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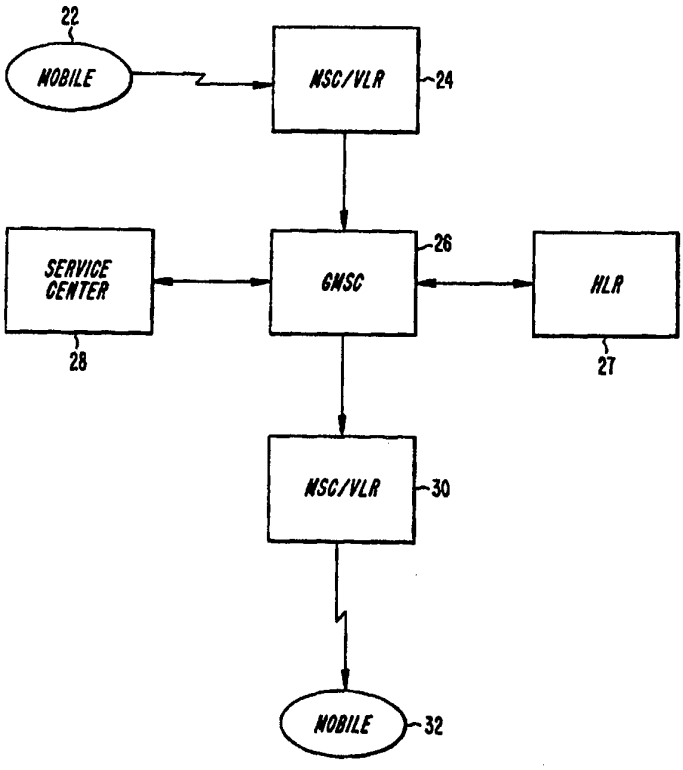
(57) Abstract

A method and system for improving the routing of messages in a radio communication system are disclosed. In an exemplary system, messages which originate at a mobile unit are routed through both a service center associated with the originating mobile and a service center associated with a recipient mobile.



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A SYSTEM AND METHOD FOR ROUTING MESSAGES IN RADIO COMMUNICATION SYSTEMS

BACKGROUND

The present invention generally relates to radiocommunication systems and methods for signalling in radiocommunication systems and, more particularly, an exemplary embodiment of the present invention based on the Global System for Mobile Communications (GSM) illustrates a method and system for routing messages.

The GSM describes a European standard for radiocommunication and the corresponding Public Land Mobile Network (PLMN) which is intended to provide uniformity so that users can access radiocommunication systems throughout Europe with minimal equipment compatibility problems. The GSM includes many services for subscribers, including a message function service called the Short Message Service which provides for the transmission of messages having up to 160 alphanumeric characters to be sent to a subscriber at his or her mobile unit.

This service is similar in many ways to a conventional paging function, but also has several differences. For example, if a phone is switched off, or otherwise unreachable, the message is stored and can later be sent to the designated subscriber when that subscriber is reconnected to the system. The message can originate by either being transmitted from a mobile unit to a service center for transmission to the subscriber or can simply be submitted by calling an operator at a service center who types the message into the system.

When a message is delivered from a service center to a mobile unit, under the GSM specification such a message is termed a "mobile terminated short message" (MTSM). If the message also

originates at a mobile unit, the signal to the service center requesting the message is termed a "mobile originated short message" (MOSM). The conventional protocol for transmission of MTSMs is well established in the GSM, for example in the document entitled "GSM 09.02-Version 2" published in June 1992 which is incorporated here by reference and is described in more detail below with respect to Figure 1.

An MTSM originates after a request to service center 2, which is a node that is interfaced with a gateway mobile services switching center (GMSC) 4. The network port provided by gateway mobile services switching centers are typically further described as "interworking" when messages are being sent in the direction from the GMSC to a service center, however this additional term has been dropped to simplify the description of these centers in this document. The GMSC acts as a port into the public land mobile network. The service center stores message service profiles detailing the preferences and subscription details of each subscriber with respect to messages for each of the mobile units which it services. For example, a particular subscriber may prefer that messages be transmitted in the form of facsimiles rather than other types of media (e.g., a short message) or a subscriber may prefer that the messages which he or she generates be copied and stored prior to transmission.

The request to send a message to a subscriber can be transmitted to the service center 2 in many ways, e.g., by calling an operator in the service center, by facsimile message to the service center, etc. A message is then transmitted to the GMSC 4 using, for example, an interface specified in a document entitled "Technical Report, GSM 03.47", which is incorporated here by reference. The recipient mobile station is identified by, for example, its MSISDN number.

Before the GMSC 4 can deliver the message through the chain of nodes to the base station (not shown) which is serving the recipient's mobile station, the GMSC 4 first interrogates the recipient's home location register (HLR) 6 to obtain routing information for the message. The HLR 6 stores data relating to subscribers including, for example, current location of the subscribers' equipment, directory number (MSISDN), radio number plan identification (e.g., International Mobile Subscriber Identity (IMSI)), supplementary service profiles and teleservice profiles. To interrogate the home location register 6, a GSM MAP message called "Send Routing Information for Short Message" is sent by the GMSC 4 to the home location register 6. The appropriate home location register can be determined using the recipient's MSISDN, e.g., by translating the MSISDN into a CCITT No. 7 address.

After receiving the routing information, the GMSC 4 forwards the message to the mobile services switching center (MSC) 8 which is currently serving the recipient's mobile station. The mobile services switching center provides an interface for switching functions and hardware control which are used when establishing a call. Note that for purposes of simplicity the visitor location register (VLR) has been illustrated in Figure 1 as being integrated with the mobile switching center, although in practice these two nodes can be physically separated. The VLR contains a copy of the information pertaining to a mobile unit which is stored in the mobile unit's home location register when the mobile unit has roamed into the service area of that VLR, the VLR being updated with information from a subscriber's home location register.

The message is then delivered to the mobile unit 10 via a base station (not shown) over the air interface. Acknowledgement signals are then transmitted back through the chain of nodes.

For MOSMs, on the other hand, the conventional routing procedure described by GSM is unclear. The specification identifies a procedure whereby the message is routed via one of the service centers, but no mention is made as to whether the service center is that of the originator or the recipient.

SUMMARY

These and other drawbacks and difficulties found in conventional radio communication systems, for example the GSM system, are overcome according to the present invention. According to exemplary embodiments of the present invention, messages which originate at a mobile station are routed through both an originator's and a recipient's service center to take advantage of the information stored at both centers.

Routing the message through an originator's service center has, for example, an advantage that the originator of the message can design his or her personal message service, e.g., distribution lists, storing copies of messages before they are sent, etc. Moreover, the originator's mobile unit will append the address of the originator's service center which is stored in the mobile or the originator's SIM card to the signal so that the originator need not enter a service center address for the message.

Routing the message through the recipient's service center, on the other hand, has the advantage that the recipient's preferences and current availability status can be taken into account when transmitting the message to the recipient's mobile unit. To enable such routing, the address of the recipient's service center must be known. According to the conventional systems and methods, the originating subscriber will have to know and specify not only the MSISDN number of

the recipient, but also his or her service center address (or call an operator in his own service center, who may or may not know this address). According to the present invention this address can be stored in the HLR, so that the originator need not know this information.

Thus, according to the present invention, message routing receives the advantages that are obtained when a message is routed via the originator's service center as well as via the recipient's service center. Further, exemplary embodiments also describe an interface protocol between the recipient's home location register and the recipient's service center to selectively provide profile information which can be used for routing messages.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing objects, features and advantages of the present invention will be more readily understood upon reading the following detailed description in conjunction with the drawings in which:

Figure 1 illustrates a conventional block diagram of a node map for routing messages;
Figure 2 illustrates a second node map used to describe the routing of messages which originate at a mobile through only a recipient's service center; and
Figure 3 shows a node map for routing messages according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION

To illustrate the drawbacks associated with a procedure where messages are routed through only one of the service centers, routing through the recipient's service center will now be described with respect to Figure 2. A message originates at

mobile 22 and is transmitted to that mobile station's servicing MSC/VLR 24. As mentioned above, with respect to Figure 1, the VLR can be physically separated from the MSC. If the MSC 24 is not also the gateway mobile services switching center which serves the recipient's mobile, the service center address received from the mobile unit is translated into routing information and the message can be forwarded to the GMSC 26. The GMSC 26 then sends the message to the recipient's service center 28 based on information received from HLR 27. Thereafter, the message is treated as an MTSM and sent through the GMSC 26 and MSC/VLR 30 to the recipient's mobile unit 32.

Thus, according to this routing method, MOSMs are routed through the recipient's service center but not through the originator's service center. However, this approach has, among other drawbacks, the drawback that information must be input by the originator to identify both the recipient and the recipient's service center and that message routing preferences of the originator cannot be taken into account in forwarding the message. Analogously, if the message were routed through only the originator's service center, the recipient's message routing preferences would not be taken into account.

According to an exemplary embodiment of the present invention illustrated in Figure 3, a mobile originated message can pass through both an originator's service center and an intended recipient's service center. The message is transmitted from the mobile unit 34 to a base station (not shown) and passed on to the mobile services switching center/visitor location register 38 in a conventional manner. By storing the service center address of the originator, the message can be transmitted through the originator's service center 40 although the originator need only input an identifier of the recipient, e.g., by dialing the recipient's number. The address of the originator's service center 40 can be stored, for example, in

the mobile or in a smart card which is removably attached to the mobile, and appended automatically to the transmission from the mobile.

Alternately, the service center address can be sent to the MSC/VLR 38 from the HLR of the originator (not shown). This transmission can occur, for example, during location updating when the mobile enters the service area of the MSC.

The message is next routed to the appropriate gateway mobile services switching center 42, which is connected to the originator's service center 40, based on the address forwarded from the mobile 34. The message is sent to the originator's service center 40 where it is processed according to any procedures indicated by the originator's message subscriber profile stored in the service center 40. The message is then sent back to the GMSC 42. To route the message to the appropriate location/node that is currently serving the recipient's mobile, the GMSC 42 will interrogate the recipient's home location register 44 to retrieve routing information. Note that although the GMSC 42 is illustrated as being directly connected to HLR 44, the GMSC 42 interrogates the HLR 44 through the network and this direct connection is shown for clarity in Figure 3.

However, according to an exemplary embodiment of the present invention, the HLR 44 and recipient's service center 46 can communicate via a previously unknown and undefined interface. The protocol for this interface is herein called "SC-MAP" and is structured in a manner similar to the protocol known as the GSM 09.02 MAP which is described in the earlier incorporated document. That is, SC-MAP can be structured using a CCITT No. 7 based protocol using MTP, SCCP and TCAP from the CCITT No. 7 protocol stack. The CCITT No. 7 signalling system is well known to those skilled in the art and, accordingly, is not further discussed herein. Although this exemplary format for

the communication between HLR 44 and service center 46 is chosen for its similarity to other communication formats, there has previously been no such interface between the recipient's HLR and service center in conventional systems, such as the GSM, and those skilled in the art will readily appreciate that other interface formats can also be used.

The HLR 44 can store an indication for each subscriber indicating whether that subscription includes the enhanced message service that the HLR-service center interface offers. This indication is herein called the Enhanced Message Service Indicator (EMSI). Further, a service center address for each subscriber can also be stored in the HLR 44.

When the HLR 44 is interrogated, e.g., by sending a MAP operation "Send Routing Information For SM", the HLR 44 checks the EMSI for that particular subscriber to see whether the recipient's service center 46 shall be interfaced or not. If the EMSI indicates that the service center shall be interrogated, the SC-MAP message, for example, a "Message Service Enquiry" signal, is sent to the service center 46. The protocol for the exemplary "Message Service Enquiry" is discussed in more detail below. When the service center 46 receives this message it checks the service profile for the subscriber in question to determine the preferences and status of that subscriber, for example, how the subscriber wants to be notified of messages at this particular time. This information is reported back to the HLR 44 in a return message.

If the subscriber profile stored in the service center 46 indicates that the MTSM procedure should be used to send the message to the subscriber, the HLR 44 returns routing information indicating the MSC/VLR 48 which services the area where the recipient's mobile 50 is currently located to the inter-

rogating GMSC 42, and the message is transmitted as an MTSM as described above.

If the subscriber profile indicates that mapping to another message type, e.g., to facsimile, is to be performed, the MTSM is not forwarded to the MSC/VLR 48 where the recipient's mobile 50 is located, but instead is forwarded to the recipient's service center 46 where the translation of the MTSM to the requested message service is performed. To enable this forwarding, the address of the recipient's service center 46 is returned to the interrogating GMSC 42 by the HLR 44. After receiving the message, the recipient's service center 46 is now responsible for the MTSM delivery and will inform the originator's service center 40 that the message is being delivered so that the originator's service center does not resend the message. After translating the message or otherwise adapting the message to the recipient's preferences, the message is forwarded from the recipient's service center 46 to the specified equipment which can, for example, be mobile 50. The actual mapping or translation of the message into the requested service and subsequent delivery, e.g., to the recipient's mobile 50, can be performed using conventional techniques which are outside the scope of the present invention and are, therefore, not further discussed herein.

The foregoing Message Service Enquiry operation can be structured as, for example, set forth below using the Abstract Syntax Notation No. 1 specified by CCITT.

```
MessageServiceEnquiry :: =     OPERATION

PARAMETER
     msIsdn                    ISDNAddressString

RESULT                         SEQUENCE{
     mt-SM-AllowedFlag              Boolean,
     routingInformation             RoutingInformation OPTIONAL}

ERRORS                         UnknownSubscriber
```

As mentioned above, this exemplary operation can be invoked to interface the HLR 44 and service center 46 if the subscriber has access to the enhanced message service. The RESULT variable mt-SM-AllowedFlag is returned in response to the PARAMETER msIsdn being passed. If, for example, the subscriber profile stored in the recipient's service center indicates that routing the message as an MTSM is appropriate, then the mt-SM-AllowedFlag is returned with a TRUE value. The optional routing information variable will not be returned since the message need not be routed through the recipient's service center.

If, on the other hand, the recipient subscriber's profile indicates that some procedure other than that used to route an MTSM is to be used for routing the message, then the mt-SM-AllowedFlag is set to FALSE and the address of the recipient's service center, or B-number relating thereto, is returned in the optional routing variable. As mentioned earlier, however, this protocol and functional implementation are simply an example of one way in which the interface between the HLR and service center can be implemented and those skilled in the art will understand that many other types of interfaces could also be implemented within the scope of the present invention. For example, the HLR could store all of the message service related subscriber data and instruct the service center as to how to perform in different traffic situations, for example, conversion from one media to another, e.g., from an MTSM to a facsimile.

While the present invention has been described using the foregoing exemplary embodiments, these embodiments are intended to be illustrative in all respects, rather than restrictive of the present invention. For example, although the term "mobile" has been used throughout this specification, the present invention can be applied to systems and methods wherein any type of remote equipment which supports the

message service is originating or receiving the message, e.g., a portable unit, a personal digital assistant, a data terminal, etc.

Moreover, although the foregoing exemplary embodiments refer to messages which originate at "mobiles", those skilled in the art will also recognize that the present invention can also be applied where other types of equipment originate the message, e.g., PSTNs or data networks. Further, although the present invention has been exemplified by embodiments which refer to the GSM, the present invention is equally applicable to any system or standard (e.g., PDC or ADC) wherein messages may be routed using methods or systems that include service centers or analogous equipment. Thus, the scope of the present invention is instead set forth by the appended claims and encompasses any and all equivalents and modifications embraced thereby.

WHAT IS CLAIMED IS:

1. A method for routing a message from an originator to a recipient comprising the steps of:
sending the message to an originator's service center which handles messages that are transmitted by the originator;
interrogating a home location register to obtain first routing information for the message;
interfacing the recipient's service center to obtain second routing information; and
informing a switching center of at least one of said first and second routing information.

2. The method of claim 1, further comprising the step of:
storing, prior to said sending step, addresses of subscribers' service centers in said home location register.

3. The method of claim 1, wherein said step of sending the message further comprises the step of:
appending an address of said originator's service center which is stored in an originator's equipment.

4. The method of claim 3, wherein said originator's equipment includes at least one of: a smart card, a SIM and a mobile unit.

5. The method of claim 2, further comprising the step of:
informing said switching center of an address of said originator's service center which has been retrieved from said home location register.

6. The method of claim 1 wherein said step of interfacing further comprises the step of:
determining whether said message is to be routed according to a standard procedure.

7. The method of claim 6, further comprising the step of:
routing said message, based on a result of said determining step, to either said recipient or to said recipient's service center.

8. The method of claim 7, further comprising the step of:
if said message is routed to said recipient's service center, processing said message according to said recipient's subscriber profile.

9. The method of claim 1, wherein said step of interrogating further comprises:
determining if a recipient's service center can be interfaced.

10. The method of claim 9, wherein said step of interfacing is selectively performed based on a result of said determining step.

11. The method of claim 1, wherein said step of interfacing further comprises the step of:
interfacing the recipient's service center from said recipient's home location register.

12. A radiocommunication system for transmitting a message from an originator to a recipient comprising:
an originator's service center means for storing
a subscriber profile of said originator;
a recipient's service center means for storing a subscriber profile of said recipient; and
means for forwarding said message from said originator to said recipient using subscriber profile information received from said originator's service center and, if available, from said recipient's service center.

13. The radiocommunication system of claim 12, wherein said forwarding means further comprises:
a gateway mobile services switching center means for receiving said message from a remote unit and sending said message to said originator's service center for processing according to subscriber profile information.

14. The radiocommunication system of claim 13, wherein said forwarding means further comprises:
home location register means for storing location information relating to said recipient; and
wherein said gateway mobile services switching center means is also for interrogating said home location register means to obtain routing information for said message.

15. The radiocommunication system of claim 14, wherein said forwarding means further comprises:
interface means for selectively allowing subscriber profile information to be transferred between said home location register means and said recipient's service center.

16. The radiocommunication system of claim 15, wherein said home location register means is also for determining if said recipient has subscribed to an enhanced message service and to actuate said interface means to transfer subscriber profile information based on a result of the determination.

17. The radiocommunication system of claim 16, wherein:
said gateway mobile services switching center routes said message to either said recipient or said recipient's service center based on said subscriber profile information.

18. The radiocommunication system of claim 12, wherein said forwarding means further comprises:
means for retrieving an address of said originator's service center which is stored in an originator's equipment.

19. The method of claim 18, wherein said originator's equipment includes at least one of:
a smart card, a SIM and a mobile unit.

20. The radiocommunication system of claim 12, further comprising:
home location register means for storing service center addresses of subscribers.

21. The radiocommunication system of claim 20, wherein said forwarding means further comprises:
means for informing said switching center of an address of said originator's service center which has been retrieved from said home location register.

22. A radiocommunication system for transmitting a message from an originator to a recipient comprising:
an originator's service center means for storing first message routing information;
a recipient's service center means for storing second message routing information; and
means for routing said message through both of said originator's service center means and said recipient's service center means.

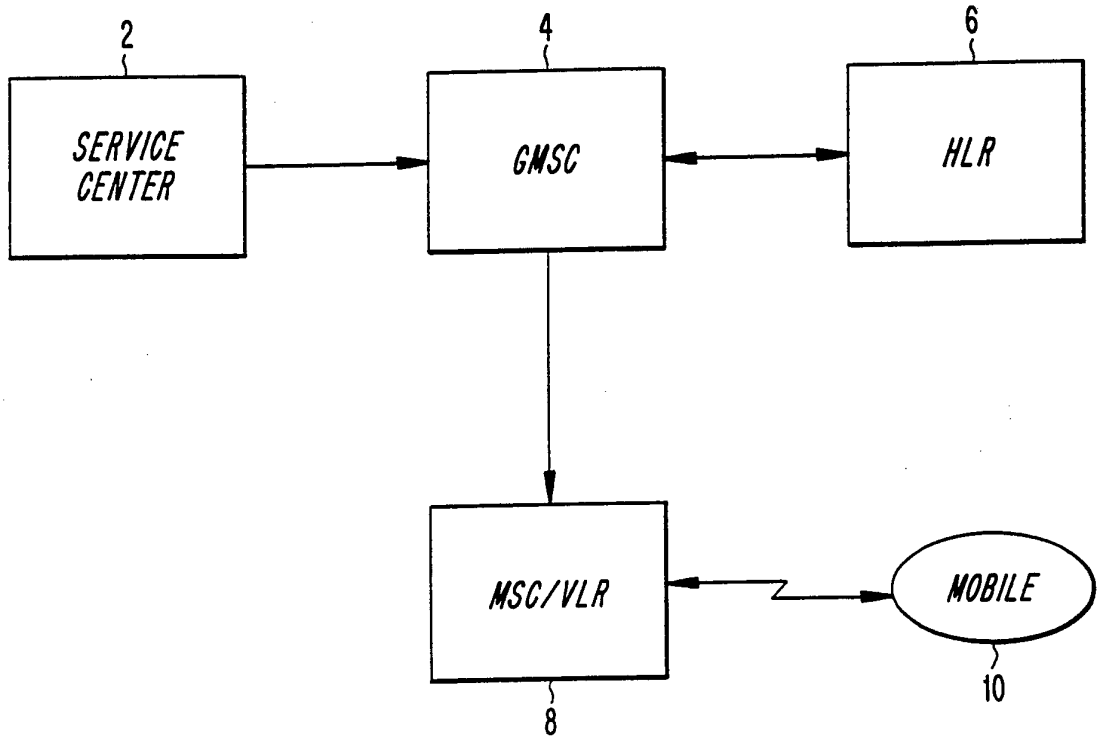

Fig. 1
(PRIOR ART)

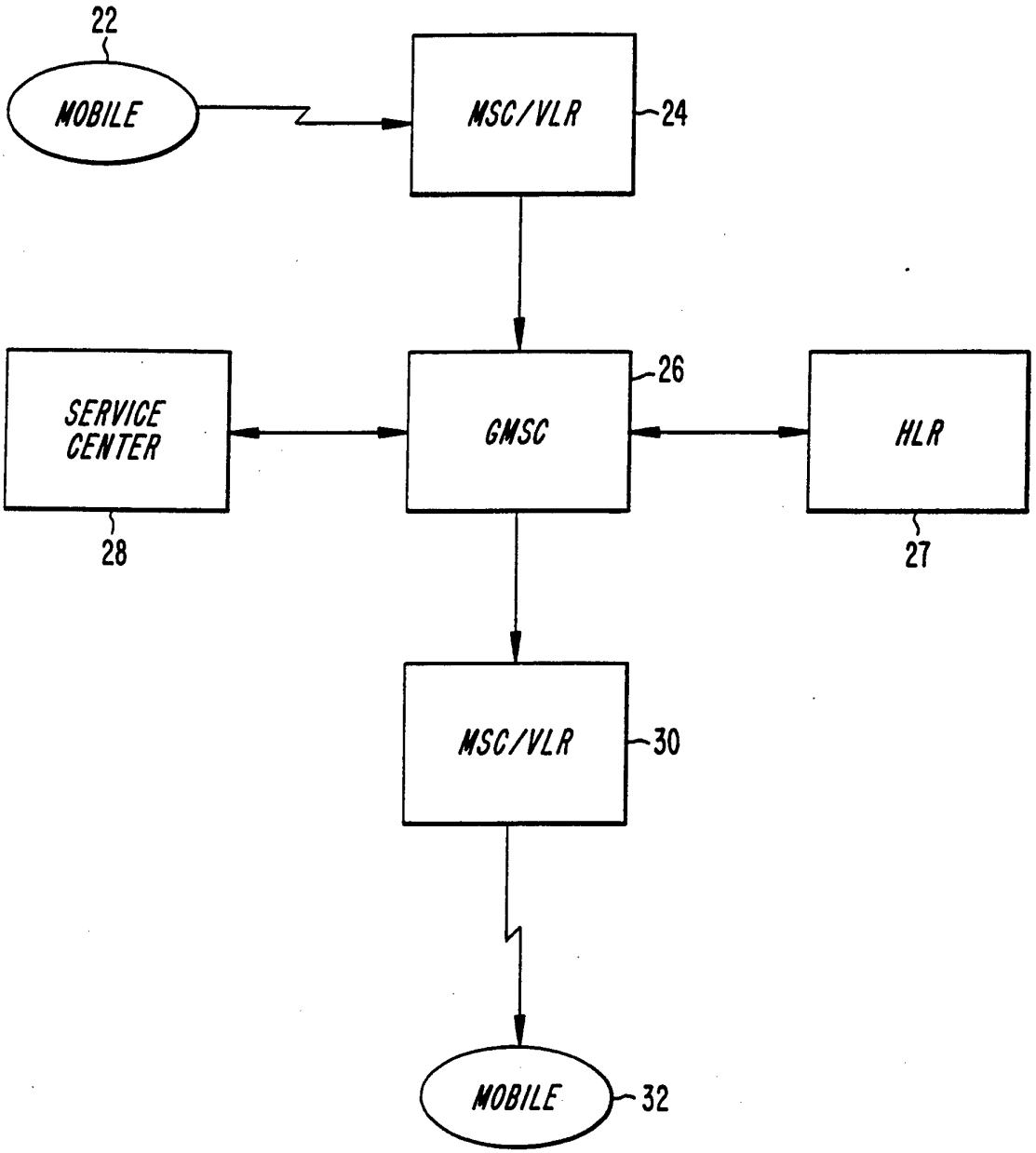
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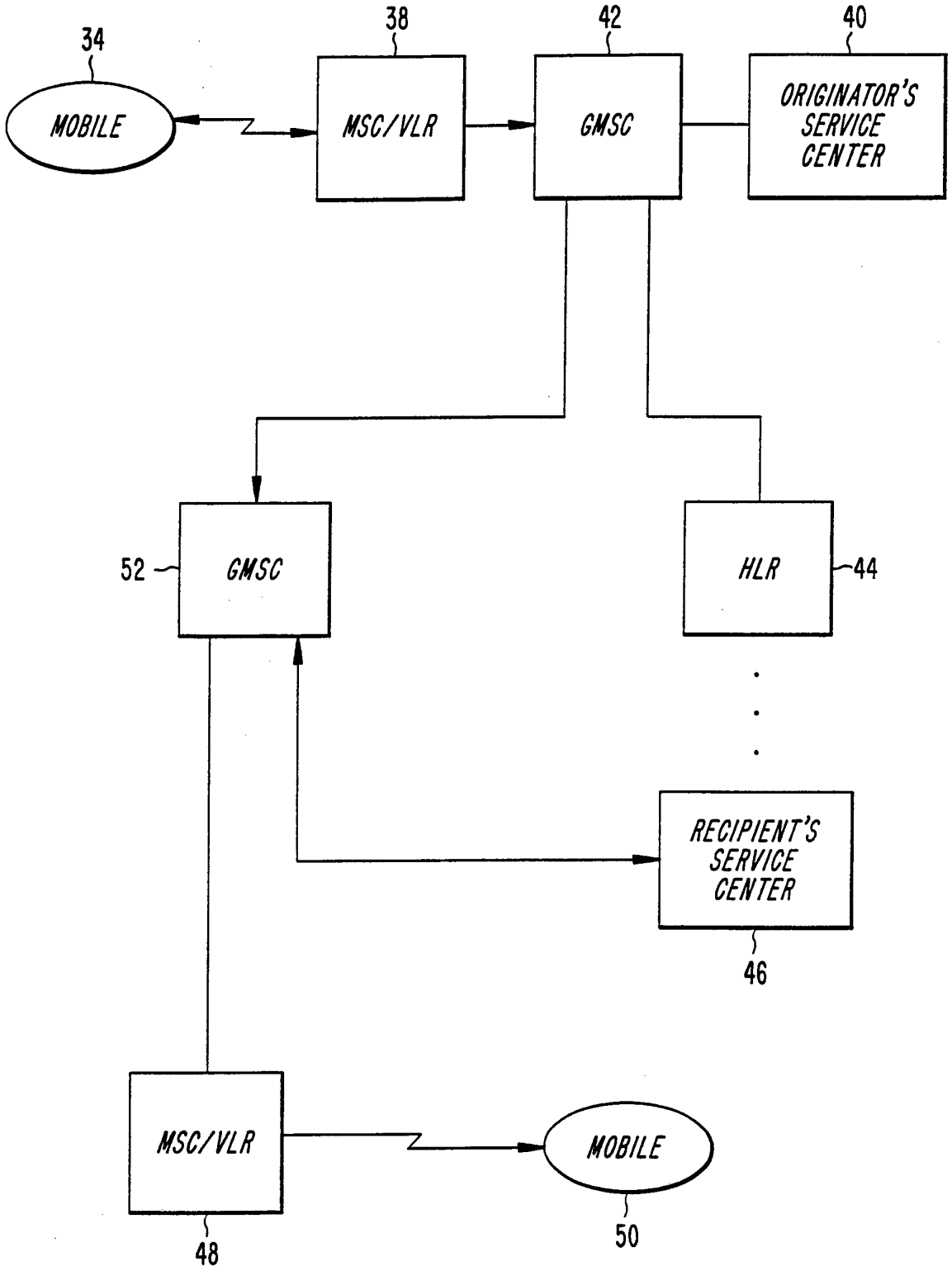
Fig. 2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50

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 94/00999

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/22
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)

IPC6: 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, A1, 9326131 (NOKIA TELECOMMUNICATIONS OY), 23 December 1993 (23.12.93), page 8, line 1 - page 9, line 35 --	1-22
X	ITG-Fachbericht 124 Mobile Kommunikation Vorträge der ITG-Fachtagung vom 27, bis 29. September 1993 in Neu-Ulm, Hientz et al: "Der Short Message Service - ein neuer Dienst der Digitalen Mobilkommunikation" paragraphs 1.2,1.3 and 1.5	1,2,4,6-11, 22
A	-- --------	12-21

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Date of the actual completion of the international search	Date of mailing of the international search report
28 February 1995	02 -03- 1995
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 Bengt Jonsson Telephone No. +46 8 782 25 00

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

09/02/95

International application No.
PCT/SE 94/00999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A1- 9326131	23/12/93	NONE	