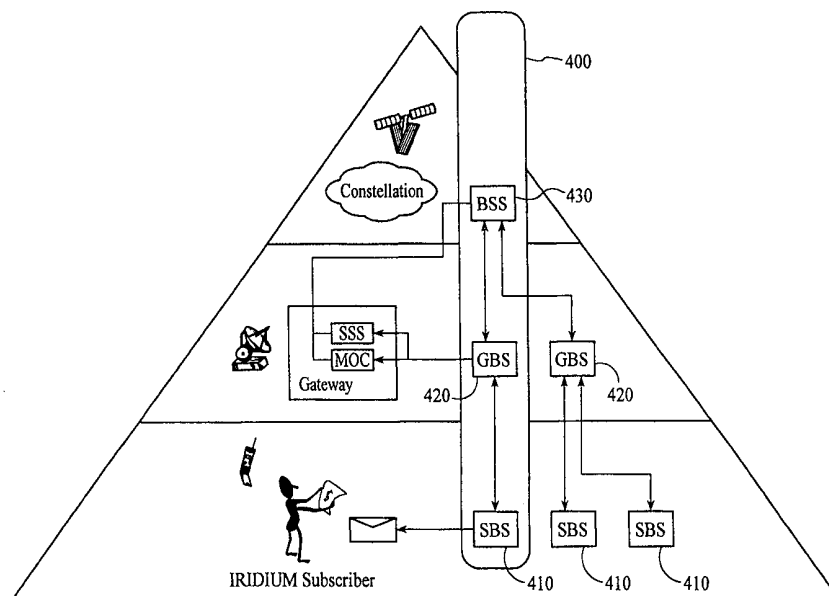




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<b>(21) International Application Number:</b> PCT/US99/21242  <b>(22) International Filing Date:</b> 22 September 1999 (22.09.99)  <b>(30) Priority Data:</b> 60/101,427                      22 September 1998 (22.09.98)      US  <b>(71) Applicant:</b> IRIDIUM IP, LLC [US/US]; 1575 Eye Street, N.W., Washington, DC 20005 (US).  <b>(72) Inventor:</b> SMITH, Robert, Kyle; 3418 Valewood Drive, Oakton, VA 22124 (US).  <b>(74) Agents:</b> SAWYER, Joseph, A., Jr. et al.; Sawyer & Associates, P.O. Box 51418, Palo Alto, CA 94303 (US).		<b>(81) Designated States:</b> AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RQ, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.          Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

**(54) Title:** METHOD AND SYSTEM FOR PROVIDING A GLOBAL SATELLITE BASED TELECOMMUNICATION NETWORK

**(57) Abstract**

A system and method for providing services to users of a global telecommunications network (100). The system and method use service business system (410) which includes service providers who sell subscriptions for usage of the telecommunications network (100), a gateway business system (420) which includes service activation, Tier II customer support, payment and settlement processing, service provider management, usage collection, and retail rating, and a business support system (430) which includes gateway relationship management, financial and treasury and usage collection. Billing files and reports are distributed to a plurality of destinations.

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## **METHOD AND SYSTEM FOR PROVIDING A GLOBAL SATELLITE BASED TELECOMMUNICATION NETWORK**

### **FIELD OF THE INVENTION**

The present invention relates to global telecommunications networks and more particularly to a method and system for providing a global satellite based telecommunication network.

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### **BACKGROUND OF THE INVENTION**

With the development of a global economy, business people who regularly travel internationally are a fast growing breed. To meet their needs, satellite-based global telecommunications networks are being developed. The first such network is to be commercially activated by Iridium LLC on November 1, 1998. These networks provide services, such as international cellular phone and paging services. Such networks inevitably involve numerous entities in many different countries which work together as part of the network. Such entities involve governments, service providers, industry clearinghouses, and others. Each call made through the network often involves numerous entities and often crosses national sovereignty lines.

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In providing services, it is desirable to allow a subscriber to be contacted from a variety of sources. This is particularly true of paging messages. Some conventional telecommunications systems allow messages originating in the conventional system to be sent from a central repository to a pager within the conventional system. However, conventional telecommunications systems which allow messages to be delivered typically use a distributed architecture. Thus, access for a user is provided through a particular conventional network within the conventional system. There are several conventional networks in the conventional system. Each conventional network provides Internet access for a particular set of users. A message to the user is sent directly to the conventional network for the user.

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Although the conventional system functions, one of ordinary skill in the art will readily realize that as the conventional system grows, more conventional networks are added to be able to service more users. The addition of more conventional networks makes administration of the conventional system more difficult. In addition, administrators of the

conventional system may not be able to ensure that the conventional networks are uniform. Different services may be provided on different conventional networks. Moreover, different users are associated with different networks. The point of entry for users is, therefore, different. Thus, it may be difficult to provide paging from sources.

5           Accordingly, what is needed is a system and method for allowing pages to originate in sources such as the Internet. The present invention addresses such a need.

### **SUMMARY OF THE INVENTION**

10           The present invention provides a system and method for providing a global satellite telecommunication network.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 illustrates a global telecommunications network which may use the present invention.

15           Figure 2 illustrates satellite footprints of the global telecommunications network of Figure 1.

Figure 3 illustrates a gateway of the global telecommunications network of Figure 1.

Figure 4 illustrates a business system for managing the telecommunications network of Figure 1.

20           Figure 5 illustrates in more detail the business system of Figure 4.

Figure 6 is a flow chart which illustrates the pathway processes of the business system of Figure 4.

Figure 7 is a block diagram including a system in accordance with the present invention.

25           Figure 8 is a flow chart depicting one embodiment of a method for providing messages from the Internet to a user in accordance with the present invention.

Figure 9 is a flow chart depicting one embodiment of a method for routing messages to a home gateway in accordance with the present invention.

30           Figure 10 is a flow chart depicting one embodiment of a method for providing messages to a user in accordance with the present invention.

Figure 11 depicts a method for providing Internet messaging in accordance with the

present invention.

Figure 12 depicts one embodiment of the method for routing messages to the Home Gateways.

Figure 13 depicts one embodiment of the method for providing messages to the users.

Figure 14 is a flow chart depicting a method for providing services in accordance with the present invention.

Figure 15 is a flow chart depicting a preferred embodiment of the present invention for determining the intersections between the MDAs or other service areas and the geometry of the network.

Figure 16 is a flow chart depicting a method for activating the appropriate satellites in accordance with the present invention.

Figure 17 is a diagram depicting the GNS functionality of the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to an improvement in providing a global satellite based telecommunications network. The following description is presented to enable one of ordinary skill in the art to make and use the invention and is provided in the context of a patent application and its requirements. Various modifications to the preferred embodiment will be readily apparent to those skilled in the art and the generic principles herein may be applied to other embodiments. Thus, the present invention is not intended to be limited to the embodiment shown but is to be accorded the widest scope consistent with the principles and features described herein.

### Definitions

“AMPS” stands for Advanced Mobile Phone Service.

“BRB” stands for ILLC Business Review Board.

“BSS” stands for Business Support Systems. The Iridium system as a whole. It includes Iridium Business System, Gateway Business System, and Service Provider Business System.

“Button” stands for a push button with a text label. When clicked, it performs a given process or set of processes.

“Capcode” stands for a paging port number (similar to IMSI). Linked capcodes are those assigned to a specific pager. Unlinked capcodes are those that can be assigned to any pager.

“CCPP” stands for Complete Calling Party Pays.

5 “CDMA” stands for Code Division Multiple Access.

“Cellular” stands for a personal telecommunications system which utilizes base station controllers (radio to PSTN interface), each having multiple directional antenna beams which create spatial cells for the purpose of frequency reuse through space division multiplexing.

10 “Check box” stands for boxes that maintain a specific state. Usually checked for active and unchecked for inactive.

“Choice box” – each choice box has an “option menu” – a menu of options that drops down from a button. The currently selected option displays as the label of the button.

15 “CIBER” stands for Cellular Intercarrier Bill Exchange Roamer. The format for records exchanged between cellular carriers to support billing of roaming subscribers.

“CSR” stands for Customer Service Representative. A person responsible for answering subscriber inquiries and solving subscriber problems.

“DCS” stands for Digital Communications System.

20 “Dealer” sells equipment; performs no activation or customer service functions. May provide limited support for activation. Generally contacts Service Provider or Gateway for service.

“Drop-down menu” stands for a menu used to navigate from one part of the system to another.

“DTMF” stands for Dual Tone Multiple Frequency.

25 “ECC” stands for Enhanced Call Completion.

“E-mail” stands for electronic mail. Used to communicate status messages between Service Providers and Gateways.

30 “ESN” stands for Electronic Serial Number. An 11 digit number intended to be unique for every IS-41 type cellular phone, combined with a MIN and authentication variables for the purpose of validating a subscriber’s identity.

“Fraud Management” is the process by which Business Operations prevents, detects, investigates, and resolves cases of unauthorized use of Iridium services.

“Gateway” is the Iridium network entity which provides the interface with the host countries’ local land based network and performs local control.

“GBS” stands for Gateway Business System.

5 “GEO-Codes” stand for Geo-Political Entity Codes. A three digit code that exists as part of a MSISDN. It identifies the country that the MSISDN is assigned to.

“GNS” stands for Global Notification Service.

“GSM” stands for Global System for Mobile Communications.

“GSM to IS-41” is a GSM subscriber roams on to an IS-41 network.

“HLR” stands for Home Location Register.

10 “IBS” stands for Iridium Business System. Used for call processing and settlements.

“ICRS” stands for Iridium Cellular Roaming Service.

“IIU” stands for Iridium Networking Unit.

15 “IMEI” stands for International Mobile Station Equipment Identity. A number used to uniquely identify each mobile station. Using this number, the mobile station can be blacklisted to prevent use in the event the equipment is lost.

“IMSI” stands for International Mobile Subscriber Identity. A number used to provide each GSM subscriber a unique identification number. The security applied to IMSI ensures that it is not made available to unauthorized individuals or entities.

20 “IMSI-in-the-clear” refers to a scenario in which a GSM Roaming Partner requires their own IMSIs to be sent to a Gateway via an encrypted file transfer. This file includes the Roaming Partner’s IMSI and SIM serial number. This file will be loaded into the GBS database. During provisioning using SPNet, the GSM Roaming Partner will complete the SIM serial number field and send the provisioning request to the GBS. During processing  
25 at the GBS, the IMSI is sent to the IIU for provisioning.

“IMSI Replacement” refers to a scenario in which a Service Provider’s existing system will not accept call records which include the Iridium IMSI. In this case it is necessary for the Service Provider to use its own IMSI, called a Carrier IMSI, to identify the Iridium subscriber in its existing system. This Service Provider will transfer these Carrier  
30 IMSIs to the GBS, where they will be associated with Iridium SIMs and IMSIs. During provisioning of Iridium telephony service, the Carrier IMSI will be displayed to the Service Provider based on the Iridium SIM entered.

"IS-41" stands for Interim Standard 41.

"IS-41 to GSM" refers to an IS-41 customer roams onto a GSM type network.

"ISDN" stands for Integrated Services Digital Network.

"ISDN-A" stands for the Iridium pager number assigned to a paging subscriber.

5 "ISDN-D" stands for the modem line at each Gateway used for message orientation via a Message Entry Device.

"ISDN-J" stands for the number used internally by the Iridium system for forwarding unanswered (Busy, No Answer, Not Reachable) calls to a subscriber's mailbox. It may also be dialed by the subscriber to access his mailbox.

10 "ISU" stands for Iridium Subscriber Unit.

"IU" stands for Interoperability Unit. This unit is the resource mapping that allows subscribers to access multiple cellular networks.

"Iridium homed" refers to the Iridium network on which a user subscribes and receives his primary mobile telephone number.

15 "LAC" stands for Location Area Code.

"MCF" stands for Master Control Facility.

"MDA" stands for Message Delivery Area, which is a physical zone of coverage provided by the satellite system. Each subscriber will be programmed into the Iridium system with a default MDA assignment which will determine where his paging messages will be transmitted by the Iridium satellite system. Subscribers will be able to change their MDA so as to facilitate roaming outside of their home coverage area.

20 "MIN" stands for Mobile Identification Number. The ten digit, digital phone number assigned to IS-41 based subscribers.

"MOC" stands for Messaging Operation Controller. The switch used to generate pages and interact with subscribers who leave pages. The MOC also provides fax and voice mail services.

"MSC" stands for Mobile Switching Center.

"MSISDN" stands for Mobile Subscriber Integrated Services Digital Network number.

30 "MSISDN Number" stands for Mobile Station Integrated Services Digital Network. A unique 12 digit number (i.e. telephone number) allocated to the subscribers in the Iridium network.

“MTC” stands for “Message Termination Controller.

“NC” stands for Notification Center.

“OGW” stands for Originating Gateway.

5 “PAGER” means the subscriber equipment capable of receiving and displaying a numeric or text message sent from the Iridium satellite system.

“PCS” stands for Personal Communications System.

“PDC” stands for Personal Digital Communications.

“Person” means an individual, a partnership, a corporation, an association, a joint stock company, a trust, a joint venture, an unincorporated organization or a Government.

10 “PIN” means the pager identification number which is assigned by Iridium to registered customers of Iridium paging.

“PLMN” stands for Public Land Mobile Network.

“PSTN” means a Public Switch Telephone Network.

15 “Radio button” – a radio button has two states: selected and not selected. Radio buttons always appear as two or more labeled buttons in a radio button group.

“Radio button group” enforces mutual exclusion among any number of radio buttons in a given group. If a radio button with a given radio button group is selected, then the previously selected radio button becomes unselected.

20 “RM” refers to Roaming MIN. The IRM is allocated by a company such as Iridium LLC to the Gateways. With an Iridium ESN and IRM activated on the IIU, an Iridium or GSM subscriber is able to roam IS-41 networks.

“Satellite network” stands for the space system, network systems, business systems, and all terrestrial communication links necessary to support satellite and ICRS services.

“Service Area” means the geographic region(s) specified in Exhibit B hereto.

25 “Service Bureau” refers to the facility which is comprised of live human operators, answering phone calls and transcribing text and numeric messages into a computer terminal which in turn sends the messages to the Iridium system for delivery to Iridium pagers.

“SIM” stands for Subscriber Identity Module.

30 “SIM Card” stands for Subscriber Identification Module Card. The physical item related to a subscription. It contains all necessary information for uniquely identifying the subscriber.

“SIM Serial Number” stands for the equipment identification for the subscriber’s

Subscriber Identification Module Card.

“Service Provider” is the organization or entity licensed Iridium LLC to provide service in a geographical area. Sells Iridium equipment, bills subscribers and provides some customer care.

5 “SMS” stands for Short Message Service.

“SPNet Online Help” is a help system provided at point of need for SPNet users.

“Subscriber” means the Person who enters an agreement with Service Provider for the right to access and use the Iridium Services.

“TRC” stands for Terrestrial Radio Cassette.

10 “Tail Charges” means the costs imposed by the PSTN for delivery and/or receipt of communications to or from the Iridium system.

“TAP” stands for Transferred Account Procedure, similar to CIBER, used to support roaming in GSM telephony.

15 “Tickler” refers to a notation added to a customer account, used to document special issues or circumstances.

“User” refers to an individual that has access to Iridium LLC Systems.

“VLR” stands for Visited Location Register.

20 The present invention provides a method for providing communication from a source. The following description is presented to enable one of ordinary skill in the art to make and use the invention and is provided in the context of a patent application and its requirements. Various modifications to the preferred embodiment will be readily apparent to those skilled in the art and the generic principles herein may be applied to other embodiments. Thus, the present invention is not intended to be limited to the embodiment shown but is to be accorded the widest scope consistent with the principles and features  
25 described herein.

To understand the method and system in accordance with the present invention, first the preferred embodiment of the telecommunications network which may use the present invention is described.

30 Figure 1 illustrates a telecommunications network which may be used with the present invention. The network 100 includes low earth orbiting satellites 105, gateways 110, system control 115, and Mobile Exchange Units 120 (MXU). System Control 115 serves as the central management component for the network 100. Gateways 110

interconnect the satellite constellation 105 with public switched telephone networks 125 (PSTN), making communication possible between network cellular phones 130 and any other telephone in the world. The MXU 120 provide access to the network 100 at remote locations. Telecommunications services may also be provided to pagers 135, aircraft 140, and automobiles 145.

The satellites 105 of the network 100 employ intersatellite links 150, or "crosslinks", to communicate directly with each other. These crosslinks 150 provide reliable, high-speed communications between neighboring satellites, allowing call routing and administration to occur efficiently. As illustrated in Figure 2, each satellite 105 in the constellation has a ground coverage area called a "footprint" 210. The footprint 210 is further divided into smaller areas called "cells" 220. The footprints 210 of the satellites are overlapped to provide maximum coverage.

For a preferred embodiment of the call processing architecture of the network 100, the globe is divided into Location Area Codes (LACs). Each LAC is a service location for the network 100. Each gateway 110 services a certain set of LACs. For example, when a user makes a call from his/her cellular phone 130 to a particular location, the cellular phone 130 first links with a satellite 150 which has a cell servicing his/her current LAC. The cellular phone 130 requests a satellite channel for the call. The request is sent to the gateway 110 which services the caller's LAC. This gateway 110 then initiates the opening of a channel between phone 130 and the satellite 110. Once the channel is established, the signal for the phone call is routed through the crosslinks 150 of the satellites 105 to the gateway 110 servicing the LAC of the call's destination. This gateway 110 then sends the call to the PSTN 125 which routes the signal to the particular phone called.

Figure 3 illustrates in more detail a preferred embodiment of the gateway 110 of the network 100. The heart of the gateway 110 is the Mobile Switching Center 310 (MSC) or the "switch". An example of a switch 310 which may be used is the Siemens GSM-D900 switch. The switch 310 has two "sides": a land side which connects to the local telephone network via the PSTN 315, and a mobile side which connects to Earth Terminal Controllers 320 which communicate with the satellite constellation 105 using K-band radio links. Information for the physical subscriber equipment (cellular phone 130, pager 135, etc.) is kept in the Equipment Identification Register 325 (EIR). The gateway's 110 Message Origination Controller 330 (MOC) supports a variety of messaging services such as direct

messaging to pagers. The Gateway Management System 335 (GMS) provides operations, administration, and maintenance support for each of the gateway subsystems.

In addition to the EIR 325, the switch 330 includes a Home Location Register 340 (HLR) and a Visited Location Register 345 (VLR). The HLR 340 stores subscriber service information for the "Home Gateway". A Home Gateway is assigned to each subscriber to the network 100 and is related to the LAC at which the subscriber is based. The Home Gateway is responsible for granting network access. Whenever a subscriber places or receives a call, the network 100 will determine the subscriber's location with accuracy sufficient for call control. The Home Gateway will receive and evaluate this location information to determine whether it is permissible for the call to proceed. This feature is essential to help ensure compliance with calling restriction laws in nations where such laws exist.

The Home Gateway is also responsible for the assignment of a Visited Gateway as part of the network access process. Subscriber location information is used to index into a map of the world kept at the Home Gateway. This determines a LAC for the visited location which in turn will be used to identify a Visited Gateway which will serve and control the mobile subscriber end of a call.

The Visited Gateway temporarily retains a copy of select subscriber information in its VLR 345. This information remains within the Visited Gateway until the subscriber "roams" into a new Visited Gateway territory or until it expires. When a subscriber is at "Home", the Visited Gateway and the Home Gateway are one and the same.

To manage usage information of the network 100, a business system 400 is used. Figure 4 illustrates a preferred embodiment of a business system 400 which may be used with the present invention. The business system 400 comprises three subsystems: the Service Business System 410 (SBS), the Gateway Business System 420 (GBS), and the Business Support System 430 (BSS).

The SBS 410 includes service providers who sell subscriptions for usage of the telecommunications network 100 directly to the consumer and roaming partners who resells usage of the network 100 and also provide other cellular services in their own systems. SBS 410 functions include pre-sales support, service negotiation, general and billing inquiries, payment remittance, pricing and invoicing, receivables management, and account profile maintenance. The functioning of the SBS 410 will be described in more detail later.

The GBS 420 includes gateways 110 (Figure 1) of the telecommunications network 100 and their operators. The functions of the GBS 420 includes service activation, Tier II customer support, payment and settlement processing, service provider management, usage collection, and retail rating. These functions are performed in the gateways 110. The functioning of the GBS 420 will be described in more detail later.

The functions of the BSS 430 includes gateway relationship management, financial and treasury management, and usage collection. They also include usage verification, revenue distribution, settlement statement generation, and payable/receivable processing. These functions are managed by a Clearinghouse and occur in the satellites 105.

To more particularly describe the processes of the BSS 430, please refer to Figures 5 and 6 in conjunction with the discussion below.

Figure 5 illustrates in more detail the processes of the business subsystems of the preferred embodiment of the business system 400 in the usage management of the telecommunications network 100, including the BSS 430. Figure 6 is a flow chart illustrating the pathway processes 504 of the BSS 430.

The BSS 430 processes begin with the Collection Process, via step 610. Each time a call is made through the network 100, a record of the call event, called a Call Detail Record (CDR) is created in the gateway 110 in the Operations Maintenance Controller-Gateway 502 (OMC-G). These records could be in any number of formats, such as Siemens D900 (D900), Cellular Inter-carrier Billing Exchange Roamer (CIBER), Transfer Account Protocol (TAP), and Modular Voice Processing (MVP). The D900 files contain voice records; the MVP files contain messaging records; and the CIBER and TAP files contain roaming partner billing exchange records. The OMC-G 502 notifies the BSS 430 when files containing CDRs in the D900 format are ready for collection. These files are then collected from the OMC-G 502 by the BSS 430. Files containing CDRs in the CIBER and TAP formats are received by the GBS 420. The Collection Process then collects the CIBER and TAP files from the GBS 420. The Collection Process also collects Subscriber and Customer Status files from the GBS 420. These records contain subscriber and cellular customer information, such as activation, deactivation, and service changes. Lastly, the Collection Process collects Product Change files from an internal source 602. These files contain monthly and one-time charge records. The Collection Process then performs a series of validations on the collected files to ensure that the files are complete and properly

formatted with industry-standard information, that subsequent BSS processes receive usable information, and that the BSS system integrity is maintained. Once the files have passed validations, the Collection Process converts the CDRs in the D900, MVP, CIBER, TAP, and product charge files into a standard format required for subsequent BSS processing.

5 Sometimes, multiple CDRs are generated for a single call, called multiple records calls. From the Collection Process, the CDRs in D900 files that are not part of a multiple record call are sent directly to the Rating Process. Those that are part of a multiple record call is first sent to the Matching Process, via step 620, where they are matched with other CDRs in the call. These CDRs are then combined into a single call event and then sent to  
10 the Rating Process.

The Rating Process, via step 630, first performs record-level validations. The validation ensures that the files are complete and properly formatted. This pre-processing step ensures that the CDRs, and the information they contain, are valid and comply with industry standards. It then translates this input into an industry standard format called Data  
15 Message Handling (DMH). The Rating Process then determines which DMH formatted call events are ratable and which call events are not ratable. A call event is ratable if it can be subjected to a rate model or pricing adjustment. For all that are ratable, the Rating Process applies the appropriate pricing model, pricing adjustments, and taxes to determine total charges. The total call revenue is allocated between all entities (service providers,  
20 gateway operators, roaming partners, government agencies, etc.) involved in the call event, as each entity receives a portion of the total call revenue. The outputs of the Rating Process are rated call events and rated product charge files which are sent to the Call Conversion Process.

The Call Conversion Process of the present invention, via step 640, prepares rated  
25 call events sent from the Rating Process for storage and distribution. The Call Conversion Process converts the rated call events into formats readable by subsequent repositories, or storage areas for call events, and processes. The Call Conversion Process creates valid records for any rated call events that do not contain errors. Valid records are then loaded in the Usage Repository 508. Invalid records are created for any rated call events that contain  
30 errors and stored in the Error Repository 508. The original CDRs are assembled into files for loading into a directory 506 separate from the Usage Repository 508. The original CDRs are important because they serve as a complete record of the original data as it was

received from the gateway 110. Rated call events that do not contain errors are converted to different types of event records, such as Billing Event Records (BER), Settlement Event Records (SER), Net Settlement Event Records (NSER), and Outcollect Settlement Event Records (OSER). The purpose of a BER is to bill a subscriber for using the network 100. BERs are sent to the home gateway of a chargeable subscriber. The purpose of a SER is to notify gateways 110 of their settlement roles in a call, but not to bill a subscriber. SERs are sent to all gateways 110 involved in the handling of the call, excluding the home gateway. NSERs contain a summary of all charge information associated with a particular call. NSERs are sent to the Tier 1 Settlements Repository 512. OSERs contain call activity and charge information for calls in which the customer of a roaming partner is the chargeable party. OSERs are sent to the gateway 110 associated with the roaming partner whose customer made a call.

The Tier I Settlements Process, via step 650, receives NSERs from the Call Conversion process and translates them into data suitable for loading into the Tier 1 Settlements Repository 512. This data takes the form of extract files, which contain important financial and usage information necessary for reporting purposes. These files are held in temporary storage for later release to the Distribution Process. In addition to creating extract files, the Tier I Settlements Process also creates settlement reports and releases them to the GBS 420 and the Clearinghouse. There are three types of settlement reports: financial reports, usage reports, and operational reports. Financial reports capture daily and month to date financial activity of entities involved in the calls. Usage reports capture the monthly system activity for each gateway 110. Operational reports capture information pertaining to BSS processing, such as collection and distribution, audit, error, reject management, rate package, and roaming agreement information. These reports are released to the Distribution Process where they will be grouped according to their destination point and distributed.

The Distribution Process of the present invention, via step 660, receives BER files, SER files, OSER files, and settlements reports from the Tier I Settlements Process, and sends them to their final destinations: the GBS 420, roaming partners 604, and industry clearinghouses 606. The Distribution Process first groups and formats the files according to their type and destination. Once grouped, the BER, SER, and roaming partner settlement files, and settlement reports are ready for final distribution. However, OSER files require

conversion into TAP and CIBER files before it is ready for distribution. The BER files are distributed to the home gateway of a subscriber. The SER files are distributed to a gateway 110 involved in the handling of a portion of a call, excluding the home gateway. The original OSER files are distributed to a gateway 110 involved in handling a portion of a call in which a roaming, non-system customer is the chargeable party. The TAP and CIBER files converted from the original OSER files are then distributed to roaming partners and industry clearinghouses. Roaming partner settlement files are distributed to gateways or directly to a roaming partner or industry clearinghouse. These files contain charges payable to roaming partners or receivable from roaming partners, and is used by gateways 110 to perform Tier II settlements processing and reporting, as described later. Settlement reports are distributed to all gateways 110 and the Clearinghouse. The Distribution Process of the present invention will be described in more detail later.

The Collection, Matching, Rating, Call Conversion, and Settlements Processes are disclosed, respectively, co-pending U.S. Patent Applications entitled, "A Billing Records Collection Process for a Business System for a Global Telecommunications Network," Serial No. ( ), filed on \_\_\_\_; "A Matching Process for a Business System for a Global Telecommunications Network," Serial No. ( ), filed on \_\_\_\_; "A Call Rating Process for a Business System for a Global Telecommunications Network," Serial No. ( ), filed on \_\_\_\_; "A Call Conversion Process for a Business System for a Global Telecommunications Network," Serial No. ( ), filed on \_\_\_\_; and "A Settlements Process for a Business System for a Global Telecommunications Network," Serial No. ( ), filed on \_\_\_\_.

Applicant hereby incorporates the above-mentioned Patent Applications by reference.

In addition to the processes described above, the preferred embodiment of the BSS 430 also includes five BSS applications which may be accessed by Clearinghouse personnel. These include Audits and Controls, Usage Inquiry, Error Administration, Reject Management, and Table Maintenance. Each of these applications has a Graphical User Interface (GUI) that provides Clearinghouse personnel the ability to track errors, view usage information, and update reference tables in the system. Information from these interfaces is provided to gateways 110 via operational reports.

The purpose of the Audits and Controls application is to track information as it flows through the processing steps described above. This application allows Clearinghouse personnel to monitor the status of files as they move through the BSS 430.

The Usage Inquiry GUI allows access to information contained in the Usage Repository 508. This Usage Inquiry application allows Clearinghouse personnel to view original D900, CIBER, TAP, and MVP records, charge information associated with a particular call, or product charge information.

5           The Error Administration application allows Clearinghouse personnel to track and troubleshoot records that have erred out of the processing path. The application searches for erred records that are located in the Error Repository 510 and displays this information in varying levels of detail. This application is also used to respond to trouble notification generated by an error threshold monitoring process. This error threshold monitoring  
10       process examines the contents of the Error Repository 510 and compares the error volumes and potential revenue loss to defined pre-determined thresholds. If a threshold is exceeded, a trouble ticket is opened in the Maintenance Ticket Tracking System 514 (MTTS) and stored in the Trouble Ticket Repository 516. Clearinghouse personnel can then access Error Administration to reduce the level of errors associated with the trouble ticket.

15           The Reject Management application accesses any records or files which do not pass validation. This application allows Clearinghouse personnel to view, reject, and recycle these records or files. It also allows for the tracking and verification of the accuracy of all records coming into the system from roaming partners and industry clearinghouses.

20           The Table Maintenance application allows Clearinghouse personnel to input and update reference information contained in tables used by the normal processes. It also provides an audit trail so that the history of each table update is recorded.

25           The BER, SER, and original OSER files and settlement reports resulting from the Distribution Process of the BSS 430 are collected by the GBS 420. These files are then processed by the Billing System and Control System 518 (BSCS). The BSCS 518 first converts the BER and SER files into the Data Message Handler (DMH) format, or Interim Standard 124 (IS124). With files in this format, the BSCS 518 performs wholesale and retail billing. Conversion of the files into the DMH format before billing allows the billing to be done more easily. This billing process rates the call events, taking into account the countries involved in the call, the tax laws of these countries, the currencies of these  
30       countries, and the languages of these countries. The result of the wholesale and retail billing performed by the BSCS 518 is files in the TAP format. The billings for direct network customers 532 (retail billing) are forwarded to the DOC1 process 520, which

creates invoices which are then sent to the customers. For the billings for service providers 530 (wholesale billing), some service providers require billings in the TAP formats while others require them in the CIBER format. Those that require them in the TAP format receive the billings directly from the BSCS 518. Those that require them in the CIBER  
5 format have their billings first sent to the conversion engine, ACE 522, which converts these billings into the CIBER format. They are then sent to the service providers of the SBS 410. In addition to billing, the BSCS 518 also performs Tier II Settlement where the appropriate settlement reports are sent to the correct entities, be it service providers, roaming partners, or some other entity. With SPNet 524, service providers may use their  
10 existing systems and still provide the network's 100 services. This eliminates the need for service providers to have hardware and software specifically designed to work with the network 100.

When a service provider of the SBS 410 sells network services to a customer, the service provider may activate that customer's account through the Service Provider Net (SPNet) system 524. The SPNet 524 is a personal computer with software to access to the  
15 Internet. Through the Internet, the service provider can access an account software, called QA Partner, and enter all the information required for the activation of the customer's account. The QA Partner then sends the information to the BSCS 518. The SPNet 524 may also be used to input problems experienced by the customer which is input into the MTTS  
20 526 on the GBS 420. The MTTS 526 functions similar to the MTTS 514 of the BSS 430.

The BSCS 518 stores a copy of this information in its Customer Data Repository 528. Once received, the BSCS 518 sends the information to the switch 310 of the gateway 110 which would be the customer's Home Gateway and activates the network elements for service to this customer. The switch 310 sends back to the BSCS 518 a confirmation of  
25 receipt of the information. Once the BSCS 518 receives confirmation, it notifies the BSS 430 of the activation so that when it receives CDRs for this customer, it will recognize it as a valid record.

### Internet Messaging

30 As described above, a user can receive messages on a pager 135 or phone 130 via the network 100. It is desirable to allow the user to receive messages from a variety of sources, including the Internet. In addition, it is desirable to allow senders of the message to

utilize a single identifier, such as a subscriber number, regardless of the source of the message.

The present invention provides a system and method for providing a message to a user of a global telecommunications network. The message originates from the Internet. The message includes an address indicating an identity of a user within the global telecommunications network. The method and system comprise receiving the message at a central location and routing the message to a Home Gateway of the user. The method and system further comprise providing the message from the Home Gateway to the user.

The present invention will be described in terms of a particular telecommunications network. However, one of ordinary skill in the art will readily recognize that this method and system will operate effectively for other types of telecommunications network having a centralized mechanism for receiving messages.

## **PAGING MARKET OPPORTUNITIES**

### System Overview

The Iridium network consists of 66 satellites in Low Earth Orbit that can send alphanumeric messages anywhere in the world. The following section describes the messaging portion of this network.

The methods of origination of a message include ISU, PSTN phone, Service Bureau, PC Modem, and Internet. These methods use a variety of transport such as PSTN, Leased line, and L-Band. The Message Origination Controller (MOC) and the Notification Center (NC) are located at the gateway and provide the interface that the paging party encounters when generating a page.

The page is processed and sent via the Operational Data Network (ODN) to the Master Control Facility (MCF) in Virginia, USA. Located at the MCF is the Message Termination Controller (MTC) which collects all the pages from every gateway and schedules spacecraft resources for delivery to the pager. The page is then sent over the constellation and directly to the pager.

The subscriber either tells the system the current location for basic alphanumeric paging service or the network uses the subscriber's phone registration to direct the page for global notification service. By centralizing the collection and delivery of the page,

this network ensures that resources for the L-Band are used most efficiently.

### Service Description

#### Alphanumeric Paging Service

5           The Alphanumeric Paging Service allows subscribers to receive alphanumeric messages of up to 200 characters and numeric messages of 20 digits anywhere in the world. The service allows messages to be sent to specified delivery areas worldwide and received on a belt-worn pager. The service will operate in a manner similar to terrestrial-based paging services and can act as an extension of existing paging Service Providers' networks.

10

### Features

The following features will be available at Iridium commercial activation:

Custom Greeting/Voice Prompt-Subscriber recorded greeting and system voice prompts for caller sessions

15

Preferred Language - Subscriber can choose from eight languages for system prompts

DTMF Input - Touch-tone entry functionality

Group Subscriber - Allows for message to be sent to all subscribers that share a specified address

20

Message Recall - Ability to call the network and have numeric messages automatically enunciated over the phone

Message Sequencing - Numbering of messages sent to subscriber

Message Retransmission - Ability to have a particular message resent

25           Message Blocking - Prevents callers from sending messages to the subscriber

Message Transmit Enable/Disable - Prevents the message from being sent over the constellation

Time & Date Stamp - Marks the time and date of message deposit

Originator Deferred Delivery - Allows caller to set delta time for deferred delivery

30

MDA Selection - Adds and deletes a to be determined number of message delivery areas.

### Origination Methods

The following methods of origination can be used by a caller to send a message to an Iridium paging subscriber.

#### 5      Direct Numeric Page

1.      A call is placed to the subscriber's Iridium pager number (ISDN-A)
2.      A standard system prompt or a custom greeting recorded by the subscriber directs the caller to leave a numeric page.
3.      The caller uses a touch-tone phone to leave a 20-digit numeric page.
- 10      4.      The system sends the numeric page to the pager.
5.      The pager displays the numeric page.

#### Direct Numeric Page via Toll-Free or Toll PSTN Call

- 15      1.      The caller dials a PSTN number that connects to the MOC through a PBX in the subscriber's Home Gateway.
2.      The caller uses a touch-tone phone to enter the subscriber's ISDN-A.
3.      The caller uses a touch-tone phone to enter a numeric page.
4.      The numeric page is collected and sent through the Iridium network.
5.      The pager displays the numeric page.

20

#### PC Software or Message Entry Device

1.      Using PC messaging software or a dedicated message entry device (e.g. Motorola Wordsender), the caller dials an Iridium modem number (ISDN-D or PSTN) associated with the subscriber's Home Gateway.
- 25      2.      The message entry device is used to enter the subscriber's ISDN-A and a numeric or alphanumeric page.
3.      The page is collected and sent through the network.
4.      The subscriber receives the message at this pager.

#### 30      Paging Service Bureau or Paging Service Provider

1.      The caller dials a Service Provider or a Paging Service Bureau through existing origination methods currently defined by either entity.

2. The page is collected and sent via leased or dial-up line directly to the Iridium Gateway paging infrastructure.
3. The page is sent through the Iridium network.
4. The subscriber receives the message at the pager.

5

#### Internet

1. The caller sends a message to a pager's internet address provided by the subscriber or logs onto an Iridium Internet Web page and enters a message.
2. The page is collected and sent via leased or dial-up line directly to the Iridium Gateway paging infrastructure.
3. The page is sent through the Iridium network.
4. The subscriber receives the message at the pager.

10

#### Message Delivery Areas

The subscriber will be offered Message Delivery Areas (MDAs) that will be used by the Iridium network for directing the message to the pager. These MDAs are geographic areas that will represent local, regional and national boundaries of most use to paging subscribers. Since the pager is a one-way device and cannot tell the Iridium system its location, the subscriber will choose one or more MDAs for delivery of messages.

20

The following methods can be used by the subscriber for assigning MDAs:

#### Touch-Tone Registration

The subscriber can call an access number in the Home Gateway and use a touch-tone phone to set or edit the MDA locations as described below.

25

1. The subscriber calls his Iridium pager number (ISDN-A or PSTN) and uses a touch-tone phone to access the subscriber service session.
2. The subscriber selects the MDA option from a menu.
3. The subscriber enters or edits the MDA list, referring to a predefined list of MDAs by number.
4. The subscriber exits the subscriber service session and ends the call.

30

### Operator Assisted Registration

The subscriber can call the Service Provider's customer service number to get assistance in setting or changing the MDA locations. In this instance, the Service Provider would dial into the subscriber service session using the subscriber's PIN and password and set the MDA. This assistance is available at the discretion of the service provider for instances where the subscriber does not have DTMF access.

### Value Added Services

Value-added services are services which supplement basic services. These services provide calling conveniences and enhanced reachability.

### Global Notification Service

Figure 17 illustrates the GNS functionality of the present invention. Global Notification Service is a unique product enhancement to ensure continuous communications capability for the Iridium subscriber. This service offers the Iridium subscriber with voice service a global paging capability that automatically follows the subscriber, based on the last location of the subscriber's wireless handset. The Iridium system will be unique in its ability to offer a global "follow-me" paging service which will be able to interconnect terrestrial wireless networks and the Iridium satellite network.

The Global Notification Service provides several benefits to the subscriber. These benefits include being reachable through a pager with an average battery life of 30 days, as opposed to the limited battery life associated with traditional portable wireless handsets. Perhaps the most important benefit is the ability to receive communications in areas outside terrestrial wireless coverage or where a subscriber's satellite phone would not be capable of receiving calls. An Iridium Subscriber Unit may not receive calls for several reasons: dense urban areas cause signal attenuation; a satellite antenna may not be deployed; or the satellite phone may be turned off to conserve battery life.

In order to provide automatic inbound call reception to an Iridium pager with GNS capability, the subscriber will periodically register the Iridium or cellular handset. If the subscriber is registered on Iridium, then the LAC will be used as the location for

delivery of the message. For terrestrial cellular registration, the MSCid of the current serving cellular switch is identified and the message is delivered to all the LDAs containing any portion of that MSCid coverage area.

If the subscriber has not registered on either the Iridium or cellular network, the default MDA is used as a delivery area. This MDA may be set at provisioning and modified as described in the Alphanumeric Paging Service section.

When a subscriber is not available via the voice communications services, the calling party has the following options with GNS:

-Use DTMF to leave a numeric page of up to 20 digits that is sent to the subscriber's/customer's pager.

-Leave a voice mail message and have a voice mail notification sent to the subscriber's pager.

At their discretion, the service provider may also offer any of the alphanumeric message origination methods described in the Alphanumeric Paging Service.

GNS may be offered as part of any of the following Iridium service packages:

- Iridium Satellite Service
- Iridium Universal Service
- Iridium City Service

#### Enhanced Call Completion

Enhanced Call Completion (ECC) service allows the caller to leave a numeric message when the Iridium subscriber is in a "not reachable" condition except for Unconditional call forwarding. The number can be sent to the ISU, pager or both depending upon how the service is provisioned or later changed during a subscriber service session.

When the ISU is in any of the following conditions ECC may be invoked:

1. Call Forward Busy (CFB)
2. Call Forward No Answer (CFNA)
3. Call Forward No Reply (CFNRy)
4. Call Forward Not Reachable (CFNRc)

When the caller encounters one of these conditions, the call is routed to the MOC. The MOC answers the call with voice prompts in the language selected by the

subscriber. The caller is instructed to leave a numeric message. The numeric message is stored in the subscriber's account and scheduled for future delivery.

When the caller encounters one of these conditions, the call is routed to the MOC. The MOC answers the call with voice prompts in the language selected by the subscriber. The caller is instructed to leave a numeric message. The numeric message is stored in the subscriber's account and scheduled for future delivery.

The message can be delivered to either the ISU, pager, or both. In delivering the numeric message to the pager, the MOC will send the message to the Message Termination Controller (MTC) via the ODN, which includes the MSCid, or LAC based upon the location query made to the HLR and/or VLR. The MTC schedules the message for transmission over the constellation.

The message can be delivered to the ISU by routing the numeric message from the MOC to the Notification Center (SMS-C) in the Home Gateway. The MOC acts as a Short Message Entity (SME) routing the numeric data to the NC. The NC queries the HLR and/or VLR and delivers the message via the D900 switch, Earth Termination Controller (ETC) and Earth Terminal (ET) and the constellation. If the subscriber ISU is not reachable, a flag is set in the NC indicating that a message is waiting. The message is stored in the Subscriber account record in the MOC until such time as the ISU registers with the system or the message ages out of the system.

When the ISU receives the message it sends an acknowledgement back to the NC via the constellation and D900 switch.

#### Voicemail

Iridium voicemail service is available to both voice and paging subscribers. Callers who are forwarded to Iridium voice mail are given the option of leaving a voicemail message for subscriber retrieval.

#### Voice Subscriber

Calls may be directed to voice mail under any or all of the following call forwarding conditions:

- Busy

- No Reply

-Not Reachable

-Unconditional

If the caller leaves a voice mail message, a notification is sent to either the subscriber's phone or pager. The subscriber can then retrieve the voicemail message by calling a voicemail retrieval number (ISDN-J) and entering a PIN.

#### Paging Subscriber

Callers who dial a subscriber's Iridium pager number (ISDN-A) will hear a personal greeting asking the caller to leave a voicemail message. If the caller leaves a voicemail message, a notification is sent to the subscriber's pager. The subscriber can then retrieve the voicemail message by calling a voicemail retrieval number (ISDN-J) and entering a PIN.

#### Number Administration for MDAs

The following section describes the numbering plan for the Message Delivery Areas (MDA) that will be used on the Iridium network. These MDAs are geographic locations that are used by the system to direct a message from the satellite constellation to the subscriber's pager. For GNS, MDAs are only used if the phone location is not known by the network.

#### Delivery Area Description

The smallest unit of measure is the Logical Delivery Area or LDA. The Location Area Codes or LCAs are comprised of multiple LDAs. The LACs are generally defined by the largest geopolitical entities contained within a country. For example, in the United States, the LACs are defined by the state boundaries. The largest area type shown is the MDA. In many cases, the MDA will cover the entire country. With large countries, such as the United States, several MDAs will be defined. Stand-alone paging customers will maintain a table of multiple IDAs.

When a message delivery request is generated, the MTC converts each MDA into a list of the LDAs that comprise that MDA. Pages for that customer are then transmitted to the combined list of LDAs. One of the benefits of bundling the paging and telephony through the GNS service is the ability to reduce the number of LDAs in the delivery list in order to more efficiently use Iridium's satellite resources.

For subscribers roaming on Iridium, the particular LAC in which they are located is identified. Their GNS pages are then transmitted to the LDAs that make up their current LAC. For subscribers roaming on a cellular network, the MSCid of their current serving cellular switch is identified. Their GNS page is then delivered to all of the LDAs containing any portion of that MSCid coverage area.

The Message Termination Controller (MSC) contains three databases that are used to determine the list of LDAs for message delivery:

-MDA to LDA

-LAC to LDA

-MSCid to LDA

The following graphic depicts the relationship between MDAs and LDAs in the Iridium network:

#### Methodology

In order to simplify the identification of Iridium MDAs for use by the subscriber, the numbering plan will follow current ITU E.164 country code designations. This should allow a subscriber the association of MDAs with current basic knowledge of the designated country code and mitigate memorization of additional codes.

The following guidelines are proposed for countries with a total of less than 10 beams:

Country Code 1 to 3 digits

For example:

505 Nicaragua-Entire Country

33 France-Entire Country

An assignment of a country code for a particular MDA will allow a subscriber the ability to enter MDAs without referring to brochures in many cases. Additional numbering of regions for larger countries can continue as in the following example:

1 US-Entire Country (reserved for future billing implementation)

11 US-Northeast

12 US-Southeast

13 US-Midwest

etc.

A list of initial MDAs will be developed from these guidelines and loaded for use by the Iridium network. Motorola SATCOM is currently working to expand the range of numbers to a total of 65535 that will be used for MDA definition. Issues such as ocean regions, international air routes, and specialized industry MDAs will be resolved when the total numbering resources are finalized. Capacity issues will also be analyzed to optimize an implementation plan for commercial activation and beyond.

The strategy for MDA definition will be to modify regions based on actual usage patterns as subscribers are loaded onto the network. This allows for a simplified set of MDAs to be distributed initially with additional MDAs following at a later date. Usage based billing capabilities will also be factored into this MDA growth plan to allow Iridium the best capacity utilization.

#### Numbering Administration and Resource Management

In order to properly manage access to Iridium messaging services, the following table of messaging numbers was designed to support origination and retrieval of different types of Iridium messages:

Depending on the service offering, a combination of the above numbers will be provided to the subscriber.

For example: A telephony, voice mail, and paging subscription would have

- MSISDN for the ISU
- ISDN-A for the pager
- ISDN-D for TAP paging
- ISDN-G for general MOC access

The following paragraphs discuss specific uses for the messaging numbers listed in the above table.

#### ISDN-A

An ISDN-A number is assigned to each Alphanumeric and GNS paging subscriber. The ISDN-A number can also be used to access voice mail for paging subscribers. When the ISDN-A number is dialed, the call will be routed to the paging subscriber's account in the MOC. ISDN-A can be used to originate and retrieve messages, or conduct a subscriber service session.

### ISDN-D

The ISDN-D number is used to originate alphanumeric pages with Telocator Alphanumeric Paging Protocol (TAP) paging software on a user's computer. The TAP software would allow the user to select the paging subscriber's ISDN-A number and message prior to dialing the ISDN-D number with their computer. Because the ISDN-A number is specified by the TAP user, only one ISDN-D number is required per MOC to originate TAP pages.

### ISDN-G

When an ISDN-G number is dialed, the caller will be prompted by the MOC to enter the user ID of the subscriber they are calling. The user ID could be the MSISDN number for telephony subscribers or the ISDN-A number for paging subscribers. The ISDN-G number can also be used by subscribers to conduct a subscriber service session.

When a call is terminated at the MOC, voice prompts are provided to inform the caller of commands used to originate or retrieve messages. Voice prompts are available in different languages that are supported by the MOC. An ISDN-G number allows the caller to hear voice prompts in a specific language that is supported by the MOC. By dialing a unique ISDN-G number, the caller always hears voice prompts in a familiar language. A gateway may support up to eight different languages or eight different ISDN-G numbers in their MOC.

### ISDN-J

The ISDN-J number is used internally by the Iridium system for incomplete calls to telephony subscribers. An incomplete call is caused by a Busy, No Answer, Not Reachable, or Unconditional Forwarding condition. The ISDN-J number is used with call forwarding to terminate the call at the MOC, so that a caller can leave a message for the telephony subscriber. This call treatment requires that telephony subscribers be provisioned with Call Forward Not Reachable, Call Forward No Answer, and Call Forward Busy to the ISDN-J number of their home gateway.

When the D900 executes the call forward condition to the ISDN-J number, the calling party in the call setup message contains the subscriber's MSISDN. The MOC uses the calling party address of the MSISDN to decide which MOC account will be

used to answer the call. Therefore, the ISDN-J number can terminate to the correct MOC account without additional digits being dialed by the caller. A gateway may support up to eight different languages or eight different ISDN-J numbers in their MOC.

The ISDN-J number may be replaced by a language specific ISDN-G number selected by the subscriber during provisioning.

### Capcodes

Iridium uses pager capcodes to properly address and deliver pages to a specific Iridium pager. Capcodes are also used by terrestrial-based paging carriers to address specific pagers. A capcode is a sequence of characters that represent a pager's unique characteristics or address. An Iridium pager monitors the L-band paging traffic channel for its specific capcode. When the pager detects its specific capcode, it recognizes that the paging message should be received. The Iridium pager can support multiple capcodes.

The following sections discuss how capcodes are defined in the Iridium system. This discussion is provided as background information on capcodes. Iridium LLC is responsible for generating capcodes and allocating them to the gateways. Gateways are responsible for managing the pool of capcodes assigned to them and provisioning their pagers with capcodes.

The Iridium capcode contains four unique parameters: block, address, frequency access code, and group hierarchy. Each of these parameters can also be derived from the capcode. The following discussion describes each of the parameters.

### Group Hierarchy (GH)

The GH field subdivides blocks into smaller units of time. The GH, like the Block number, relates to when the pager listens. By using the GH field, pagers do not have to listen to the complete block of time. There are 3 Group Hierarchy states in the Iridium system. The GH values should be distributed equally over the pagers in each of the 12 FACs in each Block. Due to the low initial traffic levels, the GH feature is not expected to provide significant benefit at commercial activation and therefore is not part of the baseline design. This situation is being reevaluated as increased paging traffic evolves.

### Gateway

The Gateway Messaging Subsystem consists of the following primary pieces of equipment.

The Gateway Messaging Subsystem consists of the following primary pieces of equipment.

- Siemens D900 GSM Switch
- Message Origination Controller (MOC)
- Notification Center

The Siemens D900 Switch provides the interface to the International Switching Center (ISC) for access to the Messaging Subsystem. The D900 is connected to the MOC and NC via E-1 trunks. The MOC and NC are connected via a TCP/IP interface.

The messages are sent from the MOC at each Gateway to the Messaging Termination Controller (MTC), which is located at the Master Control Facility (MCF) via a TCP/IP connection on the Operational Data Network (ODN). The ODN is a global frame relay network that connects all Gateways to the MCF.

The following diagram illustrates the core messaging subsystem:

### Message Orientation Controller

The MOC is a Glenayre MVP designed to handle paging orientation, voicemail, and fax store and forward. The MOC is configured in 4 different sizes, which include subscriber database and trunking to support a certain level of subscribers. The sizes are as follows:

- M030 supports 25,000 subscribers and 2 E-1 trunk groups
- M060 supports 50,000 subscribers and 6 E-1 trunk groups
- M090 supports 75,000 subscribers and 8 E-1 trunk groups
- M120 supports 100,000 subscribers and 11 E-1 trunk groups

The MOC hardware is configured in two or more cabinets depending on size. The hardware configuration is as follows:

### MOC Main Cabinet

- CPU (MVME147-16MB)
- Trunk Configuration includes

- E-1 interface
- R2 Channel Termination Cards
- 64-Trunk expansion options
- SS& Configuration includes
  - SS&Package with SS& links
- Voice Disk Configuration includes
  - Voice Disks in multiples of 1.2 GB
- Serial Port Board
- Redundancy Configuration includes
  - Redundant-48Vdc Power Supplies
  - Redundant System Disks
  - Redundant Voice Disks

#### MOC Peripheral Cabinet

- Terminal Server and Modern Bank
- Modem Card Package
- 48 Vdc Hub
- Redundant -48Vdc Power Supplies

The MOC receives messages and stores them in the subscriber account record for delivery to the MTC. The MOC sends a Message Delivery Request (MDR) to the MTC. The MTC returns Message Disposition Notification (MDN), which indicates whether the MTC accepted or rejected the MDR.

A maximum of 114 MDRs/second can be sent from the MOC to the MTC. A maximum of 319 MDOs can be sent from the MTC to the TTACs. The following diagram shows the message flow between the MOC and the MTC:

#### MOC Access Methods

There are a variety of ways to access the messaging system to send both numeric and alphanumeric messages. The most common forms of access are Direct Dial (8816 or 8817), local PSTN access via a PBX, Terrestrial Paging Interconnection, Service Bureau Interconnection, and Internet or E-Mail access. All access methods are currently being

worked through the ILLC Service Development Process.

#### DMS Direct Dial

The Direct Messaging Service (DMS) access by dialing the 8816 or 8817 ISDN-A number associated with each MTD directly. The call is connected to the MOC through the D900 Siemens switch. The caller hears the voice prompts in the language as specified by the subscriber and is prompted to leave a numeric or voice mail message. The message is stored in the subscriber record, routed through the Iridium's system and delivered to the MTD.

To send an alphanumeric message the caller will dial the ISDN-D number of the subscriber with a computer equipped with a Messaging Software package capable of sending the message in either TAP or TNPP protocol. The message is sent to the ISDN-A address, which is the last 8 digits of the ISDN-A number or equivalent of the 8 digits after the country code (8816 or 8817).

#### PBX Local Access

Local PSTN access can be provided with either local interconnection to the MOC (in countries with MVP type acceptance) or through a PBX installed in the Gateway. In either case the call is connected to the MOC via the ISDN-A number (without the country code 8816 or 8817). The calling party then leaves either a voice mail or numeric message by entering the DTMF digits. The message is stored in the subscriber record, routed through the Iridium system and delivered to the MTD.

Alphanumeric access is provided by dialing the ISDN-D number with a computer equipped with the appropriate Messaging Software package. The message is sent as an ISDN-A address (8 digits, without the country code 8816 or 8817) in the TAP or TNPP protocol.

#### Terrestrial Paging Interconnection

Terrestrial Paging Interconnection provides local access from the Terrestrial Paging Carriers in the Gateway territories. The paging carriers interconnect by either dial up or dedicated facilities. The messages are sent to an 8 digit ISDN-A address without the country code 8816 or 8817 in the TAP or TNPP protocol. The numeric or

alphanumeric messages are stored in the subscriber record, routed through the Iridium system and delivered to the MTD.

#### Service Bureau Interconnection

5           The Service Bureau Interconnection provides access from Service Bureaus within the Gateway Operators territory. The Service Bureau's interconnection with each Gateway by either dial up or dedicated facilities. The message is sent to an 8 digit ISDN-A address without the country code 8816 or 8817 in the TAP or TNPP protocol. The numeric or alphanumeric messages are stored in the subscriber record, routed  
10           through the Iridium system and delivered to the MTD.

#### Notification Center (NC)

          The NC can be, for example, a Short Messaging Service Center (SMS-C) that is designed to handle SMS applications. The first generation SMS services are Mobile  
15       Terminated services for Enhanced Call Completion (ECC), Voice Mail and Fax Mail notification. The NC also queries the HLR in order to direct the message for GNS.

          The Aldiscon SMS-C does not have a database for provisioning services. The MOC contains all subscriber account information in the MOC database. The Aldiscon is capable of supporting new SMS services that will be developed by ILLC. The NC  
20       Hardware is configured in a single NC cabinet. The hardware configuration in a typical embodiment comprises the following:

##### NC Cabinet:

- 25       -HP9000 K210-T Server, running HP UNIX
- HP Telecommunications Disk System (A and B)
- 2 GB Fwd SCSI-2 Disk Drive
- Quad speed 600 MB CD-ROM Drive
- 4 GB DDS DAT Drive
- SS7 Interface Unit (SIU), supporting an SS& interface and 2 SS7 links
- 30       -Power Distribution block (-48Vdc)

#### SMS Services

          The Iridium SMS services are defined as GSM services provided by a SMS-C.  
35       SMS allows short text messages of 160 characters. Up to four SMS messages can be

concatenated to provide up to 640 character messages. SMS services can be Mobile Originated or Mobile Terminated.

The SMS-C stores SMS messages for delivery to the Mobile or Service provider. It controls the interface, scheduling and delivery of messages. The SMS-C confirms  
5 delivery of the message to the ISU. It also stores the message for future delivery for an ISU that is not reachable.

The SMS-C supports enhanced Call Completion (ECC) and Voice Mail or Fax Mail notification. When a subscriber's ISU is not reachable, the call is routed to the subscriber's mailbox. The calling party is prompted by a personal or system greeting to  
10 leave a numeric message. The calling party enters the DTMF message of up to 20 numeric digits, which is transmitted to the ISU or stored for future delivery in the MOC. The MOC transmits the message to the NC, which schedules the message for delivery and confirms receipt of the message by the ISU. If the ISU is not reachable, it stores the message and sets a flag indicating that a SMS message is waiting for delivery. When the  
15 ISU registers with the Iridium system, the message is sent. The following is the message flow for ECC.

The SMS-C is used to track subscribers that use the GNS service utilizing Messaging/Telephony Location Interworking (MTLI). The SMS-C determines the GNS paging location by querying the telephony subscribers HLR for routing information. It  
20 also queries the Iridium VLR for LAC information for subscribers who may be roaming. This information is used to determine where to route the paging message, and is passed from the SMS-C to the MOC and MTC. The message sent to the GNS subscriber is then routed to the MDA and LDA that services the area identified by the MSCid or LAC. The MDA-MSCid and MDA-LAC tables are maintained in the MTC at the MCF.

25 Other Mobile Terminated and Mobile Originated SMS services are under development by ILLC. As they progress through the ILLC Service Development process they will be included in this document.

#### Message Termination Controller

30 The MTC is located in the Iridium Master Control Facility. Its purpose is to collect all the messages from each MOC and schedule their delivery through the constellation. The following is a diagram of the MTC as part of the messaging system.

The MTC controls the flow of Message Delivery Requests (MDRs) transmitted by all MOCs. A maximum of 114 MDRs per second from all MOCs can be sent to the MTC. A maximum of 319 Message Delivery Orders (MDOs) per second can be sent from the MTC to the TTACs.

5           The redundant MTC at the MCF and the BCF control and schedule message delivery via the constellation. The MTC writes the message to disk (protected storage), verifies the message length of up to 200 characters, verifies valid MDA, LAC or MSCid and maps the message to the corresponding LDA for delivery to the MTD. The MTC will break long messages into segments to fit into each transmission burst. It schedules  
10       the appropriate opportunity to delivery the primary message and diversity message.

          The Iridium system provides for improved performance due to message delivery diversity. Messages can be sent more than once, which improves the overall performance of the Iridium network. Ninety percent of the first pages are delivered within seven minutes of MOC receipt and ninety nine percent are delivered within  
15       fourteen minutes.

          All MDRs are written to RAID disks shared by both MTC hosts. The RAID disks provide redundancy to ensure messages are not lost during a MTC host failure. All MTC tables are stored in RAID disks and in RAM. INM provides MTC table updates. The MPS generates the active beam tables used by the MTC to determine SV  
20       opportunities. Comm Services provides the OSN connection to the TTACs. The message flow between the MOC, MTC and SCS is documented earlier in the manual.

#### Voice Mail and Numeric Messaging Feature

For calls to a customer's pager number:

25           Caller dials customer's pager number, where he is connected to the customer's mailbox and prompted to:

1. leave a numeric message
2. leave a voice mail message

Customer sets up mailbox to send numeric message and voice mail notifications to:

- 30           -the phone  
              -the pager  
              -both the phone and pager

### Text Messaging Feature

There are several ways a text message may be sent to a customer:

#### E-mail

Message is sent via the internet to the customer's Iridium internet ID

#### Iridium Web Page

Sender accesses Iridium Web Site and uses "Send A Message" feature

#### Dial-up to Gateway

Sender uses Iridium-supplied messaging software and sends message directly to the Gateway

Every Iridium-home voice and paging customer is given an internet ID (phone number or pager number) @iridium.com, to which text messages may be sent via the internet.

### **Emergency Calling**

#### Description

This service is provided when using the Iridium satellite network only.

The Iridium satellite network will support emergency calling throughout the world. Two methods of emergency calling are provided, both of which will route emergency calls to an Emergency Service Center based on the user's location.

#### User dials the Iridium System-Wide Emergency Calling code (112)

The number 112 is recognized throughout the Iridium satellite network as an emergency call. When dialed by the user, the ISU recognizes the call as an emergency call and handles the call accordingly.

The Gateway will determine the appropriate Emergency Service Center to route the call to based on the user's LAC. The Gateway will have a lookup table of Emergency Service Center numbers for each LAC for each LAC for 112 emergency calls.

#### User Dials SIM Card-Supported Emergency Calling Code

in order to:

-provide users with the ability to dial an emergency number which is familiar to

them, and

-allow Gateway Operators to support multiple emergency calling numbers (e.g., police, ambulance, maritime),

an Iridium Service Provider may provide up to five additional Emergency Calling  
5 Codes (each number may be up to 6 digits in length) on the user's SIM card that the ISU  
will recognize as an emergency call.

For users who are accustomed to using a single emergency code, the SIM card  
can be configured to handle that code in the same manner as 112 calls.

For users who are accustomed to multiple emergency codes (each for a different  
10 emergency service), multiple codes can be programmed on the SIM card and will be  
recognized by the ISU as emergency calls. When the user is in the country in which  
these codes are relevant, these calls will be routed based on the subscriber's location and  
the particular code dialed. In other countries, calls initiated with these codes will be  
treated as 112 emergency calls.

15 The SIM card must be inserted in the ISU and a valid PIN entered in order to  
place an emergency call.

#### Provisioning

All satellite voice users will be automatically provisioned for emergency calling  
20 capability (using the 112 code). Iridium Service Providers may also provide country-  
specific Emergency Calling Codes for the subscriber on the SIM card (this information  
would be specified on the SIM card personalization profile).

#### Charging Principles

25 Emergency calls will not be charged to the subscriber. PSTN charges for  
terminating emergency calls will be absorbed by the Terminating Gateway.

#### Message Delivery Areas and LDAs

Select from the following and click the map:

30

#### Geolocation

In order to provide the above services, the location of the subscriber equipment  
(cellular phone 130, pager 135, etc.) with respect to the satellites 105, as well as the LAC in

which the subscriber resides must be determined. As discussed with respect to Figure 2, above, each satellite 105 has a footprint 210 containing cells 220. Thus, the information used by the satellite 105 and the network 100 is based on the geometry such as cells 220 and footprints 210. The cells 220 can be thought of as a grid superimposed on and fixed  
5 with respect to the earth. However, the cells 220 in the grid do not take into account geographic features of the earth. For example, the globe is also divided into LACs. The LAC may be based on a variety of geographic features. For example, the LACs serviced by a particular gateway 110 may be defined to fall within a particular country. The LACs may also be defined to ensure that signals can adequately be provided to subscribers with the  
10 LAC. Thus, the LACs may be defined so that two LACs border a mountain range. LACs can also be gathered into a group, called a service control area (SCA). An SCA includes LACs within a particular geopolitical region. Thus, an SCA includes LACs sharing the same country. Based on the identity of the LACs or SCAs serviced, various aspects of a call can be determined. For example, using the Home gateway of the cellular phone 130 and the  
15 country of the destination LAC for a call, it can be determined whether a call to a particular LAC can proceed. The billing and tariff information for the country of the destination LAC can also be determined. Thus, the LACs and SCAs are to be linked to the geometry, including the cells 220 of the network 100.

The present invention provides a method and system for managing an interaction  
20 with a user of a telecommunications network. The telecommunications network utilizes data relating to a geometry of the network. The method and system comprise identifying a plurality of geographic regions and correlating the geometry with plurality of geographic regions. Thus, data relating to the geographic regions can be used in the telecommunications network.

25 The present invention will be described in terms of a particular network using particular equipment and providing particular services. However, one of ordinary skill in the art will readily recognize that this method and system will operate effectively for other types of networks, other equipment, and other services. The method and system in accordance with the present invention provide particular utility when correlation of  
30 geometry and geography is desired.

A method and system for determining the spatial overlap of LACs and cells is disclosed in co-pending U.S. Patent Application Serial No. \_\_\_\_\_ (1121P) entitled

"Method and System for Locating Subscribers in a Global Telecommunications Network," filed on \_\_\_\_ and assigned to the assignee of the present application. Applicant hereby incorporates by reference the above-mentioned co-pending application.

To more particularly illustrate the method and system in accordance with the present invention, refer now to Figure 7, depicting a flow chart of a method 700 in accordance with the present invention. The geographic regions are identified, via step 710. In a preferred embodiment, step 710 includes identifying each of the plurality of LACs and the SCAs which will be used by the network 100. In a preferred embodiment, therefore, the geographic regions include LACs and/or SCAs. In a preferred embodiment, step 710 also includes generating a map indicating each of the LACs and SCAs. The map can be utilized by a computer system which will provide information to the network 100. In a preferred embodiment, the map can be provided using conventional geographic software. The geographic regions are then correlated with the geometry of the network 100, via step 720. In step 720, the geographic regions are correlated with the geometry so that the network 100 can utilize the information to manage services to users. In a preferred embodiment, step 720 includes correlating LACs and/or SCAs with cells 220. Also in a preferred embodiment, step 720 includes generating a table correlating the cells 220 with LACs and/or the SCAs. The table can be used by the network 100 to manage services provided to a user. The table is preferably an ASCII file, which can be converted to a binary format. The binary file is used by the network 100 to manage services to a user.

Figure 8 depicts a more detailed flow chart of the step 720, correlating geographic regions with the geometry of the network 100. A cell 220 is identified, via step 722. The cell 220 is one of a number of cells which form a grid over the earth. In a preferred embodiment, the cell 220 identified in step 722 is a zeroth level cell. The zeroth level cell is not at the highest spatial resolution allowed in the network 100. In a preferred embodiment, the zeroth level cell is on the order of sixty-four kilometers by sixty-four kilometers. Also in the preferred embodiment, the spatial resolution is approximately four kilometers. Although cells 220 depicted in Figure 2 have the same size, in a preferred embodiment of the network 100, cells 220 include cells 220 and subcells 220. The cells 220 and subcells 220 can have a plurality of sizes. In one embodiment, each cell is provided with a unique identifier. Thus, step 724 is performed by associating the cell with a unique identifier. In a preferred embodiment, the identifier is a grid identifier based on a latitude and longitude.

This identifier is what is used by the network 100 to identify the cell 220.

It is then determined if a boundary of an LAC intersects the current cell 220, via step 724. If a boundary of an LAC does not intersect the current cell 220, then the cell 220 is contained in an LAC. Thus, the LAC which contains the cell 220 is correlated with the cell 220, via step 734. In a preferred embodiment, step 734 includes identifying the LAC containing the cell 220 and writing the identities of the LAC and the cell 220 to a table. Thus, in a preferred embodiment step 734 includes writing the identifier of the cell 220 and an identifier for the LAC into the table. Also in a preferred embodiment, step 734 also includes writing the identity of the SCA containing the LAC in the table. Step 734 also preferably includes choosing whether or not to set a flag for the cell 220 in the table. If the flag is set, then the cell 220 will contain subcells. If the flag is not set, then the cell 220 is not intersected by a boundary of an LAC and the cell 220 does not contain subcells.

If it is determined in step 724 that the boundary of an LAC intersects the cell 220, then it is determined whether the cell 220 is at the maximum resolution of the network 100, via step 726. In a preferred embodiment, the maximum resolution is a cell 220 approximately four kilometers by four kilometers. If the cell 220 is at the maximum resolution, then the LAC which covers the largest portion of the cell 220 (centroid LAC) is correlated with the cell 220, via step 728. In a preferred embodiment, step 728 includes not only identifying the centroid LAC, but also writing the identities of the cell 220 and the centroid LAC to a table. Thus, step 728 includes writing the identifier for the cell 220 and an identifier for the LAC into the table. Also in a preferred embodiment, step 728 includes writing the SCA containing the centroid LAC to the table.

If it is determined that the cell 220 is not at the maximum resolution of the network 100, then the cell 220 is divided, via step 730. In a preferred embodiment, the cell 220 is bisected into subcells 220, via step 730. Consequently, step 730 may be carried out five times from the zeroth level cell 220 to reach the maximum resolution of the network 100. It is then determined if a boundary of an LAC intersects the subcell 220, via step 732. If a boundary of an LAC does not intersect the subcell 220, then the LAC containing the subcell 220 is correlated with the subcell 220, via step 734. In a preferred embodiment, step 734 includes identifying the LAC containing the (sub)cell 220 and writing the identities of the (sub)cell 220 and the LAC to a table. Also in a preferred embodiment, step 734 includes writing the SCA containing the LAC in the table. Step 734 also preferably includes

choosing whether or not to set a flag for the cell 220 in the table. If the flag is set, then the cell 220 will contain subcells. If the flag is not set, then the cell 220 is not intersected by a boundary of an LAC and the cell 220 does not contain subcells. If a boundary of an LAC intersects the subcell 220, then step 726 is returned to. Thus, the process of determining if a boundary of an LAC intersects a cell 220 and correlating the appropriate LAC with the cell 220 or subcell 220 continues until either the maximum resolution of the network 100 is reached or until a cell 220 is contained completely within an LAC.

Once either step 728 or step 734 is performed, it is determined whether all of the subcells 220 for a particular zeroth cell 220 have been correlated with LACs, via step 736. If not all subcells 220 have been treated in the method 720, then the next subcell 220 is identified, via step 738. The method then returns to step 724 and the process repeats for that subcell 220. If all of the subcells 220 have been correlated with LACs, it is determined whether all of the cells 220 for the network 100 have been correlated with LACs, via step 740. If not, then the zeroth cell 220 is identified, via step 742. The method then returns to step 724 and the process repeats for that cell 220. If all of the cells 220 have been correlated with LACs which either contain the cell 220 or are centroids of the cell 220, then the method terminates, via step 744.

Figure 9 depicts a high level flow chart of a method 750 for managing interactions in accordance with the present invention. The geographic regions are identified, via step 752. Thus, step 752 is analogous to step 710 of the method 700. The geographic regions are then correlated with the geometry of the network 100, via step 754. Step 754 is analogous to step 720. Consequently, the resultant of step 754 is preferably a table which lists each cell 220, or subcell 220, the LAC which is correlated with it, and the SCA in which the LAC is grouped. The table is then converted into a format which can be directly used by the network 100, via step 756. In a preferred embodiment, step 756 includes converting the table into a binary object which can be used by various portions of the network 100 to identify the cell 220, the LAC correlated with the cell 220, and the SCA containing the LAC. In a preferred embodiment, the conversion of the table utilizes the flag set in step 734 to ensure that data is provided in the correct order. In a preferred embodiment, data for all cells and subcells is contained together. If the flag is set, then data for a cell 220 and its subcells 220 are accessed and written to the binary object in order, from zeroth level cell 220 to smallest subcell 220. Then, data for the next cell 220 will be

accessed from the table and written to the binary object. The network 100 then utilizes the geometry and geography information to manage interactions with a user, via step 758. In a preferred embodiment, step 758 includes but is not limited to determining if a particular call can be placed to a particular LAC, and determining billing information.

5           Thus, the geometry of the network 100 has been correlated to geography. Because this correlation has been provided, laws, tariffs, and other sovereignty issues for individual geopolitical entities can be taken into account by the network 100. Geographic features, such as mountain ranges, can also be taken into account by the network 100. Although the network 100 utilizes a geometry which would not otherwise be correlated to geographic  
10 features, the network 100 can be used to provide global telecommunications services to users.

A method and system has been disclosed for managing user interactions using geographic and geometry information. Although the present invention has been described in accordance with the embodiments shown, one of ordinary skill in the art will readily  
15 recognize that there could be variations to the embodiments and those variations would be within the spirit and scope of the present invention. Accordingly, many modifications may be made by one of ordinary skill in the art without departing from the spirit and scope of the appended claims.

#### 20    Internet Messaging

As described above, a user can receive messages on a pager 135 or phone 130 via the network 100. It is desirable to allow the user to receive messages from a variety of sources, including the Internet. In addition, it is desirable to allow senders of the message to  
25 utilize a single identifier, such as a subscriber number, regardless of the source of the message.

The present invention provides a system and method for providing a message to a user of a global telecommunications network. The message originates from the Internet. The message includes an address indicating an identity of a user within the global telecommunications network. The method and system comprise receiving the message at a  
30 central location and routing the message to a Home Gateway of the user. The method and system further comprise providing the message from the Home Gateway to the user.

The present invention will be described in terms of a particular telecommunications

network. However, one of ordinary skill in the art will readily recognize that this method and system will operate effectively for other types of telecommunications network having a centralized mechanism for receiving messages.

To more particularly illustrate the method and system in accordance with the present invention, refer now to Figure 10 depicting a block diagram of one embodiment including such a system. The system 800 includes portions of the network 100 in accordance with the present invention. The system 800 includes gateways 110. For clarity, only a portion of each of the gateways 110 is labeled. The gateways 110 are coupled to an operations data network (ODN) 804. The ODN 804 is also coupled to a central Internet server 802. The central Internet server 802 is coupled with the Internet 808 via Internet service provider 810. In a preferred embodiment, the central Internet server 802 is coupled with a service platform 806.

Note that in a current implementation, the services platform 806 is not included. The services platform 806 allows users of the network 100 to be able to choose services offered via the network 100 to which the users want to have access. Also in the current implementation, the MOCs 330 are coupled with the central Internet server 802 only through the ODN 804. However, in a preferred embodiment, the MOCs 330 are coupled with the central Internet server 802 both through the ODN 804 and the Internet 808. Also in a current implementation, the central Internet server 702 is not provided. Instead, messages received at a central location, where the central Internet server 702 might reside, are routed via the ODN 804.

Messages may originate from a user coupled with the central Internet server 802 through the Internet 808. For example, an individual using the computer 814 coupled with the Internet 808 through Internet service provided 812 may desire to send a message to a user of the network 100. The message may be a paging message, a phone message, or other message.

Figure 11 depicts a method 900 for providing Internet messaging in accordance with the present invention. Messages are provided over the Internet 808. The messages are addressed to users of the network 100. The central Internet server 802 receives messages for users of the network 100 from the Internet 808, via step 910. In an alternate embodiment, step 910 includes receiving the messages at a centralized location not including the Internet server 802. Thus, the central Internet server 802 or central location

provides a uniform point of access for individuals desiring to send a message to users of the network 100 via the Internet 808. In a preferred embodiment, a message to a user of the network 100 can be addressed using a subscriber number of the user with the string "@IRIDIUM.com". Thus, in a preferred embodiment, a sender of a message via the Internet need only remember the subscriber number of the user of the Internet to whom the message is sent and the appellation "IRIDIUM.com".

Once the messages are received at the central Internet server 802, the messages are sent to the Home Gateway of the users to whom the messages are addressed, via step 920. In a preferred embodiment, step 920 routes the each message from the central Internet server 804 to the MOC 330 in the Home Gateway of the user to whom the message is addressed. As discussed above, the Home Gateway is the gateway 110 which is associated with a LAC to which the user is based. In the current implementation, step 920 is performed by routing the message to the Home Gateway via the ODN 804. However, in a preferred embodiment, step 920 may be performed by routing the message to the Home Gateway via the ODN 804 or through the Internet 808. Once the message is received at the home gateway, the message is provided to the user to whom the message is addressed, via step 930. In a preferred embodiment, step 930 is performed by sending the message to the user via the satellites 105. Thus, the user may be paged or receive another form of the message in step 930.

Figure 12 depicts one embodiment of the method 920 for routing the messages to the Home Gateways. In a preferred embodiment, each MOC 330 has an Internet protocol (IP) address. Also in a preferred embodiment, the subscriber number, which is used to address each message, includes several portions. One portion of the subscriber number uniquely identifies a user of a particular Home Gateway. Another portion of the subscriber number includes a geopolitical entity code (GE code). Each gateway 110 is associated with at least one geopolitical entity. Each geopolitical entity is identified using a GE code. Thus, each gateway 110 is associated with several GE codes.

The GE codes associated with each gateway 110 are mapped to the IP addresses for the MOCs 330 of the corresponding gateways 110, via step 922. The GE codes embedded in addresses of the messages are then extracted, via step 924. Using the map created in step 922, the IP addresses of the MOCs 330 in the Home Gateways are then obtained, via step 926. Using the IP address of the MOCs 330, the messages are then routed to the MOCs 330

of the Home Gateways, via step 928. Consequently, messages from the Internet can be routed to the appropriate Home Gateway.

As discussed above, once the messages are at the Home Gateways of the users to whom the messages are directed, the messages can be provided to the users, via step 930. Figure 13 depicts one embodiment of the step 930. As discussed above, the equipment provided to a user of the network 100 may include a phone 130, a pager 135, or other equipment. Consequently, the messages at the users' Home Gateways are processed, via step 932. In one embodiment, step 932 includes formatting the message for the particular equipment of the user to whom the message is directed. The processed message may then be sent to the user through the network 100, via step 934. In one embodiment, step 934 may include simply notifying the user that a message has arrived. The user may then access the message through another mechanism.

Because a centralized server receives the messages, a uniform access point is provided for messages received from the Internet. Because some of the Internet related functions are provided by the central Internet server 802, the MOCs 330 need not contain significant additional architecture designed for Internet use. In addition, the services provided to a user of the network 100 may be based on the Internet server 802, rather than on the specifics of each gateway 110. Thus, uniform service may be provided to users of the network 100. Moreover, users can be accessed via the Internet using their subscriber number and a central address, such as "@IRIDIUM.com". Consequently, use of the Internet capabilities of the network 100 is facilitated.

A method and system has been disclosed for providing Internet messaging using a centralized architecture. Although the present invention has been described in accordance with the embodiments shown, one of ordinary skill in the art will readily recognize that there could be variations to the embodiments and those variations would be within the spirit and scope of the present invention. Accordingly, many modifications may be made by one of ordinary skill in the art without departing from the spirit and scope of the appended claims.

#### Provision of Services to Users

In order to provide the above services, the location of the subscriber equipment (cellular phone 130, pager 135, etc.) with respect to the satellites 105 must be determined.

As discussed with respect to Figure 2, above, each satellite 105 has a footprint 210 containing cells 220. Thus, the information used by the satellite 105 and the network 100 is based on the geometry such as cells 220 and footprints 210. The cells 220 can be thought of as a grid superimposed on and fixed with respect to the earth. However, the satellites 105  
5 providing service to the users of the network 100 move with respect to the earth. In addition, the cells 220 in the grid do not take into account geographic features. These geographic features are also taken into account in delivering service to users.

For example, the earth can be divided based on the services provided. For paging, the earth is preferably divided into areas known as message delivery areas (MDAs). Each  
10 MDA is associated with a particular geographic area. When a user of the network 100 roams from his or her Home Gateway, the user may still desire to receive pages. In order to do so, the user notifies the Home Gateway of the MDA in which the user currently resides. When a paging message is received at the user's Home Gateway, a notification that the user has been paged is provided to the user at the MDA in which the user currently resides. In  
15 order to do so, the network 100 determines how to contact the user in this new MDA. Similarly, a call may be desired to be routed to a user when the user roams to another geographic region. In order to provide the call to the user, the LAC in which the user currently resides must be determined and the call provided to the user. To provide cellular services the identity of the MSC 310 (MSCid) in the corresponding gateway 110 (depicted  
20 in Figure 3) should also be determined.

A method and system for correlating LACs and cells is disclosed in co-pending U.S. Patent Application Serial No. \_\_\_\_ entitled "Method and System for Providing Services to Users of a Global Telecommunications Network" filed on \_\_\_\_ and assigned to the assignee of the present application. Applicant hereby incorporates by reference the above-mentioned  
25 co-pending application.

The present invention provides a method and system for providing a service to a user of a telecommunications network. The telecommunications network utilizes data relating to a geometry of the telecommunications network. The telecommunications network includes a plurality of satellites. The method and system comprise identifying a  
30 plurality of service areas, and determining a plurality of intersections between the geometry and plurality of service areas. The method and system further comprise activating a satellite of the plurality of satellites to use in providing the service to the user based on the

intersections between the geometry and the plurality of service areas.

The present invention will be described in terms of a particular network using particular equipment and providing particular services. However, one of ordinary skill in the art will readily recognize that this method and system will operate effectively for other types of networks, other equipment, and other services. The method and system in accordance with the present invention provide particular utility when correlation of geometry and geography is desired.

To more particularly illustrate the method and system in accordance with the present invention, refer now to Figure 14, depicting a flow chart of a method 1000 for providing services in accordance with the present invention. The services being provided through the method 1000 are associated with service areas. In one embodiment, the service areas for paging are MDAs because the page is provided to the MDA in which the user currently resides. In one embodiment, the service areas for calls are LACs. The service areas may also correspond to MSCids. In such a case, a cellular service provider determines a position where the service provider is located. The service area for the MSCid around this position is then defined. Note that a service discussed with respect to Figures 14-16 is paging. However, the method 1000 is consistent with other services, such as calls.

The service areas, such as MDAs, are identified or defined, via step 1010. If another service is provided, then step 1010 includes identifying LACs, the MSCids, or other service areas. In a preferred embodiment, step 1010 also includes generating a map indicating each of the MDAs. The map can be utilized by a computer system which will provide information to the network 100. In a preferred embodiment, the map can be provided using conventional geographic software. In one embodiment, step 1010 also includes providing each MDA with a unique MDA identifier. The intersections between the geometry utilized by the network 100 and the MDAs or other service areas are determined, via step 1020. Thus, the network 100 can link the MDAs to which pages are to be sent based to the geometry used by the network 100. Similarly, the network 100 link the service areas associated with other services to on the geometry used by the network 100. The appropriate satellites are activated to provide the paging or other services based on the intersections of the geometry and the MDAs or other service.

Figure 15 depicts a more detailed flow chart of a preferred embodiment of step 1020, determining the intersections between the MDAs or other service areas and the

geometry of the network 100. In the embodiment of step 1020 depicted in Figure 14, the geometry used by the network 100 includes a plurality of cells 220. The cells 220 are fixed with respect to the earth. In one embodiment, each cell 220 is also provided with a unique identifier. In a preferred embodiment, the identifier is a grid identifier based on a latitude and longitude. The network 100 uses this identifier to identify the cell 220. However, the satellites 105 move with respect to the earth and, therefore, with respect to the cells 220.

An MDA is selected, via step 1022. The cells 220 which intersect the MDA are then determined, via step 1024. In a preferred embodiment, a cell 220 intersects an MDA if a portion of the cell 220 is contained within the MDA. The cells 220 which intersect the MDA are then associated with the MDA, via step 1026. Thus, in a preferred embodiment, the cell 220 need not be contained completely within the MDA to be associated with the MDA. In a preferred embodiment step 1026 includes writing the identifier of the cells 220 and the MDA identifier for the MDA into a table. Steps 1022 through 1026 are then repeated until all of the MDAs are associated with the cells which intersect the MDAs.

Figure 16 depicts a high level flow chart of a method 1030 for activating the appropriate satellites in accordance with the present invention. As discussed with respect to Figure 2, each satellite 105 has a footprint 210. The satellites 105 move with respect to the earth and, therefore, the cells 220. Thus, the cells 220 within a footprint 210 change. The motion of the satellites with respect to the earth is predictable. Consequently, a scheduler can determine which cells 220 correspond to a particular footprint 210 at any time.

The MDAs which correspond to the services being provided are determined, via step 1032. In one embodiment, step 1032 includes determining the MDAs associated with the users being paged. In another embodiment, step 1032 includes determining the LACs in which the users making or receiving a call reside. The cells 220 which have been associated with these MDAs in step 1020 are then determined, via step 1034. Using the scheduler, the satellites 105 having footprints 210 which correspond to these cells are then determined, via step 1036. These satellites 105 are then activated, via step 1038. Consequently, a user of the network 100 can receive a page. Other services, such as calls, can be treated similarly.

Because service areas have been associated with the geometry of the network 100, the appropriate satellites 105 can be activated. Consequently, paging and other services can be provided to users of the global telecommunications network 100.

5 A method and system has been disclosed for providing services to users of a global telecommunications network. Although the present invention has been described in accordance with the embodiments shown, one of ordinary skill in the art will readily recognize that there could be variations to the embodiments and those variations would be within the spirit and scope of the present invention. Accordingly, many modifications may be made by one of ordinary skill in the art without departing from the spirit and scope of the present invention.

## CLAIMS

What is claimed is:

1. A method for billing call events in a global telecommunications network, comprising sequentially the steps of:

(a) collecting a plurality of billing files records from a plurality of sources in a global telecommunications network;

5 (b) matching at least two of a plurality of call event records in the plurality of billing files if they relate to a same call event;

(c) rating the plurality of call event records;

(d) converting the plurality of call event records;

10 (e) settling the plurality of billing files, wherein one or more reports are created based upon the plurality of call event records; and

(f) distributing the plurality of billing files and the reports to a plurality of destinations.

15 2. The method of claim 1, wherein the plurality of sources comprise service providers, roaming partners, industry clearinghouses, and internal collection sources.

3. The method of claim 1, wherein the collecting step (a) comprises the steps of:

20 (a1) collecting the plurality of billing files;

(a2) validating the plurality of billing files;

(a3) converting a plurality of call detail records in the plurality of billing files into a standard format; and

(a4) checking for duplicate call detail records for at least a portion of the plurality of billing files.

25

4. The method of claim 3, wherein the plurality of call event records are collected from a plurality of files, the plurality of files comprising Siemens D900 files, Cellular Inter-carrier Billing Exchange Roamer files, Transfer Account Protocol files,

Modular Voice Processing files, and subscriber/customer status files.

5. The method of claim 4, wherein the Siemens D900 files and the Modular Voice Processing files are collected from an Operations Maintenance Controller-Gateway of the network.

6. The method of claim 4, wherein the Cellular Inter-carrier Billing Exchange Roamer files and the Transfer Account Protocol files are collected from a plurality of roaming partners and a plurality of industry clearinghouses.

7. The method of claim 4, wherein the subscriber/customer status files are collected from internal network sources.

8. The method of claim 3, wherein the validating step (a2) comprises:  
(a2i) ensuring the plurality of call detail records are complete and properly formatted;  
(a2ii) ensuring subsequent network process receive usable information from the plurality of call detail records; and  
(a2iii) ensuring the network's integrity is maintained.

9. The method of claim 3, wherein the converting step (a3) comprises:  
(a3i) converting the plurality of call detail records to a standard network format; and  
(a3ii) associating each record in the plurality of call detail records to either a matching process or a rating process.

10. The method of claim 3, wherein the checking step (a) comprises:  
(a4i) checking at least a portion of the plurality of call detail records against previous billing records sent from the same network entity.

11. The method of claim 1, wherein the matching step (b) comprises:  
(b1) receiving a plurality of call detail records from a collections process;

- (b2) locating call head call detail records;
- (b3) grouping intra-switch call detail records with matching call head call detail records;
- (b4) grouping inter-switch call detail records with matching call head call detail records; and
- (b5) grouping call tail records with matching call head call detail records.

12. The method of claim 11, wherein the matching step (b) further comprises the steps of:

- (b6) placing call detail records which were not matched into a pool; and
- (b7) rematching the call detail records in the pool.

13. The method of claim 12, wherein the rematching step (b7) is repeated if one or more call detail records remain in the pool.

14. The method of claim 1, wherein the rating step (c) comprises the steps of:

- (c1) receiving a plurality of call detail records from a matching process;
- (c2) converting the plurality of matched call detail records to a standard format;
- (c3) determining an appropriate pricing model to each of the plurality of call detail records;
- (c4) rating the plurality of call detail records according the appropriate pricing model for each of the plurality of call event records; and
- (c5) determining charges and allocations for the plurality of rated call detail records.

15. The method of claim 14, wherein the converting step (c2) comprises:

- (c2i) converting the plurality of call detail records to a Data Message Handling format.

16. The method of claim 14, wherein the pricing model comprises a zone to zone pricing model.

17. The method of claim 14, where in the rating step (c4) comprises:

(c4i) determining a charge type for each of the plurality of call detail records;

(c4ii) applying a base rate to each of the plurality of call detail records; and

(c4iii) applying a plurality of adjustments to each of the plurality of call detail

5 records.

18. The method of claim 14, further comprising the steps of:

(c6) validating the plurality of call detail records;

(c7) identifying ratable call detail records from the plurality of call detail

10 records; and

(c8) determining call attributes for the plurality of call detail records.

19. The method of claim 18, wherein the ratability of call detail records are identified in step (c7) using a release indicator, feature indicator, redirection indicator, and event indicator fields of the plurality of call detail records.

15

20. The method of claim 18, wherein the call attributes are determined in step (c8) using a call detail record type, feature type, and redirection type fields in the plurality of call detail records.

20

21. The method of claim 1, wherein the converting step (d) comprises the steps of:

(d1) receiving a plurality of call detail records from a rating process;

(d2) converting the plurality of call detail records, wherein the call detail

25 records have a plurality of destinations;

(d3) sending a first portion of the plurality of call detail records to a first destination; and

(d4) sending a second portion of the plurality of call detail records to a second destination.

30

22. The method of claim 21, wherein the first destination is a plurality of repositories comprising a usage repository, an error repository, and an original call detail

record directory.

23. The method of claim 21, wherein the second destination is a plurality of subsequent processes, the subsequent processes comprising a settlements process and a distribution process.

24. The method of claim 21, wherein the types of the plurality of call detail records comprise valid records, original call detail records, invalid records, and event records,  
wherein the valid records, the invalid records, and the original call detail records are sent to the first destination,  
wherein the events records are sent to the second destination.

25. The method of claim 24, wherein  
valid records are sent to a usage repository,  
invalid records are sent to an error repository, and  
original call detail records are sent to an original call detail record directory.

26. The method of claim 24, wherein a plurality of final destinations for the call detail records comprise:  
sending a first portion of the call detail records to a home gateway,  
sending a second portion of the call detail records to a plurality of gateways involved in handling a portion of a call,  
sending a third portion of the call detail records to a settlements repository, and  
sending a fourth portion of the call detail records to a plurality of gateways involved with handling of a call and settling with a roaming partner.

27. The method of claim 1, wherein the settling step (e) comprises the steps of:  
(e1) receiving a plurality of billing files from a converting process;

(e2) translating the plurality of billing files into a plurality of extract files;  
(e3) creating a plurality of reports from the plurality of extract files; and  
(e4) releasing the plurality of reports for distribution to a plurality of entities in  
the global telecommunications network.

5

28. The method of claim 27, wherein the translating step (e2) comprises:  
(e2i) creating a plurality of extract records from the plurality of billing files;  
(e2ii) aggregating the plurality of extract records based on type; and  
(e2iii) creating a plurality of extract files from the aggregated extract records.

10

29. The method of claim 28, wherein the types of extract records comprise  
financial, tier 1 usage, roaming, government charge, and country to country.

15

30. The method of claim 29, wherein the tier 1 usage, roaming, government  
charge, and country to country types of extract records are sent to further aggregation  
processing.

20

31. The method of claim 29, wherein the financial type of extract records are  
sent to a settlements repository.

32. The method of claim 31, wherein the settlements repository comprise a  
daily database and a month to date database.

25

33. The method of claim 27, wherein the plurality of reports comprise a  
plurality of settlement reports.

34. The method of claim 33, wherein the settlement reports are of types  
comprising financial, usage, and operational.

30

35. The method of claim 27, further comprising:  
(e5) receiving a plurality of return files;  
(e6) creating a plurality of roaming partner settlement files from the plurality

of return files; and

(e7) releasing the plurality of roaming partner settlement files for distribution to a plurality of roaming partners in the global telecommunications network.

5           36.    The method of claim 1, wherein the distributing step (f) comprises the steps of:

(f1) receiving a plurality of billing files and one or more reports from a settlement process;

10           (f2) grouping the plurality of billing files and the reports according to destination and type; and

(f3) distributing each of the plurality of billing files and the reports to its destination.

37.    The method of claim 36, wherein the grouping step (f2) comprises:

15           (f2i) examining a first field in each of the plurality of billing files and each of the reports, the first field pertaining to the destination of the billing file or report; and

(f2ii) examining a second field in each of the plurality of billing files and each of the reports, the second field pertaining to the type of billing file or report.

20           38.    The method of claim 37, wherein the first field is a Call Detail Collection Point field.

39.    The method of claim 37, wherein the second field is a Call Detail Information Source ID field.

25           40.    The method of claim 36, wherein the destination comprises gateways, roaming partners, and industry clearinghouses.

41.    The method of claim 36, further comprising:

(f4) copying the plurality of billing files for storage in an archive.

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100

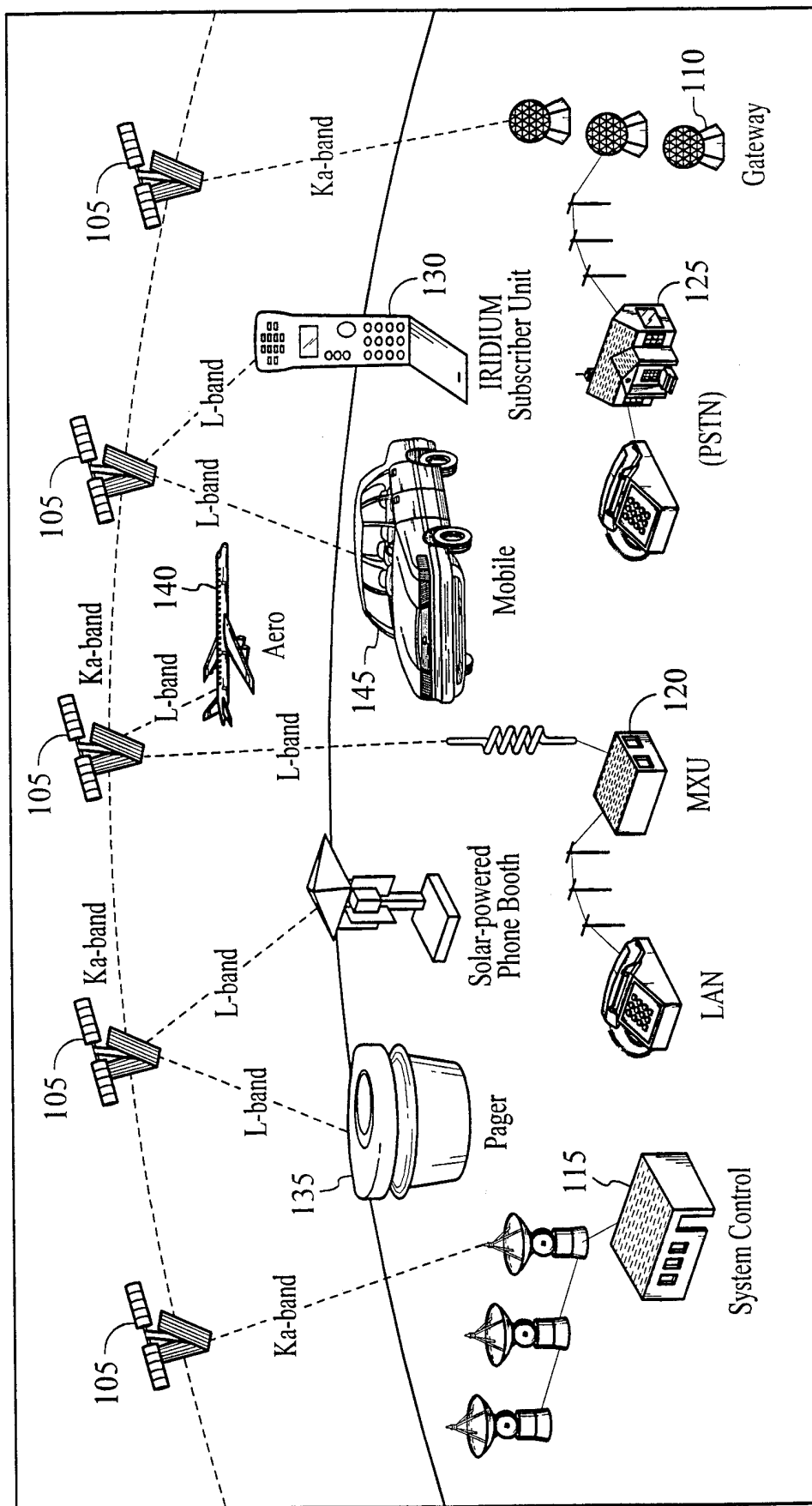


FIG. 1

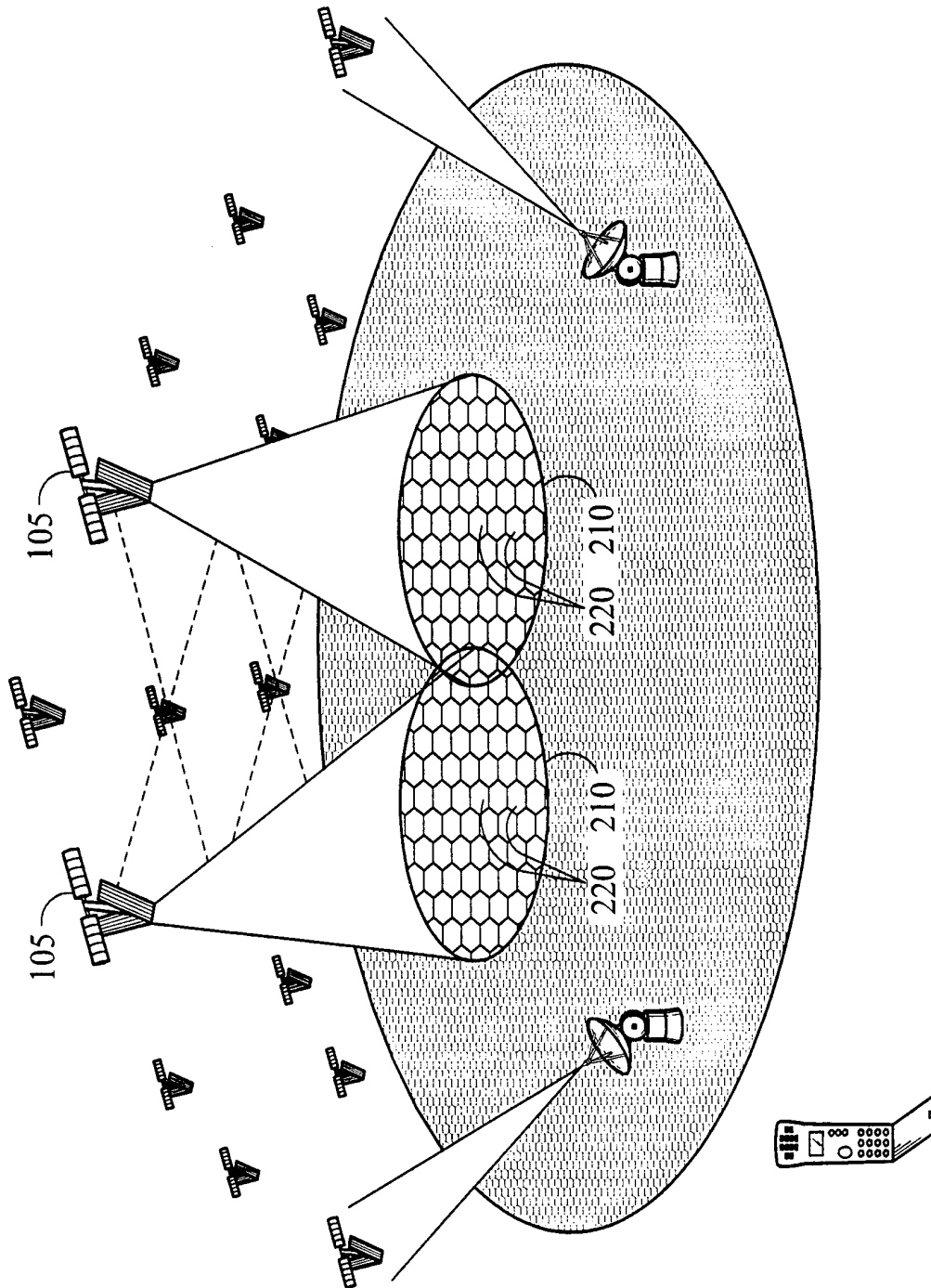


FIG. 2

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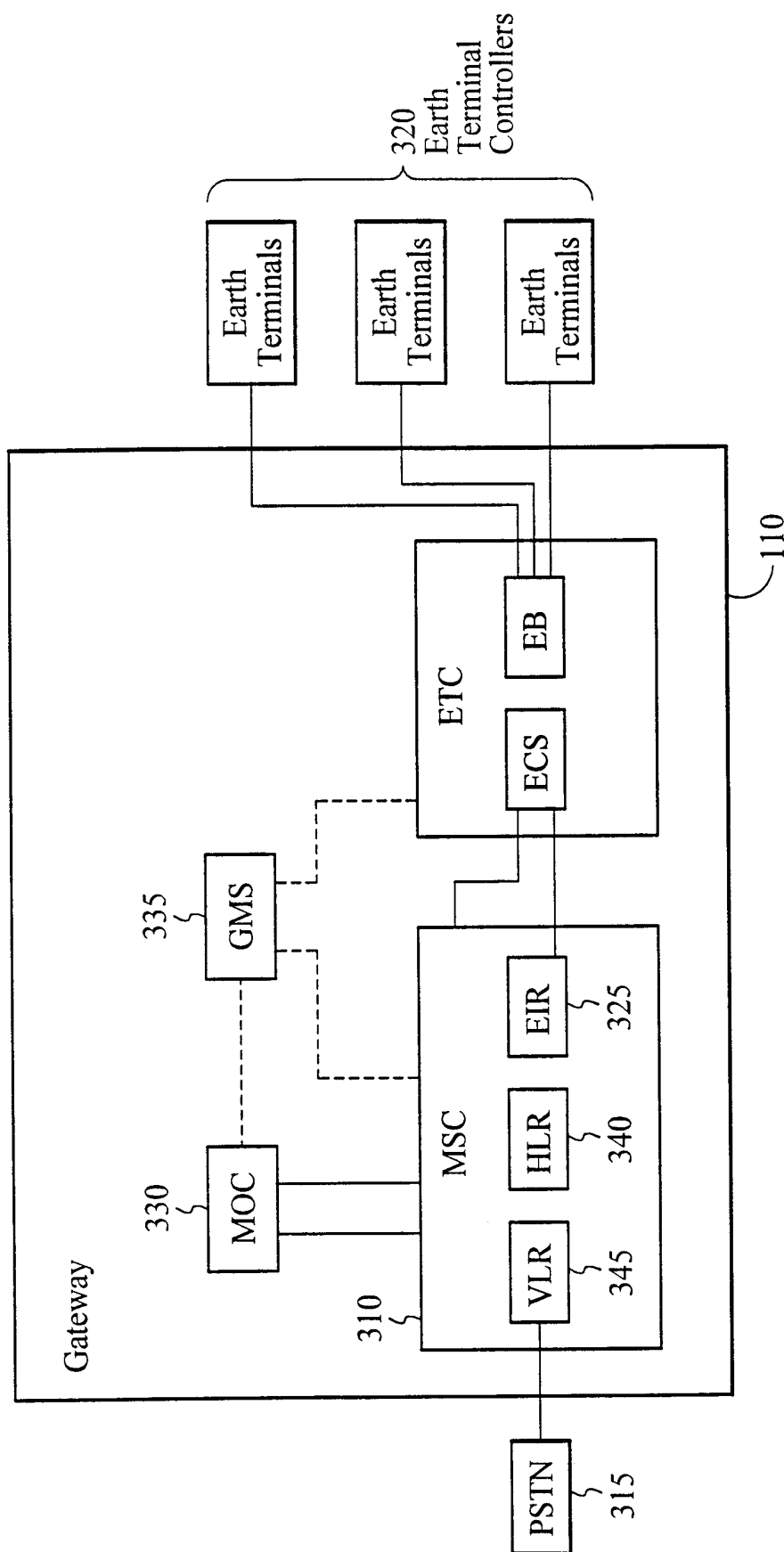


FIG. 3

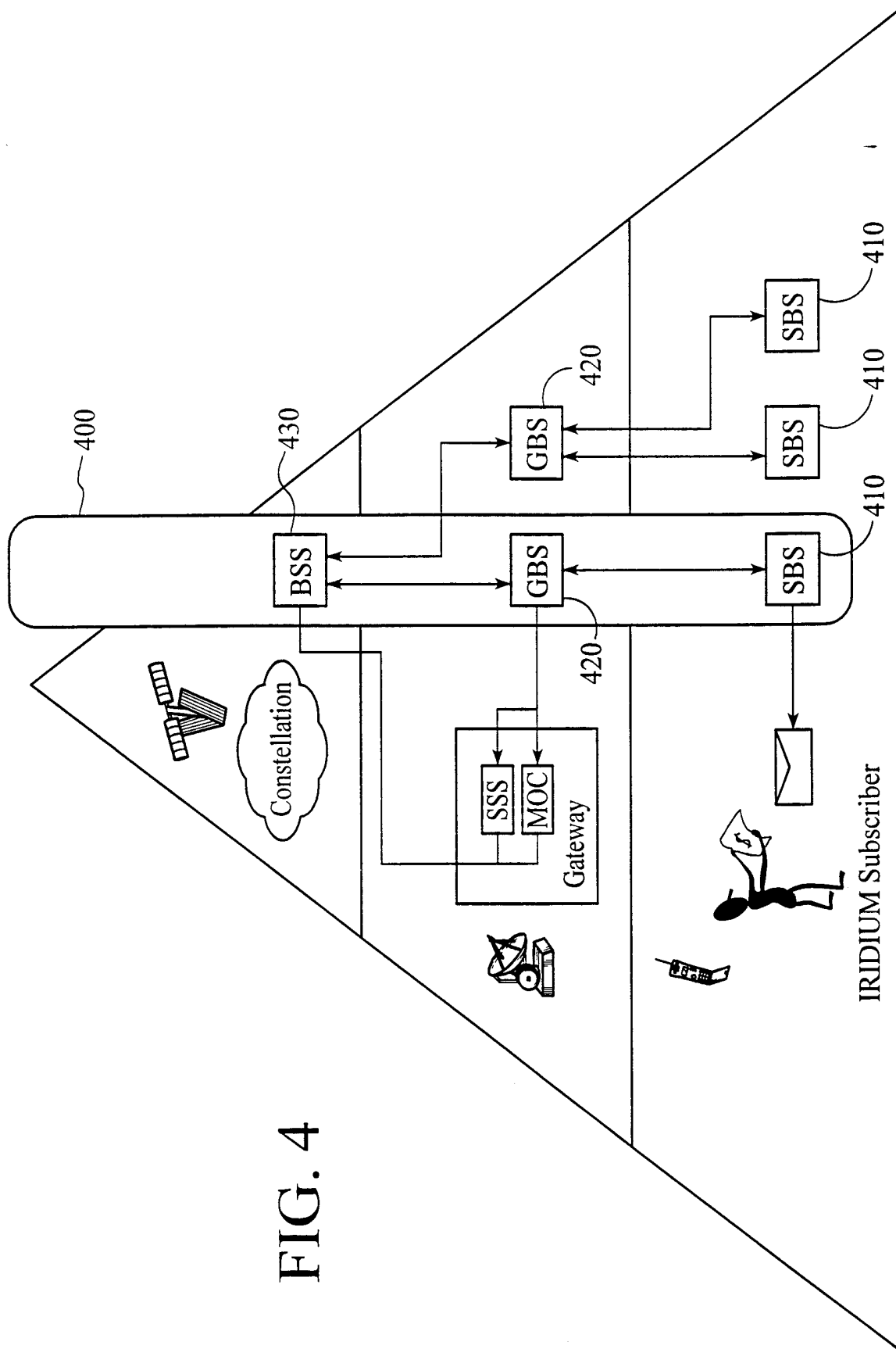


FIG. 4

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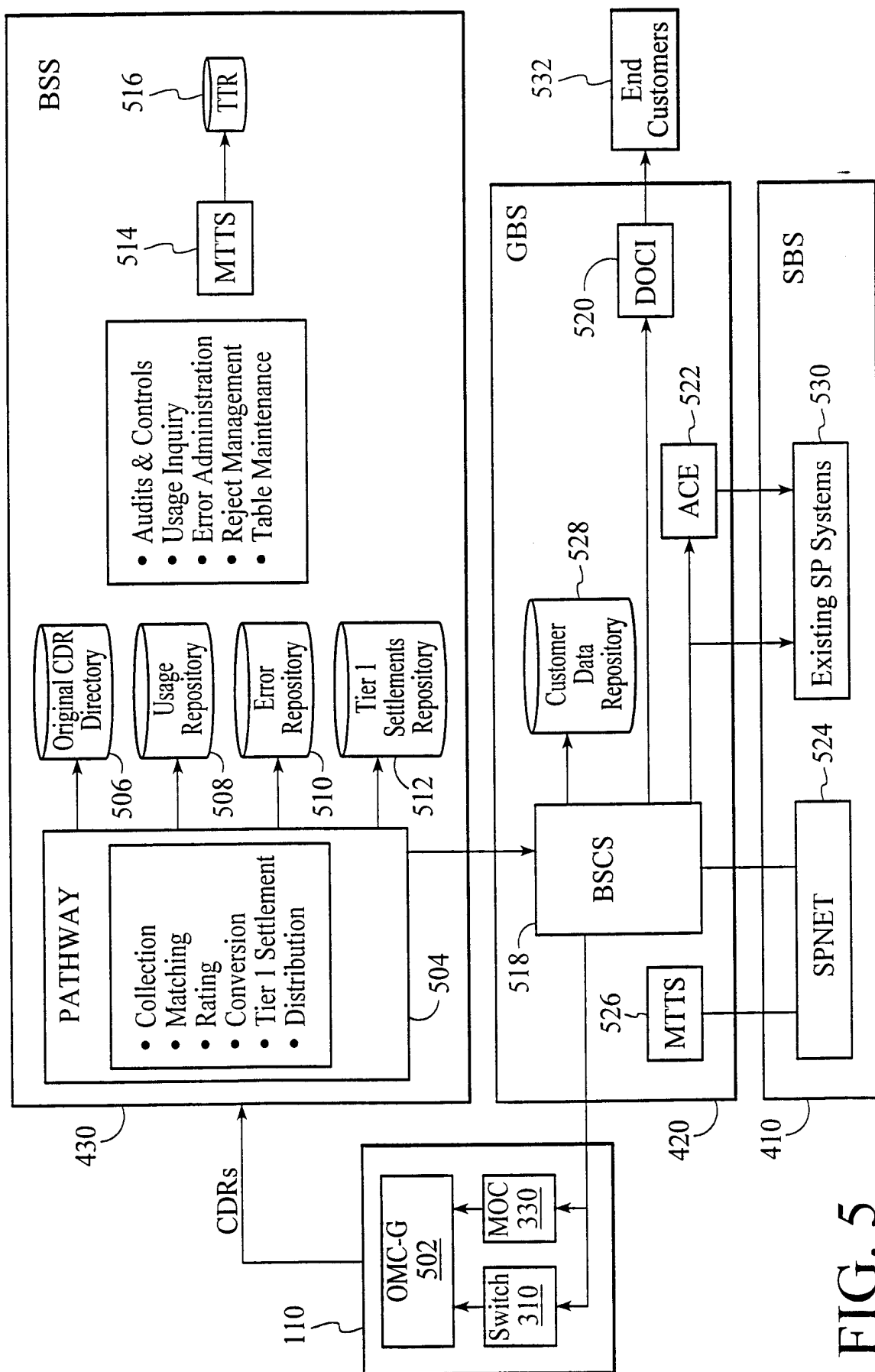


FIG. 5

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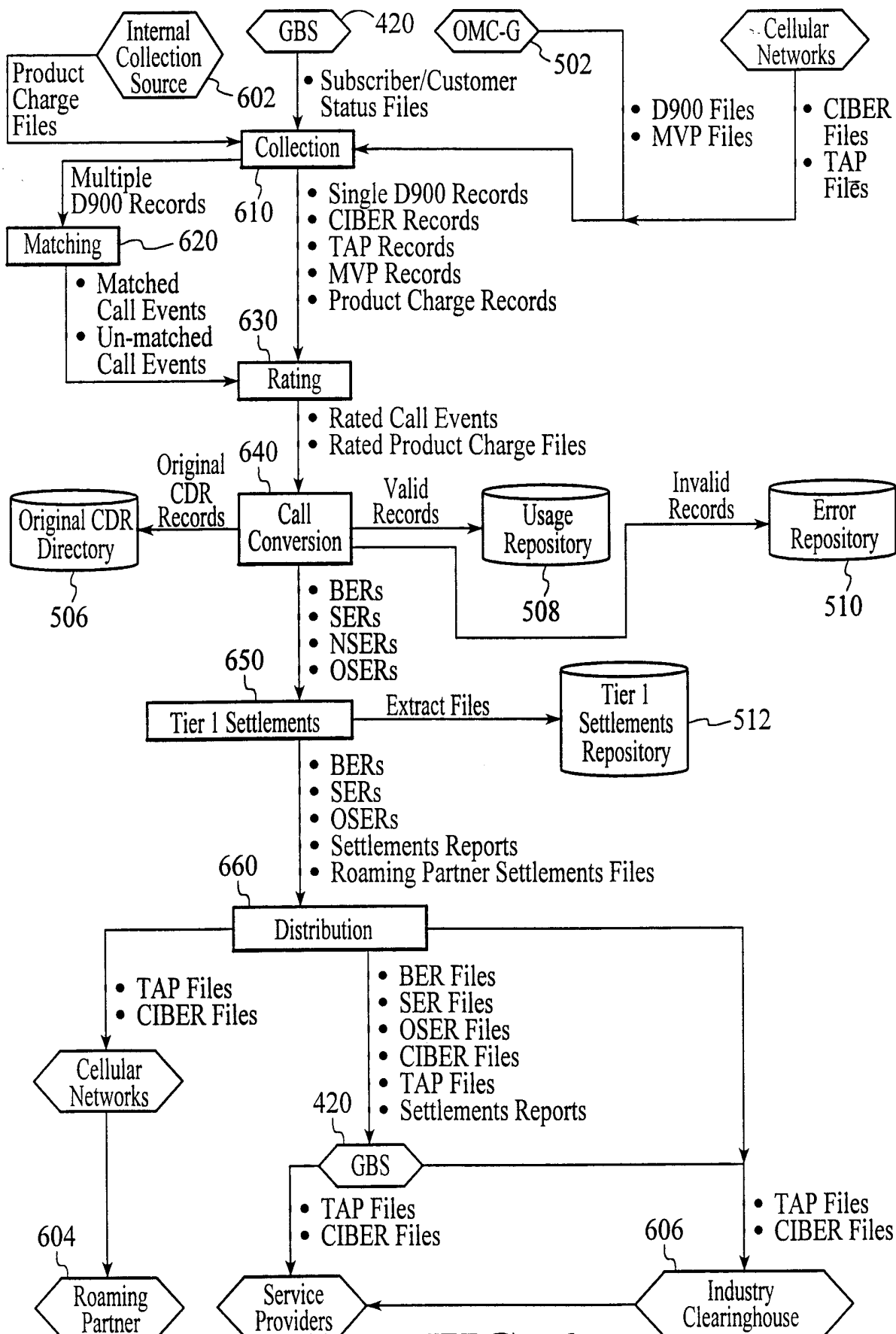


FIG. 6

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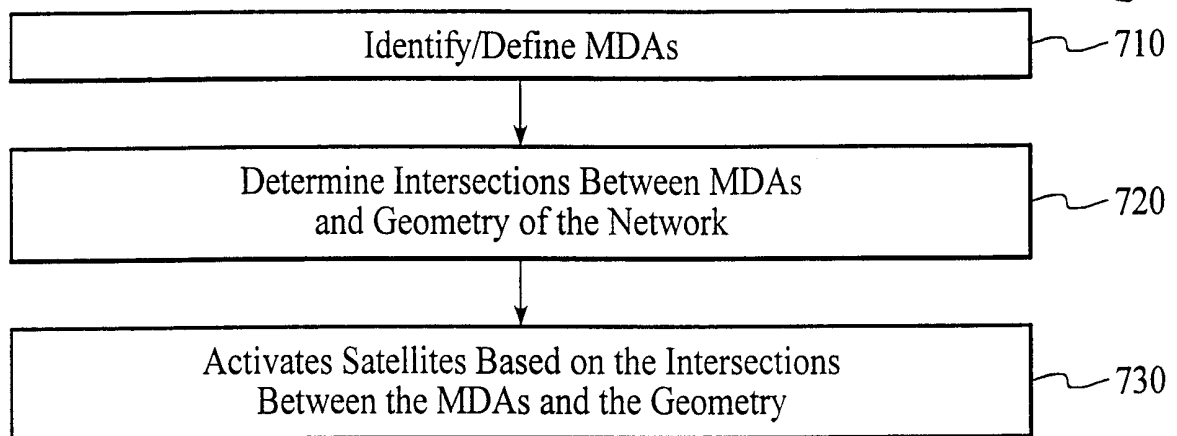
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FIG. 7

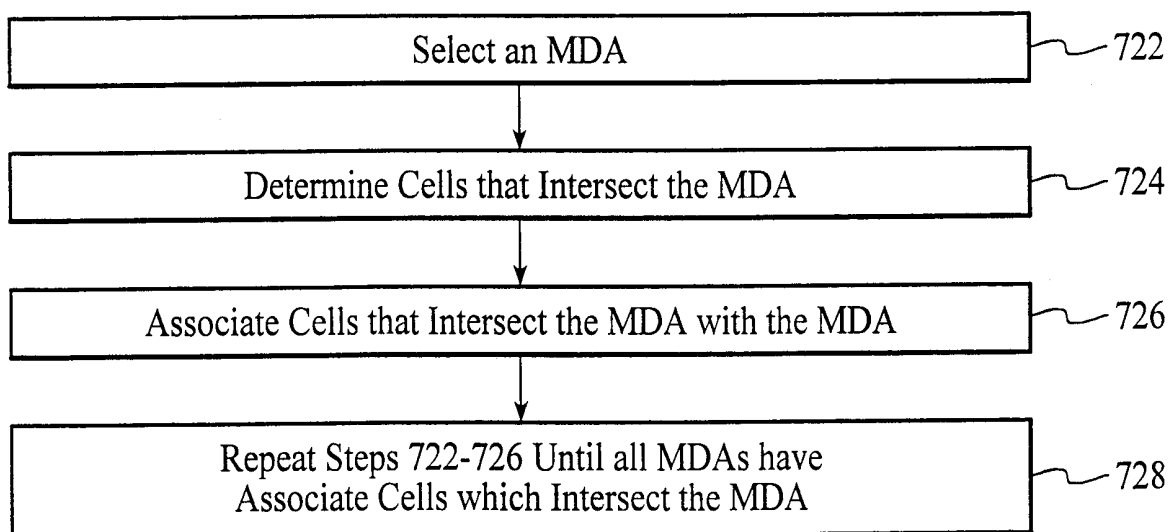
720

FIG. 8

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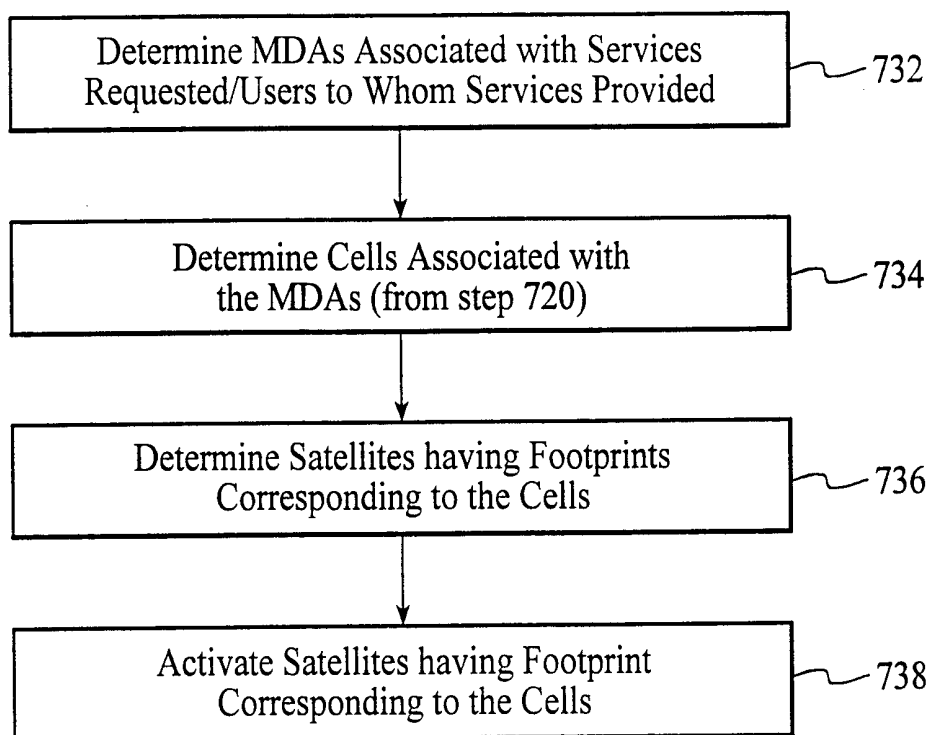
730

FIG. 9

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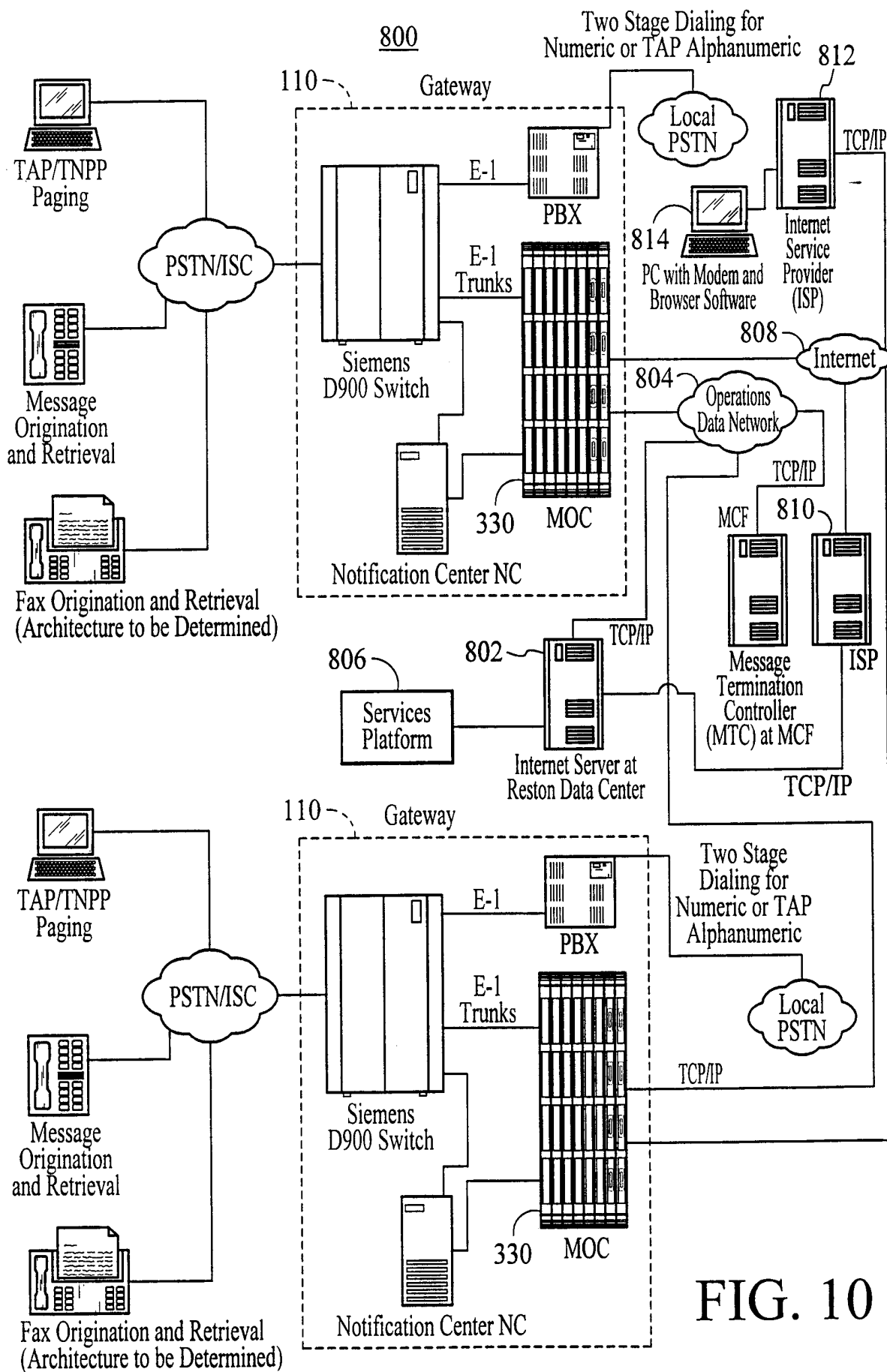
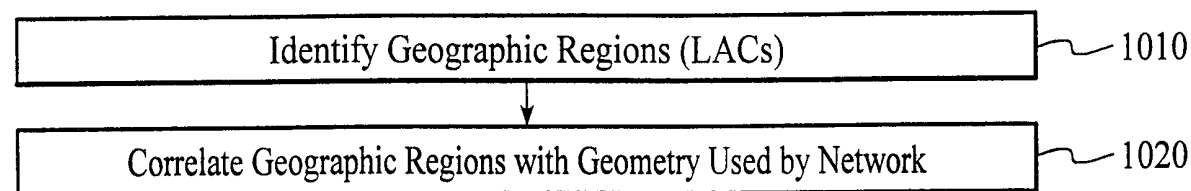
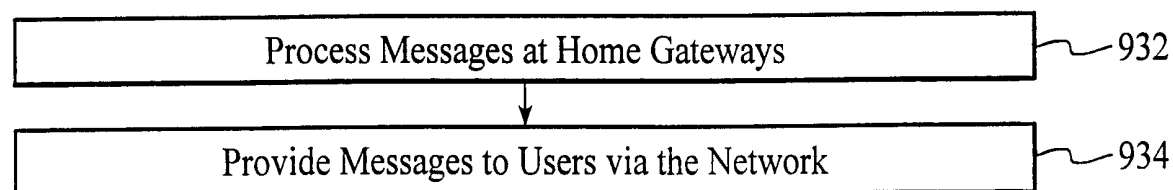
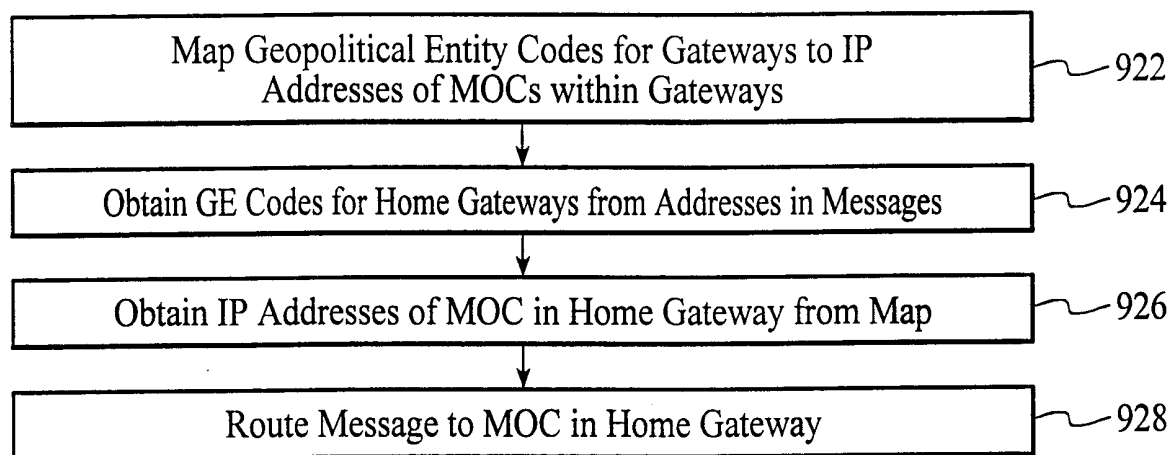
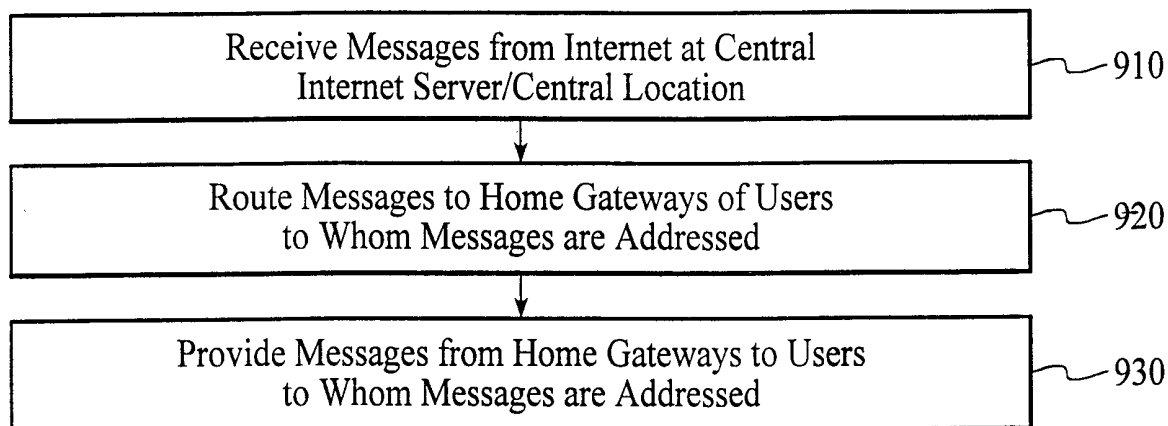


FIG. 10

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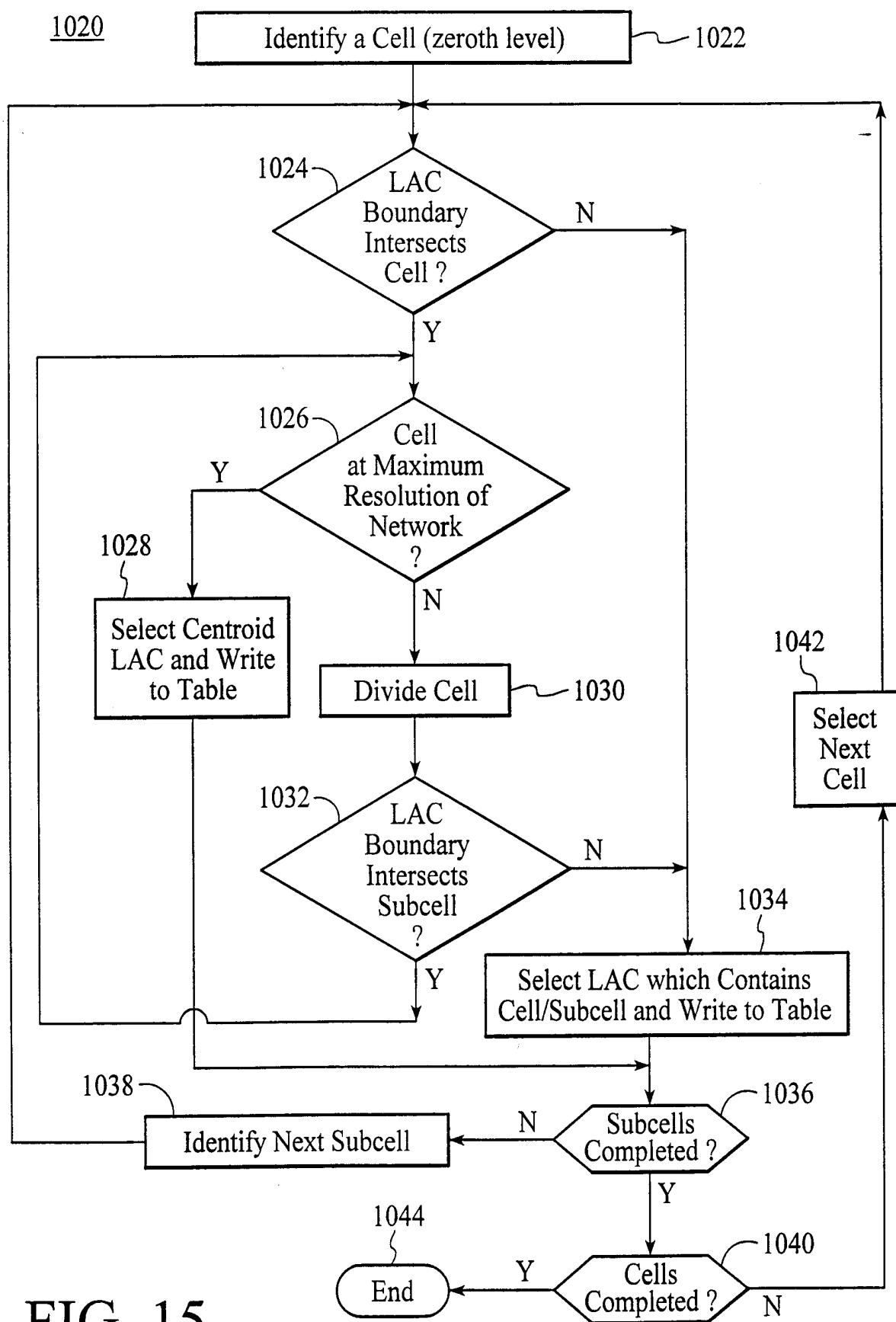


FIG. 15

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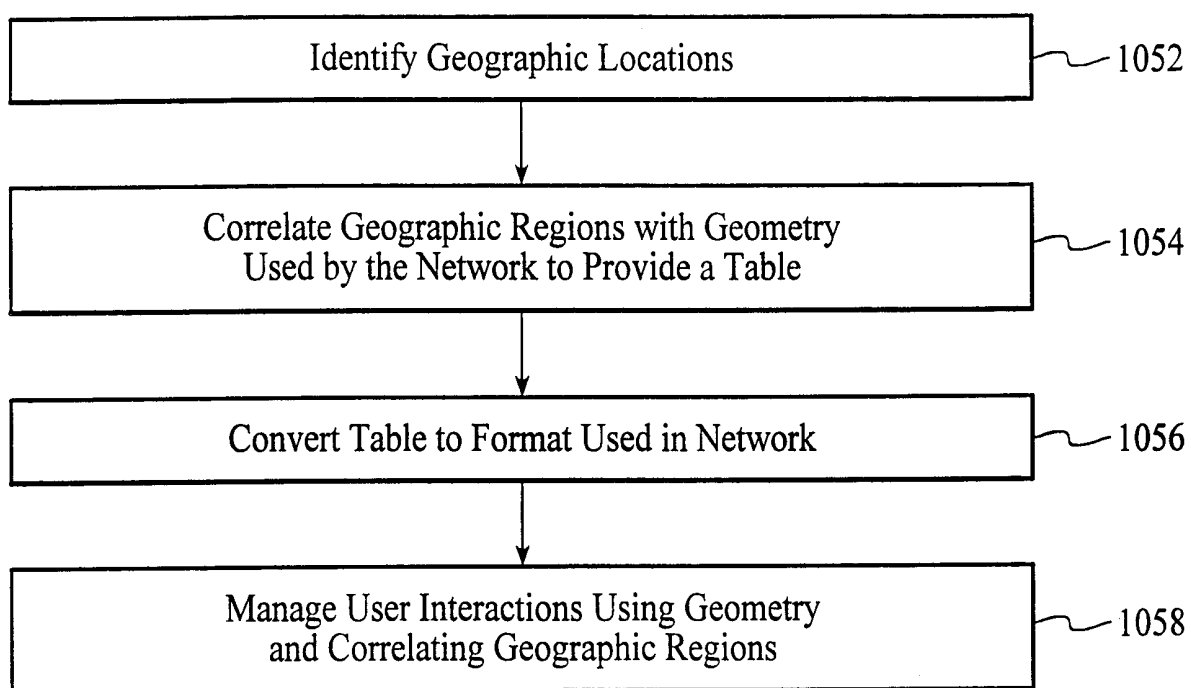
1050

FIG. 16

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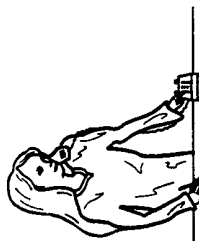
# Voice Mail and Numeric Messaging Feature

For Calls to a Customer's Pager Number

Caller Dials Customer's Pager number, where he is Connected to the Customer's Mailbox and Prompted to:

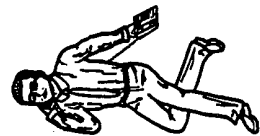
1. Leave a Numeric Message
2. Leave a Voice Mail Message (optional)

## Numeric Message

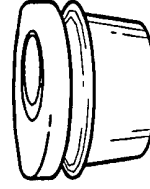
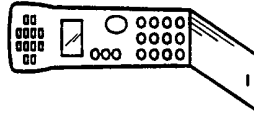


Caller Leaves a Numeric Message via the Telephone Keypad (DTMF)

## Voice Mail Message



Caller Leaves a Voice Mail Message



Customer Sets Up Mailbox to Send Numeric Messages and Voice Mail Notifications to:

- the phone
- the pager
- both the phone and pager

FIG. 17

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US99/21242

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : G06F 151/00

US CL : 705/40

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)

705/34, 39, 40, 53; 455/405-406; 379/113-114, 133

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 practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,276,731A (ARBEL ET AL) 04 JANUARY 1994, COLUMN 12, LINES 20-50.	1-41
A	US 5,784,442 A (FOTI) 21 JULY 1998, COLUMN 2, LINES 1-64.	1-41

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

* Special categories of cited documents.	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to explain and the principle or theory underlying the invention
*A* document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
*E* earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*G* document member of the same patent family
*O* document referring to an oral disclosure, use, exhibition or other means	
*P* document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

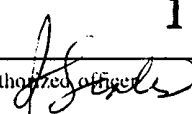
19 DECEMBER 1999

Date of mailing of the international search report

10 FEB 2000

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