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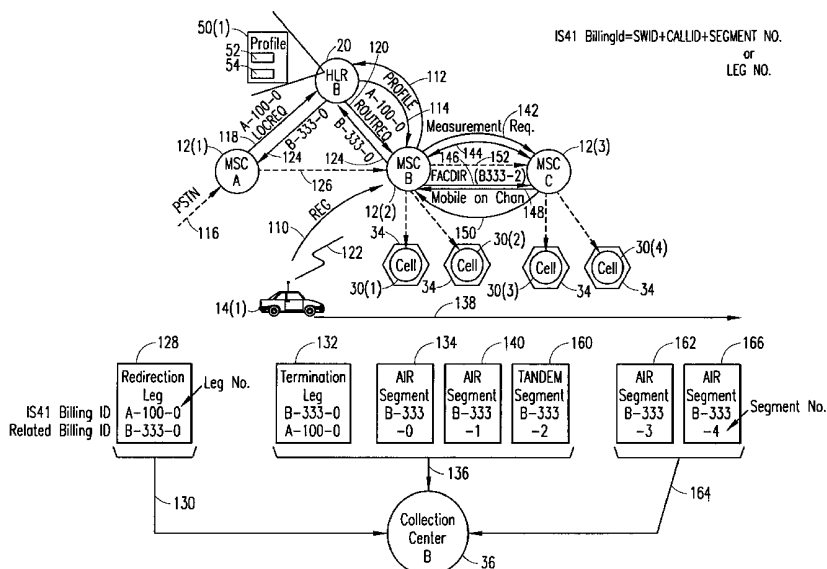
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(54) Title: **EVENT RECORDING REPORTING DESIGNATION DOWNLOADED WITH SUBSCRIBER PROFILE**



(57) **Abstract:** A home location register (20) stores the service profile (50) for each individual subscriber. The stored profile includes instructions specifying for that particular subscriber the amount and nature of calling service related atomic data to be reported by telecommunications network service nodes. In connection with the provision (102) of calling services to that subscriber's mobile station, the home location register stored service profile is downloaded to, and propagated between, the implicated network service nodes (12). Responsive to the instructions contained in the subscriber profile, each network service node implicated in providing calling services collects (104) and reports (106) on only that calling service related atomic data as is specified by that subscriber's service profile.



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**EVENT RECORDATION REPORTING DESIGNATION
DOWNLOADED WITH SUBSCRIBER PROFILE**

BACKGROUND OF THE INVENTION

Technical Field of the Invention

The present invention relates to the collection of cellular call event related atomic data from cellular telephone network service nodes (like mobile switching centers) and, in particular, to the designation on a subscriber-by-subscriber basis of the nature and amount of the event information to be reported in connection with subscriber calling activities.

Description of Related Art

Reference is now made to FIGURE 1 wherein there is shown a schematic diagram of a cellular telephone network 10 including a plurality of interconnected mobile switching centers (MSCs) 12. Although only three mobile switching centers 12 are shown, it will be understood that the network 10 likely includes many more interconnected service nodes. The first, second and third mobile switching centers 12(1), 12(2) and 12(3) may comprise any one of a number of known telecommunications switching devices as commonly used and known in the art for providing either digital or analog cellular telephone service to a plurality of mobile stations (MS) 14. The mobile switching centers 12 are interconnected with each other for communication via both voice trunks 18 (illustrated with broken lines) and signaling links 16 (illustrated with solid lines) providing a known connection, such as an ISUP, TUP, MAP, IS-41 or R1 or R2 type connection. The voice trunks 18 provide voice and data communications paths used to carry subscriber communications between the mobile switching centers 12. The signaling links 16 carry command signals between the mobile switching centers 12. These signals may be used, for example, in setting up and tearing down voice and data communications links over the voice trunks 18 and controlling the provision of calling services to the mobile stations 14. The mobile switching centers 12 are also connected to a home location register (HLR) 20 database by means of signaling links 22 providing a known connection, such as a Mobile Application Part (MAP) or IS-41 type connection. The home location register 20 stores information concerning the mobile stations 14 (and

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their associated subscribers) comprising location information and service information (more generally referred to as a service profile).

In one implementation, the mobile switching centers 12 are further connected to at least one associated base station controller (BSC) 24 via both a signaling link 26 and a voice trunk 28. Only one base station controller 24 is shown connected to the mobile switching center 12(1) in order to simplify the illustration. The voice trunk 28 provides a voice and data communications path used to carry subscriber communications between the mobile switching center 12(1) and its base station controller 24. The signaling link 26 carries command signals between the node 12 and its associated base station controller 24. The base station controller 24 is then connected to a plurality of base stations (BS) 30 which operate to effectuate radio frequency communications with proximately located mobile stations 14 over an air interface 32. The base station controller 24 functions in a well known manner to control this radio frequency communications operation. In another implementation, the mobile switching center 12(2) is connected directly to the plurality of base stations (BS) 30. The functionality provided by the base station controller 24 in controlling the radio frequency communications operation is then instead performed by the mobile switching center 12(2).

The base stations 30 engage in simultaneous communications with plural mobile stations 14 operating roughly within the area of an associated cell 34. The control channel assigned to each cell 34 is used to carry system control signals between the base station 30 and proximately located mobile stations 14, and also to assist in the network with mobile station cell reselection. Such control signals include call originations, page signals, page response signals, location registration signals, traffic channel assignments, maintenance instructions, and cell selection or reselection instructions. The traffic channels provided in each cell 34 are used to carry subscriber voice or data communications between the base station 30 and proximately located mobile stations 14 and also to assist in the hand-off operation.

Although direct communications links (signaling and/or trunk) are illustrated in FIGURE 1, it is understood by those skilled in the art that the links are not necessarily direct between the illustrated nodes, and may instead pass through many other communications nodes (not shown) of the mobile network, and perhaps even

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utilize other communications networks (such as the public switched telephone network - PSTN). Illustration of the links in the virtual manner shown in FIGURE 1 is therefore by way of simplification of the drawing. The cellular telephone network 10 may comprise a Global System for Mobile (GSM) communications, an Advanced Mobile Phone System (AMPS), a digital Advanced Mobile Phone System (D-AMPS),
5 a code division multiple access (CDMA) system, or the like.

It is well known in the art for the nodes of the network 10 to collect and remotely report on certain data concerning subscriber calling activities. To this end, certain ones of the network service nodes (most likely comprising mobile switching
10 centers (as shown), service switching points, or service control points) are connected to a data collection center 36 via data communication links 38 that may comprise either SS7 signaling links of the network 10 or a separate data communications network (like an X.25 network). The collected and reported data is then stored at the collection center 36 awaiting further distribution (perhaps in real time) to entities 40
15 having a need for that information. Examples of such entities 40 that may need access to the reported information include service providers, service operators, law enforcement agencies, maintenance personnel, billing entities, resellers, customer care, credit monitoring, fraud detection, subscriber profiling, long distance scrutinization, and the like.

20 The collected and reported data is sometimes referred to in the art as "atomic data," and composes, for example, leg data, air interface data, tandem data, audit data, event data, and the like. The atomic data comprises, for example, account code digits, air channel duration, bearer indication, billing digits, called digits, called party identification, calling digits, CDMA code channel, CDMA pilot strength, cell
25 identifier, cell name, dialed digits, destination digits, duration, location (longitude, latitude), mobile directory number, mobile identification number, modulation indicator, radio channel number, SAT color code, signal quality, system identification, time of day, time date offset, trunk group, trunk number, voice mobile attenuation code, and the like, as generated by the network service nodes during the handling of
30 calling services for mobile station subscribers. In accordance with the teachings of the prior art, a designation is made by the network operator within each implicated network 10 service node as to what (if any) atomic data is to be collected and reported

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by that node to collection center 36. The service node then operates in accordance with the network operator specified data collection instruction and collects and reports on that specified data for each call and with respect to all serviced subscriber mobile stations. In this way, the prior art teaches specification of atomic data collection and reporting efforts on a service node-by-service node basis.

It is sometimes the case, however, that the network operator selection of the atomic data to be collected and reported does not match the needs of the entities to whom the collection center distributes collected data. The collected, reported and distributed data often comprises either too little or too much or not the right information. As the collected data, especially with respect to true third parties as entities (i.e., other than the network operator) and recipients of the data, often times comprises a commodity that is sold, the collection of not the right amount or nature of atomic data lessens the value of the data and adversely affects its marketability and the revenues that may be collected from its sale. Another adverse affect from not collecting the right amount or nature of the atomic data is that the reporting of unwanted or unnecessary data wastes valuable network resources (such as is provided through the data communication links 38) expended in collecting and transporting the data.

What is needed is better way to specify the amount and nature of the atomic data to be collected by network service nodes such that the data that is collected and reported is more pertinent and valuable than the data historically collected on a service node-by-service node basis.

SUMMARY OF THE INVENTION

An instruction specifying on a subscriber-by-subscriber basis the amount and nature of calling service related atomic data to be reported by telecommunications network service nodes is stored by the home location register in each subscriber's service profile. The service profile is then downloaded to, and propagated between, network service nodes in connection with the provision of calling services to a certain subscriber mobile station. In accordance with the included instructions, each network service node, in the context of providing calling services to that certain subscriber

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mobile station, collects and reports on the calling service related atomic data as specified by that subscriber's service profile.

BRIEF DESCRIPTION OF THE DRAWINGS

5 A more complete understanding of the method and apparatus of the present invention may be acquired by reference to the following Detailed Description when taken in conjunction with the accompanying Drawings wherein:

FIGURE 1 is a block diagram of a portion of a cellular telephone network in which the present invention may be implemented;

10 FIGURE 2 is a flow diagram illustrating a method of operation for a network service node in accordance with the present invention to collect and report atomic data on a subscriber-by-subscriber basis; and

FIGURE 3 is a diagram illustrating the specification and propagation of an individual subscriber's atomic data collection and reporting instruction in the context of an exemplary calling scenario.

15 DETAILED DESCRIPTION OF THE DRAWINGS

Continued reference is now made to FIGURE 1. As mentioned above, the home location register 20 stores information concerning each of the mobile stations 14 comprising location information and service information (more generally referred to as a subscriber service profile 50). In addition to the conventional, well known, 20 information 52 (like subscribed to services, calling lists, and the like) stored in each service profile 50 for each subscriber, the present invention proposes also including another piece of information 54 in the service profile for each subscriber comprising a specification for that subscriber of the amount and nature of the atomic data to be collected by the network service nodes that provide calling service to that mobile 25 station (subscriber). This allows the network operator to set, on a subscriber-by-subscriber basis instead of a network service node-by-service node basis, the amount and nature of the atomic data to be collected and reported.

30 At each instance where the home location register 20 would retrieve and deliver a service profile 50 for a certain subscriber mobile station, that delivered service profile would include both the conventional service information 52 as well as

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the atomic data collection and reporting instruction information 54. For example, the information 52 and 54 would be communicated to a serving mobile switching center (service node) upon registration or in response to a profile update request.

5 Still further, the information 52 and 54 is propagated through the network in all cases where the certain subscriber's service profile must be provided. As an example, in the case of an intelligent network (IN) application, the information 52 and 54 would be passed in an origination request towards the serving service control point (SCP service node). As another example, in the context of an inter-exchange handoff, the information 52 and 54 would be passed on to the next serving mobile switching
10 center (the target exchange service node) in a facilities directive message. As yet another example, the information 52 and 54 would be passed among and between service nodes in the appropriate signaling messages for short message service (SMS), unknown page response, and the like, examples of which are well known to those skilled in the art.

15 In each instance, the network service node that receives the service profile 50 (including the information 52 and 54) would utilize the instructions provided by the information 54 to determine the amount and nature of the atomic data to be collected and reported by that service node. Thereafter, in connection with the provision of service to the mobile station subscriber, the network service node will collect atomic
20 data in accordance with the information 54 specified instructions, with the collected data reported back to the collection center 36.

Reference is now made to FIGURE 2 wherein there is shown a flow diagram illustrating a method of operation for a network service node in accordance with the present invention. In step 100, the network service node receives a service profile for
25 a subscriber mobile station. The service profile includes both the conventional service information as well as the atomic data collection and reporting instruction information in accordance with the present invention. The network service node then provides calling services to the mobile station in step 102. While providing the step 102 calling services to the mobile station subscriber, the network service node collects, in step
30 104, the atomic data relating to the provided calling services in accordance with the collection and reporting instruction contained within the received service profile for that mobile station subscriber. In this way, the atomic data to be collected by the

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network service node may be specified on a subscriber-by-subscriber basis in order to ensure that only the most appropriate and relevant data is collected. In step 106, the collected atomic data is then reported to the collection center for subsequent post processing.

5 Reference is now made to FIGURE 3 wherein there is shown a diagram illustrating the specification and propagation of an individual subscriber's atomic data collection and reporting instruction in the context of an exemplary calling scenario. The home location register 20 includes a subscriber service profile 50(1) for subscriber mobile station 14(1) that contains atomic data collection and reporting
10 instruction information 54 in accordance with the present invention. This information 54, in the context of the present example, specifies that for this subscriber mobile station 14(1), the collected and reported atomic information comprises leg and segment information.

 Responsive to a mobile station 14(1) registration 110 with a serving mobile
15 switching center 12(2), that mobile switching center retrieves 112 and 114 from the home location register 20 the service profile 50(1) for that registering mobile station. The service profile 50(1) includes both the conventional service information 52 as well as the atomic data collection and reporting instruction information 54 for that subscriber mobile station 14(1). The home location register 20 further records the
20 location of the mobile station 14(1) as currently being served by mobile switching center 12(2).

 Thereafter, an incoming call 116 dialed to the mobile station 14(1) is received (for example, from the PSTN), and an originating mobile switching center 12(1) contacts the home location register 20 with a location request message 118. The home
25 location register 20 determines from its stored location records that the called mobile station 14(1) is currently being served by mobile switching center 12(2), and sends a routing request message 120 to that mobile switching center. The serving mobile switching center 12(2) then pages for the mobile station 14(1) (not shown) and responsive to an acknowledgment (also not shown) establishes an air interface
30 connection 122 with the mobile station. In the meantime, the serving mobile switching center assigns a routing number (such as a temporary location directory number - TLDN) to the mobile station 14(1) and reports 124 that number, along with

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the atomic data reporting and collection information 54, back to the originating mobile switching center 12(1). Using the TLDN, the originating mobile switching center 12(1) forwards 126 the call 116 on to the serving mobile switching center 12(2) for delivery to the called mobile station 14(1) over the air interface connection 122.

5 In accordance with the atomic data reporting and collection information 54 instructions as specified for the subscriber mobile station 14(1), the originating mobile switching center 12(1) collects redirection leg data in a jacket 128 and delivers 130 that information to the collection center 36. Similarly, the serving mobile switching center 12(2) collects termination leg data in a jacket 132 and air segment data (relating
10 to serving base station 30(1)) in a jacket 134 and delivers 136 that information to the collection center 36.

 The called mobile station 14(1) was originally served through cell 34 base station 30(1) in connection with mobile switching center 12(2). As the mobile station 14(1) moves 138, an intra-exchange handoff occurs to base station 30(2). Responsive
15 to that handoff, and in accordance with the atomic data reporting and collection information 54 instructions as specified for the subscriber mobile station 14(1), the serving mobile switching center 12(2) collects air segment data (relating to serving base station 30(2)) in a jacket 140 and delivers 136 that information to the collection center 36.

20 The serving mobile switching center 12(2) next detects, due to the continued movement 138 of the subscriber mobile station 14(1), a need for a handoff, and in this case a need specifically for an inter-exchange handoff to another mobile switching center 12. The serving mobile switching center 12(2) sends a handoff measurement request message 142 to its neighboring mobile switching center 12(3) and receives
25 responsive measurements results 144. From the processing of those measurement results, the serving mobile switching center 12(2) determines that neighboring (target) mobile switching center 12(3) should take over handling the call, and sends a facilities directive message 146 to the target mobile switching center requesting assignment of a traffic channel for the call and including in that message the specified atomic data
30 reporting and collection information 54 for the mobile station 14(1). The target mobile switching center 12(3) selects a channel managed through one of its base stations 30(3) and reports 148 that information back to the serving mobile switching

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center 12(2). The serving mobile switching center 12(2) then sends the mobile station 14(1) a handoff order (not shown) identifying the selected channel of base station 30(3). The mobile station 14(1) next accesses that channel (not shown). Responsive to target mobile switching center 12(3) detection of the mobile station 14(1) on the selected channel of base station 30(3), a mobile on channel message 150 is sent to the serving mobile switching center 12(2), and the call 116 is forwarded 152 on to the target mobile switching center 12(3) for delivery to the called mobile station 14(1) over the air interface connection 122.

In accordance with the atomic data reporting and collection information 54 instructions as specified for the subscriber mobile station 14(1), the serving mobile switching center 12(2) collects tandem segment data in a jacket 160 and delivers 136 that information to the collection center 36. Similarly, the target mobile switching center 12(3) collects air segment data (relating to serving base station 30(3)) in a jacket 162 and delivers 164 that information to the collection center 36.

The called mobile station 14(1) was originally served through cell 34 base station 30(3) with respect to mobile switching center 12(3). As the mobile station 14(1) continues to move 138, an intra-exchange handoff occurs to base station 30(4). Responsive to that handoff, and in accordance with the atomic data reporting and collection information 54 instructions as specified for the subscriber mobile station 14(1), the target (now serving) mobile switching center 12(3) collects air segment data (relating to serving base station 30(4)) in a jacket 166 and delivers 164 that information to the collection center 36.

Although a preferred embodiment of the method and apparatus of the present invention has 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 embodiment 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.

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WHAT IS CLAIMED IS:

1. A home location register for a cellular telecommunications network, the register storing a subscriber profile for each serviced subscriber mobile station, that stored subscriber profile containing (a) subscriber service information specifying
5 services to be provided by the cellular telephone network for the subscriber mobile station and (b) instructions specifying for the associated subscriber mobile station the amount and nature of calling service related atomic data to be reported by service nodes of the cellular telecommunications network that provide calling services to that subscriber mobile station.
- 10 2. A method for collecting cellular calling service related atomic data on a subscriber-by-subscriber basis, comprising the steps of:
storing in a cellular service profile for each subscriber mobile station an instruction specifying for that subscriber mobile station the amount and nature of calling service related atomic data to be collected and reported by cellular
15 telecommunications network service nodes;
providing the cellular service profile to certain cellular telecommunications network service nodes that provide calling services to that subscriber mobile station;
collecting by those certain cellular telecommunications network service nodes during the provision of calling services to that subscriber mobile station of that calling
20 service related atomic data as specified in the cellular service profile provided instructions for that subscriber mobile station; and
reporting that collected calling service related atomic data to a data collection center.
- 25 3. The method as in claim 2 further including the step of propagating the cellular service profile provided instructions for that subscriber mobile station to each cellular telecommunications network service node implicated in the provision of calling services to that subscriber mobile station.
4. The method as in claim 3 wherein the step of propagating comprises the step of passing the information back to an originating service node from a

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currently serving service node in connection with a delivery of an incoming call to that subscriber mobile station.

5 5. The method as in claim 3 wherein the step of propagating comprises the step of passing the information forward to a target service node from a currently serving service node in connection with a subscriber mobile station call handoff.

6. A cellular communications network, comprising:
a home location register storing a subscriber profile for each serviced subscriber mobile station, that stored subscriber profile containing instructions specifying for the associated subscriber mobile station the amount and nature of
10 calling service related atomic data requested to be reported;
a cellular service node that provides calling services to a certain subscriber mobile station and receives the stored subscriber profile from the home location register for that certain subscriber mobile station, the cellular service node further operating, in response to the instructions contained in the subscriber profile, to collect
15 during the provision of calling service to that certain subscriber mobile station of only that calling service related atomic data as is specified in the cellular service profile provided instructions for that subscriber mobile station; and
a data collection center to which the cellular service node reports the collected calling service related atomic data.

20 7. The cellular communications network as in claim 6 wherein the cellular service node comprises a currently serving service node with respect to the provision of calling services to the certain subscriber mobile station, the network further comprising an originating service node with the currently serving service node further operating to pass the cellular service profile provided instructions back to that
25 originating service node in connection with a delivery of an incoming call to that subscriber mobile station through the currently serving service node.

8. The cellular communications network as in claim 6 wherein the cellular service node comprises a currently serving service node with respect to the provision

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of calling services to the certain subscriber mobile station, the network further comprising a target service node with the currently serving service node further operating to pass the cellular service profile provided instructions forward to the target service node in connection with a subscriber mobile station call handoff to the target
5 service node.

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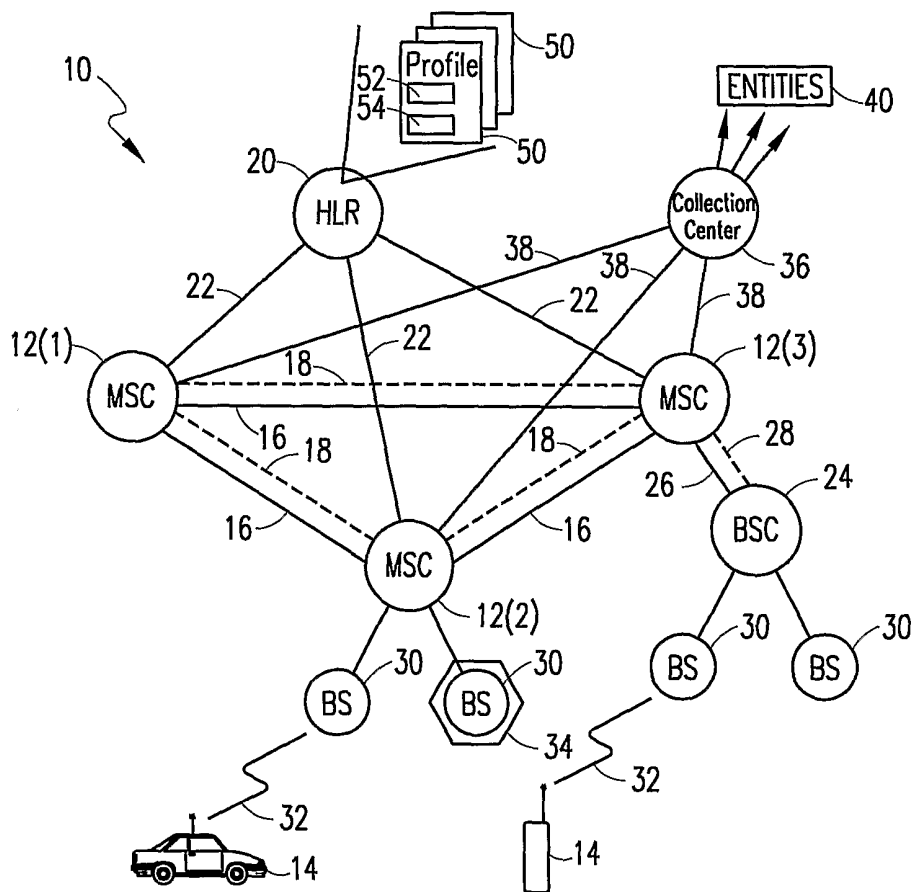


FIG. 1

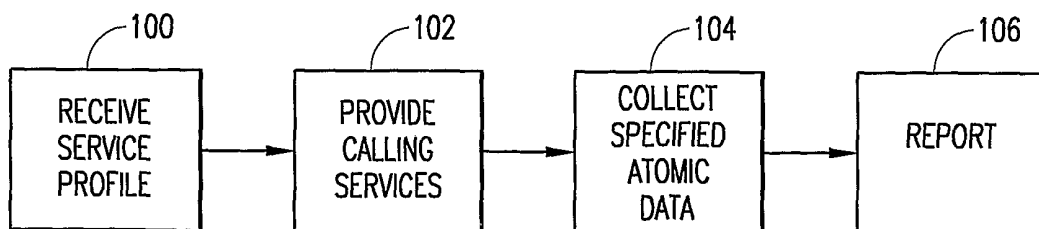
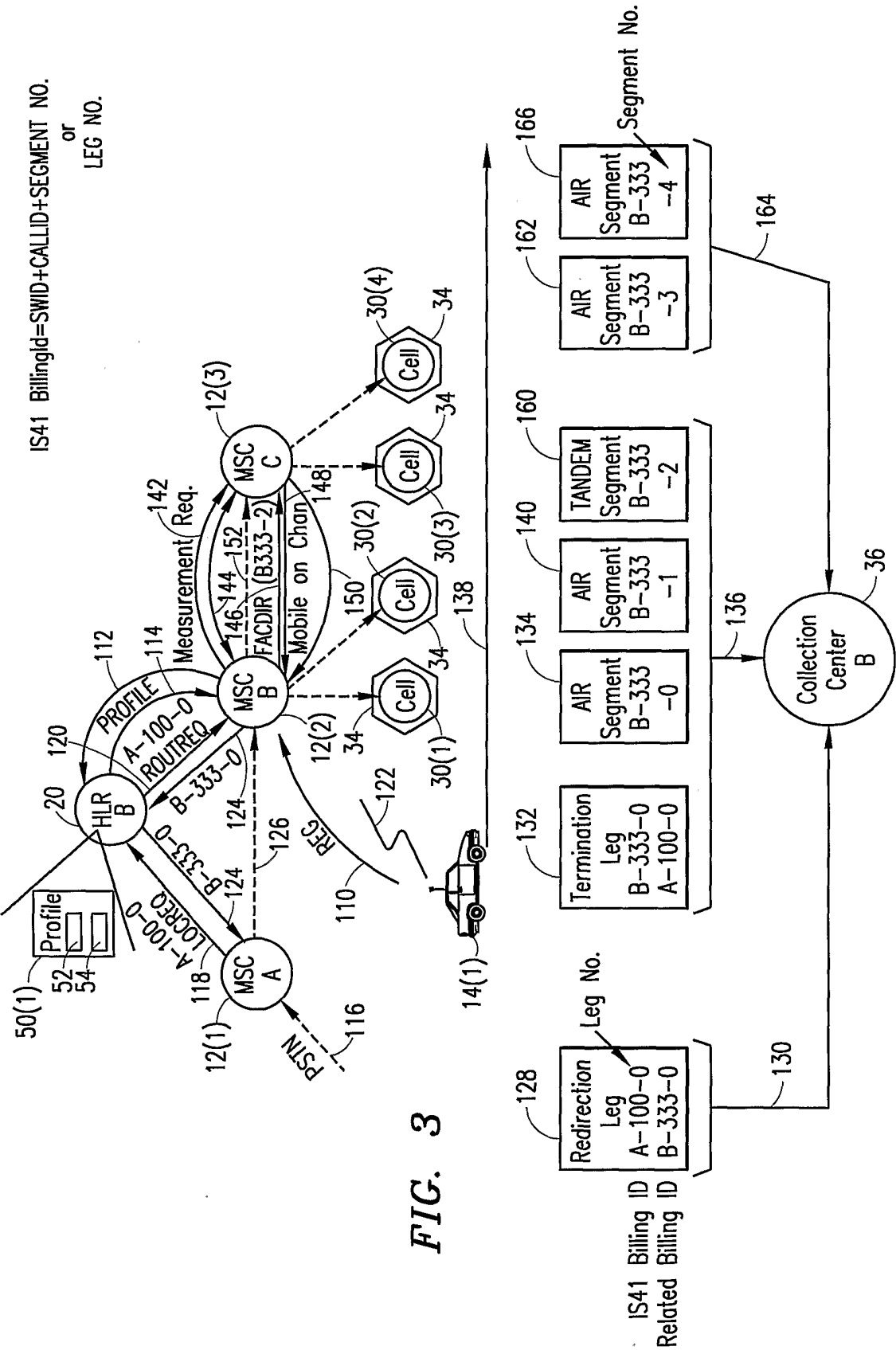


FIG. 2



INTERNATIONAL SEARCH REPORT

International Application No

PCT/SE 01/00379

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 H04M15/00 H04Q7/38

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04M H04Q

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

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

EP0-Internal

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Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	US 5 206 899 A (GUPTA ALOK K ET AL) 27 April 1993 (1993-04-27) column 1, line 36 - line 37 column 2, line 45 -column 3, line 44 column 9, line 55 -column 10, line 10 column 10, line 27 - line 43 column 12, line 30 - line 44 abstract --- -/--	1-8



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/SE 01/00379

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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