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(54) **SIGNALING WIRELESS WIDE AREA NETWORK MECHANISM FOR A TERMINAL LOCATED IN A WIRELESS LOCAL AREA NETWORK**

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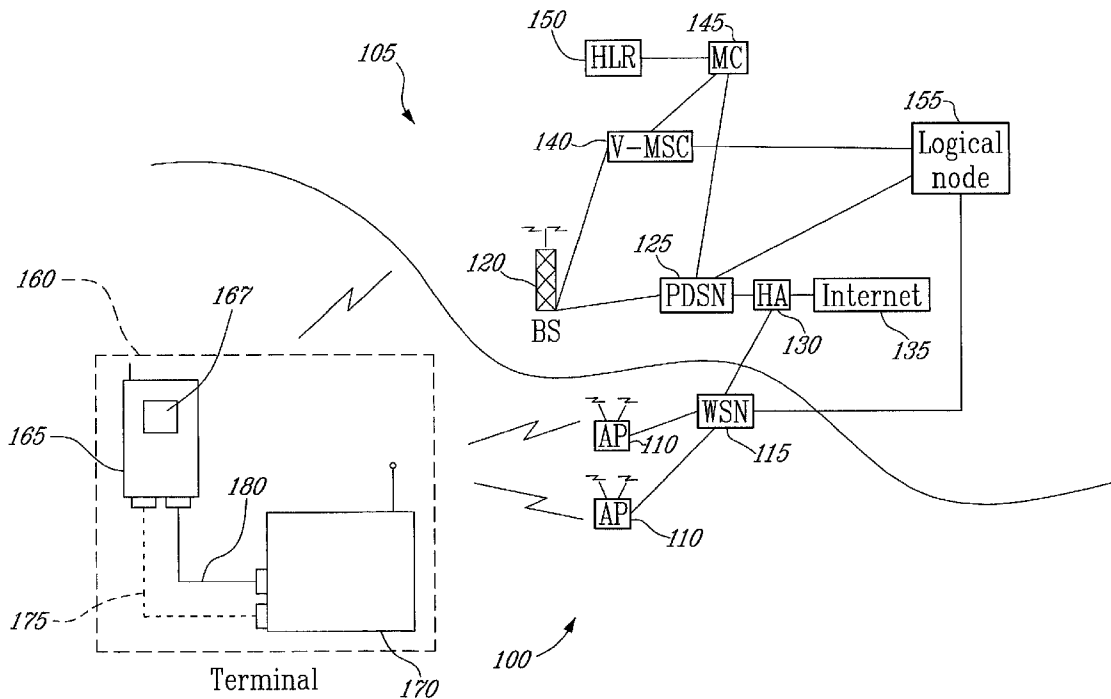
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(57) **ABSTRACT**

The present invention relates to a text message for carrying control information from a Wireless Wide Area Network (WWAN) to a terminal in a Wireless Local Area Network (WLAN). The text message has a code for indicating to the terminal that the text message contains control information and a text portion being the control information. A logical node located in the WWAN sends control information to the terminal located in a WLAN. The logical node receives information regarding the terminal from a Wireless Serving Node (WSN) located in the WLAN. The logical node has knowledge of an access point connected to the WSN that currently serves the terminal in the WLAN. The logical node triggers in a message center of the WWAN the sending of the text message the terminal.



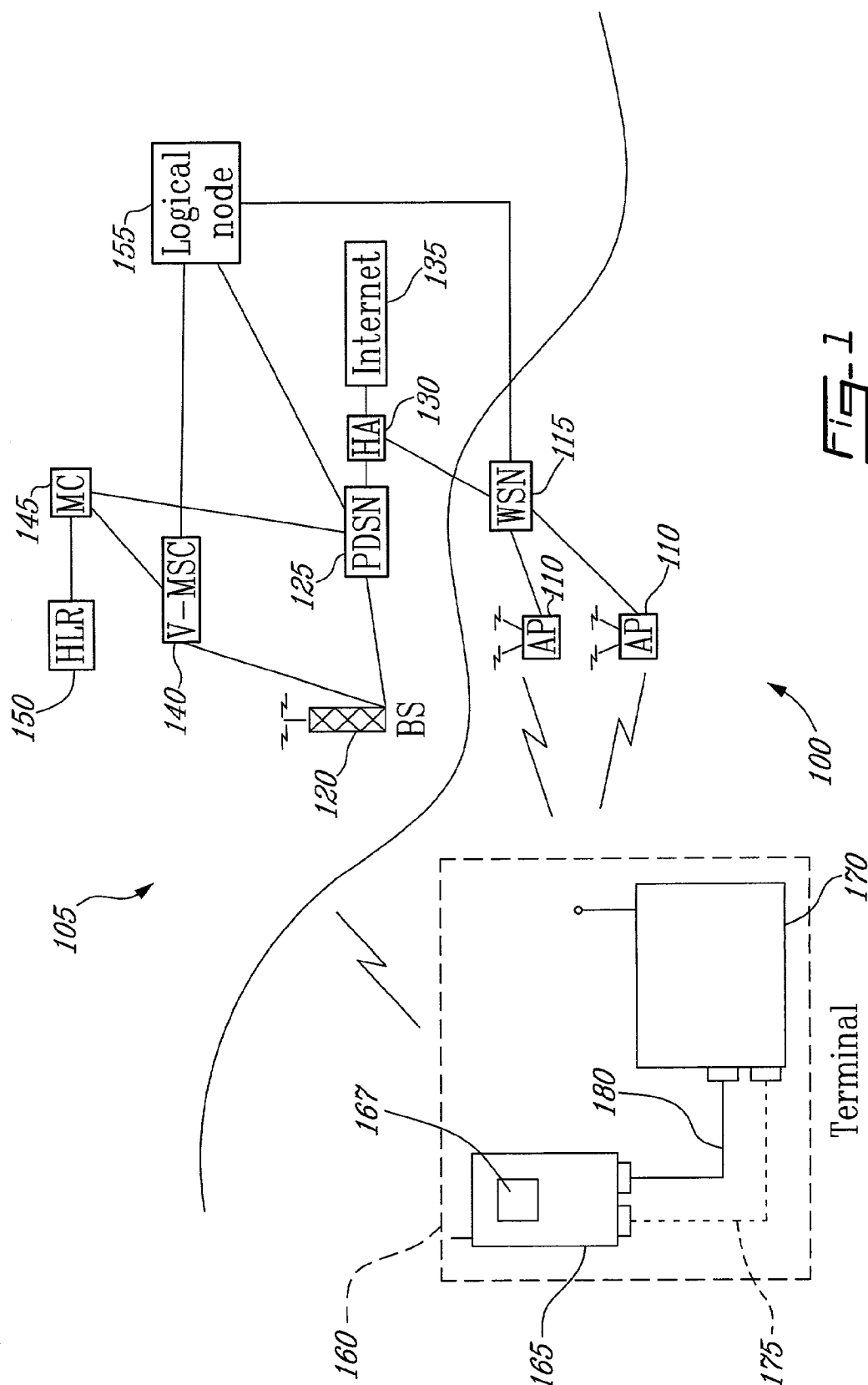


Fig. 1

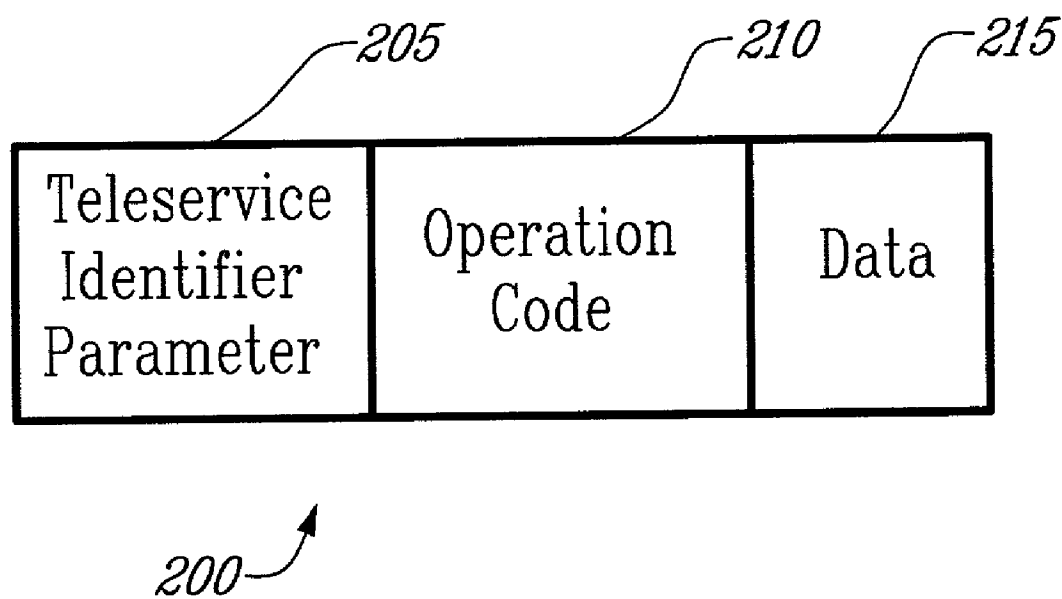


FIG. 2

SIGNALING WIRELESS WIDE AREA NETWORK MECHANISM FOR A TERMINAL LOCATED IN A WIRELESS LOCAL AREA NETWORK

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The invention relates to a signaling mechanism between different types of networks such as a Wireless Local Area Network and a Wireless Wide Area Network.

[0003] 2. Description of the Related Art

[0004] Today, there exist many types of wireless networks such as Wireless Local Area Networks (WLANs) that are used to provide coverage in smaller areas such as building or plants. Other basic types of Wireless Networks include the Wireless Personal Area Network (WPAN) such as Bluetooth™ or the Wireless Wide Area Network (WWAN), which covers large geographic areas.

[0005] On one hand, WLANs are deployed by hotspot service providers in different public places such as shopping mall, hotels or airports. A WLAN allows a user of a wireless client (laptop or desktop computer equipped with PC or PCI cards) to access a plurality of services. More particularly, PC or PCI cards receive radio signals from an access point with which it is communicating and translates that signal into digital data that PCs can understand. In the WLAN, access points are provided for granting access to the user. Access points are hard-wired to a LAN. Using an ordinary RJ-45 cable, it is possible to connect an access point to a wired LAN such as an Ethernet network. Also, access points can be described as software that run on a server, however the vast majority of access points are separate pieces of hardware. Access points translate digital data from the network into radio signals that wireless clients can understand for providing services to a user, while within the coverage of the WLAN.

[0006] WLANs use unregulated frequencies. For example access points and wireless clients can communicate over channels within a 2.4 GHz frequency band. Channel 2 in the 2.4 GHz band runs specifically at 2.402 GHz. Channel 3 runs at 2.403 GHz. The 2.4 GHz frequency band has a total of 80 channels, however some countries such as the United States and Canada allow the use of different frequencies. In these mentioned countries channels 1 through 11 are used.

[0007] On the other hand, WWANs generally use digital cellular phone networks to enable wireless clients to access among other things the Internet across extensive geographic areas. Unlike WLANs, which offer limited user mobility, WWANs facilitate connectivity for mobile users, and use regulated frequencies.

[0008] In WWANs, communication occurs predominantly through the use of radio signals over different types of networks such as analog or digital cellular. As it is well known today, many wireless data communication takes place across 2G (second generation) networks such as TDMA (Time Division Multiple Access), CDMA (Code Division Multiple Access), GSM (Global System for Mobile Communication), and PDC (Pacific Digital Cellular (GSM in Japan)), or through packet-data technology over old analog systems such as CDPD (Cellular Digital Packet Data) overlay on AMPS (Advanced Mobile Telephone Service).

Although traditional analog networks have been designed for voice rather than data transfer this causes some inherent problems. Some 2G and/or new 3G (third generation) digital cellular networks such as CDMA2000 or UMTS (Universal Mobile Telecommunication System) are fully integrated for data/voice transmission. Therefore, it is possible to develop 3G Wireless Wide Area Network (3G WWAN).

[0009] Nowadays, 3G networks (3G WWAN) operators offer many services. However, WLAN access and 3G WWAN access are completely independent access technologies. Therefore, 3G WWANs require a complement such as a Multi-Access Environment for allowing mobile users to roam from a WLAN to a 3G WWAN and vice versa. For doing so, the Multi-Access Environment uses a technology called MobileIP for allowing roaming issues. With this complement, users may roam back and forth from a WLAN to a 3G WWAN. However, even though the user is allowed to roam from the WLAN to the 3G WWAN, the operator is not able to manage roaming in the WLAN in view of security and billing purposes. Therefore, there is a need to improve signaling between WLANs and 3G WWANs. The invention provides a solution to this problem.

SUMMARY OF THE INVENTION

[0010] It is therefore one broad object of this invention to provide a text message for carrying control information from a Wireless Wide Area Network (WWAN) to a terminal in a Wireless Local Area Network (WLAN). The text message comprises a code for indicating to the terminal that the text message contains control information and a text portion being the control information.

[0011] It is also another object of the present invention to provide a logical node located in a WWAN for sending control information to at least one terminal located in a WLAN. The logical node receives information regarding the at least one terminal from a Wireless Serving Node (WSN) located in the WLAN. The logical node is further being capable of having knowledge of an access point currently serving the terminal in the WLAN while being connected to the WSN. The logical node further triggers in a message center of the WWAN the sending of a text message including a code indicating to the at least one terminal that the text message contains control information and a text portion being the control information at a message center for the at least one terminal based on the collected information.

[0012] It is a further object of the present invention to provide a terminal for receiving control information from a WWAN while located in a WLAN. The terminal is capable of receiving a text message including a code for indicating to the terminal that the text message contains control information. The text message further includes a text portion being the control information.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] For a more detailed understanding of the invention, for further objects and advantages thereof, reference can now be made to the following description, taken in conjunction with the accompanying drawings, in which:

[0014] FIG. 1 is illustrating a terminal currently roaming in a Wireless Local Area Network WLAN; and

[0015] FIG. 2 is illustrating a short message service message content according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] Reference is now made to **FIG. 1**, which illustrates a terminal **160** that is currently roaming in a Wireless Local Area Network (WLAN) **100**. The terminal **160** is registered in a third generation Wireless Wide Area Network (3G WWAN) **105**. The terminal **160** is operable in the WLAN **100** and in the 3G WWAN **105** and comprises a mobile device **165** for receiving messages from the 3G WWAN **105**. The mobile device further stores these messages in an internal memory **167**. The terminal also comprises a wireless client **170** for receiving messages from the WLAN **100** and for accessing the memory **167** and for interpreting messages stored in the memory **167**. The mobile device **165** can be for example a mobile telephone or a Personal Data Application (PDA) and the wireless client **170** can be for example a laptop computer or desktop computer equipped with an access card. Furthermore, the mobile device **165** and the wireless client **170** are connected via a wireless connection **175** or via a wired connection **180**. The wireless connection **175** can be made with Bluetooth™ or similar infrared devices while the wired connection **180** can be made with an ordinary RS-232C serial cable or any other existing cable that can support a wired connection between the mobile device **165** and the wireless client **170**.

[0017] The terminal **160** is registered in the third generation 3G WWAN **105**. The exemplary 3G WWAN **105** comprises at least one Base Station (BS) **120** for receiving signals from the terminal **160** and sending signals to the terminal **160** over an air interface. The BS **120** is ultimately connected to a Packet Data Serving Node (PDSN) **125**, for providing data packet services to the terminal **160**. The PDSN **125** is connected to a Home Agent (HA) **130** for providing a link to the Internet **135**. The BS **120** is also connected to a Visitor Mobile Switching Center (V-MSC) **140**. The PDSN **125** and the V-MSC **140** are connected to a Logical Node (LN) **155** and a Message Center (MC) **145** for generating messages to the terminal **160**. In **FIG. 1**, the MC **145** is connected to a Home Location Register (HLR) **150** for obtaining location information for at least one terminal. The present invention is not limited to the number of nodes or the shown nodes or connections in **FIG. 1**.

[0018] Since the terminal **160** is registered in the 3G WWAN **105**, the terminal **160** accesses the WLAN **100** in a Multi-Access Environment. This access is granted via at least one of possibly many APs **110**. The AP **110** acts as an authenticator for the terminal **160** in the WLAN **100**. The AP **110** such as other APs **110** located in the WLAN **100** are connected to a Wireless Serving Node (WSN) **115**. The WSN **115** is connected to the HA **130** for providing a link to the Internet **135**. The WSN **115** also communicates and sends information to the LN **155** and later grants access to the WLAN **100** to the terminal **160**. More particularly, the terminal **160** obtains access to the WLAN **100** by sending a request for services to the AP **110**. Following this, the AP **110** receives the request for services from the terminal **160** and sends an authentication request for granting access to the terminal **160**. This authentication request is sent to the WSN **115**, which further communicates and sends information to the LN **155** in the 3G WWAN **105** for billing and authentication purposes. The information sent from the WSN **115** to the LN **155** is stating an address of the AP **110** that currently serves the terminal **160**. Following a reception

of information from the WSN **115**, the LN **155** authenticates the terminal **160** and sends a response to the WSN **115**. After receiving the response from the LN **155**, the WSN **115** forwards the response to the AP **110**. Afterwards, the AP **110** sends the response to the terminal **160** and the terminal accesses the WLAN **100**.

[0019] As an example, the LN **155** can be a node such Authentication, Authorization and Accounting (AAA) server (not shown) in a CDMA2000 network. The AAA server authenticates and authorizes the mobile client, provides user profile and Quality of Service (QoS) information to a PDSN, and stores accounting data regarding registered terminals in its network.

[0020] In a Multi-Access Environment, it is advantageous for 3G WWAN operators to be able to control which access medium his subscribers are to access. For example, 3 G WWAN operators would wish to control this for quality assurance reason or traffic distribution or dimensioning purposes. Giving the choice to access a 3G WWAN or a WLAN, operators may wish to only redirect traffic on the WLAN network to supplement a limited capacity available on their 3G networks. Therefore, a 3G WWAN operator can be able to monitor the performance and available capacity of its 3G WWAN. When traffic load warrants, service may be off-loaded to a WLAN.

[0021] Since WLANs are deployed on unregulated frequencies, a multitude of WLAN hotspot providers with differing WLAN technology may co-exist in a service area of a 3G WWAN. When it comes to handing-off or initiating service on WLAN, 3G WWAN operators would like to instruct which AP in the WLAN his subscribers should be associated with. For doing so, a 3G WWAN operator of the 3G WWAN needs to maintain control of terminals registered in its network and which are in communication with a WLAN. The control of these terminals is maintained via signaling that carry control information.

[0022] In addition, QoS type of services and or priority access service may be introduced when a terminal is in communication with the WLAN. Based on a subscription parameter value or network conditions, the terminal may be directed to alter its behavior or limit its bandwidth transmission on an uplink. Furthermore, the terminal behavior may also be altered or modified based on its current location and availability of radio and network resources. This may be especially useful, in high traffic concentration area.

[0023] Reference is now made to **FIG. 2**, which illustrates a short message service (SMS) message content according to the invention, and further to **FIG. 1**, which illustrates the terminal **160** that is currently roaming in the WLAN **100**. The present invention is not limited to SMS, but applicable to any other type of text messages known and used in WWANs to convey text to the terminal. The SMS **200** is used by the 3G WWAN **105** for carrying signaling, such as control information in a way to control a terminal located in the WLAN **100**. For being able to be used as a control message, the SMS **200** comprises a Teleservice Identifier parameter **205** for indicating a teleservice for which the SMS **200** message applies. The SMS **200** also comprises an Operation Code parameter **210**, which contains control information sent from the 3G WWAN **105** such as a Routing address of the receiving terminal and an Origination address identifying the network node that sends the SMS **200**, which

is the MC 145 in the present case. The SMS 200 comprises data 215 for defining a text portion of the SMS 200.

[0024] The Teleservice Identifier parameter 205 can take different values from 49152 to 65535. A SMS teleserviceID is introduced in the Teleservice Identifier parameter 205 for indicating that the SMS message 200 contains control information for the terminal 160 in a Multi-Access Environment. Typically the payload of such a message would adhere to the following format represented in table 1.

TABLE 1	
Example of a Format of a SMS message	
Operation Code	Octet 1
Number of Parameter	Octet 2
Length of Parameter 1	Octet 3
Parameter 1 octet 1	Octet 4
Parameter 1 octet 2	Octet 5
Length of Parameter 2	Octet 6
Parameter 1 octet 1	Octet 7
Parameter 2 octet 2	Octet 8
Parameter n octet n	Octet n

[0025] The Operation Code in table 1 may take different values such as 0 for a Handover Directive, 1 for a WLAN AP Selection, and 2 for a Data Throughput Directive. In the particular case of a Handoff Directive, there will be 1 parameter used. This parameter indicates whether to handover to WLAN network or to handover to a 3G network. If Parameter 1 is 0, the indication will be a WLAN network handover. However, if the Parameter 1 is 0, the indication will be a 3G network handover. Table 2 below represents a message for instructing a terminal to handover to a WLAN network while table 3 represents a message for instructing a terminal to handover to a 3G network.

TABLE 2	
Message for instructing the terminal to handover to a WLAN network.	
Operation Code	1
Number of Parameter	1
Length of Parameter 1	1
Parameter 1 octet 1	0

[0026]

TABLE 3	
Message for instructing terminal to handover to a 3G network.	
Operation Code	1
Number of Parameter	1
Length of Parameter 1	1
Parameter 1 octet 1	1

[0027] When the terminal 160 is in communication with the AP 110, the 3G WWAN 105 sends a message such as the SMS 200 for ordering the terminal 160 to access services directly from the 3G WWAN 105 instead of the WLAN 100. The message can also be sent for instructing the terminal 160 to maintain communication with the WLAN 100 or to access the WLAN 100 if the terminal 160 is already in communication with the 3G WWAN 105.

[0028] The SMS 200 is sent to the terminal 160 from the 3G WWAN 105 based on a request received at the MC 145.

In FIG. 1, the LN 155 is responsible for triggering the SMS 200 at the MC 145. More precisely, the LN 155 triggers in the MC 145 the SMS 200 for sending control information to the terminal 160. The LN 155 triggers the MC 145 based on received and collected information from the WLAN 100 and the 3G WWAN 105. For doing so, the LN 155 sends a request (not shown) including control information to the MC 145. Next, the MC 145 receives the request and includes the control information in the text portion of the SMS 200. Before generating and sending the SMS 200 to the terminal 160, the MC 145 interrogates the HLR 150 for retrieving the location of the terminal 160. Alternatively, the position may also be provided in the request sent from the LN 155 to the MC 145. After retrieving the location of the terminal 160, the MC 145 generates and sends the SMS 200 to the terminal 160.

[0029] Upon reception of the SMS 200 at the terminal 160, the mobile device 165 uses the Teleservice Identifier parameter 205 for determining that the SMS 200 contains control information. Following this determination, the mobile device 165 stores the SMS 200 in its memory 167 until the wireless client 170 retrieves it. The wireless client 170 retrieves the SMS 200 by looking periodically in the memory 167 of the mobile device 165. The wireless client 170 further analyzes the SMS 200 and interprets the control information in the SMS 200. This may result in a handover of the terminal 160 from the WLAN 100 to the 3G WWAN 105.

[0030] It can be understood that some messages sent from the WLAN to the 3G WWAN and vice versa are not mentioned nor described for clarity reasons. Also some messages sent between some network elements in the 3G WWAN 105 and WLAN 100 are omitted for clarity reasons.

[0031] Although several preferred embodiments of the present invention have been illustrated in the accompanying Drawings and described in the foregoing Detailed Description, it will be understood that the invention is not limited to the embodiments disclosed, but is capable of numerous rearrangements, modifications and substitutions without departing from the spirit of the invention as set forth and defined by the following claims.

What is claimed is:

1. A text message for carrying control information from a Wireless Wide Area Network (WWAN) to a terminal in a Wireless Local Area Network (WLAN), the text message comprising:

a code for indicating to the terminal that the text message contains control information; and

a text portion, the text portion being the control information.

2. The text message of claim 1, wherein the text message is triggered in the WWAN at a message center by a logical node.

3. The text message of claim 1, wherein the text message is generated in the WWAN at a message center prior to be sent to the terminal.

4. The text message of claim 1, wherein the text message is sent from a message center located in the WWAN to the terminal.

5. The text message of claim 1, wherein the control message further ordering the terminal to access the WWAN.

6. The text message of claim 1, wherein the control message further ordering the terminal to maintain access with the WLAN.

7. A logical node located in a Wireless Wide Area Network (WWAN) for sending control information to at least one terminal located in a Wireless Local Area Network (WLAN), the logical node being capable of:

receiving information regarding the at least one terminal from a Wireless Serving Node (WSN) located in the WLAN;

having knowledge of an access point currently serving the terminal in the WLAN, the access point being connected to the WSN; and

triggering in a message center of the WWAN the sending of a text message including a code indicating to the at least one terminal that the text message contains control information and a text portion being the control information at a message center for the at least one terminal based on the collected information.

8. The logical node of claim 7, wherein the logical node further being capable of managing a hand off operation for the at least one terminal.

9. A terminal for receiving control information from a Wireless Wide Area Network (WWAN) while located in a

Wireless Local Area Network (WLAN), the terminal being capable of:

receiving a text message, the text message including a code for indicating to the terminal that the text message contains control information, and the text message including a text portion being the control information.

10. The terminal of claim 9, wherein the terminal comprises a mobile device having a memory for storing the text message received from the WWAN.

11. The terminal of claim 9, wherein the terminal comprises a mobile device using the code of the text message for storing the text message in a memory.

12. The terminal of claim 9, wherein the terminal comprises an application part connected to a mobile device for looking into a memory of the mobile device.

13. The terminal of claim 9, wherein the terminal comprises an application part interpreting the control information.

14. The terminal of claim 9 for receiving control information from the WWAN being operable in the WLAN and the WWAN.

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