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(54) **MISSED CALL NOTIFICATION TO CELLULAR TELEPHONE USING SHORT TEXT MESSAGING**

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Issued: **Sep. 28, 2004**
Appl. No.: **09/839,217**
Filed: **Apr. 23, 2001**

U.S. Applications:

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H04B 7/00 (2006.01)

(52) **U.S. Cl.** **455/70**; 455/435.1; 455/416; 455/466; 379/205.01

(58) **Field of Classification Search** 455/458, 455/416, 466, 70, 435.1; 379/205.01
See application file for complete search history.

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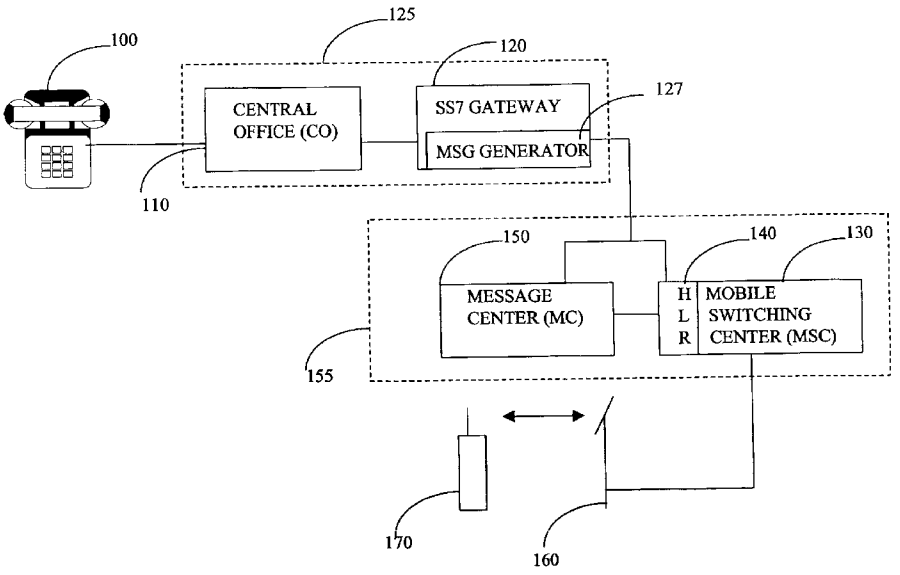
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(57) **ABSTRACT**

A system for and method of providing Short Message Service (SMS) message notification to a cellular telephone customer regarding missed incoming calls that are missed while the cellular telephone is unavailable such as when the telephone is powered off. This is accomplished by generating a notification message at a SS7 gateway that includes caller ID/name ID information and/or time of the missed call. The message is preferably generated at the SS7 gateway only upon receipt of an "access denied" response with a reason code of at least one of MS Inactive, Busy, No Page Response or Unavailable that is sent from a home location register in response to a location request sent by the SS7 gateway. Once the generated message is complete it is sent to a message center where it is stored until it is retrieved by the cellular telephone soon after registration with the cellular network.

8 Claims, 4 Drawing Sheets



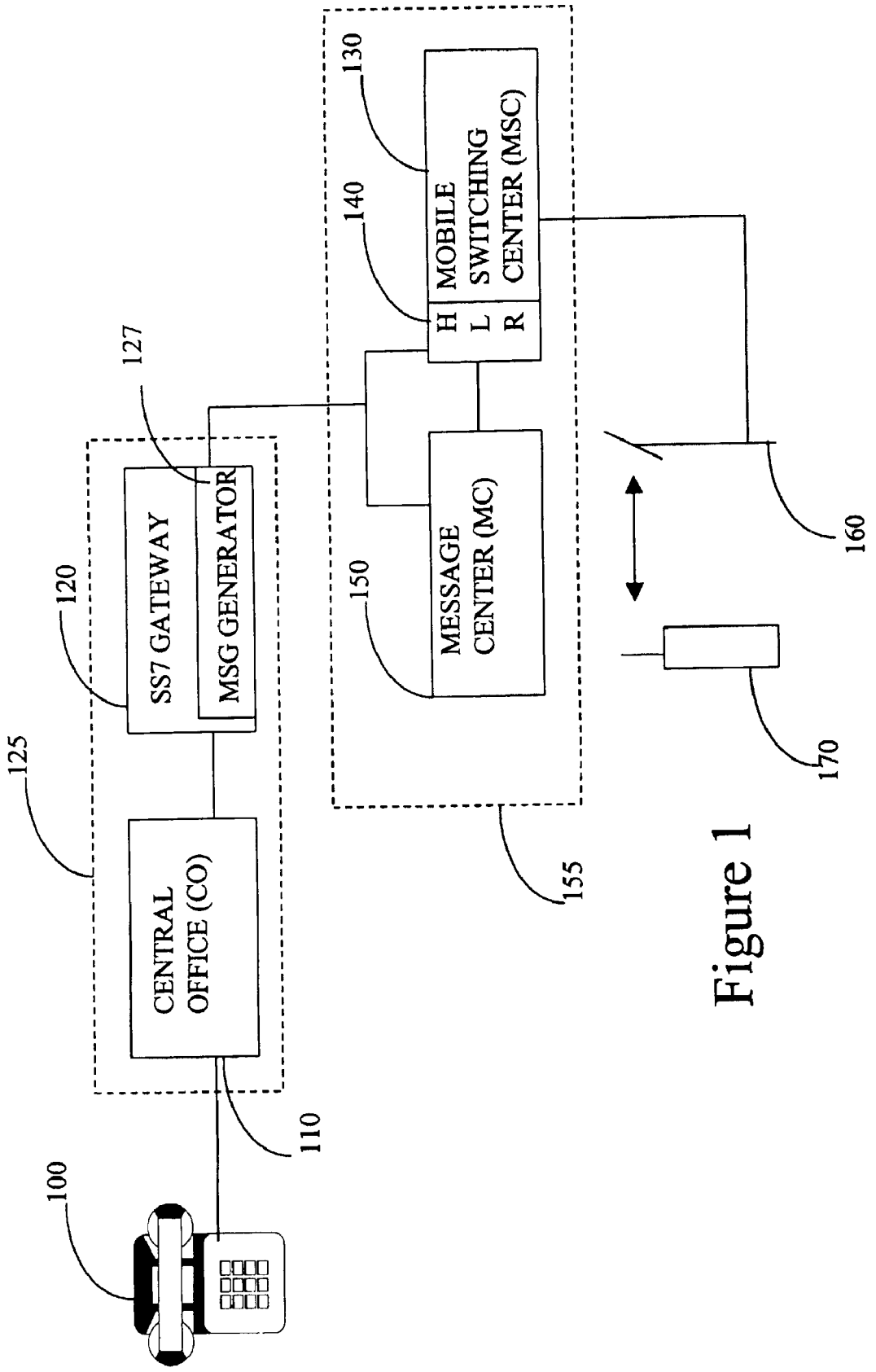

100
110
125
CENTRAL OFFICE (CO)
120
SS7 GATEWAY
MSG GENERATOR
127
130
MOBILE SWITCHING CENTER (MSC)
140
H
L
R
150
MESSAGE CENTER (MC)
155
160
170

Figure 1

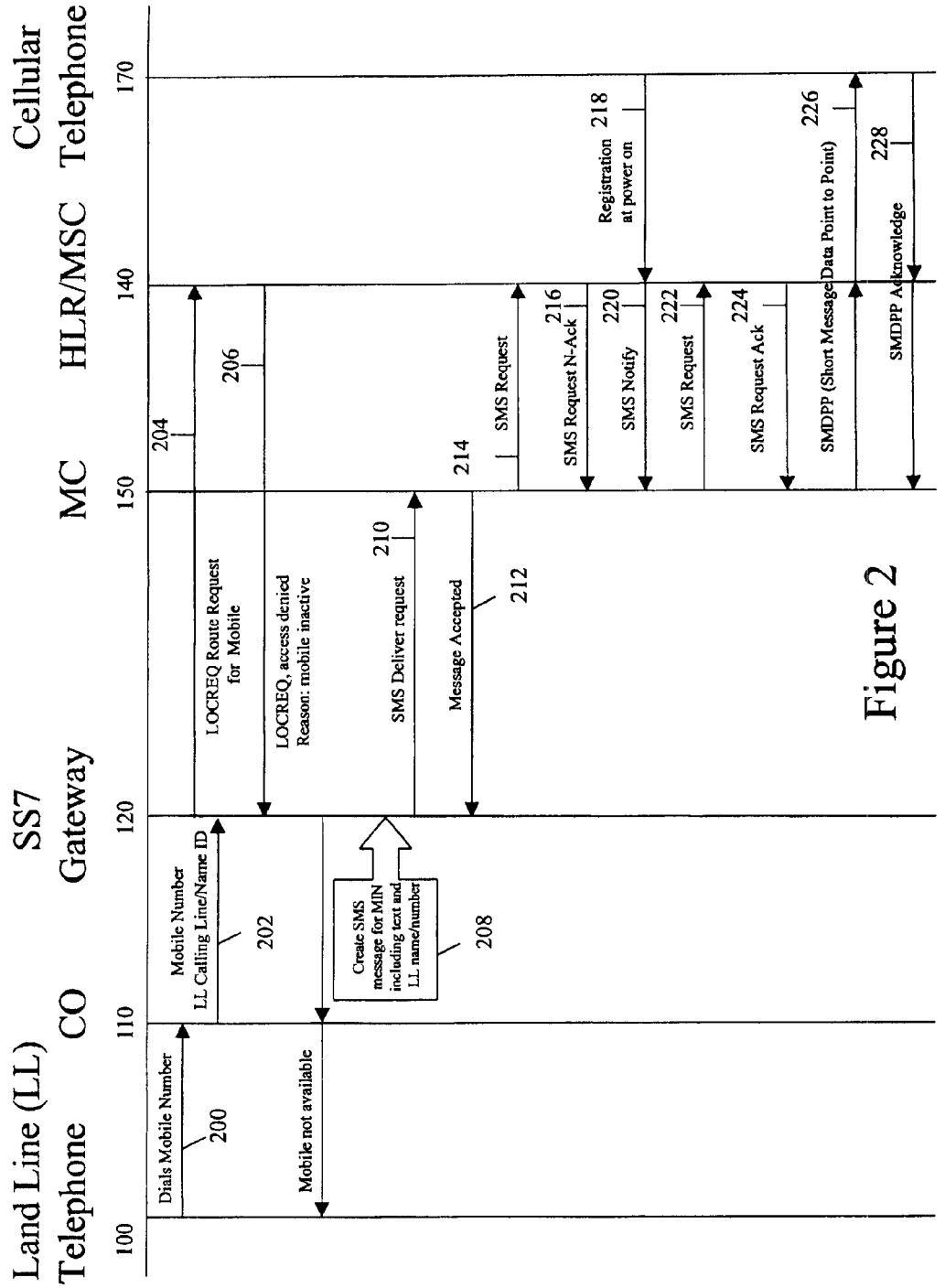

Land Line (LL) Telephone
CO
SS7 Gateway
MC
HLR/MSC
Cellular Telephone
100
110
120
150
140
170
Dials Mobile Number
200
Mobile Number LL Calling Line/Name ID
202
Mobile not available
LOCREQ Route Request for Mobile
204
206
LOCREQ, access denied Reason: mobile inactive
Create SMS message for MIN including text and LL name/number
208
SMS Deliver request
210
Message Accepted
212
SMS Request
214
SMS Request N-Ack
216
Registration at power on
218
SMS Notify
220
SMS Request
222
SMS Request Ack
224
SMDPP (Short Message Data Point to Point)
226
SMDPP Acknowledge
228

Figure 2

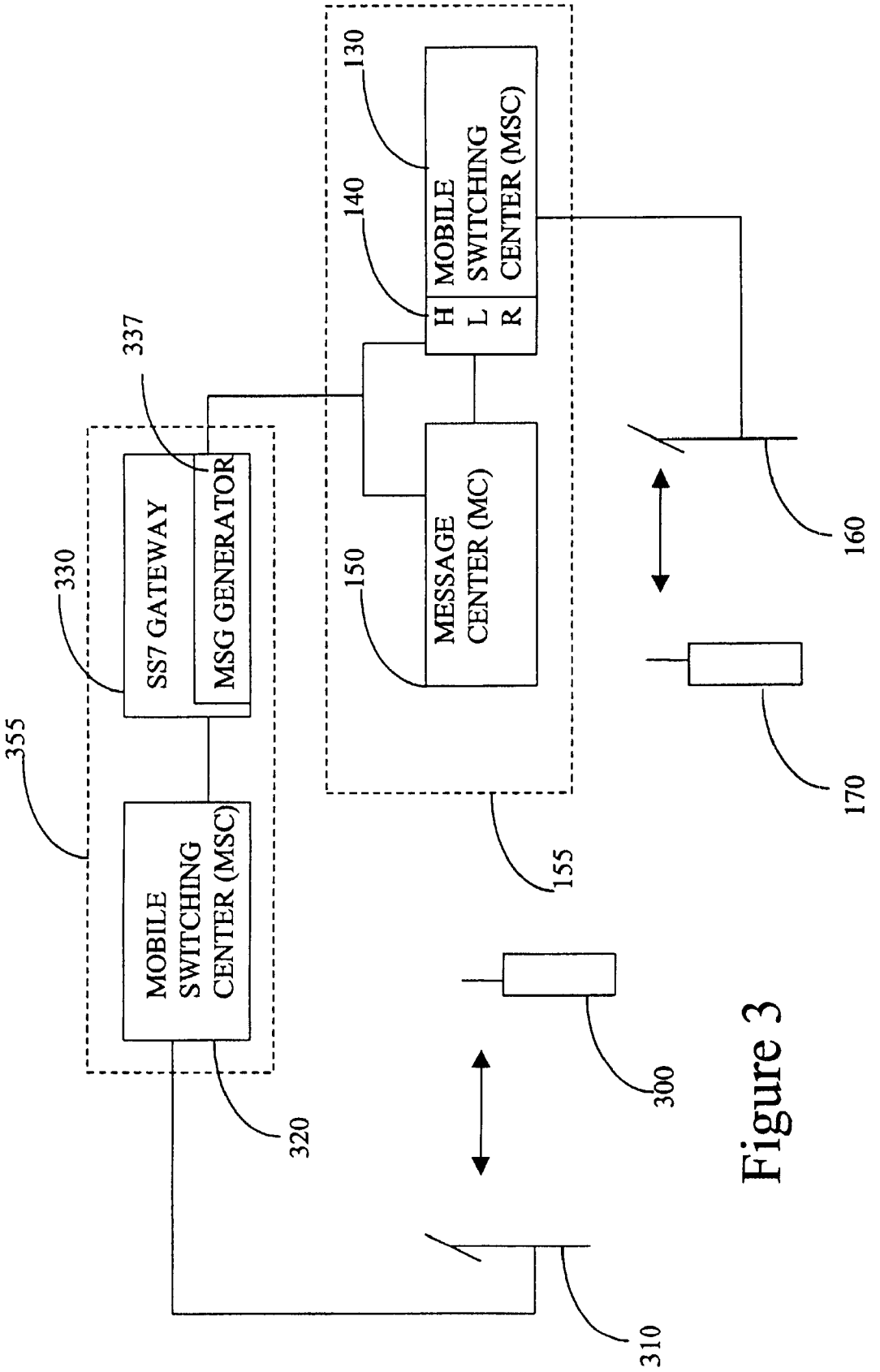

MOBILE SWITCHING CENTER (MSC)
H
L
R
MESSAGE CENTER (MC)
SS7 GATEWAY
MSG GENERATOR
MOBILE SWITCHING CENTER (MSC)
130
140
150
155
160
170
300
310
320
330
337
355

Figure 3

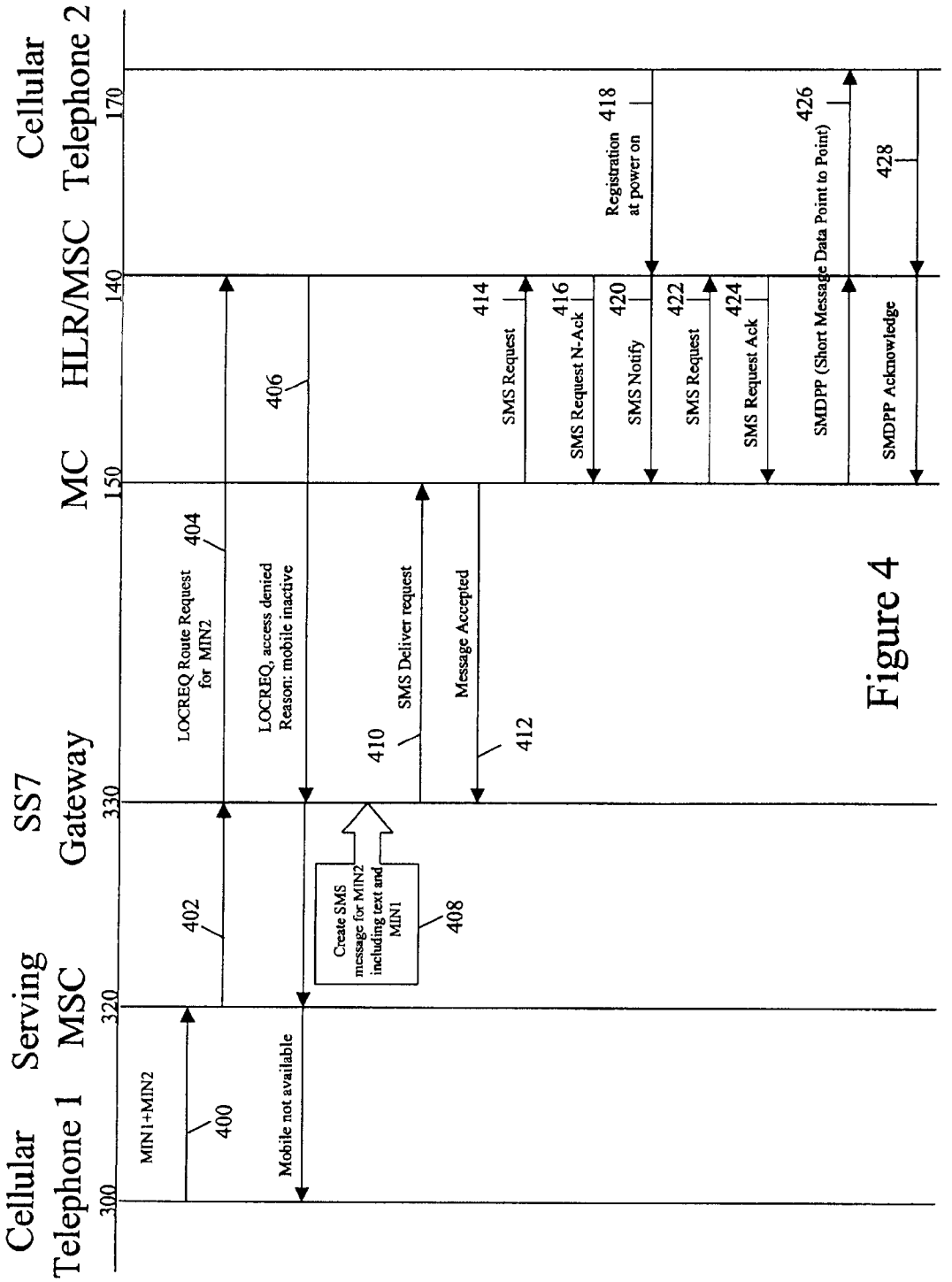

Cellular Telephone 1
300
Serving MSC
320
SS7 Gateway
330
MC
150
HLR/MSC
140
Cellular Telephone 2
170
MIN1+MIN2
400
402
LOCREQ Route Request for MIN2
404
LOCREQ, access denied Reason: mobile inactive
406
Mobile not available
Create SMS message for MIN2 including text and MIN1
408
410
SMS Deliver request
Message Accepted
412
SMS Request
414
SMS Request N-Ack
416
Registration at power on
418
SMS Notify
420
SMS Request
422
SMS Request Ack
424
SMDPP (Short Message Data Point to Point)
426
SMDPP Acknowledge
428

Figure 4

MISSED CALL NOTIFICATION TO CELLULAR TELEPHONE USING SHORT TEXT MESSAGING

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

Notice: More than one reissue application has been filed for the reissue of U.S. Pat. No. 6,799,017. The reissue applications are application Ser. No. 11/528,677, which is a reissue application of U.S. Pat. No. 6,799,017, and the present application, which is a divisional reissue application of reissue application Ser. No. 11/528,677.

This application is a continuation-in-part application of U.S. Ser. No. 09/822,332, filed Apr. 2, 2001, which is incorporated herein in its entirety.

BACKGROUND

1. Field of the Invention

The present invention is directed to cellular telephone system call features and management. More particularly, the present invention is directed to a system for and method of notifying a cellular telephone customer of a missed call using a short text message.

2. Background of the Invention

Cellular telephone usage has been growing at an exceptional pace. People use cellular telephones for a variety of reasons including safety, increased availability while away from a conventional wireline/landline telephone and/or because cellular telephone services provided by cellular telephone providers can offer greater value compared to conventional wireline service. In all cases, however, cellular telephone customers typically seek a reliable alternative to conventional wireline means of communication wither because they are away from the wireline means of communication, or because access to those means of communication is inconvenient.

To enhance a cellular telephone customer's sense of staying in touch, cellular telephone service providers offer voice mail service as one of many service offerings. This well-known service causes an incoming call to a cellular telephone, which is not available to receive the incoming call, to be forwarded to a voice mail service where the caller can leave a message for the cellular telephone customer. Typically, an incoming call will be forwarded to voice mail when the cellular telephone is powered off (i.e., not registered), when the cellular telephone is being used (and no call waiting feature is available), or when the cellular telephone customer configures his cellular telephone to forward incoming calls to voice mail even though the cellular telephone is powered on and available to receive calls.

Since voice mail is often an add-on feature that is not typically included in basic service plans offered by cellular telephone service providers, customers who desire voice mail must pay extra for this service. However, not all customers are willing to pay the full fee for voice mail service. On the other hand, some of these same customers might still desire a service that provides information regarding incoming calls that might have been missed.

SUMMARY OF THE INVENTION

The present invention addresses and overcomes the drawbacks of having to offer only conventional cellular telephone

voice mail service to cellular telephone customers by providing Short Message Service (SMS) message notification to a cellular telephone customer about incoming calls that are missed. That is, the present invention provides a means for notifying a cellular telephone customer of missed calls (e.g., because the cellular telephone is not registered) without requiring the cellular telephone customer to purchase a relatively expensive voice mail add-on feature or option as part of their cellular telephone service plan. The present invention is operable with both landline and cellular telephone-originated calls.

In the landline-originated implementation the present invention is preferably implemented in a telecommunications infrastructure including a landline telephone that is connected to a central office (CO), which itself is connected to an SS7 gateway. The SS7 gateway is able to communicate with both a SMS message center and a home location register (HLR), which is often incorporated with a mobile switching center (MSC). The MSC, in turn, is in communication with cellular telephones. In accordance with the present invention, in addition to employing the SS7 gateway to perform well-known call setup functions, the SS7 gateway is programmed or is modified to include a "message generator," which becomes operable when the HLR returns, in response to a location request query from the SS7 gateway, an "access denied" response with a reason code of "MS Inactive", "Busy", "No Page" or "Unavailable."

The message generator preferably generates a message containing the landline caller ID/calling name ID and any other text message that will fit within the remaining portion of the maximum allowable characters in a SMS message. The information for creating the SMS message is available at the SS7 gateway since the CO-typically provides that information to the gateway when the landline call is originally placed. The generated SMS message preferably also includes the time that the missed call was attempted.

Once the message is complete it is sent to the message center (MC) where it is stored in memory until the called cellular telephone is powered on, registers, or otherwise makes itself available to the cellular network. At that time, the MC delivers the short message that was generated, originally, at the SS7 gateway, thereby providing missed call notification to the cellular telephone customer.

Thus, the present invention provides numerous advantages, not the least of which is that a cellular telephone customer can receive a missed call notification service that, while not as extensive as voice mail service, nevertheless provides useful and timely information to the customer about missed calls. Further, the cost to implement the service of the present invention is relatively low since it is not necessary to purchase and field expensive voice mail systems to retain messages. Accordingly, customers will be more willing to purchase the less expensive service.

When the call originates from another cellular telephone, the call is passed to a servicing mobile switching center (MSC) and associated SS7 gateway in which the message generator of the present invention may be implemented.

It is therefore an object of the present invention to provide methods and systems for providing missed call notification to cellular telephones from landline or cellular telephones.

It is another object of the present invention to provide a missed call notification using a short message service message.

It is another object of the present invention to provide notification of a missed call due to a cellular telephone that is powered off or is otherwise unavailable to the network.

It is also an object of the present invention to provide a message generator that is co-located or integral with a SS7 gateway.

It is another object of the present invention to generate short message service messages at a SS7 gateway and pass those messages to a message center where the messages await distribution to wireless device customers, including cellular telephone customers.

It is yet another object of the present invention to block or filter predetermined missed call notifications using a message generator at a SS7 gateway.

These and other objects of the present invention will become apparent upon a reading of the following detailed description in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram of an exemplary telecommunications architecture in which the present invention can be implemented.

FIG. **2** is an exemplary chart illustrating events that typically occur between and among the components shown in FIG. **1** when a landline telephone attempts to call a mobile telephone, in accordance with the present invention.

FIG. **3** is a schematic diagram of another exemplary telecommunications architecture in which the present invention may be implemented.

FIG. **4** is an exemplary chart illustrating events or steps that typically occur between and/or among the components shown in FIG. **3** when a mobile telephone attempts to call another mobile telephone, in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides notification to a cellular telephone customer (or other wireless device customer) about missed incoming calls resulting from the customer's cellular telephone being powered off, being busy, or being otherwise unavailable to the network. That is, the present invention provides a means for notifying a cellular telephone customer of missed calls without requiring the cellular telephone customer to purchase a relatively expensive voice mail add-on feature or option for their cellular telephone service plan.

FIG. **1** is a schematic diagram of an exemplary telecommunications architecture in which the present invention can be implemented. Landline telephone **100** is connected to central office (CO) **110**. CO **110** is connected to an SS7 gateway **120**, which is used in its conventional way to set up calls between central office **100** and other nodes, such as another central office (not shown) or a mobile switching center **130**. Of course, CO **100** and SS7 gateway **120** can be co-located as shown by dotted enclosure **125**. Also shown in connection with SS7 gateway is Message Generator **127**, which will be explained in more detail below. SS7 gateway **120** is preferably in communication with mobile switching center (MSC) **130**, which typically includes or has access to a home location register (HLR) **140**. SS7 gateway **120** is also preferably in communication with a short message service (SMS) message center (MC) **150**.

SMS is a means by which short messages can be sent over the air from a base station, such as MC **150**, to wireless digital devices including digitally-enabled cellular telephones. Alphanumeric messages up to **160** characters can be supported according to well-known protocols. As with the CO and SS7 gateway, MSC **130**, HLR **140** and MC **150** can also be co-located as shown by dotted enclosure **155**.

Finally, as is conventional, MSC **130** is connected to or is in communication with a base station or antenna **160**, which communicates with cellular telephone **170**, sometimes referred to herein as a mobile telephone.

In accordance with the present invention, a cellular telephone customer can receive a notification of a call that was missed because, for example, his cellular telephone was powered off. This is achieved by generating and sending a SMS text message comprising the name and number of the caller who was trying to reach the cellular telephone. A more detailed explanation of the various aspects and embodiments of the present invention is set forth below.

FIG. **2** is an exemplary chart illustrating events or steps that typically occur between and/or among the components shown in FIG. **1** in accordance with the present invention. In the following example, a telephone call is placed from a landline telephone to a mobile telephone. Referring to FIG. **2**, a call originates from the landline telephone **100** and connects to CO **110** (event **200**). CO **100** recognizes the dialed digits sent from telephone **100** as they are entered on the keypad and then sends the cellular telephone number (i.e., the dialed digits) and the landline/calling line ID or calling name ID to SS7 Gateway **120** (event **202**). As mentioned previously, SS7 is a signaling system that is used for setting up calls between offices, nodes, and other components of the telephone network. Because the dialed number is recognized at the SS7 gateway as a cellular telephone number, SS7 gateway **120** sends a locate request (LOCREQ) to home location register (HLR) **140** using well-known operating software within the gateway (event **204**).

As is well known in the art, the home location register (HLR) is a database that contains cellular telephone customer or subscriber profiles. If the cellular telephone to which the call is directed is, for example, not powered on at the time the HLR receives the location request, then the HLR returns an "access denied" message with a reason code of "MS Inactive", "Busy", "No Page Response" or "inavailable" (event **206**). If the cellular telephone customer does not have voice mail, then SS7 gateway **120** forwards the inactive notification to central office **110** and then ultimately back to the landline caller. A message is typically played for the landline caller that indicates that the mobile or cellular telephone is not available. In prior art systems, the sequence of events typically ends here, assuming the cellular telephone customer does not subscribe to voice mail.

In accordance with the present invention, however, when an access denied message with a reason code of "MS Inactive", "Busy", "No Page Response" or "Unavailable" is received at SS7 gateway **120**, SS7 gateway **120** not only causes a message to be played for the landline caller indicating the called cellular telephone is not available, but the SS7 gateway also creates, via Message Generator **127**, a SMS message containing the landline caller ID/calling name ID (event **208**) and any other text message that will fit within the remaining portion of maximum allowable characters in the SMS. Message Generator **127** preferably comprises one or more software routines and or hardware components that can be programmed to provide the functionality described herein. The information for creating the SMS message is available at the SS7 gateway since CO **110** provided that information to the gateway when the landline call was originally placed. That is, SS7 gateway **120** and/or Message Generator **127** preferably buffers the calling number, and also the mobile telephone number that was called so that this information remains available for creating the SMS message in the event such a message is desired. The SMS message preferably

includes the telephone number (and preferably also name) of the calling party. The time of the call may also be included.

Once the message is complete it is sent to MC **150** via the well-known IS**41** standard SMS Deliver request (event **210**). Message centers capable of receiving SMS messages are well-known in the art. MC **150** accepts the message (event **212**) and sends a SMS request (event **214**) to HLR **140**. Because the cellular telephone to which the SMS message is directed is not powered on, HLR **140** returns a SMS Request N-ack response (event **216**) and simultaneously sets a flag within HLR **140** that a message is waiting in MC **150** (not shown).

Later, when cellular telephone **170** is powered on, it registers with the cellular system (event **218**), namely, HLR **140**. HLR **140**, having previously set a message waiting flag for the cellular telephone customer, sends a SMS notify message to MC **150** (event **220**). MC **150** then sends another SMS Request (event **222**), which is answered by HLR **140** with a SMS Request Ack (event **224**). Thus, the short message that was generated, originally, at the SS7 gateway is passed to and acknowledged by cellular telephone **170** via the well-known Short Message Data Point to Point (SMDPP) and SMDPP Acknowledge exchange (events **226** and **228**).

Advantages of the foregoing system are evident. For example, it is relatively simple to generate the short message at the SS7 gateway since all the information is being buffered there in any event. Moreover, the triggering event for generating the short message, namely, a "LOCREQ, access denied" communication, is received by the SS7 gateway and thus is readily available to Message Generator **127**. Further still, a cellular telephone customer can receive a level of service that, while not as extensive as voice mail, nevertheless provides useful and timely information to the customer-about missed-calls. Further still, the cost to implement the service of the present invention is relatively low since it is not necessary to purchase and field expensive voice mail systems to retain messages.

FIG. **3** is another exemplary telecommunications architecture in which the present invention may be implemented. FIG. **3** shows the case where a cellular telephone **300**, rather than a landline telephone, is attempting to contact another cellular telephone **170**. Thus, FIG. **3** shows a cellular telephone **300**, a base station or antenna **310**, a MSC **320**, a SS7 gateway **330**, with the latter two components capable of being co-located as shown by dotted enclosure **335**. SS7 gateway **330** preferably also includes Message Generator **337**, which is functionally similar to Message Generator **127**.

FIG. **4** is a chart illustrating the events or steps that occur between and/or among the components shown in FIG. **3** when a mobile telephone attempts to call-another mobile telephone that is powered off. As shown, a call originates from cellular telephone **300** and is passed to MSC **320** (event **400**). In this case, both of the mobile telephone numbers or mobile identification numbers (MINs) are passed to MSC **320**. MSC **320** then passes that information to SS7 Gateway **330** (event **402**). The dialed number is recognized at the SS7 gateway as a cellular telephone number and, as such, SS7 gateway **330** sends a locate request (LOCREQ) to home location register (HLR) **140** using well-known operating software within the gateway (event **404**).

If the called cellular telephone, i.e., cellular telephone **170**, is not powered on at the-time the HLR receives the location request, then the HLR returns an "access denied" message with a reason code of "MS Inactive", "Busy", "No Page Response" or "Unavailable" (event **406**), which triggers a message to be played on cellular telephone **300** indicating that the called mobile or cellular telephone is not available. In prior art systems, the sequence of events typically ends here, assuming the cellular telephone customer does not subscribe to voice mail.

In accordance with the present invention, however, when an access denied message with a reason code of "MS Inactive", "Busy", "No Page Response" or "Unavailable" is received at SS7 gateway **330**, SS7 gateway **330** not only causes a message to be played for the calling cellular telephone indicating the called cellular telephone is not available, but the SS7 gateway also creates a SMS message containing the calling cellular telephone's MIN and/or name ID (event **408**) and any other text message that will fit within the remaining portion of maximum allowable characters in the SMS. The information for creating the SMS message is available at the SS7 gateway since MSC **320** provided that information to the gateway when the cellular telephone **300** call was originally placed. That is, SS7 gateway **330** preferably buffers the calling number and called MINs (MIN**1** and MIN**2**), so that this information remains available for creating the SMS message in the event it is desired. The time of the call may also be included as can be a small message such as, "a call from xxxxx was missed at date, hh:mm".

Once the message is complete it is sent to MC **150** via the well-known IS**41** standard SMS Deliver request (event **410**). MC **150** accepts the message (event **412**) and sends a SMS request (event **414**) to HLR **140**. Because the cellular telephone to which the SMS message is directed is not powered on, HLR **140** returns a SMS Request N-ack response (event **416**) and simultaneously sets a flag within HLR **140** that a message is waiting in MC **150**.

When cellular telephone **170** is powered on and/or it registers with the cellular system (event **418**), HLR **140**, having previously set a message waiting flag for the cellular telephone customer, sends a SMS notify message to MC **150** (event **420**). MC **150** then sends another SMS Request (event **422**), which is answered by HLR **140** with a SMS Request Ack (event **424**). Thus, the short message that was generated, originally, at Message Generator **337** is passed to and acknowledged by cellular telephone **170** via the SMDPP and SMDPP Acknowledge exchanges (events **426** and **428**).

Thus, whenever an SS7 gateway is involved in setting up a call to a cellular telephone that is SMS-enabled and that cellular telephone is powered off at the time of the attempted call setup, a Message Generator, which can be integral with the SS7 gateway, preferably generates a short message in accordance with the SMS standard (or any other similar standard or protocol that is receivable by the cellular telephone or other mobile device) and that message is sent to a message center. The message is then automatically retrieved and displayed by the called cellular telephone when that cellular telephone is powered on and registers.

The present invention should not necessarily be construed to be limited to automatically generating messages for all missed calls. Rather, the described notification feature or service is preferably enabled only for those customers who request the feature as part of their cellular telephone service plan.

Also, Message Generator **127** or **337** is also preferably programmable to filter calls. For example, a cellular telephone customer who primarily uses his telephone for business and regularly calls his office while on the road does not need to know that his office called while his mobile telephone was powered off since he will likely be calling his office anyway. On the other hand, that customer would want to know about other calls that may have been missed. Accordingly, Message Generator **127** or **337** preferably includes a calling party filtering table or that is used to disable the notification feature for predetermined telephone numbers.

The present invention also provides a competitive advantage to cellular telephone service providers that also operate conventional landline telephone systems. Specifically, landline telephone service providers will typically control and manage central offices and associated SS7 gateways through-

out the telephone network, whereas cellular telephone service providers do not control or manage central offices. Thus, only landline telephone service providers are able to control whether a SS7 gateway can be configured in accordance with the principles of the present invention. That is, unless central offices and associated SS7 gateways include the functionality described herein, a cellular telephone customer cannot receive a missed call notification from a landline-placed call. In view of the foregoing, service providers that offer both cellular and conventional landline services can offer cellular telephone customers enhanced service (namely, missed call notification for landline as well as mobile originated calls) that cellular service-only providers cannot offer.

The foregoing disclosure of the preferred embodiments of the present invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many variations and modifications of the embodiments described herein will be obvious to one of ordinary skill in the art in light of the above disclosure. The scope of the invention is to be defined only by the claims appended hereto, and by their equivalents.

Further, in describing representative embodiments of the present invention, the specification may have presented the method and/or process of the present invention as a particular sequence of steps. However, to the extent that the method or process does not rely on the particular order of steps set forth herein, the method or process should not be limited to the particular sequence of steps described. As one of ordinary skill in the art would appreciate, other sequences of steps may be possible. Therefore, the particular order of the steps set forth in the specification should not be construed as limitations on the claims. In addition, the claims directed to the method and/or process of the present invention should not be limited to the performance of their steps in the order written, and one skilled in the art can readily appreciate that the sequences may be varied and still remain within the spirit and scope of the present invention.

What is claimed is:

[1. A method of providing missed call notification to a cellular telephone, comprising the steps of:

(a) receiving a telephone call, which is directed to a cellular telephone, at a central office;

(b) forwarding call setup information that is representative of the telephone call from the central office to a SS7 gateway and sending a location request communication to a home location register;

(c) receiving an access denied response with a reason code of at least one of MS Inactive, Busy, No Page Response and Unavailable from the home location register;

(d) generating, in response to step (c), a message at the SS7 gateway including information identifying the origin of the telephone call;

(e) sending the message to a message center; and

(f) forwarding the message to the cellular telephone when the cellular telephone registers with the home location register, thereby providing notification of a missed call.**]**

[2. The method of claim **1**, further comprising generating the message only when the cellular telephone is not registered with the home location register.**]**

[3. The method of claim **1**, further comprising generating the message only when the cellular telephone is powered off.**]**

[4. The method of claim **1**, wherein the message comprises at least one of a telephone number from which the telephone call originated, a name and a time of the telephone call.**]**

[5. The method of claim **1**, further comprising filtering telephone calls for which notification is provided.**]**

[6. The method of claim **1**, wherein the home location register is associated with a mobile switching center.**]**

[7. The method of claim **1**, wherein the same business entity operates both the central office and a cellular telephone network.**]**

[8. The method of claim **1**, wherein an incremental cost to a customer for receiving missed call notification in accordance with steps (a)-(f) is less than an incremental cost to the customer for voice mail service.**]**

[9. The method of claim **1**, wherein the message generator is implemented in one of hardware, software or a combination thereof.**]**

[10. The method of claim **1**, wherein the message is a short message service (SMS) message.**]**

[11. A method of providing missed call notification, comprising the steps of:

(a) receiving a telephone call from a first cellular telephone, which is directed to a second cellular telephone, at a mobile switching center;

(b) forwarding call setup information that is representative of the first cellular telephone call from the mobile switching center to a SS7 gateway and sending a location request communication to a home location register;

(c) receiving an access denied response with a reason code of at least one of MS Inactive, Busy, No Page Response and Unavailable from the home location register;

(d) generating, in response to step (c), a message at the SS7 gateway including information identifying the origin of the telephone call;

(e) sending the message to a message center; and

(f) forwarding the message to the second cellular telephone when the second cellular telephone registers with the home location register, thereby providing notification of a missed call.**]**

[12. The method of claim **11**, further comprising generating the message only when the second cellular telephone is not registered with the home location register.**]**

[13. The method of claim **11**, further comprising generating the message only when the second cellular telephone is powered off.**]**

[14. The method of claim **11**, wherein the message comprises at least one of a telephone number from which the telephone call originated, a name and a time of the telephone call.**]**

[15. The method of claim **11**, further comprising filtering telephone calls for which notification is provided.**]**

[16. The method of claim **11**, wherein the home location register is associated with a mobile switching center.**]**

[17. The method of claim **11**, wherein an incremental cost to a customer for receiving missed call notification in accordance with steps (a)-(f) is less than an incremental cost to the customer for voice mail service.**]**

[18. The method of claim **11**, wherein the message generator is implemented in one of hardware, software or a combination thereof.**]**

[19. The method of claim **11**, wherein the message is a short message service (SMS) message.**]**

[20. A system for providing missed call notification to a cellular telephone, comprising:

(a) a central office operable to receive a telephone call, which is directed to a cellular telephone;

(b) a SS7 gateway in communication with a central office operable to receive call setup information that is representative of the telephone call and send a location request communication to a home location register based on the call set up information;

(c) means for receiving an access denied response with a reason code of at least one of MS Inactive, Busy, No Page Response and Unavailable from the home location register;

(d) a message generator operable to generate, in response to the home location register, a message at the SS7 gateway including information identifying the origin of the telephone call;

(e) means for sending the message to a message center; and

(f) means for forwarding the message to the cellular telephone when the cellular telephone registers with the home location register, thereby providing notification of a missed call.]

[**21**. The system of claim **20**, wherein the message is generated only when the cellular telephone is not registered with the home location register.]

[**22**. The system of claim **20**, wherein the message is generated only when the cellular telephone is powered off.]

[**23**. The system of claim **20**, wherein the message comprises at least one of a telephone number from which the telephone call originated, a name and a time of the telephone call.]

[**24**. The system of claim **20**, further comprising means for filtering telephone calls for which notification is provided.]

[**25**. The system of claim **20**, wherein the home location register is associated with a mobile switching center.]

[**26**. The system of claim **20**, wherein the same business entity operates both the central office and a cellular telephone network.]

[**27**. The system of claim **20**, wherein an incremental cost to a customer for receiving missed call notification via the system of claim **20** is less than an incremental cost to the customer for voice mail service.]

[**28**. The system of claim **20**, wherein the message generator is implemented in one of hardware software or a combination thereof.]

[**29**. The system of claim **20**, wherein the message is a short message service (SMS) message.]

[**30**. A system for providing missed call notification, comprising:

(a) a mobile switching center operable to receive a telephone call from a first cellular telephone, which is directed to a second cellular telephone;

(b) means for forwarding call setup information that is representative of the first cellular telephone call from the mobile switching center to a SS7 gateway and sending a location request communication to a home location register;

(c) means for receiving an access denied response with a reason code of at least one of MS Inactive, Busy, No Page Response and Unavailable from the home location register;

(d) a message generator operable to generate, in response to receipt of the access denied response, a message at the SS7 gateway including information identifying the origin of the telephone call;

(e) means for sending the message to a message center; and

(f) means for forwarding the message to the second cellular telephone when the second cellular telephone registers with the home location register, thereby providing notification of a missed call.]

[**31**. The system of claim **30**, wherein the message is generated only when the cellular telephone is not registered with the home location register.]

[**32**. The system of claim **30**, wherein the message is generated only when the cellular telephone is powered off.]

[**33**. The system of claim **30**, wherein the message comprises at least one of a telephone number from which the telephone call originated, a name and a time of the telephone call.]

[**34**. The system of claim **30**, further comprising means for filtering telephone calls for which notification is provided.]

[**35**. The system of claim **30**, wherein the home location register is associated with a mobile switching center.]

[**36**. The system of claim **30**, wherein the same business entity operates both the central office and a cellular telephone network.]

[**37**. The system of claim **30**, wherein an incremental cost to a customer for receiving missed call notification via the system of claim **20** is less than an incremental cost to the customer for voice mail service.]

[**38**. The system of claim **30**, wherein the message generator is implemented in one of hardware, software or a combination thereof.]

[**39**. The system of claim **30**, wherein the message is a short message service (SMS) message.]

40. An apparatus to provide missed call notification to a mobile communication device, comprising a control signaling facility configured to:

receive call setup information regarding a call to said mobile communication device;

send an inquiry to a facility for maintaining status of said mobile communication device;

receive a response to said inquiry indicating that said mobile communication device cannot receive communications; and,

in response to receiving said response, provide a message containing information identifying the origin of said call to a message forwarding facility for subsequent forwarding to said mobile communication device when said mobile communication device is able to receive the message.

41. The apparatus according to claim 40, wherein said control signaling facility utilizes SS7.

42. The apparatus according to claim 40, wherein said control signaling facility comprises a message generator to provide a message to a message forwarding facility.

43. A system to provide missed call notification to a mobile communication device, comprising:

a control signaling facility configured to:

receive call setup information regarding a call to mobile communication device;

send an inquiry to a facility for maintaining status of said mobile communication device;

receive a response to said inquiry indicating that said mobile communication device cannot receive communications; and,

in response to receiving said response, generate a message containing information identifying the origin of said call; and

a message center configured to receive said message from said control signaling facility and forward said message to said mobile communication device when said mobile communication device is able to receive the message.

44. The system according to claim 43, wherein said control signaling facility utilizes SS7.

45. The system according to claim 43, wherein said control signaling facility comprises a message generator to provide a message to said message center.

46. The system according to claim 43, wherein said facility for maintaining status of said mobile communication device comprises a home location register.

47. The system according to claim 43, further comprising:

a filter to filter telephone calls for which messages are to be provided to said mobile communication device.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : RE43,726 E
APPLICATION NO. : 12/099930
DATED : October 9, 2012
INVENTOR(S) : Kregel

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Specifications:

In Column 3, Line 50, delete "central office 100" and insert -- central office 110 --, therefor.

In Column 3, Line 52, delete "CO 100" and insert -- CO 110 --, therefor.

In Column 4, Line 20, delete "CO 100" and insert -- CO 110 --, therefor.

In Column 4, Line 38, delete ""inavailable"" and insert -- "Unavailable" --, therefor.

In Column 5, Line 43, delete "335." and insert -- 355. --, therefor.

In the Claims:

In Column 9, Line 30, in Claim 28, delete "hardware" and insert -- hardware, --, therefor.

In Column 10, Line 39, in Claim 43, delete "call to mobile" and insert -- call to said mobile --, therefor.

Signed and Sealed this
Fourth Day of June, 2013

Teresa Stanek Rea

Teresa Stanek Rea
Acting Director of the United States Patent and Trademark Office