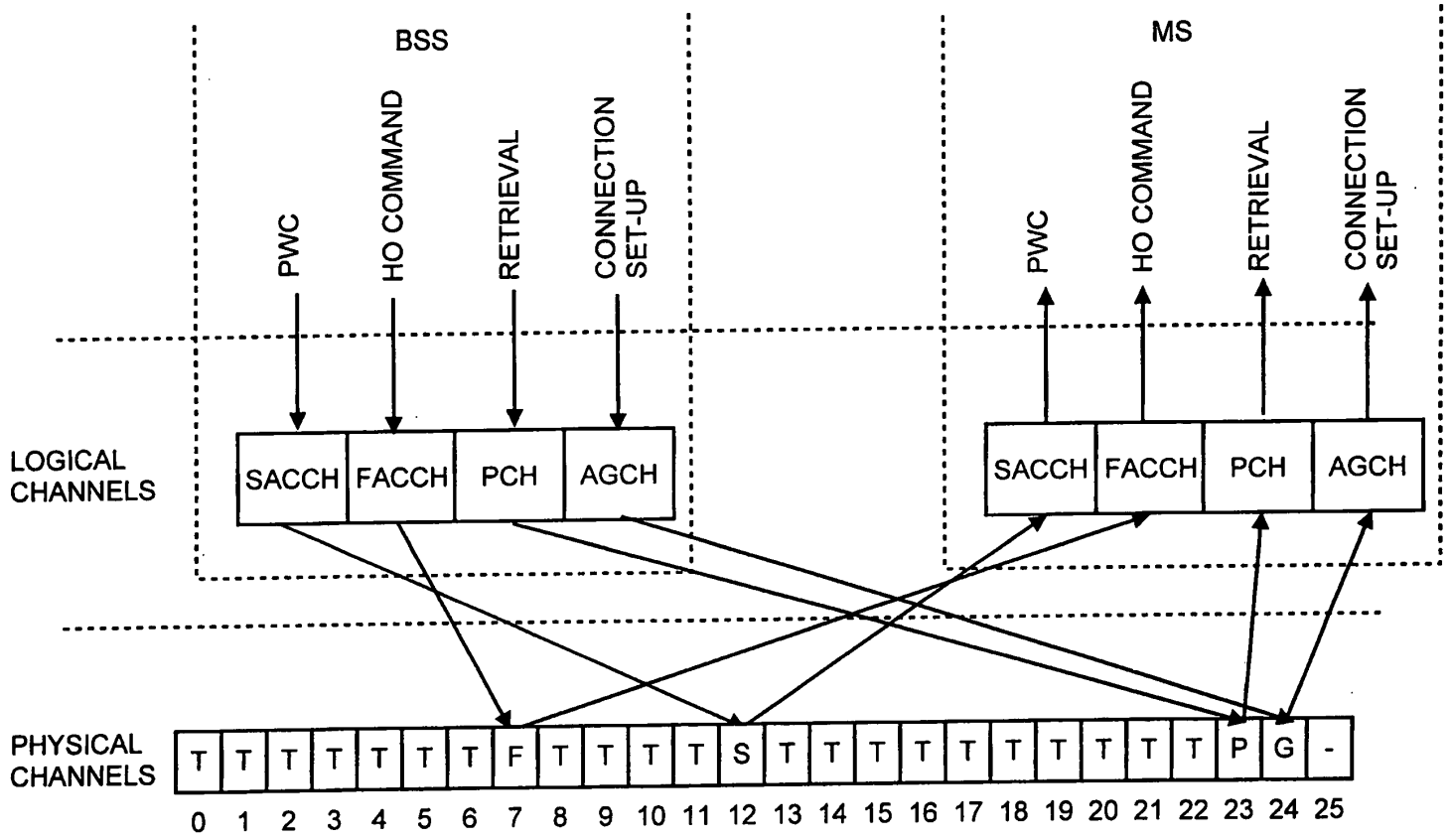

BSS
MS
PWC
HO COMMAND
RETRIEVAL
CONNECTION SET-UP
LOGICAL CHANNELS
SACCH
FACCH
PCH
AGCH
PHYSICAL CHANNELS
T T T T T T T F T T T T S T T T T T T T T T T P G -
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

FIG. 1.

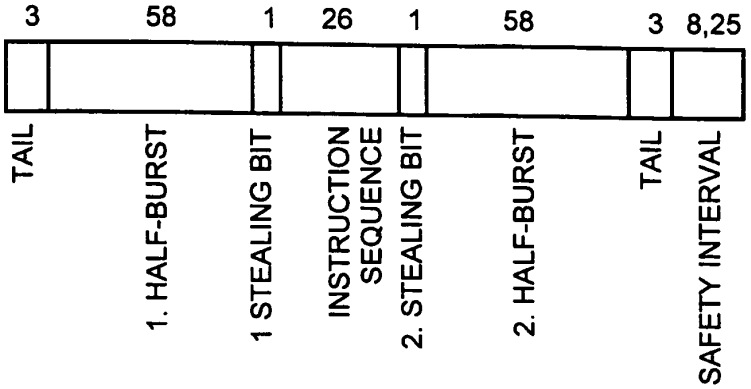

3
58
1
26
1
58
3
8,25
TAIL
1. HALF-BURST
1 STEALING BIT
INSTRUCTION SEQUENCE
2. STEALING BIT
2. HALF-BURST
TAIL
SAFETY INTERVAL

FIG. 2.

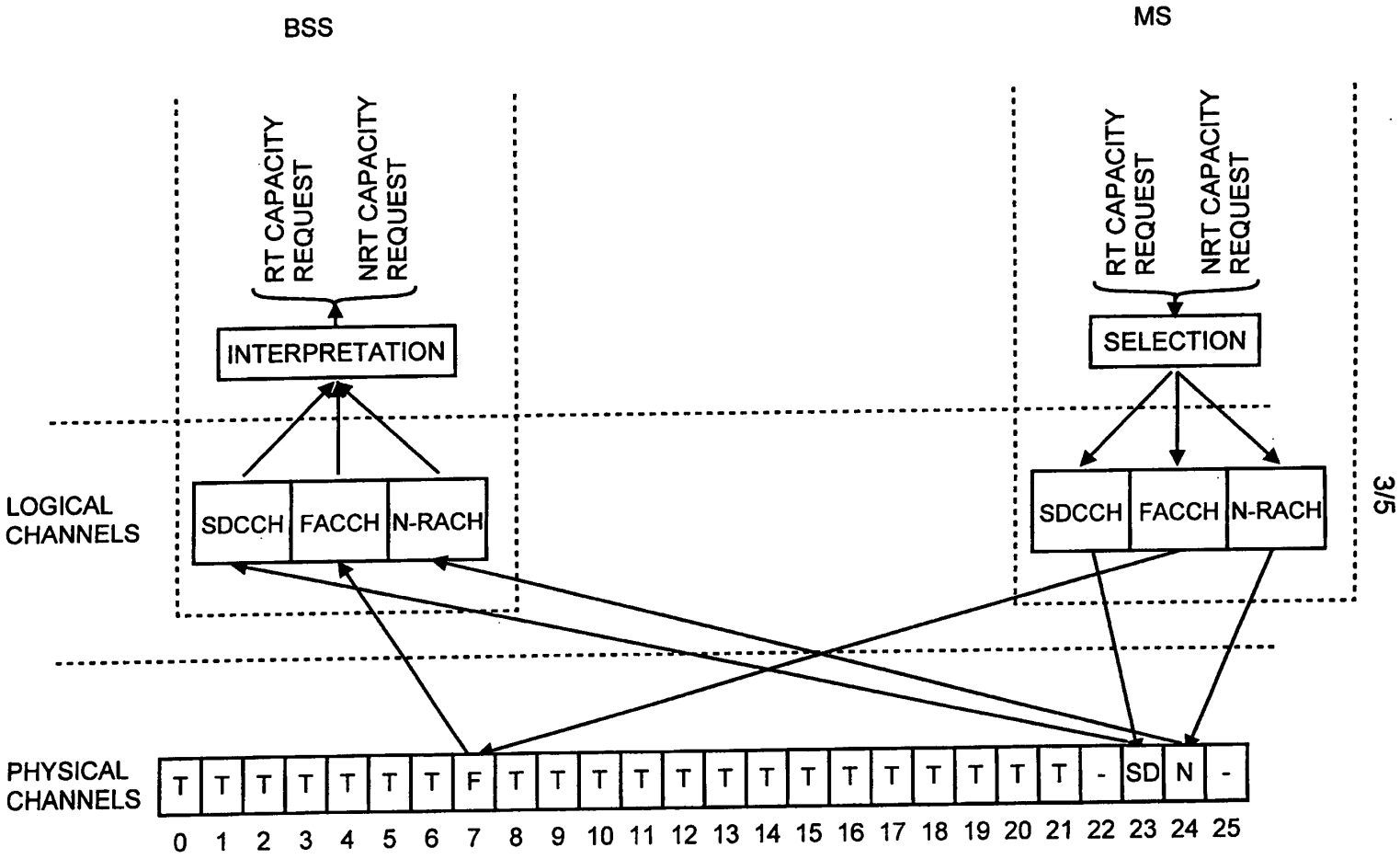

BSS
MS
RT CAPACITY REQUEST
NRT CAPACITY REQUEST
INTERPRETATION
SELECTION
LOGICAL CHANNELS
SDCCH
FACCH
N-RACH
PHYSICAL CHANNELS
T T T T T T T F T T T T T T T T T T T T T T - SD N -
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

FIG. 3.

FIG. 4.

WO 99/09775 PCT/FI98/00633

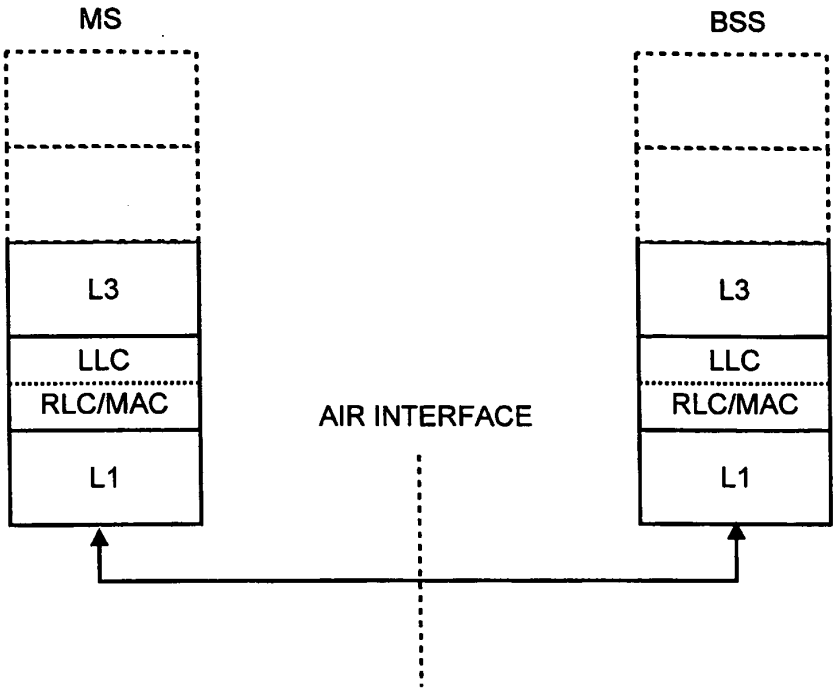


FIG. 5.

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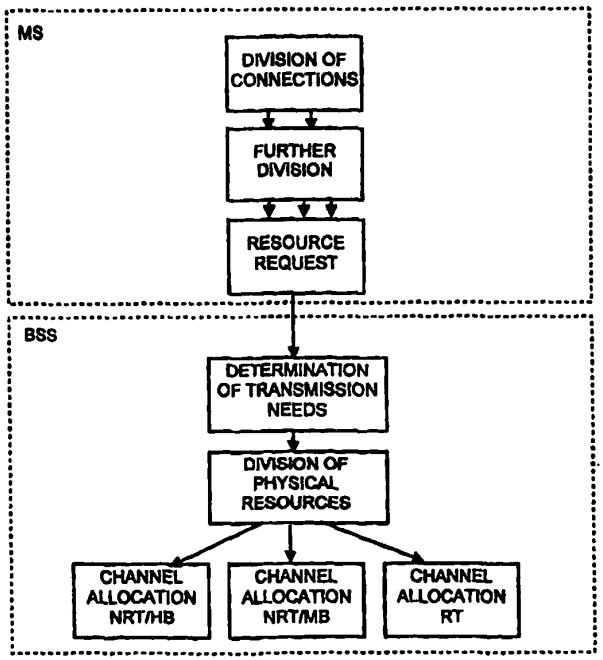
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(57) Abstract

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 1/16th 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, characterized 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, characterized 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, characterized 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, characterized 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,

characterized 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, 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.

20. A base station controller according to claim 18, 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.

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.

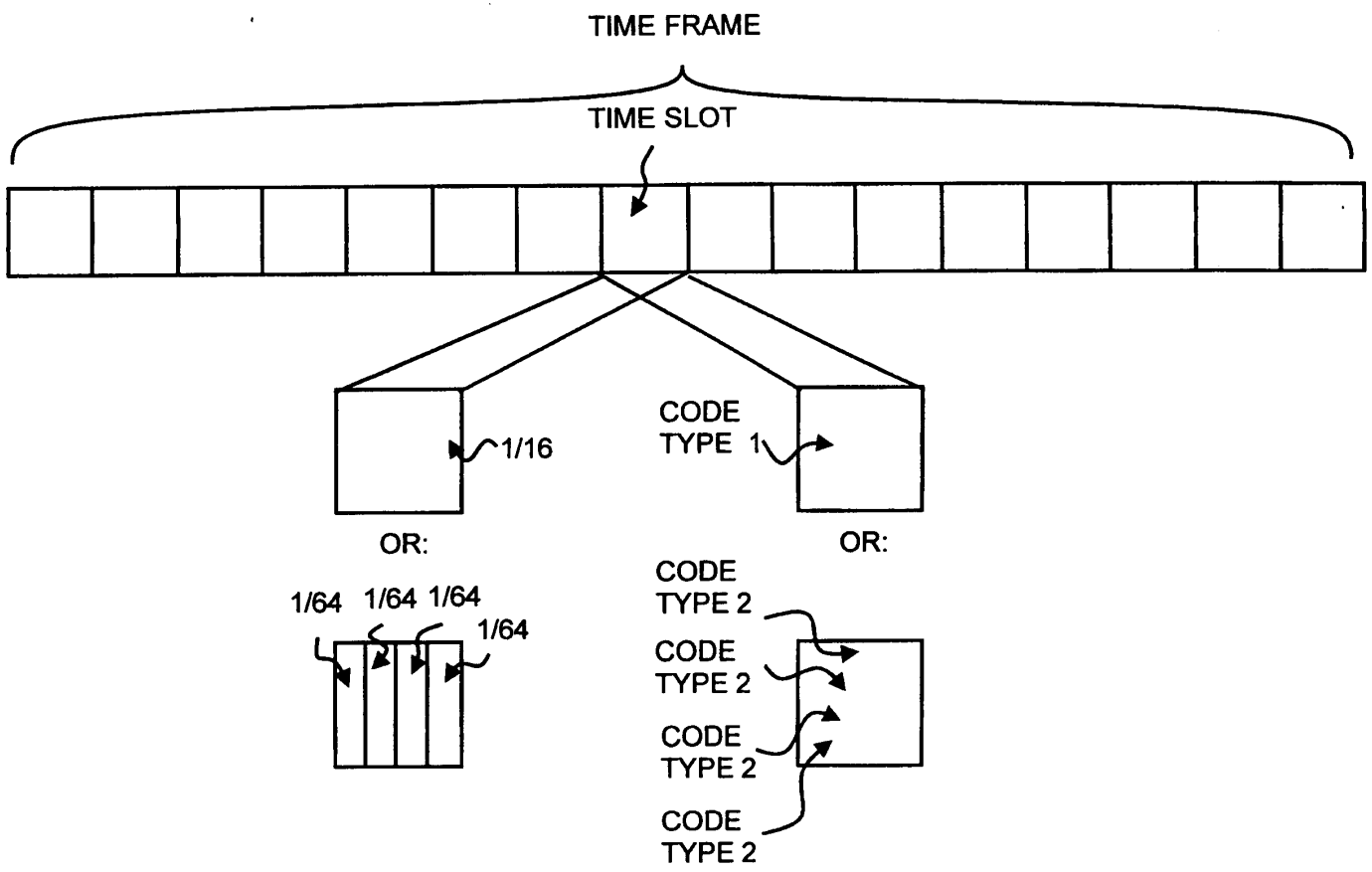

TIME FRAME
TIME SLOT
1/16
CODE
TYPE 1
OR:
OR:
1/64 1/64 1/64
1/64
CODE
TYPE 2
CODE
TYPE 2
CODE
TYPE 2
CODE
TYPE 2

FIG. 1.

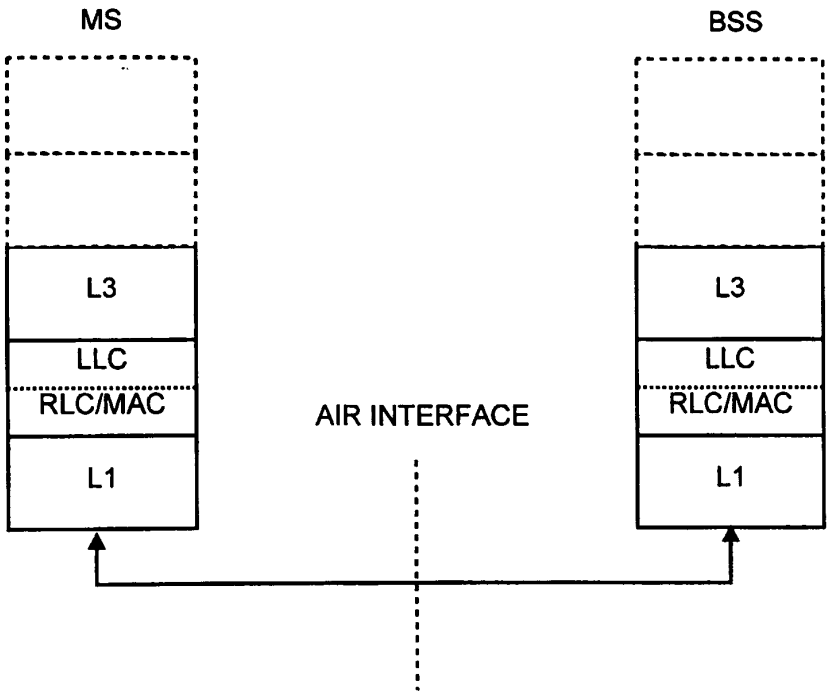


FIG. 2.

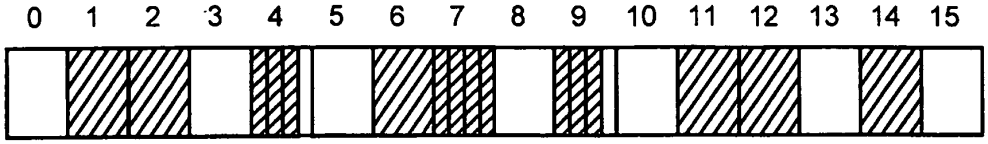


FIG. 3A .

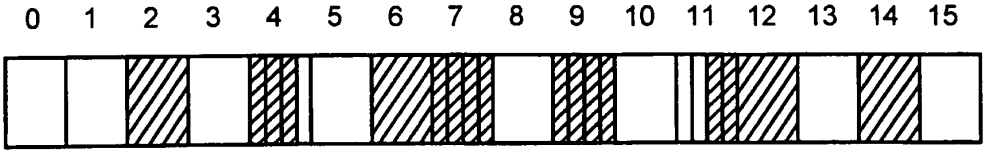


FIG. 3B.

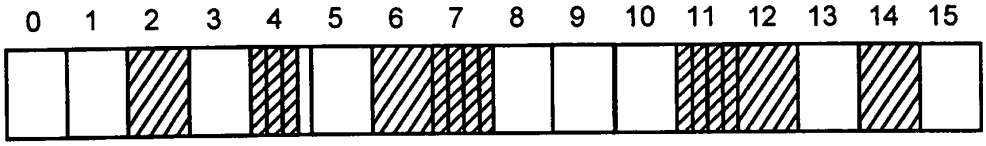


FIG. 3C.

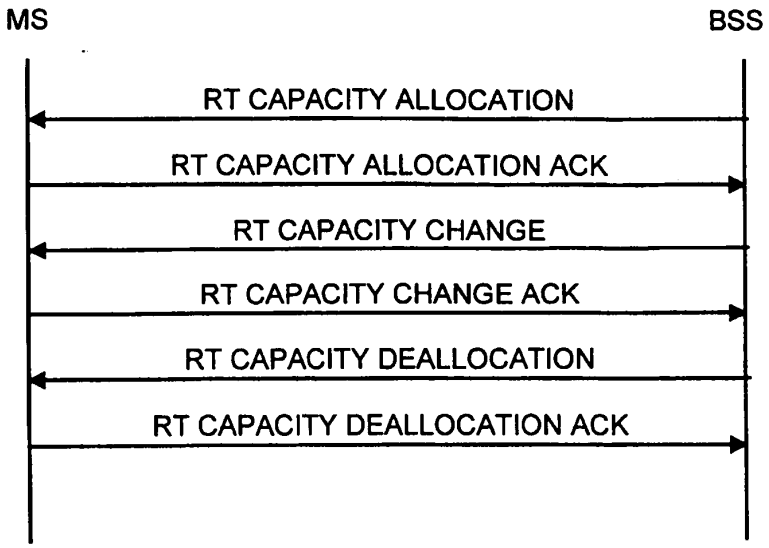

MS
BSS
RT CAPACITY ALLOCATION
RT CAPACITY ALLOCATION ACK
RT CAPACITY CHANGE
RT CAPACITY CHANGE ACK
RT CAPACITY DEALLOCATION
RT CAPACITY DEALLOCATION ACK

FIG. 4.

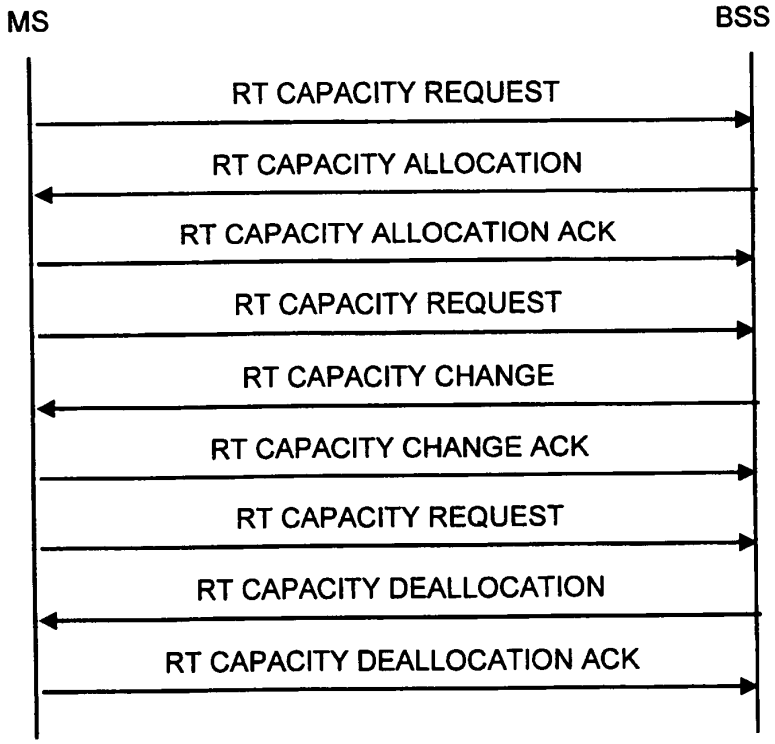

MS
BSS
RT CAPACITY REQUEST
RT CAPACITY ALLOCATION
RT CAPACITY ALLOCATION ACK
RT CAPACITY REQUEST
RT CAPACITY CHANGE
RT CAPACITY CHANGE ACK
RT CAPACITY REQUEST
RT CAPACITY DEALLOCATION
RT CAPACITY DEALLOCATION ACK

FIG. 5.

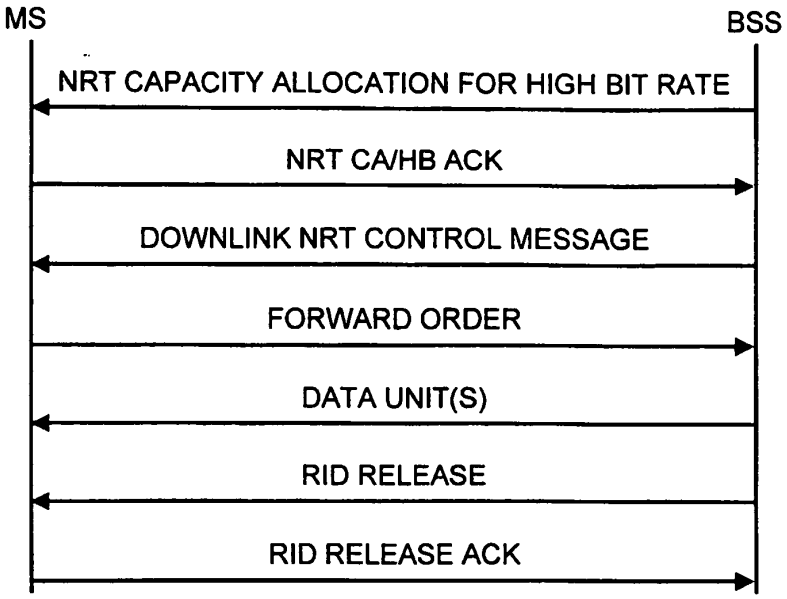

MS
BSS
NRT CAPACITY ALLOCATION FOR HIGH BIT RATE
NRT CA/HB ACK
DOWNLINK NRT CONTROL MESSAGE
FORWARD ORDER
DATA UNIT(S)
RID RELEASE
RID RELEASE ACK

FIG. 6.

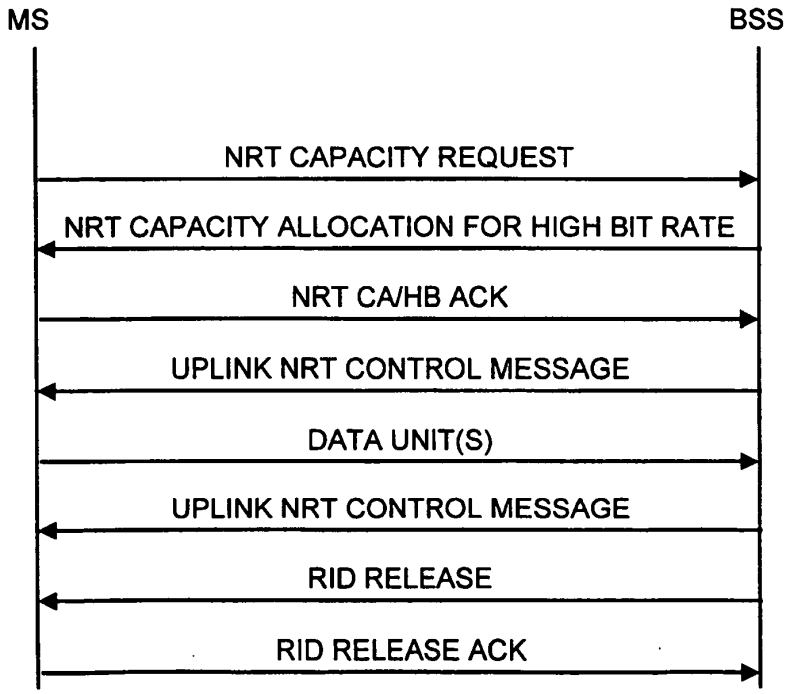

MS
BSS
NRT CAPACITY REQUEST
NRT CAPACITY ALLOCATION FOR HIGH BIT RATE
NRT CA/HB ACK
UPLINK NRT CONTROL MESSAGE
DATA UNIT(S)
UPLINK NRT CONTROL MESSAGE
RID RELEASE
RID RELEASE ACK

FIG. 7.

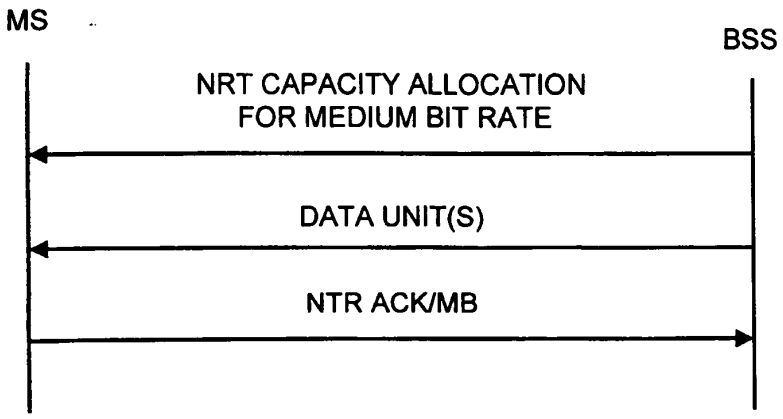

MS
BSS
NRT CAPACITY ALLOCATION
FOR MEDIUM BIT RATE
DATA UNIT(S)
NTR ACK/MB

FIG. 8.

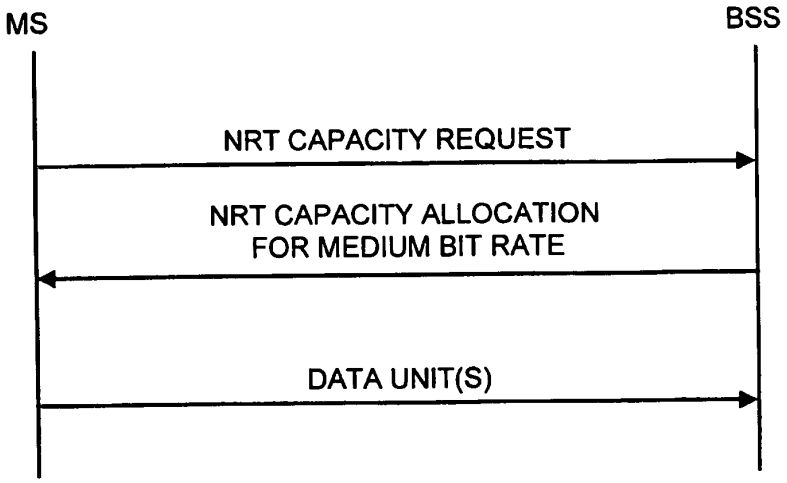

MS
BSS
NRT CAPACITY REQUEST
NRT CAPACITY ALLOCATION
FOR MEDIUM BIT RATE
DATA UNIT(S)

FIG. 9.

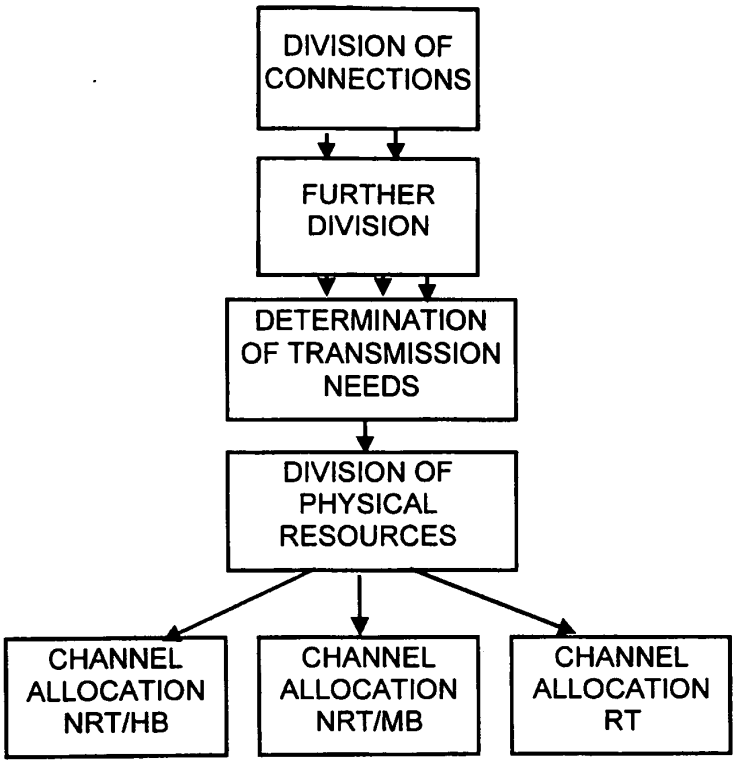

DIVISION OF CONNECTIONS
FURTHER DIVISION
DETERMINATION OF TRANSMISSION NEEDS
DIVISION OF PHYSICAL RESOURCES
CHANNEL ALLOCATION NRT/HB
CHANNEL ALLOCATION NRT/MB
CHANNEL ALLOCATION RT

FIG. 10.

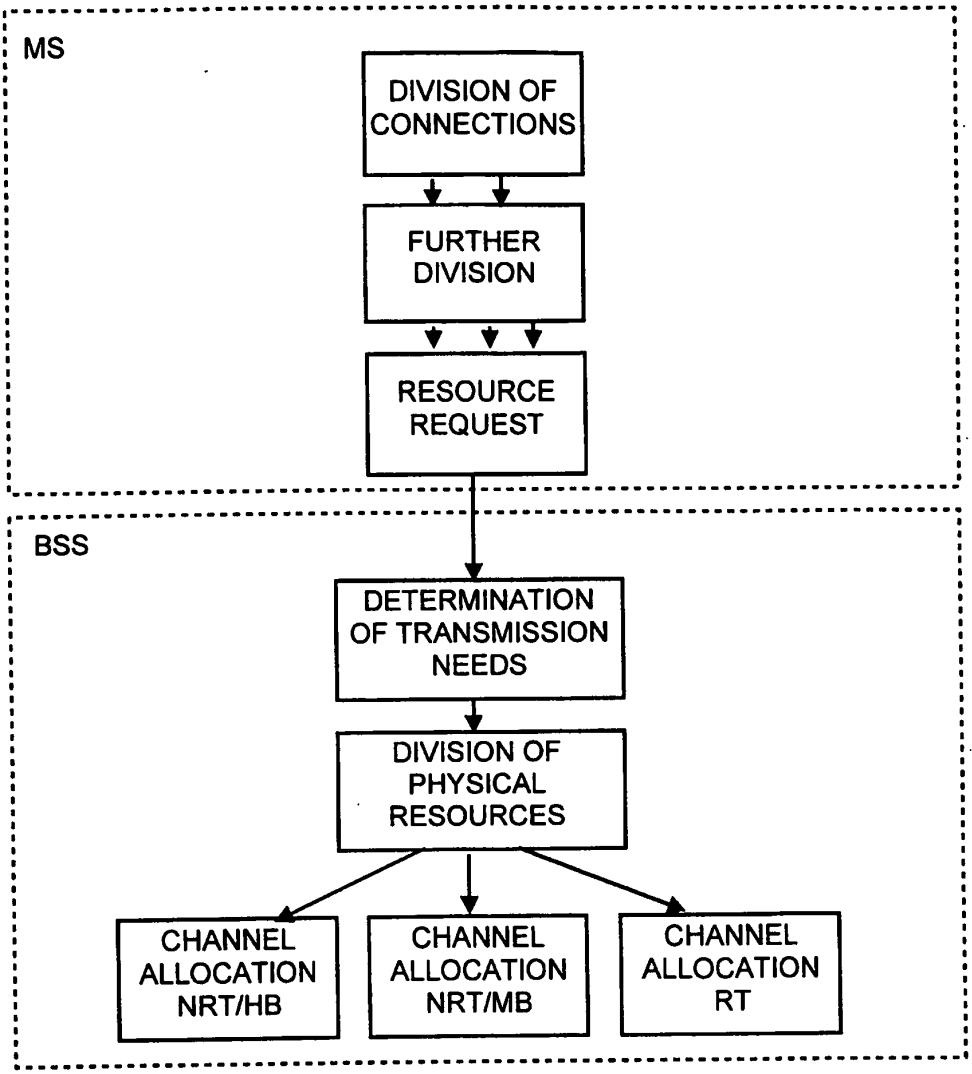

MS
DIVISION OF CONNECTIONS
FURTHER DIVISION
RESOURCE REQUEST
BSS
DETERMINATION OF TRANSMISSION NEEDS
DIVISION OF PHYSICAL RESOURCES
CHANNEL ALLOCATION NRT/HB
CHANNEL ALLOCATION NRT/MB
CHANNEL ALLOCATION RT

FIG. 11.

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	3518	location near3 (mobile wireless portable cellular).CLM.	US-PGPUB	OR	ON	2006/04/02 11:08
L2	20010	(access adj right authoriz$5).CLM.	US-PGPUB; USPAT	OR	ON	2006/04/02 11:09
L3	218	1 AND 2	US-PGPUB; USPAT	OR	ON	2006/04/02 11:14
L4	131	locat$3 with (cellular portable wireless) with (access adj3 right authoriz$5 authentica$5).CLM.	US-PGPUB	OR	ON	2006/04/02 11:10
L5	23	locat$3 with (cellular portable wireless) with (access adj3 right authoriz$5 authentica$5) WITH SERVER.CLM.	US-PGPUB	OR	ON	2006/04/02 11:10
S1	2424	location near3 (mobile wireless portable cellular).ab,ti.	US-PGPUB; USPAT	OR	ON	2006/04/02 11:08
S2	2541	455/404.1,404.2,456.1-456.3,457.ccls.	US-PGPUB; USPAT	OR	ON	2005/10/08 12:47
S3	721	S1 and S2	US-PGPUB; USPAT	OR	ON	2005/03/01 17:39
S4	69673	access adj right authoriz$5	US-PGPUB; USPAT	OR	ON	2006/04/02 11:09
S5	163	S3 and S4	US-PGPUB; USPAT	OR	ON	2005/03/01 17:40
S6	6858	access adj right	US-PGPUB; USPAT	OR	ON	2005/09/27 10:38
S7	17	S3 and S6	US-PGPUB; USPAT	OR	ON	2005/03/01 17:47
S8	1442	first adj wireless with second adj wireless	US-PGPUB; USPAT	OR	ON	2006/03/26 08:40
S9	5	S1 with S8	US-PGPUB; USPAT	OR	ON	2005/03/01 17:47
S10	21554	location near3 (mobile wireless portable cellular)	US-PGPUB; USPAT	OR	ON	2005/03/01 17:50
S11	82	S8 with S10	US-PGPUB; USPAT	OR	ON	2005/03/01 17:51
S12	19	S2 and S11	US-PGPUB; USPAT	OR	ON	2005/03/01 17:51

EAST Search History

S13	48	("5633917"|"5625682"|"5625676"|"5619557"|"5610978"|"5610774"|"5600710"|"5594791"|"5594790"|"5592543"|"5590171"|"5588049"|"5586179"|"5581607"|"5581604"|"5581602"|"5579383"|"5579377"|"5577112"|"5574784"|"5572586"|"5572576"|"5570419"|"5568540"|"5561711"|"5559878"|"5559867"|"5557668"|"5555295"|"5555290"|"5546456"|"5546452"|"5544232"|"5544220"|"5537470"|"5535257"|"5533109"|"5533107"|"5533103"|"5530931"|"5528666"|"5526417"|"5524140"|"5517566"|"5515421"|"5511112"|"5502762"|"5495528").PN.	USPAT	OR	OFF	2005/03/03 10:08
S14	0	cost adj benefit and S13	USPAT	OR	OFF	2005/03/03 10:09
S15	50	("5325292"|"6044355"|"5206903"|"6529870"|"6522726"|"6519459"|"6519259"|"6510221"|"6496568"|"6493696"|"6493432"|"6487533"|"6477494"|"6477245"|"6470077"|"6466909"|"6466654"|"6463299"|"6459784"|"6453038"|"5036535"|"5193110"|"6418424"|"6400996"|"6081750"|"5920477"|"5903454"|"5901246"|"5875108"|"5867386"|"5774357"|"6529891"|"6466970"|"6449367"|"6446035"|"6430558"|"6412012"|"6389372"|"6356899"|"6334131"|"6334127"|"6327590"|"6321221"|"6321179"|"6317722"|"6317718"|"6266649"|"6256648"|"6253193"|"6236980").PN.	USPAT	OR	OFF	2005/03/03 10:09
S16	9	cost adj benefit and S15	USPAT	OR	OFF	2005/03/03 10:10
S17	50	("6236978"|"6185683"|"6177932"|"6170742"|"6146026"|"6138119"|"6112186"|"6112181"|"6078928"|"6016475"|"5999908"|"5560011"|"6484123"|"6480844"|"6477246"|"6421709"|"6405922"|"6353813"|"6345264"|"6314420"|"6308175"|"6144964"|"6029161"|"6018738"|"6006218"|"5983214"|"5867799"|"5790935"|"4048452"|"4737983"|"4757529"|"4893301"|"4953204"|"5073890"|"5278898"|"5309513"|"5369695"|"5506898"|"5511117"|"5519773"|"5524147"|"5590188"|"5633922"|"5633924"|"5715307"|"5740240"|"5768360"|"5825869"|"5848143"|"5870464").PN.	USPAT	OR	OFF	2005/03/03 10:10
S18	0	cost adj benefit and S17	USPAT	OR	OFF	2005/03/03 10:11

EAST Search History

S19	50	("5878130"|"5901214"|"5905792"|"5907608"|"5910982"|"5915011"|"5917903"|"5923745"|"5926539"|"5933492"|"5940496"|"5940947"|"5946387"|"5953332"|"5953405"|"5956397"|"5960073"|"5963632"|"5970134"|"5978465"|"5982868"|"5987116"|"5987118"|"5991391"|"5991392"|"5991395"|"5995614"|"5995615"|"5999965"|"6002760"|"6005931"|"6044146"|"6058435"|"6061347"|"6064667"|"6072864"|"6104801"|"6115462"|"6118865"|"6122358"|"6122360"|"6122364"|"6128380"|"6134530"|"6147975"|"6157655"|"6175563"|"6175564"|"6185292"|"6223165").PN.	USPAT	OR	OFF	2005/03/03 10:11
S20	0	cost adj benefit and S19	USPAT	OR	OFF	2005/03/03 10:12
S21	49	("6226289"|"6229888"|"6230197"|"6233332"|"6333979"|"6333980"|"6347139"|"5890138"|"5835896"|"5905975"|"5946669"|"6005939"|"6016484"|"6029150"|"6047269"|"5999919"|"5930777"|"5857023"|"5815657"|"5793868"|"5717757"|"5666416"|"5677955"|"5839119"|"5915093"|"5937394"|"5933498"|"5903880"|"5903651"|"5884277"|"5960083"|"5963924"|"5996076"|"6018724"|"6021202"|"6035402"|"6049786"|"6049787"|"6058381"|"6061448"|"5987132"|"6057872"|"6061665"|"4977595"|"5224162"|"5237159"|"5392353"|"5511121"|"5621201").PN.	USPAT	OR	OFF	2005/03/03 10:12
S22	1	cost adj benefit and S21	USPAT	OR	OFF	2005/03/03 10:13
S23	50	("5495523"|"5493690"|"5485506"|"5481596"|"5479501"|"5479487"|"5467391"|"5465286"|"5459781"|"5448631"|"5448624"|"5442693"|"5436967"|"5434906"|"5432835"|"5430792"|"5425093"|"5420919"|"5420852"|"5402474"|"5400393"|"5390236"|"5381470"|"5365575"|"5359645"|"5351285"|"5341414"|"5341412"|"5333190"|"5329579"|"5327490"|"5321745"|"5319703"|"5313516"|"5311577"|"5311574"|"5309505"|"5309504"|"5297195"|"5297146"|"5289530"|"5283818"|"5276732"|"5253289"|"5251252"|"5239574"|"5224153"|"5218635"|"5214688"|"5185786").PN.	USPAT	OR	OFF	2005/03/03 10:13
S24	0	cost adj benefit and S23	USPAT	OR	OFF	2005/03/03 10:13

EAST Search History

S25	53	("5168517"|"5166974"|"5164981"|"5163087"|"5163083"|"5161181"|"5128984"|"5121422"|"5103449"|"5097528"|"5081711"|"5077789"|"5073929"|"5070526"|"5070525"|"5063522"|"5048075"|"5040208"|"5020097"|"5020095"|"5016270"|"5014298"|"5007078"|"5007000"|"4998272"|"4987587"|"4979171"|"4975841"|"4958371"|"4941168"|"4935956"|"4933964"|"4930150"|"4924501"|"4894857"|"4878243"|"4866754"|"4852149"|"4807279"|"4797911"|"4768221"|"4677663"|"4286118"|"RE37001"|"RE36416"|"RE35758"|"0000458"|"0024497"|"0006191"|"0009190"|"0019846"|"0021693"|"0002646").PN.	US-PGPUB; USPAT	OR	OFF	2005/03/03 10:14
S26	0	cost adj benefit and S25	US-PGPUB; USPAT	OR	OFF	2005/03/03 10:14
S27	350	S13 S15 S17 S19 S21 S23 S25	US-PGPUB; USPAT	OR	OFF	2005/03/03 10:14
S28	947	(revenue profit).ab,ti.	US-PGPUB; USPAT	OR	OFF	2005/03/03 10:22
S29	0	S27 and S28	US-PGPUB; USPAT	OR	OFF	2005/03/03 10:15
S30	436	least adj cost adj routing	US-PGPUB; USPAT	OR	OFF	2005/03/03 10:15
S31	4	S27 and S30	US-PGPUB; USPAT	OR	OFF	2005/03/03 10:22
S32	7	(revenue profit).ab,ti. and 379/265.01-266.1.ccls.	US-PGPUB; USPAT	OR	OFF	2005/03/03 10:22
S33	19	(("5442805") or ("5719563") or ("6049711") or ("6091959") or ("6240069") or ("6317718") or ("6321092") or ("6360167") or ("6400956") or ("6580914") or ("6610687") or ("6677894") or ("6714791") or ("6795710") or ("6798358") or ("6806813") or ("6816735") or ("6836667") or ("6912545")).PN.	USPAT	OR	OFF	2005/09/26 18:28
S34	0	"20040127231"	USPAT	OR	OFF	2005/09/26 18:29
S35	1	"20040127231"	US-PGPUB	OR	OFF	2005/09/26 18:30
S36	3	clark.in. and @ad="20030826"	US-PGPUB	OR	OFF	2005/09/26 18:31
S37	0	clark.in. and @ad="20030826"	USPAT	OR	OFF	2005/09/26 18:31
S38	9	clark.in. and @pd="20030826"	USPAT	OR	OFF	2005/09/26 18:31
S39	3195	access adj level	US-PGPUB; USPAT	OR	ON	2005/09/26 18:35

EAST Search History

S40	6002	city adj4 state	US-PGPUB; USPAT	OR	ON	2005/09/26 18:35
S41	238	S39 and S40	US-PGPUB; USPAT	OR	ON	2005/09/26 18:35
S42	2742	location near3 (mobile wireless portable cellular).ab,ti.	US-PGPUB; USPAT	OR	ON	2005/09/26 18:36
S43	2	S41 and S42	US-PGPUB; USPAT	OR	ON	2005/09/26 18:36
S44	2148	access adj right and profile	US-PGPUB; USPAT	OR	ON	2005/09/27 10:39
S45	2748	location near3 (mobile wireless portable cellular).ab,ti.	US-PGPUB; USPAT	OR	ON	2005/09/27 10:39
S46	52	S44 and S45	US-PGPUB; USPAT	OR	ON	2005/09/27 12:28
S47	8	nguyen-david$.xa. and vo-nguyen$.xp.	US-PGPUB; USPAT	OR	ON	2005/09/27 12:30
S48	88	nguyen-david$.xa.	US-PGPUB; USPAT	OR	ON	2005/09/27 12:31
S49	55	(location position) and S48	US-PGPUB; USPAT	OR	ON	2005/09/27 12:32
S50	2748	location near3 (mobile wireless portable cellular).ab,ti.	US-PGPUB; USPAT	OR	ON	2005/09/27 12:34
S51	2	S48 and S50	US-PGPUB; USPAT	OR	ON	2005/09/27 13:49
S52	1	("6542596").PN.	USPAT	OR	OFF	2005/09/27 13:49
S53	1273	455/404.2,456.2,456.3,456.6.ccls.	US-PGPUB; USPAT	OR	ON	2005/10/06 17:06
S54	79728	access adj right authoriz$5	US-PGPUB; USPAT	OR	ON	2005/10/06 17:22
S55	243	S53 and S54	US-PGPUB; USPAT	OR	ON	2005/10/06 17:14
S56	8702	city with state	US-PGPUB; USPAT	OR	ON	2005/10/06 17:14
S57	21	S55 and S56	US-PGPUB; USPAT	OR	ON	2005/10/06 17:14
S58	660	access adj right with authoriz$5	US-PGPUB; USPAT	OR	ON	2005/10/06 17:32
S59	16	S56 and S58	US-PGPUB; USPAT	OR	ON	2005/10/06 17:27
S60	5	prison and S53	US-PGPUB; USPAT	OR	ON	2005/10/06 17:27
S61	1159	access adj right with server	US-PGPUB; USPAT	OR	ON	2005/10/06 17:36

EAST Search History

S62	3	S53 and S61	US-PGPUB; USPAT	OR	ON	2005/10/06 17:32
S63	2	access adj right with status with (wireless cellular mobile)	US-PGPUB; USPAT	OR	ON	2005/10/06 17:36
S64	2803	provid$3 with location adj information	US-PGPUB; USPAT	OR	ON	2005/10/08 12:47
S65	3030	455/404.1,404.2,456.1-456.3,457.ccls.	US-PGPUB; USPAT	OR	ON	2005/10/08 12:47
S66	450	S64 and S65	US-PGPUB; USPAT	OR	ON	2005/10/08 12:47
S67	79728	access adj right authoriz$5	US-PGPUB; USPAT	OR	ON	2005/10/08 12:47
S68	143	S66 and S67	US-PGPUB; USPAT	OR	ON	2005/10/08 12:48
S69	106	server and S68	US-PGPUB; USPAT	OR	ON	2005/10/08 14:33
S70	1	("6377810").PN.	USPAT	OR	OFF	2005/10/08 14:46
S71	117	(date dating) with match$3 with profile	US-PGPUB; USPAT	OR	ON	2005/10/08 14:47
S72	12	compass and S71	US-PGPUB; USPAT	OR	ON	2005/10/08 14:47
S73	4909	doppler adj shift	USPAT	OR	OFF	2005/12/13 11:39
S74	222	display$3 with S73	USPAT	OR	OFF	2005/12/13 11:40
S75	49343	"455"/$.ccls.	USPAT	OR	OFF	2005/12/13 11:40
S76	6	S74 and S75	USPAT	OR	OFF	2005/12/14 16:55
S77	0	("6977993").PN.	USPAT	OR	OFF	2005/12/14 16:55
S78	1	"20050243982"	US-PGPUB; USPAT	OR	OFF	2005/12/15 11:05
S79	4	(("5740233") or ("5740238") or ("5335268") or ("6751310")).PN.	USPAT	OR	OFF	2005/12/15 15:46
S80	1	"20050058280"	US-PGPUB; USPAT	OR	OFF	2005/12/15 15:46
S81	1391	request$3 with (access adj right authoriz$5 anthentica$5) with locat$3	US-PGPUB; USPAT	OR	ON	2006/03/26 08:31
S82	180429	"455"/$.ccls. "370"/$.ccls. "379"/$.ccls.	US-PGPUB; USPAT	OR	ON	2006/03/26 08:31
S83	367	S81 and S82	US-PGPUB; USPAT	OR	ON	2006/03/26 08:31
S84	243	assign$3 with (access adj right authoriz$5 anthentica$5) with locat$3	US-PGPUB; USPAT	OR	ON	2006/03/26 08:31

EAST Search History

S85	11	S83 and S84	US-PGPUB; USPAT	OR	ON	2006/03/26 08:31
S86	92	first adj3 (wireless cellular portable) with second adj3 (cellular portable wireless) with (access adj3 right authoriz$5 authentica$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/26 09:05
S87	91	S86 not S85	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/26 08:43
S88	1228	locat$3 with (cellular portable wireless) with (access adj3 right authoriz$5 authentica$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/04/02 11:09
S89	191	request$3 with S88	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/26 09:07
S90	20	assign$3 with S88	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/26 09:29
S91	183	provid$3 with location adj information with first with second	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/26 09:30
S92	62	S91 and (access adj3 right authoriz$5 authentica$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/26 09:30
S93	62	S92 not S90	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/26 09:31

FJ

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NOTICE OF ALLOWANCE AND FEE(S) DUE

32733 7590 04/10/2006

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

EXAMINER	
TIEU, BENNY QUOC	
ART UNIT	PAPER NUMBER
2614	

DATE MAILED: 04/10/2006

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

TITLE OF INVENTION: SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$700	$300	$1000	07/10/2006

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 REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

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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.

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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.

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PTOL-85 (Rev. 01/06) Approved for use through 04/30/2007.

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32733 7590 04/10/2006

JEFFREY D. MULLEN
350 WEST 43RD ST., APT. 5H
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(Depositor's name)

(Signature)

(Date)

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

TITLE OF INVENTION: SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$700	$300	$1000	07/10/2006

EXAMINER	ART UNIT	CLASS-SUBCLASS
TIEU, BENNY QUOC	2614	455-456100

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

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2 _____

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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.

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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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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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Typed or printed name _____ Registration No. _____

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

32733 7590 04/10/2006

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

EXAMINER	
TIEU, BENNY QUOC	
ART UNIT	PAPER NUMBER
2614	

DATE MAILED: 04/10/2006

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 193 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 193 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.

PTOL-85 (Rev. 01/06) Approved for use through 04/30/2007.

Notice of Allowability	Application No.	Applicant(s)	
	10/400,296	MULLEN, JEFFREY D.	
	Examiner	Art Unit	
	Benny Q. Tieu	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 *Amendment filed Feb. 13, 2006*.

2. ☒ The allowed claim(s) is/are *1-35 and 37-49 (renumbered as 1-48, respectively)*.

3. ☐ 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.

4. ☐ 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.

5. ☐ 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).

6. ☐ 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-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

Benny Q. Tieu
Primary Examiner
Art Unit: 2642

OIPE IAP68
FEB 16 2006
PATENT & TRADEMARK

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

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 3

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

U.S. PATENT DOCUMENTS

Examiner initials*	Cite No.[1]	Document Number Number – Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
BQT		5,337,334	08/09/1994	Antero Alvesalo	
		6,035,189	03/07/2000	All-Vehmas	
		6,047,051	04/04/2000	Ginzboorg	
		6,393,274	05/21/2002	Peltonen	102(e) 06/08/1999
		6,400,946	06/04/2002	Vazvan	102(e) 03/08/1996
		6,580,918	06/17/2003	Leickel	102(e) 07/23/1998
		6,584,314	06/24/2003	Haumont	102(e) 06/09/2000
		6,603,969	08/05/2003	Vuoristo	102(e) 11/25/1998
		6,735,564	05/11/2004	Puhakainen	102(e) 11/09/2000
		6,826,398	11/30/2004	Lagerstrom et al.	102(e) 10/08/1998
		6,870,822	03/22/2005	Balogh	102(e) 02/20/2001
		6,879,838	04/12/2005	Rankin et al.	102(e) 04/20/2001
		6,912,545	06/28/2005	Lundy et al.	102(e) 06/21/2001
		6,920,319	07/19/2005	Knutsson et al.	102(e) 05/07/2001
		6,928,279	08/09/2005	Seligmann et al.	102(e) 02/27/2003
		6,932,698	08/23/2005	Sprogis	102(e) 01/31/2002
BQT		6,944,447	09/13/2005	Portman et al.	102(e) 09/04/2001

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]

Examiner Signature	Benny Q. Tieu	Date Considered	3/29/06

*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)
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PATENT & TRADEMARK OFFICE
FEB 16 2006

Substitute for form 1449A/PTO

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 2 of 3

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

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]
BQT		WO 99/00[illegible]7170	02-11-1999	Nokia Telecommunications		
BQT		WO 99/009775	02-25-1999	Nokia Telecommunications		
BQT		WO 99/051051	03-31-1999	Nokia Telecommunications		
BQT		WO 00/028760	05-18-2000	Nokia Networks		
BQT		WO 00/035228	06-15-2000	Nokia Networks		
BQT		WO 00/038350	06-29-2000	Nokia Networks		
BQT		WO 00/064075	10-26-2000	Nokia Networks		
BQT		WO 00/076194	12-14-2000	Nokia Networks		
BQT		WO 00/076243	12-14-2000	Nokia Networks		
BQT		WO 01/001711	01-04-2001	Nokia Networks		
BQT		WO 01/010718	01-04-2001	Nokia Networks		
BQT		WO 01/003406	01-11-2001	Nokia Networks		
BQT		WO 01/003454	01-11-2001	Nokia Networks		
BQT		WO 01/003461	01-11-2001	Nokia Networks		
BQT		WO 01/020938	03-22-2001	Nokia Networks		
BQT		WO 01/033885	05-10-2001	Nokia Networks		
BQT		WO 01/039525	05-31-2001	Nokia Networks		
BQT		WO 01/039528	05-31-2001	Nokia Networks		
BQT		WO 01/041468	06-07-2001	Nokia Networks		
BQT		WO 01/050544	07-12-2001	Nokia Networks		
BQT		WO 01/086834	11-15-2001	Nokia Networks		

Examiner Signature	Benny Q. Tieu	Date Considered	3/29/06

*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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OIPE IAP89
FEB 16 2006
PATENT & TRADEMARK OFFICE

PTO/SB/08A (10-01)
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U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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Substitute for form 1449A/PTO

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 3 of 3

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

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]
BQT		WO 01/086880	11-15-2001	Nokia Networks		
BQT		WO 01/089251	11-22-2001	Nokia Networks		
BQT		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]
BQT		ETSI TS 101 513. "Digital Cellular Telecommunications System (Phase 2): Location Services (LCS)," GSM 12.71, version 8.0.1. 1999.	
BQT		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	Benny Q. Tieu	Date Considered	3/29/06

*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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Issue Classification	Application/Control No. 10/400,296	Applicant(s)/Patent under Reexamination MULLEN, JEFFREY D.
	Examiner Benny Q. Tieu	Art Unit 2614

ISSUE CLASSIFICATION

ORIGINAL		INTERNATIONAL CLASSIFICATION	
CLASS	SUBCLASS	CLAIMED	NON-CLAIMED
455	456.1	H 04 Q 7 /20	/
CROSS REFERENCES		H 04 M 11 /00	/
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)	/	/
455	456.3 404.2	/	/
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********* (Assistant Examiner) (Date)	Benny Q. Tieu BENNY QUOC TIEU AU-2614 4/2/6 (Primary Examiner) (Date)	Total Claims Allowed: 48
4/5/04 (Legal Instruments Examiner) (Date)		O.G. Print Claim(s): 1 / O.G. Print Fig.: 17

☐ 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
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4	4	34	34		64		94		124		154		184
5	5	35	35		65		95		125		155		185
6	6		36		66		96		126		156		186
7	7	36	37		67		97		127		157		187
8	8	37	38		68		98		128		158		188
9	9	38	39		69		99		129		159		189
10	10	39	40		70		100		130		160		190
11	11	40	41		71		101		131		161		191
12	12	41	42		72		102		132		162		192
13	13	42	43		73		103		133		163		193
14	14	43	44		74		104		134		164		194
15	15	44	45		75		105		135		165		195
16	16	45	46		76		106		136		166		196
17	17	46	47		77		107		137		167		197
18	18	47	48		78		108		138		168		198
19	19	48	49		79		109		139		169		199
20	20		50		80		110		140		170		200
21	21		51		81		111		141		171		201
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26	26		56		86		116		146		176		206
27	27		57		87		117		147		177		207
28	28		58		88		118		148		178		208
29	29		59		89		119		149		179		209
30	30		60		90		120		150		180		210

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
10/400,296	MULLEN, JEFFREY D.
Examiner	**Art Unit**
Benny Q. Tieu	2614

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
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Claim		Date								
Final	Original	10/8/05	4/2/06							
1	1	√	=							
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Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/400,296	MULLEN, JEFFREY D.	
	Examiner	Art Unit	
	Benny Q. Tieu	2614	

SEARCHED			
Class	Subclass	Date	Examiner
Updated	Search	10/8/2005	BQT
Updated	Search	4/2/2006	BQT

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
PGPUB Text Search, See Interference Search Printout		4/2/2006	BQT

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
EAST	10/8/2005	BQT
Interference Search History Printout	4/2/2006	BQT

SMALL ENTITY
JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

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

New York, NY 10020
April 13, 2006

AMENDMENT UNDER 37 C.F.R. § 1.312

Sir:

Pursuant to 37 C.F.R. § 1.312, applicant respectfully requests entry of the following amendments in the above-identified patent application:

Amendments to the Specification (proposed) begin on page 2 of this Amendment under 37 C.F.R. § 1.312.

Amendments of the Claims (proposed) begin on page 3 of this Amendment under 37 C.F.R. § 1.312.

Remarks begin on page 15 of this Amendment Under 37 C.F.R. § 1.312.

Amendments to the Specification:

Please replace paragraph 55 that begins on page 16, and ends on page 17, of the substitute specification with the following paragraph.

--Directional information 630 may also be included on display 600 or any other display of the present invention. Directional information 630 may include a digital compass 632 so that the user of cell phone 300 (FIG. 3) knows what direction he or she is facing in. Digital compass 632 may be connected to a directional sensitive device (e.g., mechanical compass) in order to gather directional information. Directional arrow 633 may also be included in ~~Display~~ display 600 to indicate where the requested user's location is relative to the location and direction of cell phone 300 (FIG. 3) (e.g., the requesting user). Persons skilled in the art will appreciate that for some directional information 630 the location of the requesting user must be obtained. This information may be obtained either from cell phone 300, a remote facility, or by any other suitable means. If the information is gathered from a location-gathering device other than the requesting user's device (e.g., cell phone 300 (FIG. 3)), then the user's device may communicate ~~from~~ with this other location gathering device. Once both the locations of the requesting and requested/desired users are known, this information may be utilized in a number of features incorporating the principles of the present invention.--

Amendments to the Claims:

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

Listing of Claims:

1. (previously presented) A method of mobile-to-mobile locating, said method comprising:

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

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

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

storing said location access rights on said server;

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

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

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

3. (currently amended) The method of claim 1, wherein said location access rights ~~includes~~ include the ability to obtain said location, wherein said location is provided to said second wireless device from said server even when said first wireless device is OFF.

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

5. (currently amended) The method of claim 1, wherein ~~said second wireless device uses~~ said location is used to provide a location marker on a map on said second wireless device.

6. (currently amended) The method of claim 1, wherein ~~said second wireless device uses~~ said location is used to provide directions from said second wireless device to said location on said second wireless device.

7. (currently amended) The method of claim 1, wherein ~~said second wireless device uses~~ said location is used to provide directions from said second wireless device to said location and a travel time on said second wireless device.

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

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

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

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

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

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

14. (currently amended) The method of claim 1, wherein said location of said first wireless device is requested by receiving input, in the form of a telephone

number of said first wireless device, ~~from an interface~~ on said second wireless device.

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

16. (previously presented) The method of claim 1, further comprising the ability to use said first wireless device to delete said location access rights for said second wireless device.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

32. (previously presented) The method of claim 1, wherein said server stores a history of locations for said

first wireless device and said history is utilized to provide an approximate location of said first wireless device when said first wireless device is turned OFF.

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

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

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

36. (cancelled).

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

38. (currently amended) A method ~~of~~ comprising:

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

located remotely from said first and second wireless telephones;

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

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

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

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

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

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

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

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

41. (currently amended) The method of claim 38, wherein ~~said second wireless telephone uses~~ said first

location is used to provide a location marker on a map on said second wireless telephone ~~on a graphical user interface~~.

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

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

44. (previously presented) The method of claim 38, further comprising setting up an alert for said first wireless telephone dependent on said second location of said second wireless telephone.

45. (previously presented) A method comprising:

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

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

storing said location access rights on said server;

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

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

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

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

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

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

50. (new) The method of claim 3, wherein said location access rights include the ability to not obtain said location.

51. (new) The method of claim 37, wherein another one of said location access rights is the ability to allow said second wireless device to access said location.

52. (new) The method of claim 40, wherein another one of said first location access rights is the ability to allow said second wireless telephone to access said first location.

53. (new) The method of claim 47, wherein another one of said location access rights is the ability to allow said second wireless telephone to access said location.

54. (new) The method of claim 38, further comprising:

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

providing a second dating matching profile by said second wireless telephone; and

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

55. (new) The method of claim 45, further comprising:

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

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

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

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

56. (new) The method of claim 38, further comprising providing a directional arrow to display said first location relative to said second location on said second wireless telephone.

57. (new) The method of claim 38, further comprising providing a compass in said second wireless telephone, wherein said compass is utilized to display the direction that said second wireless telephone is traveling in.

58. (new) The method of claim 38, wherein said first location is used to provide directions from said second wireless telephone to said first location on said second wireless telephone.

59. (new) The method of claim 38, wherein said first location is used to provide directions from said second wireless telephone to said first location and a travel time on said second wireless telephone.

60. (new) The method of claim 38, further comprising determining how fast said first wireless telephone is traveling.

REMARKS

The Amendment Under 37 C.F.R. § 1.312

This application was allowed on April 10, 2006. The issue fee has not yet been paid. Applicant respectfully requests entry, pursuant to 37 C.F.R. § 1.312, of the foregoing amendments of the specification and claims.

Applicant respectfully submits that at least many of the proposed amendments of the claims "merely embod[ies] the correction of formal matters without changing the scope of the claims."

Applicant respectfully submits that entry of these amendments would "require no substantial amount of additional work on the part of the [Patent and Trademark] Office." (MPEP § 714.16.).

The specification has been amended to correct typographical errors.

Claims 37, 38, 40, 42, 47, and 49 have been amended to correct typographical errors.

Claims 3, 5-7, 14, 26, 28, 41, 43, 46, and 48 have been amended, depend from allowed claims, and accordingly do not require a substantial amount of additional work on the part of the USPTO.

Claims 50-53 have been added and depend from allowed claims. Claims 50-53 do not change the scope of the claims - access rights may be, for example, the ability to allow access to a location and the ability to not allow access to a location.

Claims 54 and 55 have been added and depend from previously allowed claims. Claims 54 and 55 include subject matter similar to allowed claim 24.

Claims 56, 57, 58, 59, and 60 have been added and depend from allowed claim 38. Claims 56, 57, 58, 59, and 60 include subject matter similar to allowed claims 26, 27, 6, 7, and 8, respectively.

Examiner Interview Summary

Applicant conducted a telephonic interview with Examiner Tieu on April 13, 2006, during which the merits of the application were not discussed. Particularly, applicant asked the Examiner whether or not the original claim numbering (e.g., the claim numbering used in the Reply dated February 13, 2006) should be used for an Amendment under 37 C.F.R. § 1.312 as the Examiner noted on the Notice of Allowance mailed April 10, 2006 that the claims were renumbered.

The Examiner advised applicant to file the Amendment under 37 C.F.R. § 1.312 using the original claim numbering (e.g., the claim numbering as found in the Reply dated February 13, 2006).

Applicant thanks the Examiner for the courtesies extended to him during the telephonic interview.

Conclusion

Entry of this Amendment, without withdrawing the application from allowance, is hereby respectfully requested.

Respectfully Submitted,

Jeffrey D. Mullen
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Tel.: (914) 837-7741

Electronic Patent Application Fee Transmittal

Application Number:	10400296
Filing Date:	25-Mar-2003
Title of Invention:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
First Named Inventor:	Jeffrey D. Mullen
Filer:	Jeffrey David Mullen
Attorney Docket Number:	JDM/002

Filed as Small Entity

Utility Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Claims in excess of 20	2202	11	25	275
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**275**

Electronic Acknowledgement Receipt

EFS ID:	1023318
Application Number:	10400296
Confirmation Number:	8666
Title of Invention:	SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME
First Named Inventor:	Jeffrey D. Mullen
Customer Number:	32733
Filer:	Jeffrey David Mullen
Filer Authorized By:	
Attorney Docket Number:	JDM/002
Receipt Date:	13-APR-2006
Filing Date:	25-MAR-2003
Time Stamp:	20:46:55
Application Type:	Utility
International Application Number:	

Payment information:

Submitted with Payment	yes
Payment was successfully received in RAM	$275.0
RAM confirmation Number	266
Deposit Account	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part	Pages

1		JDM-002_-_312_Amendment.PDF	1564635	yes	16

Multipart Description		
Doc Desc	**Start**	**End**
Amendment after Notice of Allowance (Rule 312)	1	1
Specification	2	2
Claims	3	14
Applicant Arguments/Remarks Made in an Amendment	15	16

Warnings:

Information:

2	Fee Worksheet (PTO-875)	fee-info.pdf	8164	no	2

Warnings:

Information:

Total Files Size (in bytes):	1572799

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.

OIPE JUL 07 2006 PATENT & TRADEMARK OFFICE

SMALL ENTITY
JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

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

New York, NY 10036
July 7, 2006

AMENDMENT

Sir:

This Amendment is being filed with a Request for Continued Examination. Applicant amends the application as follows.

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims begin on page 3 of this paper.

Remarks begin on page 21 of this paper.

07/11/2006 CNEGA1 00000046 503855 10400296
02 FC:2201 600.00 DA
03 FC:2202 475.00 DA

Express Mail: EV669671965US

Amendments to the Specification:

Please replace paragraph 55 that begins on page 16, and ends on page 17, of the substitute specification with the following paragraph.

--Directional information 630 may also be included on display 600 or any other display of the present invention. Directional information 630 may include a digital compass 632 so that the user of cell phone 300 (FIG. 3) knows what direction he or she is facing in. Digital compass 632 may be connected to a directional sensitive device (e.g., mechanical compass) in order to gather directional information. Directional arrow 633 may also be included in ~~Display~~ display 600 to indicate where the requested user's location is relative to the location and direction of cell phone 300 (FIG. 3) (e.g., the requesting user). Persons skilled in the art will appreciate that for some directional information 630 the location of the requesting user must be obtained. This information may be obtained either from cell phone 300, a remote facility, or by any other suitable means. If the information is gathered from a location-gathering device other than the requesting user's device (e.g., cell phone 300 (FIG. 3)), then the user's device may communicate ~~from~~ with this other location gathering device. Once both the locations of the requesting and requested/desired users are known, this information may be utilized in a number of features incorporating the principles of the present invention.--

Amendments to the Claims:

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

Listing of Claims:

1. (previously presented) A method of mobile-to-mobile locating, said method comprising:

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

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

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

storing said location access rights on said server;

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

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

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

3. (currently amended) The method of claim 1, wherein said location access rights ~~includes~~ include the ability to obtain said location, wherein said location is provided to said second wireless device from said server even when said first wireless device is OFF.

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

5. (currently amended) The method of claim 1, wherein ~~said second wireless device uses~~ said location is used to provide a location marker on a map on said second wireless device.

6. (currently amended) The method of claim 1, wherein ~~said second wireless device uses~~ said location is used to provide directions from said second wireless device to said location on said second wireless device.

7. (currently amended) The method of claim 1, wherein ~~said second wireless device uses~~ said location is used to provide directions from said second wireless device to said location and a travel time on said second wireless device.

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

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

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

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

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

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

14. (currently amended) The method of claim 1, wherein said location of said first wireless device is requested by receiving input, in the form of a telephone

number of said first wireless device, ~~from an interface~~ on said second wireless device.

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

16. (previously presented) The method of claim 1, further comprising the ability to use said first wireless device to delete said location access rights for said second wireless device.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

32. (previously presented) The method of claim 1, wherein said server stores a history of locations for said

first wireless device and said history is utilized to provide an approximate location of said first wireless device when said first wireless device is turned OFF.

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

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

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

36. (cancelled).

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

38. (currently amended) A method ~~of~~ comprising:

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

located remotely from said first and second wireless telephones;

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

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

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

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

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

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

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

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

41. (currently amended) The method of claim 38, wherein ~~said second wireless telephone uses~~ said first

location is used to provide a location marker on a map on said second wireless telephone ~~on a graphical user interface~~.

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

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

44. (previously presented) The method of claim 38, further comprising setting up an alert for said first wireless telephone dependent on said second location of said second wireless telephone.

45. (previously presented) A method comprising:

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

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

storing said location access rights on said server;

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

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

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

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

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

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

50. (new) The method of claim 3, wherein said location access rights include the ability to not obtain said location.

51. (new) The method of claim 37, wherein another one of said location access rights is the ability to allow said second wireless device to access said location.

52. (new) The method of claim 40, wherein another one of said first location access rights is the ability to allow said second wireless telephone to access said first location.

53. (new) The method of claim 47, wherein another one of said location access rights is the ability to allow said second wireless telephone to access said location.

54. (new) The method of claim 38, further comprising:

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

providing a second dating matching profile by said second wireless telephone; and

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

55. (new) The method of claim 45, further comprising:

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

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

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

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

56. (new) The method of claim 38, further comprising providing a directional arrow to display said first location relative to said second location on said second wireless telephone.

57. (new) The method of claim 38, further comprising providing a compass in said second wireless telephone, wherein said compass is utilized to display the direction that said second wireless telephone is traveling in.

58. (new) The method of claim 38, wherein said first location is used to provide directions from said second wireless telephone to said first location on said second wireless telephone.

59. (new) The method of claim 38, wherein said first location is used to provide directions from said second wireless telephone to said first location and a travel time on said second wireless telephone.

60. (new) The method of claim 38, further comprising determining how fast said first wireless telephone is traveling.

61. (new) A system comprising:

a first wireless device; and

a second wireless device, wherein said second wireless device is operable to request a first location of said first wireless device from a server located remotely from said first and second wireless devices, said first wireless device is operable to request a second location of said second wireless device from said server, said first wireless device is operable to assign first location access rights on said server to said second wireless device, said second wireless device is operable to assign second location access rights on said server to said first wireless device, said server storing said first and second location access rights, said first location is provided from said server to said second wireless device dependent upon said first access rights, and said second location is provided from said server to said first wireless device dependent upon said second access rights.

62. (new) The system of claim 61, wherein said first and second wireless devices are wireless telephones.

63. (new) The system of claim 61, wherein said first location is used to provide directions from said second wireless device to said first location on said second wireless device.

64. (new) The system of claim 61, wherein one of said first location access rights is the ability to not allow said second wireless device to access said first location.

65. (new) The system of claim 64, wherein another one of said first location access rights is the ability to allow said second wireless device to access said first location.

66. (new) The system of claim 61, wherein a directional arrow is displayed on said second wireless device representative of said first location relative to said second location.

67. (new) A system comprising:

a first wireless device; and

a second wireless device, wherein a location of said first wireless device is requested by said second wireless device from a server located remotely from said first and second wireless devices, location access rights are assigned on said server to said second wireless device by said first wireless device, said assignment by said first wireless device is requested for said second wireless device if said location access rights have not yet been assigned by said first wireless device for said second wireless device, said location access rights are stored on said server, said server determines said access rights assigned by said first wireless device to said second wireless device, and said server provides said location from said server to said second wireless device dependent upon said access rights.

68. (new) The system of claim 67, wherein said first and second wireless devices are wireless telephones.

69. (new) A system comprising:

a first wireless device; and

a second wireless device, wherein said second wireless device is operable of requesting a location of a first wireless device from a server located remotely from said first and second wireless devices, said first wireless device is operable to assign location access rights on said server for said second wireless device, said location access rights are stored on said server, said server is operable to determine said access rights assigned by said first wireless device to said second wireless device on said server, and said server provides said location from said server to said second wireless device dependent upon said access rights even when said first wireless device is OFF.

70. (new) The system of claim 69, wherein said first and second wireless devices are wireless telephones.

71. (new) A computer-readable medium, for a server located remotely from a first wireless device and a second wireless device, having program logic imprinted thereon for performing a method comprising:

receiving a request for a location of said first wireless device from said second wireless device;

receiving a request for an assignment of said location access rights by said first wireless device for said second wireless device if said location access rights have not yet been assigned by said first wireless device for said second wireless device;

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

storing said location access rights, wherein said location access rights are stored remotely from said first and second wireless devices;

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

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

72. (new) The computer-readable medium of claim 71, wherein said first and second wireless devices are wireless telephones.

73. (new) The computer-readable medium of claim 71, further comprising receiving said location from said first wireless device, wherein said location is determined on a positioning system located on said first wireless device.

74. (new) A computer-readable medium, for a server located remotely from a first wireless device and a second wireless device, having program logic imprinted thereon for performing a method comprising:

receiving a request for a first location of said first wireless device;

receiving a request for a second location of said second wireless device;

receiving an assignment of first location access rights from said first wireless device for said second wireless device;

receiving an assignment of second location access rights from said second wireless device for said first wireless device;

storing said first and second location access rights;

providing said first location to said second wireless device dependent upon said first access rights; and

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

75. (new) The computer-readable medium of claim 74, wherein said first and second wireless devices are wireless telephones.

76. (new) The computer-readable medium of claim 74, further comprising receiving said first location from said first wireless device, wherein said first location is determined on a positioning system located on said first wireless device.

77. (new) A computer-readable medium, for a server located remotely from a first wireless device and a second wireless device, having program logic imprinted thereon for performing a method comprising:

receiving a request for a location of a first wireless device by a second wireless device;

receiving an assignment of location access rights by said first wireless device for said second wireless device;

storing said location access rights;

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

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

78. (new) The computer-readable medium of claim 77, wherein said first and second wireless devices are wireless telephones.

79. (new) The computer-readable medium of claim 77, further comprising receiving said location from said first wireless device, wherein said location is determined on a positioning system located on said first wireless device.

REMARKS/ARGUMENTS

Summary of Applicant's Amendments

The specification has been amended to correct typographical errors.

Claims 37, 38, 40, 42, 47, and 49 have been amended to correct typographical errors.

Claims 3, 5-7, 14, 26, 28, 41, 43, 46, and 48 have been amended.

Claims 50-76 have been added.

Examiner Interview Summary

On or about April 15, 2006, the undersigned conducted a telephonic interview with the Examiner. Particularly, the undersigned notified the Examiner that the undersigned was preparing to file a Request for Continued Examination, Amendment, and an Information Disclosure Statement.

The undersigned also notified the Examiner that additional independent claims would be added in the Amendment that were system claims similar to the method claims previously allowed. The undersigned noted that the Amendment would include amendments similar to those in the 37 C.F.R. § 1.312 Amendment such that the Examiner would only need to consider the Amendment being prepared.

The undersigned would like to thank the Examiner for the courtesies extended to him during the telephonic interview.

New Claims 50-60

New Claims 50-60 depend from allowed claims 1, 38, or 45. Accordingly, applicant respectfully submits that claims 50-55 are patentable.

New Claims 61-66

New claims 61 is a system claims similar to allowed method claim 38. Accordingly, applicant

respectfully submits that claim 61 is patentable. Claims 62-67 depend from patentable claim 61. As such, applicant respectfully submits that claims 62-66 are patentable.

New Claims 67-68

New claims 67 is a system claims similar to allowed method claim 1. Accordingly, applicant respectfully submits that claim 67 is patentable. Claim 68 is patentable because claim 68 depends from claim 67.

New Claims 69-70

New claims 68 is a system claims similar to allowed method claim 45. Accordingly, applicant respectfully submits that claim 67 is patentable. Claim 70 is patentable because claim 70 depends from claim 69.

New Claims 71-73

New claim 71 is a Beauregard claim similar to allowed method claim 1. Accordingly, applicant respectfully submits that claim 71 is patentable. Claims 72 and 73 are patentable because claims 72 and 73 depend from patentable claim 71.

New Claims 74-76

New claim 74 is a Beauregard claim similar to allowed method claim 38. Accordingly, applicant respectfully submits that claim 74 is patentable. Claims 75 and 76 are patentable because claims 75 and 76 depend from patentable claim 74.

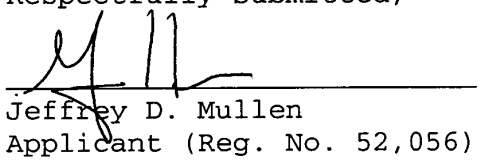
New Claims 77-79

New Claim 77 is a Beauregard claim similar to allowed method claim 45, Accordingly, applicant respectfully submits that claim 77 is patentable. Claims 78 and 79 are patentable because claims 78 and 79 depend from patentable claim 75.

Conclusion

Applicant respectfully submits that this application, including claims 1-79, is in condition for allowance. Accordingly, applicant respectfully requests that a favorable action be issued.

Respectfully Submitted,



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

07-10-06

RCE

JDM/002 IFW



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Attorney Docket No. JDM/002
Examiner Benny Quoc Tieu
Art Unit 2642

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

REQUEST FOR CONTINUED EXAMINATION

Sir:

This is a request for continued examination under 37 C.F.R. § 1.114, of pending prior Application No. 10/400,296 (Confirmation No. 8666), filed on March 25 of 2003 for SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

1. ☐ Please enter the Amendment Pursuant to 37 C.F.R. § 1.116 filed on ____ in Application No. ____, a copy of which is enclosed herewith.

2. ☐ Please consider the arguments in the Appeal Brief or Reply Brief filed on _____ _____ in Application No. _____.

3. ☐ An Amendment/Reply is enclosed in Reply to the Office Action dated _____.

4. ☒ An Amendment is enclosed.

5. ☒ An Information Disclosure Statement (and SB/08A) is enclosed.

6. ☐ A suspension of action on the above-identified patent application is requested under 37 C.F.R. § 1.103(c) for a period of _____ months.

7. ☒ A $395.00 filing fee under 37 C.F.R. § 1.17(e) is applicable hereto.

8. ☐ Please charge ____ to Deposit Account No. 50-3855, Order No. JDM-002, in payment of the fee under _____. A duplicate copy of this Request is enclosed.

9. ☐ The Director is hereby authorized to charge payment of any additional fees required under 37 C.F.R. § 1.17(e) in connection with this Request, or to credit any overpayment of same, to Deposit Account No. 50-3855, Order No. JDM-002. A duplicate copy of this Request is enclosed.

10. ☐ Please grant a ☐ one-month, ☐ two-month, ☐ three-month, ☐ four-month, extension of time under 37 C.F.R. § 1.136(a) to the Examiner's Action of _____ in the above-identified patent application.

11. ☐ A $0.00 extension-of-time fee is applicable hereto.

07/11/2006 CNEGA1 00000046 503855 10400296
01 FC:2801 395.00 DA

Express Mail: EV669671965US

12. [X] Additional claim fees have been calculated as shown below:

FOR	CURRENT NUMBER		NUMBER PAID		NUMBER EXTRA		RATE		FEE
BASIC FEE									$000.00
TOTAL CLAIMS	78	-	59	=	19	X	$25	=	$475.00
INDEPENDENT CLAIMS	9	-	3	=	6	X	$300	=	$600.00
[ ] MULTIPLE DEPENDENT CLAIMS						+	$180	=	$000.00
							TOTAL		$1075.00

13. [X] The director is hereby authorized to charge payment of $1470.00, in payment of the additional claim fees ($1075) and the RCE filing fee ($395), to Deposit Account No. 50-3855, Order No. JDM-002. A duplicate copy of this Request is being transmitted herewith.

14. [X] The Director is hereby authorized to charge payment of any extension-of-time fees required under 37 C.F.R. § 1.17, or any other additional fees in connection with this paper, or to credit any overpayment of same, to Deposit Account No. 50-3855 Order No. JDM-002. A duplicate copy of this Request is enclosed.

July 7, 2006
(Date)

Jeffrey D. Mullen
Applicant (Reg. No. 52,056)
Customer No. 32733
350 West 43rd St., Apt. 5H
New York, NY 10036
Mobile Phone: (914) 837-7741



PATENTS
Attorney Docket No. JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

New York, New York 10020
July 7, 2006

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

EXPRESS MAIL CERTIFICATION

Sir:

"Express Mail" mailing label number EV669671965US
Date of Deposit July 7, 2006

I hereby certify that the papers and fees identified below are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10 on the date indicated above and are addressed to Mail Stop: RCE, Commissioner for Patents, P.O. Box1450, Alexandria, VA 22313-1450.

Request for Continued Examination (in duplicate);

Amendment;

Third Supplemental Information Disclosure Statement;

PTO Form SB/08A (in duplicate); and,

Return Postcard.

Irene Keselman

OIPE JUL 07 2006 PATENT & TRADEMARK OFFICE

JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

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

New York, NY 10036
July 7, 2006

THIRD SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

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

Patent Documents

5,043,736	Darnell et. al	08/27/1991
6,314,365	Smith	11/06/2001

Express Mail: EV669671965US

As the above-identified documents are United States patents, copies of these documents are not being submitted herewith. It is respectfully requested that these documents be (1) fully considered by the Patent and Trademark Office during examination of this application; and (2) printed on any patent which may issue on this application. Applicant requests that a copy of Form PTO/SB/08A, as considered and initialed by the Examiner, be returned with the next communication.

This Statement is being submitted with a Request for Continued Examination. In accordance with 37 C.F.R. § 1.97(a)(4), no fee is required.

An early and favorable action is respectfully requested.

Respectfully submitted,

Jeffrey D. Mullen
Applicant (Reg. No. 52,056)
Customer No. 32733
350 West 43rd St., Apt. 5H
New York, NY 10036
Mobile: (914)837-7741

OIPE IAP17 JUL 07 2006 PATENT & TRADEMARK OFFICE

PTO/SB/08A (10-01)
Approved for use through 10/31/2002. OMB 0651-0031
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Substitute for form 1449A/PTO

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 1

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

U.S. PATENT DOCUMENTS

Examiner initials*	Cite No.[1]	Document Number Number – Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		5,043,736	08/27/1991	Darnell et. al	
		6,314,365	11/06/2001	Smith	

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		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.**

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JUL 07 2006
PATENT & TRADEMARK OFFICE

PTO/SB/08A (10-01)
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U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 1

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

U.S. PATENT DOCUMENTS

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		5,043,736	08/27/1991	Darnell et. al	
		6,314,365	11/06/2001	Smith	

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]

niner 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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10400296

PATENT APPLICATION FEE DETERMINATION RECORD
Effective January 1, 2003

Application or Docket Number: 5DM/002

CLAIMS AS FILED - PART I

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

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

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

8/8/05

CLAIMS AS AMENDED - PART II

AMENDMENT A

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

SMALL ENTITY			OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X$ 9= 35	400	OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE	400	OR	TOTAL ADDIT. FEE	

RCE
2/13/06

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 48	Minus	** 36	* 12
Independent	* 3	Minus	*** 3	*
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	300
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 78	Minus	** 48	*
Independent	* 9	Minus	*** 3	*
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

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

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

FORM PTO-1449 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTY. DOCKET NO. JDM/002	APPLICATION NO. 10/400,296
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	APPLICANT Jeffrey D. Mullen	CONFIRMATION NO. 8666
IDC-US Ref -29	FILING DATE March 25, 2003	GROUP ~~2681~~ 2642

OIPE JC22 OCT 24 2003 PATENT & TRADEMARK OFFICE

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
BQT	4,654,879	03/31/1987	Goldman et al.			
	5,197,092	03/23/1993	Bamburak			
	5,327,144	07/05/1994	Stilp et al.			
	5,341,410	08/23/1994	Aron et al.			
	5,384,824	01/24/1995	Alvesalo			
	~~5,338,147~~	02/07/1995	Grimes 5,388,147			
	5,479,482	12/26/1995	Grimes			
	5,502,757	03/26/1996	Bales et al.			
	5,519,760	05/21/1996	Borkowski et al.			
	5,537,460	07/16/1996	Holliday, Jr. et al.			
	5,548,816	08/20/1996	DeVaney			
	5,551,058	08/27/1996	Hutcheson et al.			
	5,555,286	09/10/1996	Tendler			
	5,767,788	06/16/1998	Ness			
	5,778,315	07/07/1998	Proietti			
	5,805,999	09/08/1998	Inoue			
	5,815,538	09/29/1998	Grell et al.			
	5,832,381	11/03/1998	Kauppi			
	5,847,976	12/08/1998	Lescourret			
	5,875,398	02/23/1999	Snapp			
	5,890,062	03/30/1999	Courtney et al.			
	5,920,820	07/06/1999	Qureshi et al.			
	5,929,752	07/27/1999	Janky et al.			
	5,950,125	09/07/1999	Buhrmann et al.			
	6,023,241	02/08/2000	Clapper			
	6,028,537	02/22/2000	Suman et al.			
	6,032,042	02/29/2000	Kauppi			
	6,035,198	03/07/2000	Wiehe			
BQT	6,038,446	03/14/2000	Courtney et al.			

YCC 7/7/06

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

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

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FEB 16 2006
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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

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 2 of 3

Complete if known	
Application Number	10/400,298
Filing Date	March 25, 2003
First Named Inventor	Jeffrey D. Mullen
Art Unit	2642
Examiner Name	Benny Quoc Tieu
Attorney Docket Number	JDM/002

IDC-For Ref -21

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]
BQT		~~WO 99/00717O~~ WO 99/00 7170	02-11-1999	Nokia Telecommunications		
BQT		WO 99/009775	02-25-1999	Nokia Telecommunications		
BQT		WO 99/051051	03-31-1999	Nokia Telecommunications		
BQT		WO 00/028760	05-18-2000	Nokia Networks		
BQT		WO 00/035228	06-15-2000	Nokia Networks		
BQT		WO 00/038350	06-29-2000	Nokia Networks		
BQT		WO 00/064075	10-26-2000	Nokia Networks		
BQT		WO 00/076194	12-14-2000	Nokia Networks		
BQT		WO 00/076243	12-14-2000	Nokia Networks		
BQT		WO 01/001711	01-04-2001	Nokia Networks		
BQT		WO 01/010718	01-04-2001	Nokia Networks		
BQT		WO 01/003406	01-11-2001	Nokia Networks		
BQT		WO 01/003454	01-11-2001	Nokia Networks		
BQT		WO 01/003461	01-11-2001	Nokia Networks		
BQT		WO 01/020938	03-22-2001	Nokia Networks		
BQT		WO 01/033885	05-10-2001	Nokia Networks		
BQT		WO 01/039525	05-31-2001	Nokia Networks		
BQT		WO 01/039528	05-31-2001	Nokia Networks		
BQT		WO 01/041468	06-07-2001	Nokia Networks		
BQT		WO 01/050544	07-12-2001	Nokia Networks		
BQT		WO 01/086834	11-15-2001	Nokia Networks		

ycf 7/7/06

Examiner Signature	Benny Q. Tieu	Date Considered	3/29/06

*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.

08-14-06

TFW 2642



JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

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

New York, NY 10036
August 10, 2006

FOURTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

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

Patent Document

5,388,147 Grimes 02/07/1995

As the above-identified document is a United States patent, a copy of this document is not being submitted

Express Mail: EV669671829US

herewith. It is respectfully requested that this document 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 accompanying Form PTO/SB/08A, as considered and initialed by the Examiner, be returned with the next communication.

The above-identified document was cited inadvertently and without deceptive intent in the Information Disclosure Statement filed October 21, 2003 as Grimes United States Patent No. 5,338,147. The correct citation is Grimes United States Patent No. 5,388,147.

This Statement is being submitted after a Request for Continued Examination and before a mailing of a first Office Action on the merits. In accordance with 37 C.F.R. § 1.97, no fee is required.

The Director is hereby authorized to charge any fees required in conjunction with this filing, or credit any overpayment of same, to Deposit Account No. 50-3855, Order No. JDM/002. A duplicate copy of this paper is being transmitted herewith.

An early and favorable action is respectfully requested.

Respectfully submitted,

Jeffrey D. Mullen
Applicant (Reg. No. 52,056)
Customer No. 32733
350 West 43rd St., Apt. 5H
New York, NY 10036
Mobile: (914)837-7741

OIPE IAP14
AUG 10 2006
PATENT & TRADEMARK OFFICE

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

FOURTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 1

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

U.S. PATENT DOCUMENTS

Examiner initials*	Cite No.[1]	Document Number – Number – Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		5,388,147	02/07/1995	Grimes	

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		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.**

Express Mail: EV669671829US

OIPE IAP14
AUG 10 2006
PATENT & TRADEMARK OFFICE

PATENTS
Attorney Docket No. JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

New York, New York 10020
August 10, 2006

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

EXPRESS MAIL CERTIFICATION

Sir:

"Express Mail" mailing label number EV669671829US

Date of Deposit August 10, 2006

I hereby certify that the papers and fees identified below are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10 on the date indicated above and are addressed to Mail Stop: Amendment, Commissioner for Patents, P.O. Box1450, Alexandria, VA 22313-1450.

Fourth Supplemental Information Disclosure Statement (in duplicate);

PTO Form SB/08A (in duplicate); and

Return Postcard

Isatta B. Smith

09

UNITED STATES PATENT AND TRADEMARK OFFICE

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

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

32733 7590 09/05/2006

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

EXAMINER	
TIEU, BENNY QUOC	
ART UNIT	**PAPER NUMBER**
2614	

DATE MAILED: 09/05/2006

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

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/400,296	MULLEN, JEFFREY D.	
	Examiner	Art Unit	
	Benny Q. Tieu	2614	

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

Period for Reply

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

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

Status

1)☒ Responsive to communication(s) filed on *07 July 2006*.

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

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

Disposition of Claims

4)☒ Claim(s) *1-35 and 37-79* is/are pending in the application.

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

5)☒ Claim(s) *1-35 and 37-70* is/are allowed.

6)☒ Claim(s) *71-79* is/are rejected.

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

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

Application Papers

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

10)☒ The drawing(s) filed on *25 March 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

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

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

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

Priority under 35 U.S.C. § 119

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

a)☐ All b)☐ Some * c)☐ None of:

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

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

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

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

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *7/7/06 & 8/10/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 101

1. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

2. Claims 71-79 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claims 71-79 reciting "A computer-readable medium, for a server located remotely from a first wireless device and a second wireless device, having program logic imprinted thereon for performing a method comprising: ..." do not comply with the subject matter eligibility requirement of 35 U.S.C. 101. Computer programs claimed as computer listings per se, i.e., the descriptions or expressions of the programs, are not physical "things." They are neither computer components nor statutory processes, as they are not "acts" being performed. Such claimed computer programs do not define any structural and functional interrelationships between the computer program and other claimed elements of a computer which permit the computer program's functionality to be realized. In contrast, a claimed computer-readable medium encoded with a **computer program** is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory. See Lowry, 32 F.3d at 1583-84, 32 USPQ2d at 1035. Accordingly, it is important to distinguish claims that define descriptive material per se from claims that define statutory inventions.

The specification on page 8 states the computer readable medium includes signal, hence, claims 27-29 are signal claims which fail to comply with the subject matter eligibility requirement of 35 U.S.C. 101. Claims 1-5 and 10-18 and 23-26 are apparatus for processing data records and method of processing data records that manipulate of data using software. Accordingly, Claims 1-5 and 10-18 and 23-26 fail to comply with the subject matter eligibility requirement of 35 U.S.C. 101.

Allowable Subject Matter

3. Claims 1-35 and 37-70 are allowed.

Conclusion

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

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

Or faxed to:
(571) 273-8300, (for formal communications intended for entry)
Or:
(571) 273-7490, (for informal or draft communications, please label "PROPOSED" or "DRAFT")

Hand-delivered responses should be brought to:
Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314

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

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wing Chan can be reached on 571-272-7493. The fax phone number for the organization where this application or proceeding is assigned is 571-272-8300.

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

Benny Q. Tieu
Primary Examiner
Art Unit 2614
August 31, 2006

OIPE IAP17 JUL 07 2006 PATENT & TRADEMARK OFFICE

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

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 1

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

U.S. PATENT DOCUMENTS

Examiner initials*	Cite No.[1]	Document Number – Number – Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
BQT		5,043,736	08/27/1991	Darnell et. al	
BQT		6,314,365	11/06/2001	Smith	

FOREIGN PATENT DOCUMENTS

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

NON PATENT LITERATURE DOCUMENTS

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

Examiner Signature	/Benny Q. Tieu/	Date Considered	08/23/2006

*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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AUG 10 2006
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PTO/SB/08A (10-01)
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Substitute for form 1449A/PTO

FOURTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 1

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

U.S. PATENT DOCUMENTS

Examiner initials*	Cite No.[1]	Document Number Number – Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
BQT		5,388,147	02/07/1995	Grimes	

FOREIGN PATENT DOCUMENTS

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

NON PATENT LITERATURE DOCUMENTS

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

Examiner Signature	/Benny Q. Tieu/	Date Considered	08/23/2006

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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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Express Mail: EV669671829US

Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/400,296	MULLEN, JEFFREY D.	
	Examiner	Art Unit	
	Benny Q. Tieu	2614	

SEARCHED			
Class	Subclass	Date	Examiner
Updated	Search	10/8/2005	BQT
Updated	Search	4/2/2006	BQT
Updated	Search	8/31/2006	BQT

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

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

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
10/400,296	MULLEN, JEFFREY D.
Examiner	**Art Unit**
Benny Q. Tieu	2614

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

Claim		Date								
Final	Original	10/8/05	4/2/06	8/31/06						
1	1	√	=	=						
2	2	√	=	=						
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SEP 12 2006
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SMALL ENTITY
JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

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

New York, NY 10036
September 12, 2006

REPLY TO OFFICE ACTION

Sir:

This is in Reply to the Office Action dated September 5, 2006. In Reply to the Office Action, applicant amends the application as follows:

Amendments to the Claims begin on page 2 of this paper.

Remarks begin on page 20 of this paper.

EXPRESS MAIL:
EV620761435US

Amendments to the Claims:

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

Listing of Claims:

1. (previously presented) A method of mobile-to-mobile locating, said method comprising:

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

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

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

storing said location access rights on said server;

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

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

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

3. (previously amended) The method of claim 1, wherein said location access rights include the ability to obtain said location, wherein said location is provided to said second wireless device from said server even when said first wireless device is OFF.

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

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

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

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

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

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

levels of access rights, at least one of said plurality of levels of access rights comprise the exact location of said first wireless device, and another one of said plurality of levels of access rights comprise an approximate location of said first wireless device.

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

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

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

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

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

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

16. (previously presented) The method of claim 1, further comprising the ability to use said first wireless device to delete said location access rights for said second wireless device.

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

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

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

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

21. (previously presented) The method of claim 1, further comprising selecting said first wireless device

from an identifier list wherein said identifier list comprises a list of user profiles.

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

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

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

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

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

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

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

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

26. (previously presented) The method of claim 1, wherein a directional arrow is utilized to display the location of said first wireless device relative to said

location of said second wireless device on said second wireless device.

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

28. (previously presented) The method of claim 1, further comprising setting location alerts associated with said first wireless device on said second wireless device.

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

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

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

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

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

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

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

36. (cancelled).

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

38. (previously presented) A method comprising:

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

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

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

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

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

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

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

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

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

41. (previously presented) The method of claim 38, wherein said first location is used to provide a location marker on a map on said second wireless telephone.

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

43. (previously presented) The method of claim 38, further comprising setting location alerts associated with said first wireless telephone on said second wireless telephone.

44. (previously presented) The method of claim 38, further comprising setting up an alert for said first wireless telephone dependent on said second location of said second wireless telephone.

45. (previously presented) A method comprising:

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

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

storing said location access rights on said server;

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

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

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

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

48. (previously presented) The method of claim 45, wherein said location is used to provide a location marker on a map on said second wireless telephone.

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

50. (previously presented) The method of claim 3, wherein said location access rights include the ability to not obtain said location.

51. (previously presented) The method of claim 37, wherein another one of said location access rights is the ability to allow said second wireless device to access said location.

52. (previously presented) The method of claim 40, wherein another one of said first location access rights is the ability to allow said second wireless telephone to access said first location.

53. (previously presented) The method of claim 47, wherein another one of said location access rights is the ability to allow said second wireless telephone to access said location.

54. (previously presented) The method of claim 38, further comprising:

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

providing a second dating matching profile by said second wireless telephone; and

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

55. (previously presented) The method of claim 45, further comprising:

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

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

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

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

56. (previously presented) The method of claim 38, further comprising providing a directional arrow to

display said first location relative to said second location on said second wireless telephone.

57. (previously presented) The method of claim 38, further comprising providing a compass in said second wireless telephone, wherein said compass is utilized to display the direction that said second wireless telephone is traveling in.

58. (previously presented) The method of claim 38, wherein said first location is used to provide directions from said second wireless telephone to said first location on said second wireless telephone.

59. (previously presented) The method of claim 38, wherein said first location is used to provide directions from said second wireless telephone to said first location and a travel time on said second wireless telephone.

60. (previously presented) The method of claim 38, further comprising determining how fast said first wireless telephone is traveling.

61. (previously presented) A system comprising:

a first wireless device; and

a second wireless device, wherein said second wireless device is operable to request a first location of said first wireless device from a server located remotely from said first and second wireless devices, said first wireless device is operable to request a second location of said second wireless device from said server, said first

wireless device is operable to assign first location access rights on said server to said second wireless device, said second wireless device is operable to assign second location access rights on said server to said first wireless device, said server storing said first and second location access rights, said first location is provided from said server to said second wireless device dependent upon said first access rights, and said second location is provided from said server to said first wireless device dependent upon said second access rights.

62. (previously presented) The system of claim 61, wherein said first and second wireless devices are wireless telephones.

63. (previously presented) The system of claim 61, wherein said first location is used to provide directions from said second wireless device to said first location on said second wireless device.

64. (previously presented) The system of claim 61, wherein one of said first location access rights is the ability to not allow said second wireless device to access said first location.

65. (previously presented) The system of claim 64, wherein another one of said first location access rights is the ability to allow said second wireless device to access said first location.

66. (previously presented) The system of claim 61, wherein a directional arrow is displayed on said second

wireless device representative of said first location relative to said second location.

67. (previously presented) A system comprising:

a first wireless device; and

a second wireless device, wherein a location of said first wireless device is requested by said second wireless device from a server located remotely from said first and second wireless devices, location access rights are assigned on said server to said second wireless device by said first wireless device, said assignment by said first wireless device is requested for said second wireless device if said location access rights have not yet been assigned by said first wireless device for said second wireless device, said location access rights are stored on said server, said server determines said access rights assigned by said first wireless device to said second wireless device, and said server provides said location from said server to said second wireless device dependent upon said access rights.

68. (previously presented) The system of claim 67, wherein said first and second wireless devices are wireless telephones.

69. (previously presented) A system comprising:

a first wireless device; and

a second wireless device, wherein said second wireless device is operable of requesting a location of a first wireless device from a server located remotely from said first and second wireless devices, said first wireless device is operable to assign location access rights on said

server for said second wireless device, said location access rights are stored on said server, said server is operable to determine said access rights assigned by said first wireless device to said second wireless device on said server, and said server provides said location from said server to said second wireless device dependent upon said access rights even when said first wireless device is OFF.

70. (previously presented) The system of claim 69, wherein said first and second wireless devices are wireless telephones.

71. (currently amended) A computer-readable medium, for a server located remotely from a first wireless device and a second wireless device, having computer-executable program logic ~~imprinted~~ encoded thereon for performing a method comprising:

receiving a request for a location of said first wireless device from said second wireless device;

receiving a request for an assignment of said location access rights by said first wireless device for said second wireless device if said location access rights have not yet been assigned by said first wireless device for said second wireless device;

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

storing said location access rights, wherein said location access rights are stored remotely from said first and second wireless devices;

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

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

72. (previously presented) The computer-readable medium of claim 71, wherein said first and second wireless devices are wireless telephones.

73. (previously presented) The computer-readable medium of claim 71, further comprising receiving said location from said first wireless device, wherein said location is determined on a positioning system located on said first wireless device.

74. (currently amended) A computer-readable medium, for a server located remotely from a first wireless device and a second wireless device, having computer-executable program logic ~~imprinted~~ encoded thereon for performing a method comprising:

receiving a request for a first location of said first wireless device;

receiving a request for a second location of said second wireless device;

receiving an assignment of first location access rights from said first wireless device for said second wireless device;

receiving an assignment of second location access rights from said second wireless device for said first wireless device;

storing said first and second location access rights;

providing said first location to said second wireless device dependent upon said first access rights; and

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

75. (previously presented) The computer-readable medium of claim 74, wherein said first and second wireless devices are wireless telephones.

76. (previously presented) The computer-readable medium of claim 74, further comprising receiving said first location from said first wireless device, wherein said first location is determined on a positioning system located on said first wireless device.

77. (currently amended) A computer-readable medium, for a server located remotely from a first wireless device and a second wireless device, having computer-executable program logic ~~imprinted~~ encoded thereon for performing a method comprising:

receiving a request for a location of a first wireless device by a second wireless device;

receiving an assignment of location access rights by said first wireless device for said second wireless device;

storing said location access rights;

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

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

78. (previously presented) The computer-readable medium of claim 77, wherein said first and second wireless devices are wireless telephones.

79. (previously presented) The computer-readable medium of claim 77, further comprising receiving said location from said first wireless device, wherein said location is determined on a positioning system located on said first wireless device.

REMARKS/ARGUMENTS

Summary of Office Action

Claims 1-35 and 37-79 are pending.

Claims 1-35 and 37-70 are allowed.

Claims 71-79 were rejected under 35 U.S.C. § 101 for being directed to non-statutory subject matter.

Summary of Applicant's Amendments

Applicant notes, with great appreciation, the Examiner's indication of allowable subject matter included in claims 1-35 and 37-70.

Applicant has amended claims 71, 74, and 77 solely in order to expedite prosecution.

Applicant respectfully traverses the Examiner's rejections. Applicant reserves the right to claim any subject matter lost by any amendments or cancellations during the prosecution of this application in one or more continuation or divisional applications.

Examiner Interview Summary

On September 7, 2006, as well as September 8, 2006, applicant left a voice message with the Examiner regarding the Office Action mailed September 5, 2006.

In the voice messages, applicant noted applicant's contention that the first paragraph of page 3 was mistakenly included in the Office Action and did not correspond to the present application. The first paragraph of page 3 stated that:

> "The specification on page 8 states the computer readable medium includes signal, hence, claims 27-29 are signal claims which fail to comply with the subject matter eligibility requirement of 35 U.S.C. § 101. Claims 1-5 and 10-18 and 23-26 are apparatus for processing data records and methods

> of processing data records that manipulate of data using software. Accordingly, claims 1-5 and 10-18 and 23-26 fail to comply with the subject matter eligibility requirements of 35 U.S.C. § 101." (Office Action, page 3)

The Examiner left applicant a voice message on September 11, 2006. In the voice message, the Examiner confirmed that the first paragraph of page 3 was inadvertently added to the Office Action and did not correspond to the present application. The Examiner reaffirmed that claims 1-5, 10-18, and 23-26 were patentable and were not rejected under 35 U.S.C. § 101.

Applicant's Response to the 35 U.S.C. § 101 Rejections

Claims 71-79 were rejected under 35 U.S.C. § 101 for being directed to non-statutory subject matter. More particularly, the Examiner stated that the language:

> "'A computer-readable medium, for a server located remotely from a first wireless device and a second wireless device, having program logic imprinted thereon for performing a method comprising: ... " ... [does] not comply with the subject matter eligibility requirement of 35 U.S.C. § 101. Computer programs claimed as computer listings per se, i.e., the descriptions or expressions of the programs, are not physical "things." They are neither computer components nor statutory processes, as they are not "acts" being performed. Such claimed computer programs do not define any structural and functional interrelationships between the computer program and other claimed elements of a computer which permit the computer program's functionality to be realized. In contract, a claimed computer-readable medium encoded with a **computer program** is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory..." (Office Action, page 2)

Applicant respectfully traverses the Examiner's rejection and submits that the language of claims 71, 74, and 77 do construct proper Beauregard claims that claim statutory subject matter.

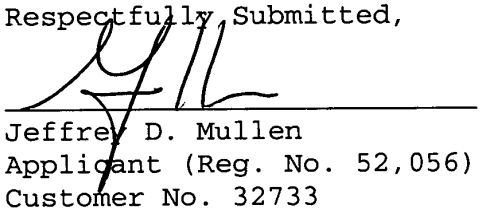
Nevertheless, solely in order to expedite prosecution, applicant has amended claims 71, 74, and 77 to include "computer-executable program logic encoded" instead of "program logic imprinted."

In light of the foregoing, applicant respectfully submits that claims 71, 74, and 77, and any claims dependent therefrom, are patentable.

Conclusion

Applicant respectfully submits that this application, including claims 1-79, is in condition for allowance. Accordingly, applicant respectfully requests that a favorable action be issued.

Respectfully Submitted,



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OIPE IAP89 SEP 12 2006 PATENT & TRADEMARK OFFICE

OIPE IAP89 SEP 12 2006 PATENT & TRADEMARK OFFICE

JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

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

New York, NY 10036
September 12, 2006

FIFTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

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

Patent Document

Craport et al.	5,796,634	08/18/1998
Craport et al.	5,961,569	10/05/1999
Craport et al.	5,961,572	10/05/1999
Craport et al.	5,978,747	11/02/1999
Gottlieb	6,446,118	09/03/2002
Vaida et al.	6,799,094	09/28/2004
Fernandez et al.	6,882,837	04/19/2005
Domnitz	6,912,398	06/28/2005

09/15/2006 HVUONG1 00000048 503855 10400296
01 FC:1806 180.00 DA

As the above-identified documents are United States patents, copies of these document are not being submitted herewith. 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 accompanying Form PTO/SB/08A, as considered and initialed by the Examiner, be returned with the next communication.

This Statement is being submitted after the mailing of a first Office Action on the merits. In accordance with 37 C.F.R. § 1.97, a fee of $180.00 is due and is being submitted herewith.

An early and favorable action is respectfully requested.

Respectfully submitted,

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OIPE IAP89
SEP 12 2006
PATENT & TRADEMARK OFFICE

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

FIFTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 1

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

U.S. PATENT DOCUMENTS

Examiner initials*	Cite No.[1]	Document Number – Number – Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		5,796,634	08/18/1998	Craport et al.	
		5,961,569	10/05/1999	Craport et al.	
		5,961,572	10/05/1999	Craport et al.	
		5,978,747	11/02/1999	Craport et al.	
		6,446,118	09/03/2002	Gottlieb	
		6,799,094	09/28/2004	Vaida et al.	
		6,882,837	04/19/2005	Fernandez et al.	
		6,912,398	06/28/2005	Domnitz	

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		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.**



PATENTS
Attorney Docket No. JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

New York, New York 10020
September 12, 2006

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

EXPRESS MAIL CERTIFICATION

Sir:

"Express Mail" mailing label number EV620761435US

Date of Deposit September 12, 2006

I hereby certify that the papers and fees identified below are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10 on the date indicated above and are addressed to Mail Stop: Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Transmittal Letter (in duplicate;
Reply to office Action;
Fifth Supplemental Information Disclosure Statement;
PTO Form SB/08A (in duplicate); and,
Return Postcard

Isatta B. Smith

OIPE IAP89
SEP 12 2006
PATENT & TRADEMARK OFFICE

09-14-06

TFW 2642 #

SMALL ENTITY
JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

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

New York, NY 10036
September 12, 2006

TRANSMITTAL LETTER

Sir:

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

[X] Reply to Office Action;
[X] Supplemental IDS; and
[X] PTO/SB/08A (in duplicate).

FEE FOR ADDITIONAL CLAIMS

[X] A fee for additional claims is not required.

[ ] A fee for additional claims is required.

EXPRESS MAIL:
EV620761435US

The additional fee has been calculated as shown below:

	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA	RATE	ADDITIONAL FEES
TOTAL CLAIMS	78	-	78	=	0	X $ 25 =	$ 0.00
INDEPENDENT CLAIMS	9	-	9	=	0	X $100 =	$ 0.00
FIRST PRESENTATION OF A MULTIPLE DEPENDENT CLAIM						+ $180 =	$ 0.00

* If less than 20, insert 20. TOTAL $ 0.00

** If less than 3, insert 3.

[X] A $180.00 fee is due as an Supplemental Information Disclosure Statement is being submitted herewith that is being filed after a first Office Action on the merits.

[X] The Director is authorized to charge the $180.00 fee for the submission of the Supplemental Information Disclosure Statement to Deposit Account No. 50-3855, Order No. JDM/002. A duplicate copy of this transmittal letter is being transmitted herewith.

[X] The Director is authorized to charge any additional fees due, or credit any overpayment, to Deposit Account No. 50-3855, Order No. JDM/002.

Respectfully submitted,

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PTO/SB/06 (12-04)
Approved for use through 7/31/2006. OMB 0651-0032
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 displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875 Effective December 8, 2004

Application or Docket Number: 10/400,896

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	150.00		N/A	300.00
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	$250		N/A	$500
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	$100		N/A	$200
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 = *		X$ 25 =		OR	X$50 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 = *		X100 =			X200 =	
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			+180=			+360=	
			TOTAL			TOTAL	

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

APPLICATION AS AMENDED – PART II

9-10-06

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
AMENDMENT A	Total (37 CFR 1.16(i))	* 78	Minus	** 78	= 0	X$ 25 =		OR	X$50 =	
	Independent (37 CFR 1.16(h))	* 9	Minus	*** 9	=	X100 =		OR	X200 =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					+180=		OR	+360=	
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	X$ 25 =		OR	X$50 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X100 =		OR	X200 =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					+180=		OR	+360=	
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

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

This collection of information is required by 37 CFR 1.16. 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, 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.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	4062	455/404.1,404.2,456.1-456.3,457.ccls.	US-PGPUB; USPAT	OR	ON	2006/10/13 16:21
L2	98720	access adj right authoriz$5	US-PGPUB; USPAT	OR	ON	2006/10/13 16:21
L3	2588	first adj wireless with second adj wireless	US-PGPUB; USPAT	OR	ON	2006/10/13 16:22
L4	40	1 and 2 and 3	US-PGPUB; USPAT	OR	ON	2006/10/13 16:22
L5	29	locat$3 with (cellular portable wireless) with (access adj3 right authoriz$5 authentica$5) with server. clm.	US-PGPUB	OR	ON	2006/10/13 17:25
S91	183	provid$3 with location adj information with first with second	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/26 09:30
S92	62	S91 and (access adj3 right authoriz$5 authentica$5)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/26 09:30
S93	62	S92 not S90	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/03/26 09:31
S94	3518	location near3 (mobile wireless portable cellular).CLM.	US-PGPUB	OR	ON	2006/04/02 11:08
S95	20010	(access adj right authoriz$5).CLM.	US-PGPUB; USPAT	OR	ON	2006/04/02 11:09
S96	218	S94 AND S95	US-PGPUB; USPAT	OR	ON	2006/04/02 11:14
S97	131	locat$3 with (cellular portable wireless) with (access adj3 right authoriz$5 authentica$5).CLM.	US-PGPUB	OR	ON	2006/04/02 11:10
S98	23	locat$3 with (cellular portable wireless) with (access adj3 right authoriz$5 authentica$5) WITH SERVER.CLM.	US-PGPUB	OR	ON	2006/10/13 17:25

JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

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

New York, NY 10036
October 15, 2006

SIXTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

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

Patent Documents

Matthews	5,086,390	02/04/1992
Matthews	5,097,416	03/17/1992
Matthews	5,305,201	04/19/1994

As the above-identified documents are United States patents, copies of these document are not being submitted herewith. 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 accompanying Form PTO/SB/08A, as considered and initialed by the Examiner, be returned with the next communication.

This Statement is being submitted after the mailing of a first Office Action on the merits. In accordance with 37 C.F.R. § 1.97, a fee of $180.00 is due. The Director is hereby authorized to charge the $180.000 fee and any additional fees required in conjunction with this filing, or credit any overpayment of the same, to Deposit Account No. 50-3855, Order No. JDM/002.

An early and favorable action is respectfully requested.

Respectfully submitted,

Jeffrey D. Mullen
Applicant (Reg. No. 52,056)
Customer No. 32733
350 West 43rd St., Apt. 5H
New York, NY 10036
Mobile: (914)837-7741

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

SIXTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 1

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

U.S. PATENT DOCUMENTS

Examiner initials*	Cite No.[1]	Document Number Number – Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		5,086,390	02/04/1992	Matthews	
		5,097,416	03/17/1992	Matthews	
		5,305,201	04/19/1994	Matthews	

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		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:	10400296
Filing Date:	25-Mar-2003
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
Filed as Large Entity	

Utility 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($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	1253732
Application Number:	10400296
International Application Number:	
Confirmation Number:	8666
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
Receipt Date:	15-OCT-2006
Filing Date:	25-MAR-2003
Time Stamp:	17:24:56
Application Type:	Utility

Payment information:

Submitted with Payment	yes
Payment was successfully received in RAM	$180
RAM confirmation Number	994
Deposit Account	503855
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 and 1.17	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Filed	JDM-002-SixthIDS-BothIDSandSB08A.PDF	308760	no	3
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
2	Fee Worksheet (PTO-875)	fee-info.pdf	8201	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	316961		

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.

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 10/24/2006

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

EXAMINER	
TIEU, BENNY QUOC	
ART UNIT	PAPER NUMBER
2614	

DATE MAILED: 10/24/2006

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

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	$700	$300	$0	$1000	01/24/2007

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.

PTOL-85 (Rev. 07/06) Approved for use through 04/30/2007.

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 10/24/2006

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

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.
10/400,296	03/25/2003	Jeffrey D. Mullen	JDM/002	8666

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	$700	$300	$0	$1000	01/24/2007

EXAMINER	ART UNIT	CLASS-SUBCLASS
TIEU, BENNY QUOC	2614	455-456100

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.
10/400,296	03/25/2003	Jeffrey D. Mullen	JDM/002	8666

32733 7590 10/24/2006

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

EXAMINER	
TIEU, BENNY QUOC	
ART UNIT	PAPER NUMBER
2614	

DATE MAILED: 10/24/2006

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 160 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 160 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.

PTOL-85 (Rev. 07/06) Approved for use through 04/30/2007.

Notice of Allowability	Application No.	Applicant(s)	
	10/400,296	MULLEN, JEFFREY D.	
	Examiner	Art Unit	
	Benny Q. Tieu	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 *Amendment filed Sept. 12, 2006*.

2. ☒ The allowed claim(s) is/are *1-35 and 37-79 (renumbered as 1-3, 5-37, 39-41, 43-46, 53-55, 57, 58, 4, 38, 42, 56, 47, 59, 48-52, and 60-78, respectively)*.

3. ☐ 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.

4. ☐ 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.

5. ☐ 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).

6. ☐ 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-1449 or PTO/SB/08), Paper No./Mail Date 9/12/06
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

Benny Q. Tieu
Primary Examiner
Art Unit: 2614

OIPE IAP89
SEP 12 2006
PATENT & TRADEMARK OFFICE

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

FIFTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 1

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

U.S. PATENT DOCUMENTS

Examiner initials*	Cite No.[1]	Document Number – Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
BQT		5,796,634	08/18/1998	Craport et al.	
		5,961,569	10/05/1999	Craport et al.	
		5,961,572	10/05/1999	Craport et al.	
		5,978,747	11/02/1999	Craport et al.	
		6,446,118	09/03/2002	Gottlieb	
		6,799,094	09/28/2004	Vaida et al.	
		6,882,837	04/19/2005	Fernandez et al.	
BQT		6,912,398	06/28/2005	Domnitz	

FOREIGN PATENT DOCUMENTS

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

NON PATENT LITERATURE DOCUMENTS

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

Examiner Signature	/Benny Q. Tieu/	Date Considered	10/13/2006

*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.

Issue Classification	Application/Control No. 10/400,296	Applicant(s)/Patent under Reexamination MULLEN, JEFFREY D.
	Examiner Benny Q. Tieu	Art Unit 2614

ISSUE CLASSIFICATION

ORIGINAL	
CLASS	SUBCLASS
455	456.1

CROSS REFERENCES				
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)			
455	456.3	404.2		

INTERNATIONAL CLASSIFICATION									
CLAIMED					NON-CLAIMED				
H	04	Q	7	/20					/
H	04	M	11	/00					/
				/					/
				/					/
				/					/
				/					/
				/					/

****
(Assistant Examiner) (Date)

(Legal Instruments Examiner) 10/17/06 (Date)

BENNY QUOC TIEU
AU-2614
10.13.06
(Primary Examiner) (Date)

Total Claims Allowed: 78

O.G. Print Claim(s)	O.G. Print Fig.
1	17

☐ 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
1	1	32	31	60	61		91		121		151		181
2	2	33	32	61	62		92		122		152		182
3	3	34	33	62	63		93		123		153		183
5	4	35	34	63	64		94		124		154		184
6	5	36	35	64	65		95		125		155		185
7	6		36	65	66		96		126		156		186
8	7	37	37	66	67		97		127		157		187
9	8	39	38	67	68		98		128		158		188
10	9	40	39	68	69		99		129		159		189
11	10	41	40	69	70		100		130		160		190
12	11	43	41	70	71		101		131		161		191
13	12	44	42	71	72		102		132		162		192
14	13	45	43	72	73		103		133		163		193
15	14	46	44	73	74		104		134		164		194
16	15	53	45	74	75		105		135		165		195
17	16	54	46	75	76		106		136		166		196
18	17	55	47	76	77		107		137		167		197
19	18	57	48	77	78		108		138		168		198
20	19	58	49	78	79		109		139		169		199
21	20	4	50		80		110		140		170		200
22	21	38	51		81		111		141		171		201
23	22	42	52		82		112		142		172		202
24	23	56	53		83		113		143		173		203
25	24	47	54		84		114		144		174		204
26	25	59	55		85		115		145		175		205
27	26	48	56		86		116		146		176		206
28	27	49	57		87		117		147		177		207
29	28	50	58		88		118		148		178		208
30	29	51	59		89		119		149		179		209
31	30	52	60		90		120		150		180		210

Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination
	10/400,296	MULLEN, JEFFREY D.
	Examiner	Art Unit
	Benny Q. Tieu	2614

SEARCHED			
Class	Subclass	Date	Examiner
Updated	Search	10/8/2005	BQT
Updated	Search	4/2/2006	BQT
Update	Search	8/31/2006	BQT
Updated	Search	10/13/2006	BQT

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
PGPUB Text Search, See Interference Search Printout		10/13/2006	BQT

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
EAST	10/8/2005	BQT
Interference Search History Printout	10/13/2006	BQT

UNITED STATES PATENT AND TRADEMARK OFFICE

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

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

32733 7590 11/14/2006

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

EXAMINER	
TIEU, BENNY QUOC	
ART UNIT	PAPER NUMBER
2614	

DATE MAILED: 11/14/2006

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

PTO-90C (Rev. 10/03)

Supplemental Notice of Allowability	Application No. 10/400,296	Applicant(s) MULLEN, JEFFREY D.	
	Examiner Benny Q. Tieu	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 *IDS filed Oct. 15, 2006*.

2. ☒ The allowed claim(s) is/are *1-35 and 37-79 (renumbered as 1-3, 5-37, 39-41, 43-46, 53-55, 57, 58, 4, 38, 42, 56, 47, 59, 48-52, and 60-78, respectively)*.

3. ☐ 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.

4. ☐ 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.

5. ☐ 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).

6. ☐ 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-1449 or PTO/SB/08), Paper No./Mail Date 10/15/06
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

Benny Q. Tieu
Primary Examiner
Art Unit: 2614

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

SIXTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 1

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

U.S. PATENT DOCUMENTS

Examiner initials*	Cite No.[1]	Document Number – Number – Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
BQT		5,086,390	02/04/1992	Matthews	
BQT		5,097,416	03/17/1992	Matthews	
BQT		5,305,201	04/19/1994	Matthews	

FOREIGN PATENT DOCUMENTS

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

NON PATENT LITERATURE DOCUMENTS

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

Examiner Signature	/Benny Q. Tieu/	Date Considered	11/03/2006

*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.**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Attorney Docket No. JDM/002
Examiner Benny Quoc Tieu
Art Unit 2642

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

REQUEST FOR CONTINUED EXAMINATION

Sir:

This is a request for continued examination under 37 C.F.R. § 1.114, of pending prior Application No. 10/400,296 (Confirmation No. 8666), filed on March 25 of 2003 for SYSTEMS AND METHODS FOR LOCATING CELLULAR PHONES AND SECURITY MEASURES FOR THE SAME

1. ☐ Please enter the Amendment Pursuant to 37 C.F.R. § 1.116 filed on ____ in Application No. ____, a copy of which is enclosed herewith.

2. ☐ Please consider the arguments in the Appeal Brief or Reply Brief filed on _____ _____ in Application No. _____.

3. ☐ An Amendment/Reply is enclosed in Reply to the Office Action dated _____.

4. ☐ An Amendment is enclosed.

5. ☒ An Information Disclosure Statement (and SB/08A) is enclosed.

6. ☐ A suspension of action on the above-identified patent application is requested under 37 C.F.R. § 1.103(c) for a period of _____ months.

7. ☒ A $395.00 filing fee under 37 C.F.R. § 1.17(e) is applicable hereto.

8. ☐ Please charge ____ to Deposit Account No. 50-3855, Order No. JDM-002, in payment of the fee under _____. A duplicate copy of this Request is enclosed.

9. ☐ The Director is hereby authorized to charge payment of any additional fees required under 37 C.F.R. § 1.17(e) in connection with this Request, or to credit any overpayment of same, to Deposit Account No. 50-3855, Order No. JDM-002. A duplicate copy of this Request is enclosed.

10. ☐ Please grant a ☐ one-month, ☐ two-month, ☐ three-month, ☐ four-month, extension of time under 37 C.F.R. § 1.136(a) to the Examiner's Action of _____ in the above-identified patent application.

11. ☐ A $0.00 extension-of-time fee is applicable hereto.

12. ☐ Additional claim fees have been calculated as shown below:

FOR	CURRENT NUMBER		NUMBER PAID		NUMBER EXTRA		RATE		FEE
BASIC FEE									$000.00
TOTAL CLAIMS	78	-	78	=	0	X	$25	=	$000.00
INDEPENDENT CLAIMS	9	-	9	=	0	X	$300	=	$000.00
[ ] MULTIPLE DEPENDENT CLAIMS						+	$180	=	$000.00
							TOTAL		$000.00

13. ☒ The director is hereby authorized to charge payment of $395.00, in payment of the RCE filing fee ($395), to Deposit Account No. 50-3855, Order No. JDM-002. A duplicate copy of this Request is being transmitted herewith.

14. ☒ The Director is hereby authorized to charge payment of any extension-of-time fees required under 37 C.F.R. § 1.17, or any other additional fees in connection with this paper, or to credit any overpayment of same, to Deposit Account No. 50-3855 Order No. JDM-002. A duplicate copy of this Request is enclosed.

January 14, 2007
(Date)

/Jeffrey D. Mullen/
Jeffrey D. Mullen
Applicant (Reg. No. 52,056)
Customer No. 32733
350 West 43rd St., Apt. 5H
New York, NY 10036
Mobile Phone: (914) 837-7741

JDM/002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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

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

New York, NY 10036
January 14, 2007

SEVENTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

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

Foreign Patent Document

WO 01/001718 01-04-2001 Nokia Networks

A copy of the foreign patent document is being submitted herewith. It is respectfully requested that this document 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 accompanying Form PTO/SB/08A, as considered and initialed by the Examiner, be returned with the next communication.

The above-identified document was incorrectly referenced, inadvertently and without deceptive intent, as WO 01/010718 in the Supplemental Information Disclosure Statement filed on February 16, 2006. The correct citation is WO 01/001718. It should be noted that the correct document, WO 01/001718, is retrievable/downloadable from the USPTO Patent Application Information Retrieval (PAIR) system for the present application and is associated with the Supplemental Information Disclosure Statement filed on February 16, 2006. In an abundance of caution, however, applicant resubmits WO 01/001718 for the Examiner's consideration.

This Statement is being submitted with a Request for Continued Examination. Accordingly, no fee is due. However, the Director is hereby authorized to charge any fees required in conjunction with this filing, or credit any overpayment of the same, to Deposit Account No. 50-3855, Order No. JDM/002.

An early and favorable action is respectfully requested.

Respectfully submitted,

/Jeffrey D. Mullen/

Jeffrey D. Mullen
Applicant (Reg. No. 52,056)
Customer No. 32733
350 West 43rd St., Apt. 5H
New York, NY 10036
Mobile: (914)837-7741

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 **SEVENTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (use as many sheets as necessary)				***Complete if known***	
				Application Number	10/400,296
				Filing Date	March 25, 2003
				First Named Inventor	Jeffrey D. Mullen
				Art Unit	2642
				Examiner Name	Benny Quoc Tieu
Sheet	1	of	1	**Attorney Docket Number**	JDM/002

U.S. PATENT DOCUMENTS

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

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]

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.**

(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

(71) Applicant *(for all designated States except US)*: **NOKIA NETWORKS OY** [FI/FI]; Keilalahdentie 4, FIN-02150 Espoo (FI).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **RAJANIEMI, Jaakko** [FI/FI]; Lapinrinne 2 A 11, FIN-00180 Helsinki (FI). **AHMAVAARA, Kalle** [FI/FI]; Hakaniemenranta 18 D 62, FIN-00530 Helsinki (FI). **EINOLA, Heikki** [FI/FI]; Kaksoiskiventie 7-9 B 5, FIN-02760 Espoo (FI). **BÄCK, Juha** [FI/FI]; Kulosaarenpuistotie 44 B 22, FIN-00570 Helsinki (FI). **HULKKONEN, Tony** [FI/FI]; Porvoonkatu 1 F 214, FIN-00510 Helsinki (FI). **HAUMONT, Serge** [FR/FI]; Riistavuorenkuja 3 B 10, FIN-00320 Helsinki (FI).

(74) Agent: **KOLSTER OY AB**; Iso Roobertinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).

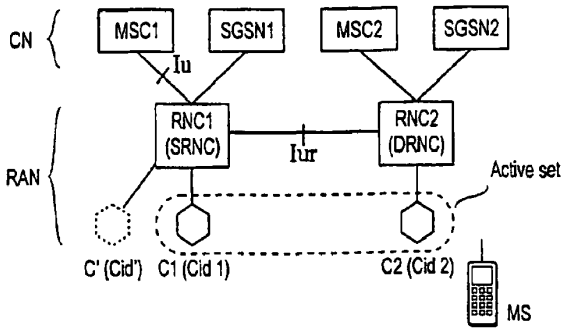
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, 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.

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(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

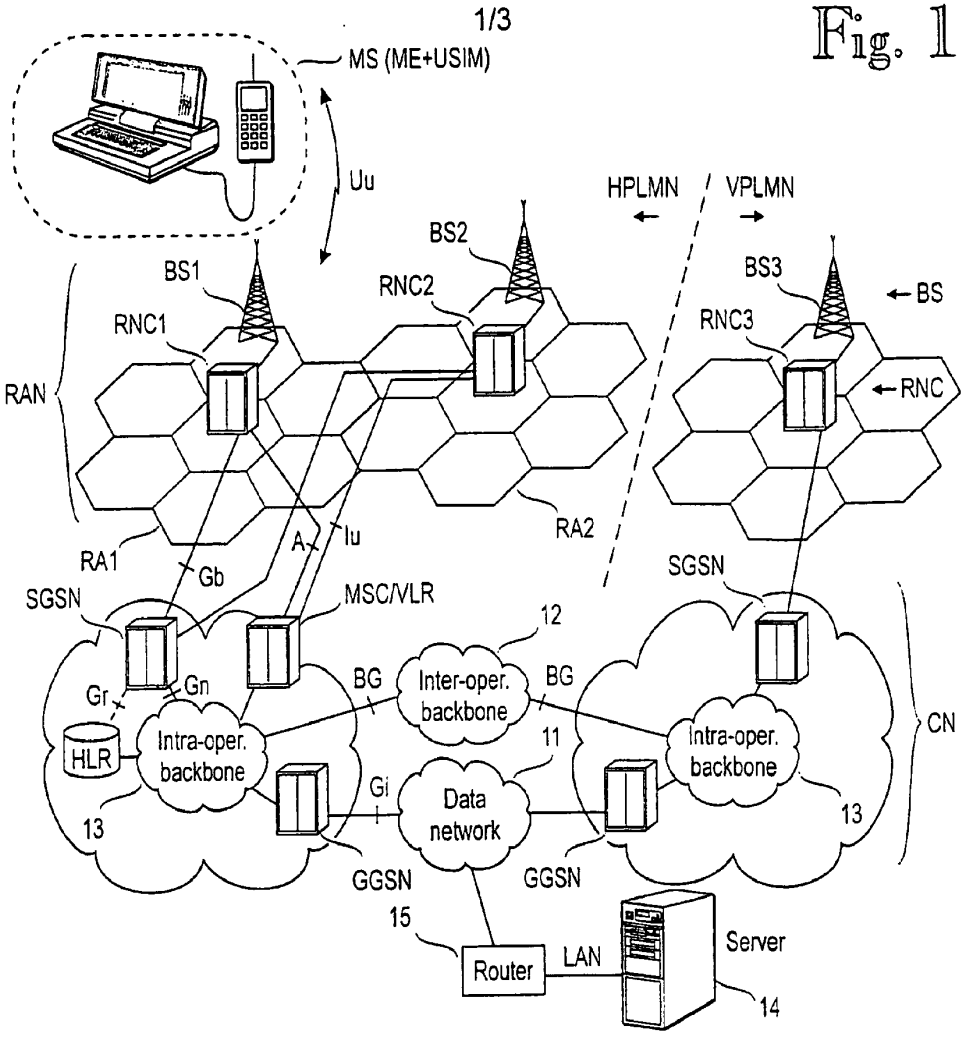
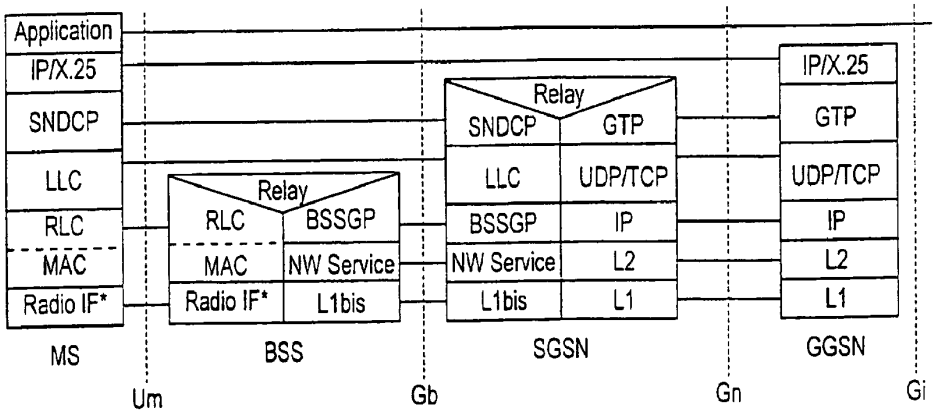


Fig. 2



*WCDMA in 3G

Fig. 3

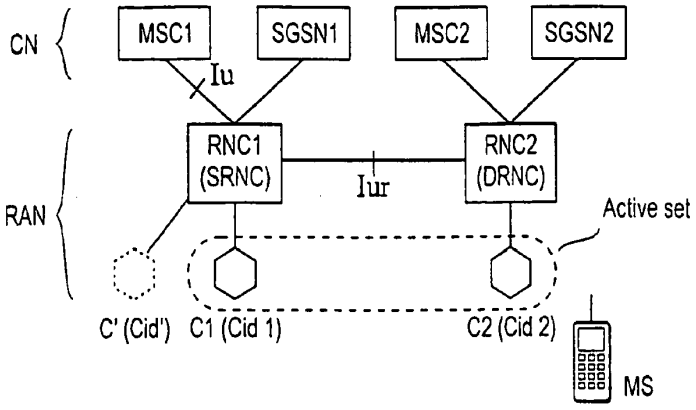

CN
MSC1
SGSN1
MSC2
SGSN2
Iu
RNC1
(SRNC)
Iur
RNC2
(DRNC)
RAN
Active set
C' (Cid')
C1 (Cid 1)
C2 (Cid 2)
MS

Fig. 4

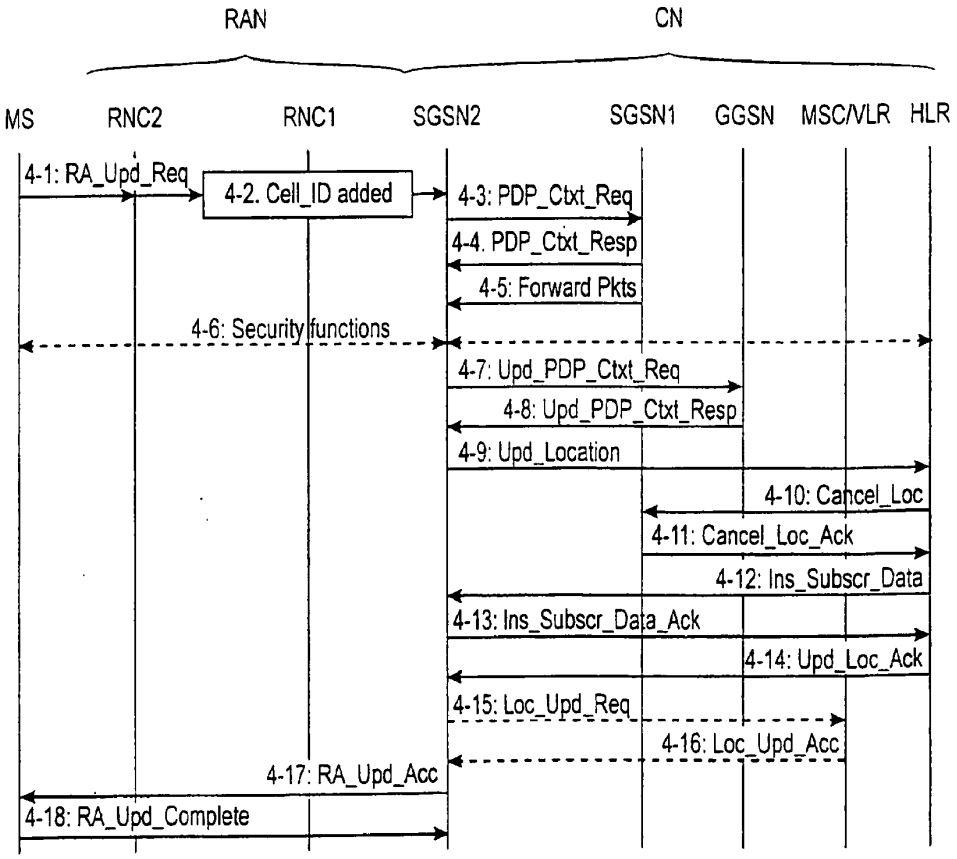
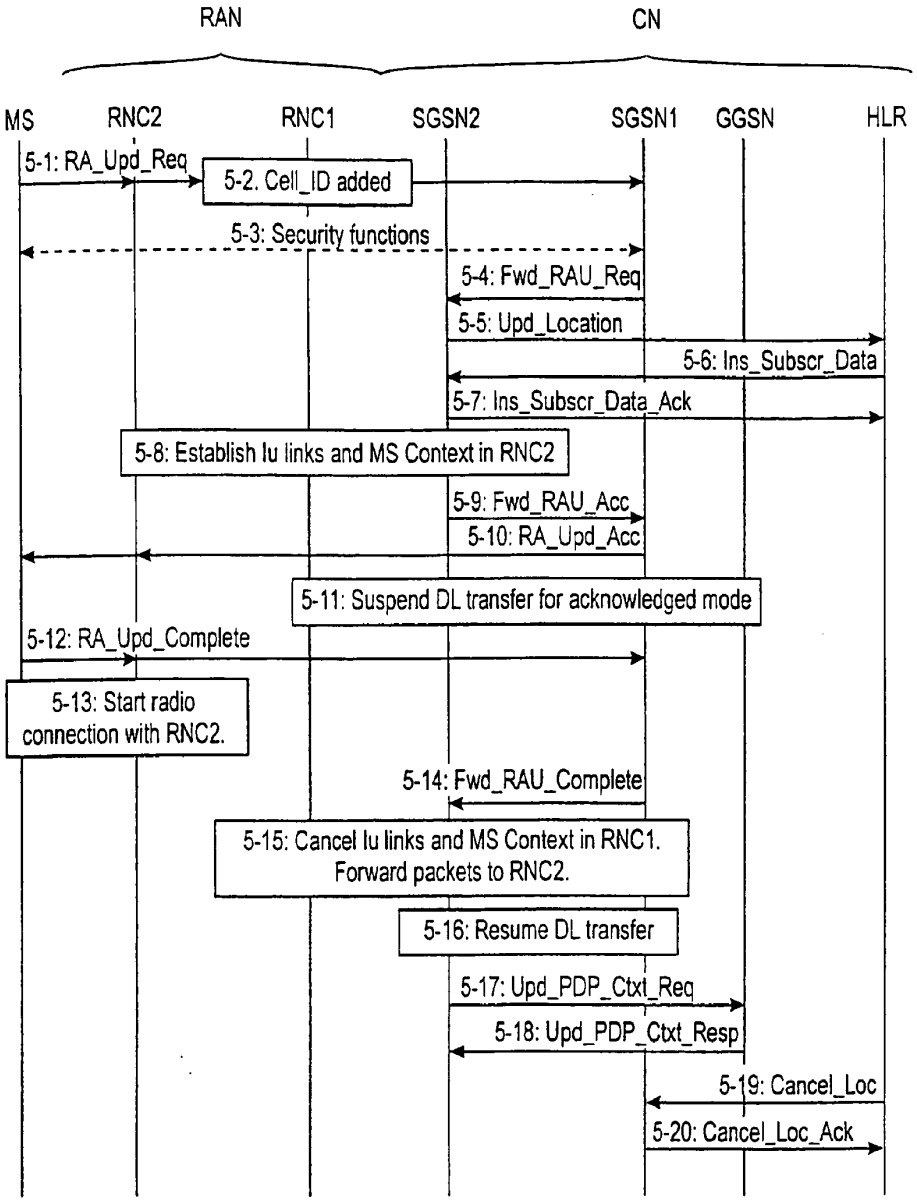

RAN
CN
MS
RNC2
RNC1
SGSN2
SGSN1
GGSN
MSC/VLR
HLR
4-1: RA_Upd_Req
4-2. Cell_ID added
4-3: PDP_Ctxt_Req
4-4. PDP_Ctxt_Resp
4-5: Forward Pkts
4-6: Security functions
4-7: Upd_PDP_Ctxt_Req
4-8: Upd_PDP_Ctxt_Resp
4-9: Upd_Location
4-10: Cancel_Loc
4-11: Cancel_Loc_Ack
4-12: Ins_Subscr_Data
4-13: Ins_Subscr_Data_Ack
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:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

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

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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:	10400296
Filing Date:	25-Mar-2003
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
Filed as Small Entity	

Utility 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($)
Miscellaneous:				
Request for continued examination	2801	1	395	395
		Total in USD ($)		**395**

Electronic Acknowledgement Receipt

EFS ID:	1438068
Application Number:	10400296
International Application Number:	
Confirmation Number:	8666
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
Receipt Date:	14-JAN-2007
Filing Date:	25-MAR-2003
Time Stamp:	22:41:29
Application Type:	Utility

Payment information:

Submitted with Payment	yes
Payment was successfully received in RAM	$395
RAM confirmation Number	1283
Deposit Account	503855
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 and 1.17	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	JDM-002-RCE.pdf	17701	no	2
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
2	Information Disclosure Statement (IDS) Filed	JDM-002-SeventhSuppIDS.pdf	17748	no	3
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Information Disclosure Statement (IDS) Filed	JDM-002-SeventhSuppIDS-SB08A.pdf	93353	no	1
Warnings:					
Information:					
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4	Foreign Reference	JDM-002-WO01001718.pdf	824918	no	19
Warnings:					
Information:					
5	Fee Worksheet (PTO-06)	fee-info.pdf	8200	no	2
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National Stage of an International Application under 35 U.S.C. 371
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