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(54) **METHOD AND APPARATUS FOR PROVIDING ENHANCED COMMUNICATION CAPABILITY FOR MOBILE DEVICES ON A VIRTUAL PRIVATE NETWORK**

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See application file for complete search history.

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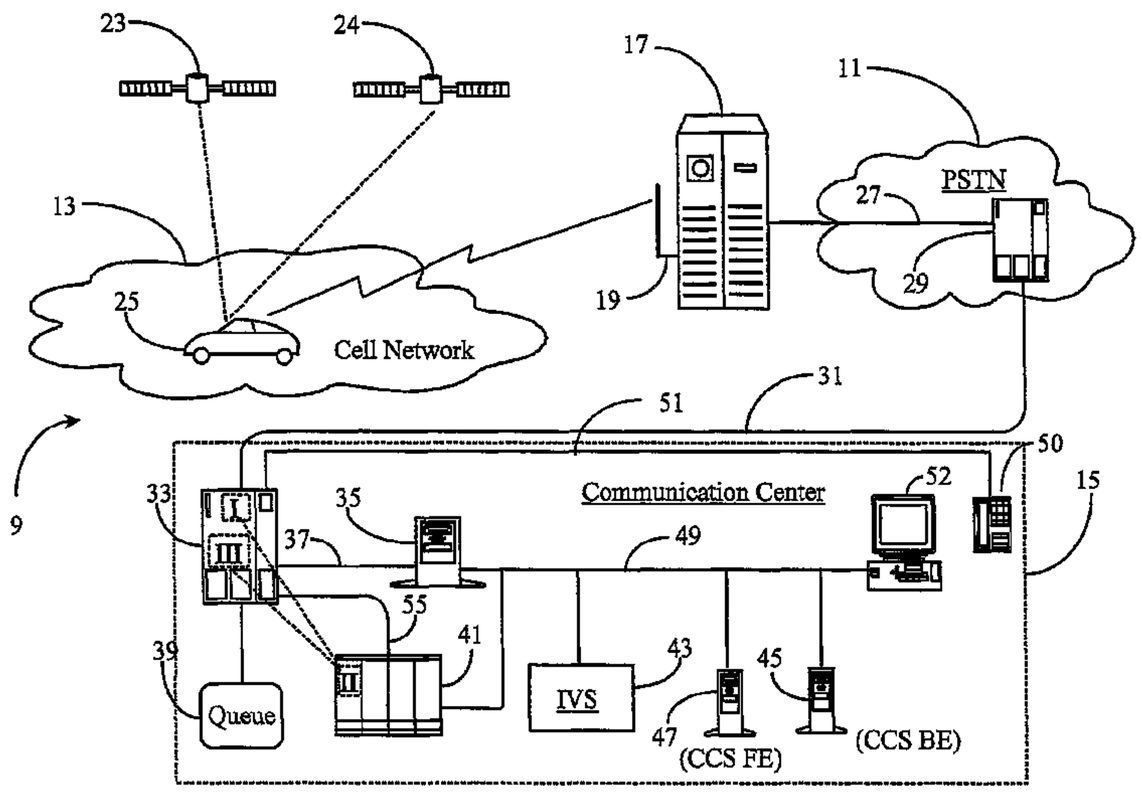
(57) **ABSTRACT**

A communication system has a cellular telephony interface in individual ones of two or more mobile vehicles, a position determination system in individual ones of the mobile vehicles, a network of cellular base stations coupled to the mobile vehicles, individual base stations coupled to one or both of a packet-switched or a line-switched telephony system, a router coupled to the base stations and enabled to retrieve GPS position from the telephony events, and a plurality of service centers coupled to one or both of the telephony systems. Telephony events from individual ones of the mobile vehicles are routed according to position reported by the position determination system.

18 Claims, 4 Drawing Sheets



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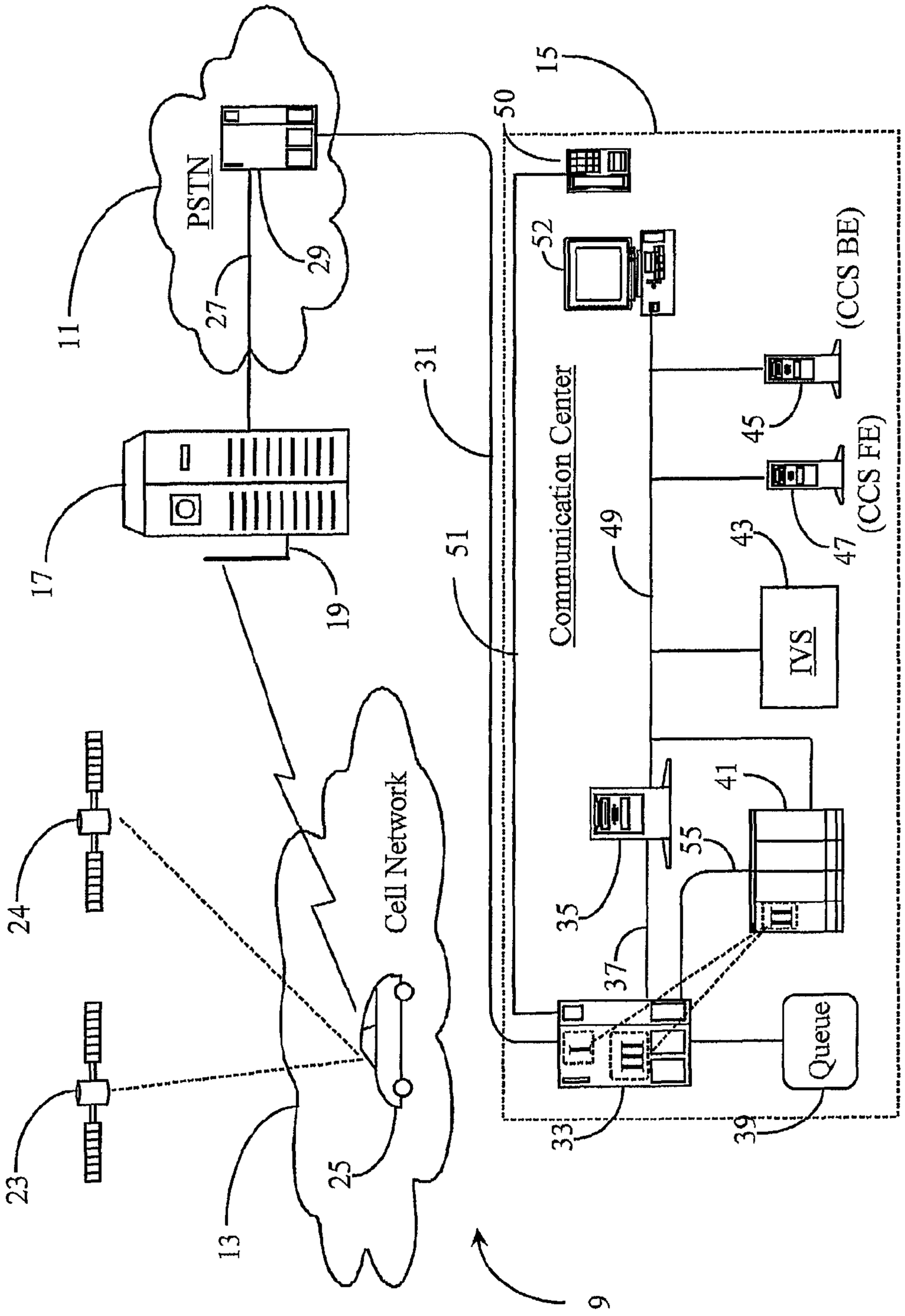

PSTN
11
27
29
15
50
52
(CCS BE)
31
51
Communication Center
49
45
43
47
(CCS FE)
IVS
17
19
24
Cell Network
41
55
35
37
Queue
33
39
23
25
13
9

Fig. 1

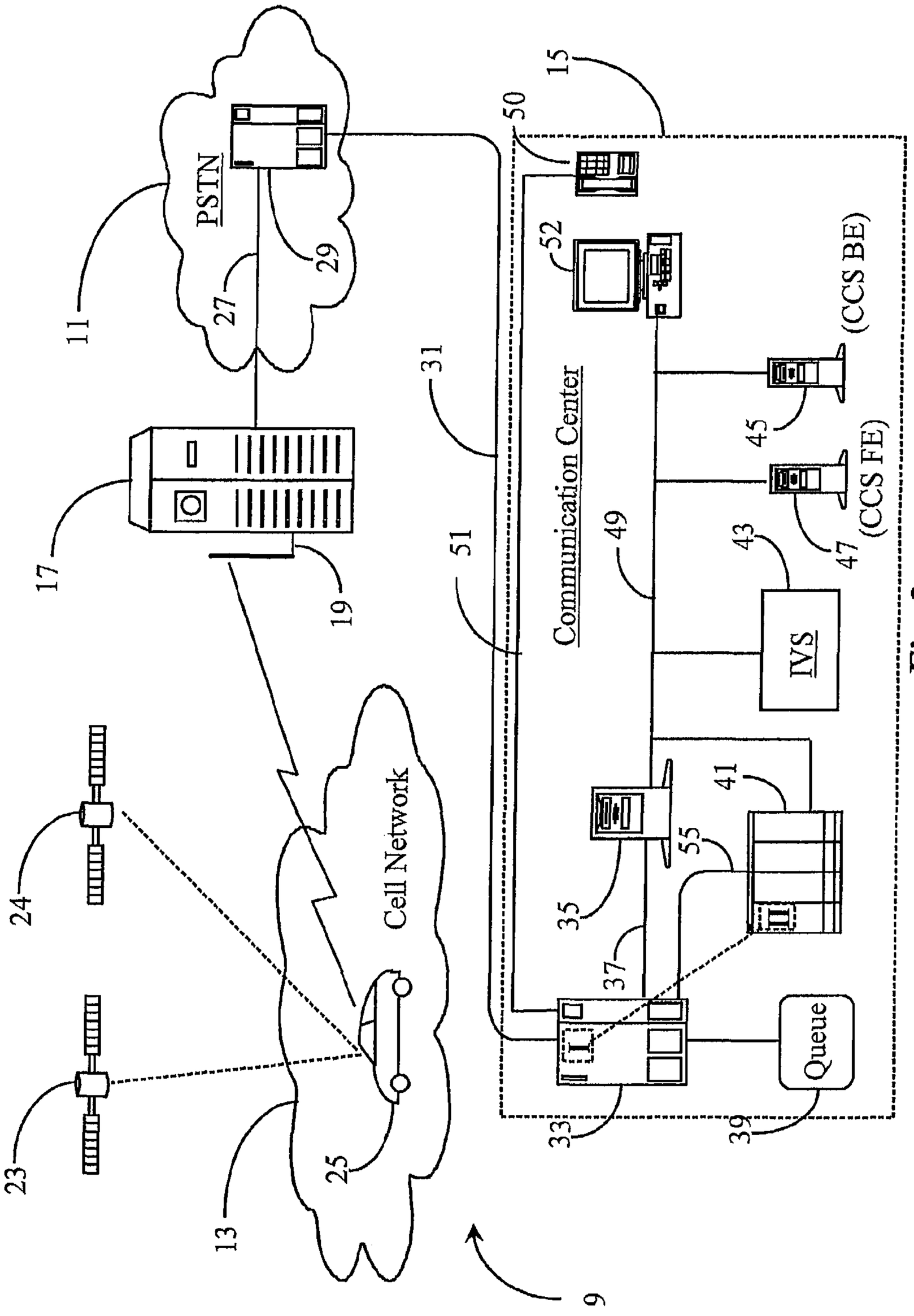

PSTN
11
27
29
15
50
52
45
47
(CCS FE)
(CCS BE)
17
19
31
51
Communication Center
49
43
IVS
24
Cell Network
41
55
35
37
23
25
13
33
39
Queue
9

Fig. 2

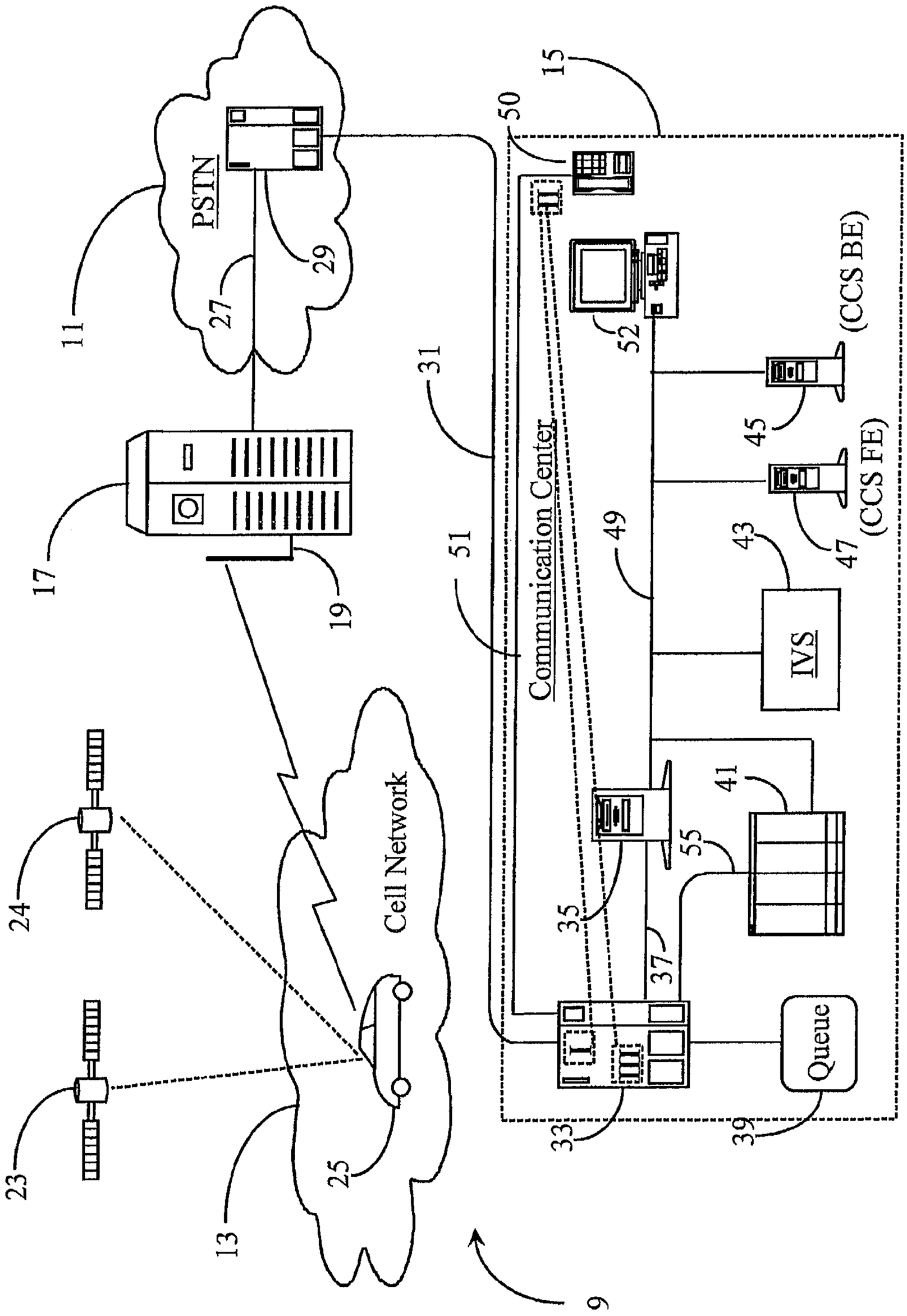
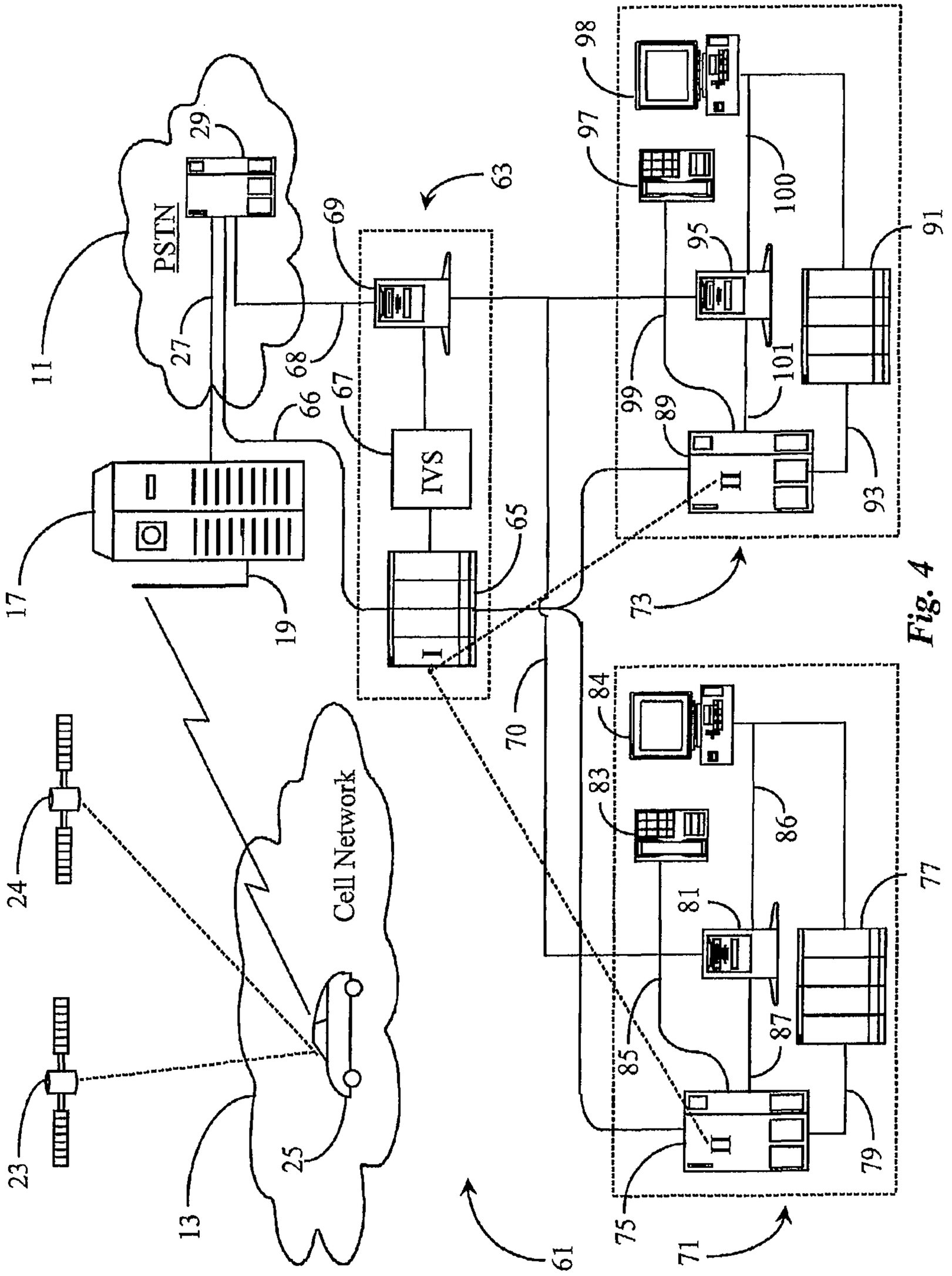

PSTN
11
27
29
17
19
24
23
13
25
Cell Network
31
51
Communication Center
15
50
52
49
43
IVS
45
47
(CCS FE)
(CCS BE)
35
41
55
37
33
39
Queue
9

Fig. 3


PSTN
Cell Network
IVS
I
II
11
13
17
19
23
24
25
27
29
61
63
65
66
67
68
69
70
71
73
75
77
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98
99
100
101

Fig. 4

METHOD AND APPARATUS FOR PROVIDING ENHANCED COMMUNICATION CAPABILITY FOR MOBILE DEVICES ON A VIRTUAL PRIVATE NETWORK

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

CROSS-REFERENCE TO RELATED APPLICATIONS

The present case is a continuation of application Ser. No. 11/749,705, filed May 16, 2007 now U.S. Pat. No. 7,561,887, which is a continuation of application Ser. No. 11/286,811, filed Nov. 22, 2005 and issued as U.S. Pat. No. 7,263,372 on Aug. 28, 2007. Application Ser. No. 11/286,811 is a continuation of application Ser. No. 10/323,450, filed Dec. 17, 2002, now U.S. Pat. No. 6,987,977, which is a continuation of application Ser. No. 09/452,768, filed Dec. 1, 1999, now U.S. Pat. No. 6,496,702. The entire disclosure of each of these applications is incorporated herein by reference, and priority is claimed to the filing date for the disclosure of each of these applications, including Dec. 1, 1999 of application Ser. No. 09/452,768.

[The entire disclosure of copending application Ser. No. 11/456,796 is incorporated herein by reference. Application Ser. No. 11/456,796 is a continuation of application Ser. No. 10/899,528, now U.S. Pat. No. 7,079,641, which is a continuation of application Ser. No. 09/912,770, filed Jul. 24, 2001, now U.S. Pat. No. 6,788,779. The entire disclosure of each of these applications is incorporated herein by reference, and priority is claimed to the filing date for the first disclosure of each of these applications, including Jul. 24, 2001 of application Ser. No. 09/912,770.]

[The entire disclosure of copending application Ser. No. 11/388,089 is incorporated herein by reference. Application Ser. No. 11/388,089 is a continuation of application Ser. No. 09/661,181, now U.S. Pat. No. 7,020,264, which is a continuation of application Ser. No. 09/443,057, now U.S. Pat. No. 6,122,360, which is a continuation of application Ser. No. 08/968,825, now U.S. Pat. No. 6,005,931, which is a continuation-in-part of application Ser. No. 08/869,815, now U.S. Pat. No. 6,148,074, which is a continuation-in-part of application Ser. No. 08/802,667, now U.S. Pat. No. 6,201,863, which is a continuation-in-part of application Ser. No. 08/797,420, now U.S. Pat. No. 6,185,291, filed Feb. 10, 1997. The entire disclosure of each of these applications is incorporated herein by reference, and priority is claimed to the filing date for the first disclosure of each of these applications, including Feb. 10, 1997 of application Ser. No. 08/797,420.]

[The entire disclosure of copending application Ser. No. 10/406,347 is incorporated herein by reference, and priority is claimed to the filing date of Apr. 2, 2003 for the disclosure.]

[The entire disclosure of copending application Ser. No. 10/229,428 is incorporated herein by reference. Application Ser. No. 10/229,428 is a continuation of application Ser. No. 09/335,423, now U.S. Pat. No. 7,020,264. The entire disclosure of each of these applications is incorporated herein by reference, and priority is claimed to the filing date for the first disclosure of each of these applications, including Jun. 17, 1999 of application Ser. No. 09/335,423.]

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is in the field of telephony communication as it pertains to mobile devices or units operating on a private network and pertains more particularly to methods and apparatus for enhancing communication capability, data transfer capability, and increasing the number of mobile devices that can successfully operate on a communication-center facilitated virtual private network (VPN).

2. Description of Related Art

The field of telephony communication has grown more diverse and flexible. Call-in centers that once were restricted to connection-oriented switched telephony (COST) are now employing computer-simulated telephony techniques generally referred to as data network telephony (DNT). Call-in centers that are enhanced with DNT and multimedia capability more appropriately termed communication centers in the art. This is due to the broad range of telephony and data transfer capabilities that are routinely practiced within or facilitated by such centers.

Communication centers are often used by enterprises to accomplish cellular communication links with fleets of vehicles having wireless communication devices installed therein for receiving instruction and responding back to personnel operating within the center, such as dispatchers, sales agents and so on. There are a variety of existing techniques used by communication centers today to track, control and support fleets of vehicles.

Services such as Omnitracs™ operated by Qualcomm and On-Star™ operated by General Motors Corp. (GM) use the well-known cellular telephone infrastructure and the global positioning system (GPS) to track and support vehicles in the field. Services offered include such as air bag deployment notification, remote door unlocking, road-side service, vehicle theft notification, and so on. In some cases device-equipped vehicles are owned and operated by a single entity that also provides the service. In some cases vehicles are owned individually, or in small groups and are subscribed to a service.

A commonality among all of these types of service communication systems is that users (i.e. drivers of subscribed vehicles) may need to be periodically tracked by the system to be given logistics support, help or advice at some point during a trip. In some cases tracking is employed for reporting purposes to customers of the service business, such as with some trucking companies and the like. The above-described systems target mostly high-end vehicles or commercial fleets as primary targets, due to the higher value and traffic they incur.

One problem with the infrastructure associated with the above-described services is that communication with the volume of serviced cars or commercial fleet of vehicles is typically implemented by a single communication center. As a result the systems are limited to a relatively small volume vehicles depending on the nature of the service. Such a communication center, as is known in the art, simply cannot handle a really large volume, such as perhaps a million vehicles or more.

The technologies (GPS and cellular services) that support the above-described services are continually being developed and made available over ever-increasing geographic regions. Therefore, it is desirable to provide similar services to a much larger customer base than the currently limited numbers serviced by today's largest system/infrastructures. As previously described, a single communications center cannot handle the desired volume. For example, a service base of a million users or more would logically encompass mostly "normal citizens"

rather than professional drivers due to shear volume. In this regard, services offered would have to be more diversified among users instead of being standardized as with a fleet of company-owned service vehicles.

An unacceptable communication load would result in any single communication center. Moreover, other problems would arise from an overload of users interacting with a center such as increased costs of long-distance routing, and lack of "local knowledge" required to effect many desired and marketable services.

What is clearly needed is a method and apparatus that enables efficient data management and routing of service events to and from a large volume of tracked vehicles maintaining wireless communication devices, wherein specific interaction and routing does not have to be performed in or facilitated by one single communication center. Such a system would allow a single service to provide cost-effective, mainstream services to millions subscribers.

BRIEF SUMMARY OF THE INVENTION

In a preferred embodiment of the present invention a service communication system for mobile vehicles is provided, comprising a cellular telephony interface in individual ones of the mobile vehicles, for establishing telephony events over a cellular network with a base station; a global positioning system in individual ones of the mobile vehicles for determining global position from transmissions from GPS satellites; a network of base stations for receiving and broadcasting to the mobile vehicles, and for bridging events between cellular and public switched telephone service (PSTN) protocol; a network-level routing system connected by first telephony trunks to the base stations and enabled to retrieve GPS position from the telephony events; and a plurality of service centers connected to the network-level routing system by second telephony trunks. The network-level routing system determines a destination for individual ones of the telephony events among the plurality of service centers according to the retrieved GPS position.

In preferred embodiments the network-level routing system further comprises an interactive voice solution (IVS) system for providing synthesized voice responses to incoming events. Also in preferred embodiments individual ones of the service centers each comprise a telephone switching apparatus connected by a computer telephony integration (CTI) link to a CTI processor for monitoring a controlling the connected telephone switching apparatus, and the network routing center comprises a network-level CTI processor connected to a network-level switch, and wherein the CTI processors at network and service center level are interconnected by a data link separate from the second telephony trunks. In some embodiments data about a call event is stripped at the network-level routing system and transmitted by the data link separate from the second telephony trunks to a service center to which the call event is routed.

In various embodiments of the invention taught in enabling detail below, services for mobile vehicles may for the first time be provided in a specialized way by having local service centers attuned to the needs of certain areas and for special purposes, and by routing service call events to specialized centers based on mobile vehicle location at the time service is requested.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. **1** is an overview of a mobile device communication network as known to the inventor illustrating typical routing points for a call event from a mobile device to a contact center.

FIG. **2** is an overview of the mobile device communication network of FIG. **1** illustrating typical routing points for incoming voice calls into the contact center of FIG. **1**.

FIG. **3** is an overview of the mobile device communication network of FIG. **1** illustrating typical routing points for a call event to a car from a PSTN through the contact center of FIG. **1**.

FIG. **4** is an overview of a mobile device communication network enhanced with network data control and routing control according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** is an overview of a current-art mobile device communication-network **9** as known to the inventor illustrating typical routing points for a call-event from a mobile device to a contact center. Communication network **9** comprises a Cell network **13**, which is in an area that has by in large also GPS coverage, a connected PSTN network **11**, and a communication center **15**. Cell network **13** represents the well-known cellular communications networks in an area with the well-known GPS system. These two technologies including their respective infrastructures are utilized by service communication centers such as center **15** to track and provide support to fleets of vehicles having both GPS devices and wireless communication devices installed therein. One vehicle of such a fleet of vehicles is represented herein by a car **25** illustrated within Cell network **13** and presumably with the GPS coverage.

PSTN network **11** may be another type of telephony network such as a private telephone network as may be known in the art. Communication center **15**, also referred to as a contact center in the art, represents in this example a national service center that offers support and service to a fleet of vehicles as was defined in the background section. Center **15** utilizes PSTN network **11** and Cell networks **13** to facilitate communication and interaction between center **15** and an equipped vehicle such as car **25**.

A network bridging (base) station **17** is provided and adapted in this example to convert wireless cellular calls into PSTN calls and PSTN calls into cellular calls. This shall be a grossly simplified view of elements as are well known in the art of telephony. Further details would obfuscate discussing the present invention and have hence been left out. Station **17** is equipped with all of the necessary hardware and software to accomplish this task as is known in the art. Station **17** has a transceiver/receiver device **19** connected thereto and adapted to pick-up and transmit cellular transmissions. Cellular communication from car **25** to center **15**, or from center **15** to car **25** is routed, in this example, through the PSTN network **11**.

Communication center **15** has installed therein a central telephony switch **33**, which may be an ACD or PBX type switch. Switch **33** is adapted to function as a first destination for inbound call events originating from such as car **25**, or from other sources within PSTN **11**. Switch **33** is CTI (computer telephony integration) enhanced by a CTI processor **35** connected thereto by a CTI link **37**. Such enhancement provides status and event monitoring of the switch, and switch function control, such as intelligent routing control. For example, switch **33** functions in this embodiment as a private service control point (SCP) with agent/system level routing intelligence for routing to various points within center **15**.

A modem pool **41** is provided and adapted to strip data from inbound and outbound call events processed at center **15**. Modem pool **41** is connected to switch **33** by an internal telephony trunk **55**, and to an internal, interconnecting local area network (LAN) **49**, which interconnects several internal

elements as described below, including the CTO processor **35**. Modem pool **41** represents a second "data" routing point within communication center **15**.

An interactive voice solution (IVS) machine **43** is provided and adapted to interact with customer's calls and contacts, and to process certain aspects of data in incoming calls to synthesized voice, which may go to an agent or back to a subscriber's vehicle. IVS **43** connects on LAN **49**. In this way IVS **43** is controlled to respond to call events according to event protocols.

A front-end communication-center server (CCS FE) **45** is provided and adapted to process workflow for incoming non-real-time events. Server **45** is connected to CTI processor on LAN **49** and is controlled by processor **35**. A back-end communication-center server (CCS BE) **47** is provided and adapted to process workflow for non-real-time outgoing events. Server **47** is connected to server **45** and also to IVS **43** on LAN **49**.

An agent's telephone **50** is provided at an agent station and adapted to enable live voice communication between such as car **25** and an agent operating within center **15**. Telephone **50** is connected to switch **35** by internal telephone wiring **51**. In other embodiments, an IP phone may be used connected to a LAN (e.g. LAN **49**). A communication queue **39** is provided in switch **33** for incoming call events that are waiting for pickup by an available agent such as one operating telephone **50**. It will be apparent to one with skill in the art that in a service communication center such as center **15**, there will be many more agents' telephones than the one telephone **50** illustrated herein. Moreover, agents may also be operating local area network (LAN) connected terminals at the agent stations, such as terminal **52** shown, having graphical user interfaces (GUI) along with processing and data input capabilities. Such terminals may be personal computers (PCs) or other adapted machines.

It is noted here that the equipment and connections illustrated within communication center **15** in this embodiment represent such as apparatus connection and control schemes known to the inventor and is not yet widely available in the art to be termed prior art. It will be apparent to the skilled artisan that there are alternative architectures that might be used for the interconnection of operational elements in the communication center.

As described in the background section, large commercial fleets, such as trucking fleets, as well as private subscribers operating private vehicles are facilitated in terms of GPS tracking and cellular support by a single national communication center. Such is the case represented here. Because of this only a limited number of vehicles, perhaps up to a few thousands, may be adequately serviced without severely straining the resources of a national center such as center **15**. Moreover, routing within a center such as center **15** may be somewhat complicated depending on the nature of events and services offered.

In this example a typical routing path is illustrated for a call event arriving to center **15** from car **25**. Such a call event may be an automatically triggered data request, a voice/data request, or a voice call. It is important to note here that the modem communication between such as modem pool **41** and a modem installed in car **25** follows such as Analog Display Services Interface (ADSI) protocols or equivalents. Hence, the connection has two states; one being a voice connection and the other being a data connection using an A/B toggle switch at each modem with control afforded to communication center **15**.

An inbound event is broadcast from car **25**, received by receiver/transceiver **19** and transmitted to station **17** where it is converted to a PSTN call. Typically, because of the nature of the subscription service, being highly dependent in many instances on the location of the vehicle originating an event, data regarding global positioning is sent with the call event. This data is available to the system in the vehicle by GPS interface which operates, as is known in the art, by monitoring transmission from multiple satellites, represented here by satellites **23** and **24**, and triangulation calculations. In some cases, because, for example, a vehicle having initiated an event continues to move, the position has to be updated, which may be done periodically as a function of the vehicle system, or may be triggered from a remote station. In any event, the GPS position information is transmitted via the cell network.

Once on PSTN **11**, the event is routed to switch **29**. The event is then switched to central switch **33** at the communication center at a first agent-level routing point I over telephony trunk **31**. Routing point I is a private SCP equivalent implemented at center **15**. Once the event reaches routing point I, the nature of the event is determined (ANI/DNIS). In this example, we assume the event is a data call requiring a non-real-time or automated response, and the GPS arrives with the call event. Call nature determination and further routing is controlled by CTI processor **35** running CTI software adapted for the purpose. It is important to note here that every inbound event is routed to a routing point II (modem pool **41**) over trunk **55**. Routing point II, which is at modem pool **41**, strips the data from the event, including the GPS location of car **25** at the time of event initiation.

Also, certain data about the call may be passed to Customer Client-Server workflow engine Front End (CCS FE) server **45** over LAN **49** for front-end processing. Data about the event passes from server **45** to Customer Client-Server workflow engine Back End (CCS BE) server **47** for back-end processing. Processed data, which reflects the command disposition of the event, passes from server **47** into IVS **43** for processing, if required, into synthesized voice instruction, which will become part of an outbound event. The Voice package necessitated is passed to modem pool **41** and an outbound event is created and forwarded to a routing point III. Hence, an outbound call event representing a synthesized voice response to the original request is routed back over trunk **31** into switch **29** in PSTN **11**. The response event is then routed to station **17** over line **27** where it is converted back to a cellular protocol and broadcast by transceiver/receiver **19** to car **25** where a motorist receives it.

Returning to routing point III, if the original event required or requested a live agent communication, the caller would either be connected to an available agent at, for example, telephone **50**, or, if none were available, be placed in queue **39**. An agent at telephone **50** will typically have access as well to a computer station **52** having a video display unit (PC/VDU), and the system may provide display for the agent related to telephony events. However, the voice aspect of a live event is not connected until all data is stripped and processed. Communication center **15**, through server **35**, controls the voice/data aspect of each event.

Because communication center **15** in this example is a national center handling all subscribing vehicles nation wide, events may have to be routed over long distances through PSTN **11** to a local cell network. Another issue is that one national center such as center **15** may not be up to date on recent local changes transpiring in the vicinity of car **25**. For example, if the original request was for a list of local motel vacancies in the immediate area of car **25**, center **15** may not have the recent listings or information on any new locations just opened for business. If, for example, the original request

was for an emergency towing service, a national center may not know that car **25** is only a few miles from a recently opened service and may recommend a more distant provider causing added expense for the motorist.

It will be apparent to one with skill in the art that a communication network, wherein a single national center must facilitate communication with a nationally spread-out fleet of vehicles, will have substantial limitations with respect to providing accurate knowledge of local resources and with providing routing of events over long distance wired networks.

FIG. **2** is an overview of the mobile device communication network **9** of FIG. **1** as known to the inventor illustrating typical routing points for an incoming voice call into the contact center of FIG. **1**. As the elements involved in this embodiment are analogous to those described in FIG. **1**, reintroduction of such elements will not be made.

In this embodiment, we assume that car **25** places a live voice call for an agent at communication center **15**. A voice call is initiated from car **25** using the voice mode on the associated modem. Initial call routing is analogous to FIG. **1**. For example, transceiver/receiver **19** picks up the event and passes it into station **17** where it is converted to a PSTN call. The event is then routed over trunk **27** to switch **29** in network **11**. Techniques typically using ANI/DNIS cause routing of the event over trunk **31** to switch **33** (SCP). At this point the voice nature of the call is determined, and the call is routed first to an available agent as a PSTN-connected call. Notification is given by the agent to the vehicle operator that he or she requires data communications with the vehicle and will be placed on hold for reconnection. This may be accomplished by a voice-synthesized message.

The event is then routed to routing point II (modem pool **41**) and the agent operating telephone **50** is placed on hold. This process must be performed so that any data associated with the live call request may be stripped by modem pool **41** and processed, including obtaining a read on car location per the GPS system if necessary. Once the data is processed by servers **45** and **47** as described above with reference to FIG. **1**, the agent at telephone **50** is reconnected to the caller in voice mode. If the agent becomes unavailable while data is being processed, then the inbound call event may be routed to queue **39** to wait for reconnection to a different agent.

It will be apparent to one with skill in the art that internal routing wherein the modem at communication center **15** must be re-linked back into the call flow in order to complete a voice call is rather complicated and uses significant resources. The modem at communication center **15** must issue a dual-tone-multiple-frequency (DTMF) or other suitable non-DTMF tone to switch the connection-state from voice to data and then back to voice as is known in the art with ADSI type modem-interfaces. Moreover, as communication network **9** is identical to the one described in FIG. **1**, the same limitations apply that were described in FIG. **1**.

FIG. **3** is an overview of the mobile device communication network **9** of FIG. **1** illustrating typical routing points for a call event to a car from a PSTN from the contact center of FIG. **1**. In this example as in the example of FIG. **2**, elements of communication network **9** remain the same as previous embodiments and therefore, will not be reintroduced. The example provided herein represents the routing path associated with a PSTN call to car **25** in Cell network **13**.

A call event represented by a vector **30** arrives at switch **29** in PSTN **11**. ANI and DNIS information indicates that the event is destined to communication center **15**. It is assumed that in this embodiment center **15**, which is a national center, must facilitate the call. This is typical of services of the type described in the background section.

Event **30** is routed from switch **29** over trunk **31** to switch **33** at communication center **15**. Because it is a conventional PSTN call, it may be routed directly to an agent (routing point II) such as one operating telephone **50**. The agent operating telephone **50** may further direct the call based on information supplied by the caller such as car identification number. In some cases a car identification number may be part of the call identification data. Based on the call data and agent input data, event **30** is routed back to switch **33** as an outbound call to car **25**. This employs the workflow process represented by servers **45** and **47** along with IVS **43** which instructs modem pool **41** to dial car **25**. Therefore, a third routing point is at switch **33**, which represents an outbound call in progress. The agent operating telephone **50** may or may not stay with the caller during this process. The outbound call is routed back through PSTN **11**, through bridging station **17** and onto car **25** through Cell network **13**. When the motorist operating car **25** picks up; he is connected to the waiting PSTN event.

It will be apparent to one with skill in the art that limitations exist with respect to communication network **9** described in FIGS. **1-3** including routing complexity, long distance costs, lack of local knowledge to aid motorists, and so on.

The above FIGS. **1-3** describe a current-art communication network that uses the GPS system and the cellular network along with the PSTN to enable national centers such as center **15** to communicate with motorists and on-board systems that may be associated with a subscribed car such as car **25**.

A communication network such as network **9** may utilize a virtual private network (VPN) comprising multiple wireless carriers and land networks as is known in the art. Therefore, networks **13** and **11** may be assumed to represent multiple wireless and land-line networks spread over large geographic areas. Even with VPN access, which limits some long distance charges, routing to one national center such as center **15** is still complicated.

FIG. **4** is an overview of a mobile device communication network **61** enhanced with network data control and routing control system **63** according to an embodiment of the present invention. New elements are introduced in this preferred embodiment. Such elements provide enhancement to overall performance and efficiency for the entire system.

In this example, instead of utilizing one single, national communication center to facilitate communication as is illustrated in current-art examples with reference to FIGS. **1-3**, the inventor illustrates a unique and novel network system **61**, which uses multiple, distributed communication-centers, illustrated herein as centers **71** and **73**, and places data control and voice/data switching capability at the network level, illustrated by a VID packet **63**. For clarity, not all the elements explained before are shown in the drawing but may or may not be present in each one of the centers.

Communication center **71** comprises a central switch **75**, a modem pool **77**, a CTI processor **81**, a representative telephone **83**, and a representative PC/VDU **84**. The separate elements are connected through a LAN **86**, and a trunk **79** connects switch **75** to modem pool **77**. IVS and CCS implementations as shown in communication center **15** of FIGS. **1-3** may be assumed to be present, but are not shown. Communication center **73** is in this embodiment is identical to center **71**, comprising a central switch **89**, a modem pool **91**, a CTI processor **95**, a representative telephone **97**, a representative PC/VDU **97**, a LAN **100**, and a trunk **93**. In center **71**, switch **75** is connected to CTI processor **81** by a CTI link **87**. Modem pool **77** is connected to switch **75** by internal telephone wiring **79**. Telephone **83** is connected to switch **75**

by internal telephone wiring **85**. In center **73**, switch **89** is connected to CTI processor **95** by a CTI link **101**. Modem pool **91** is connected to switch **89** by internal telephone wiring **93**. Telephone **97** is connected to switch **89** by internal wiring **99**.

Centers **71** and **73** represent local distributed communication service centers provided by an enterprise hosting a mainstream service and therefore may be significantly smaller in size (number of agents, modems, workstations, etc.) than one large national center. An object of the present invention is to provide distributed centers such as centers **71** and **73** to allow for a much higher service capability (number of vehicles) than is possible with current art systems.

VID packet **63** is provided and operates at PSTN network level. Packet **63** is in this example is an equipment grouping that handles GPS, voice/data switching, and workflow processing activity, which was in previous examples provided within a national communication center such as center **15** of FIGS. **1-3**. Packet **63** comprises a modem pool **65**, an IVS machine **67**, and a CTI processor **69**. CTI processor **69** is connected to switch **29** by a CTI link **68**. This connection provides CTI monitoring and control over switch **29** such that it may be used in many enhanced ways, including as a private SCP. By placing VID packet **63** in the network, GPS location data may be utilized at the network level instead of from within a communication center. Voice and data switching and interactive voice/data control is also performed at network level by modem pool **65** and associated IVS **67**.

In a preferred embodiment of the present invention, an inbound call event from car **25** is received at a local bridging station such as station **17** by way of transceiver/receiver **19** and is converted to a PSTN call event as was described in previous examples. It is assumed for this example that the incoming call event includes data for GPS position. In some embodiments there may be a function for updating position by automatic pinging back through the system to the vehicle. The call event arrives at switch **29** over trunk **27** also as previously described. Here the similarity ends with respect to previously described routing means and data handling.

Data from such a call event is passed over data-network connection **68** to processor **69** in VID packet **63**. The call event is routed to modem pool **65** over trunk **66**. Modem pool **65** represents a routing point I, which is a pre-center routing point. GPS location data associated with car **25** is accessed by modem pool **65**. Data about the call event is stripped by modem pool **65** and processed by IVS **67**. By utilizing VID capability at the network level, now the inbound call event from car **25** may be routed to either center **71** or center **73** (or another call center) whichever is more appropriate. In many cases the appropriate center will be the closest center to car **25**, and the GPS data may be used to make the routing decision. An event such as an inbound event sourced from car **25** arrives at either center **71** or **73** by way of telephony trunk **72** out of modem pool **65** in the network. Other items may be used in considering the routing, as are well known in agent skill level routing, customer requirement routing etc.

Routing points II illustrated at switch **75** (center **71**) and switch **89** (center **73**) are optional routing points depending on which center will be designated to receive the inbound event. Data about the inbound event is passed to the appropriate communication center over a separate data network represented by path **70** connecting processors **69**, **81** and **95**. Processors **81** and **95** control further routing, at centers **71** and **73**, respectively.

Now GPS location is available as a determinant in routing to various call centers. This position information has other novel uses as well. Data processing and voice/data switching is performed at network level according to CTI routines for inbound events. Therefore, the ratio of modems to agents at each center may be significantly reduced. Call events arriving from anywhere in PSTN **11** may also he handled at network level. Modem pools **71** and **73** handle outbound traffic in normal fashion as well as providing voice/data switching.

The method and apparatus of the present invention may be integrated into existing VPN networks without departing from the spirit and scope of the present invention. In this way, multiple wireless carriers as well as land connections may be utilized in routing. Inbound events are routed intelligently by virtue of processors **69** (network), **81** (center **71**), **95** (center **73**), utilizing a separate data network illustrated by network connections **68** and **70**. As a result, inbound routing decisions may be based on a variety of criteria such as load balancing requirements, statistical routing, routing according to least expensive path, routing according to defined service, routing by agent skill, and so on.

In one embodiment of the present invention, a wide area network such as the Internet packet-data network may be utilized and integrated as a data/voice carrier. For example, an Internet-based service may be available for owners of subscribed vehicles to plan such as vacation trips or the like. Such data may be configured and uploaded to an Internet server and tagged to a particular vehicle. At the time of the trip the plans can be included in a series of inbound data calls to such as car **25** from the Internet. Of course, the appropriate DNT/PSTN bridge is required in order to interface switch **29** with the source data events.

GPS may also be used to trigger portions of a trip plan to be broadcast to car **25**. For example, car **25** reaches a certain point (GPS location, latitude or longitude as more broad lines along the planned trip route). Periodic pinging of the GPS system may be used to approximate the correct location of car **25** along a route. When such location data closely matches data included in the trip plan, an automated data call from the Internet carrying the appropriate data for the matching location would be processed as an inbound call event to the appropriate communication center. That center could then generate an outbound data call to car **25** that may include locations and directions for local motels, restaurants, banks, supermarkets, camp sites, and so on. There are many possibilities. Businesses and service providers such as auto towing, truck stops, rest areas, and the like may advertise to customers through local centers.

In some cases, the location of a requested service may effect network-level routing of an inbound call request. For example, if during travel, a subscriber such as one driving car **25** requests knowledge of a nearest hospital that provides emergency services, then a network-level SCP may, after pinging for GPS position, route the event to a local communication center known to have knowledge of a name, location and directions to a nearest hospital that matches the request. Such data would, of course, have to be known at network level such as by a connected data repository adapted for the purpose.

It will be apparent to one with skill in the art that a communication/service network such as network **61** can provide service to more vehicles by virtue of utilizing multiple communication centers than can be handled by a single communication center. It will also be apparent to one with skill in the art that such multiple centers as described above can provide more specific and updated information by virtue of being in close vicinity to the services requested, and local centers may be specialized to local services, and so on.

The methods and apparatus of the present invention may be practiced over standard Cell/PSTN networks or may be inte-

grated into a VPN comprising multiple carriers. Likewise integration into such as the Internet or other WAN or G3-type digital networks is possible. Therefore, the method and apparatus of the present invention should be afforded the broadest scope. The method and apparatus of the present invention is limited only by the claims that follow.

The invention claimed is:

1. A communication transaction router, comprising:

a port receiving communication transactions from mobile units, the transactions including information regarding position of the mobile units initiating the transactions;

one or more ports to a network for routing transactions to individual ones of a plurality of service centers; and

an information repository storing information regarding individual ones of the plurality of service centers, the information accessible to the transaction router;

wherein the information regarding position of the mobile units and the information regarding individual ones of the plurality of service centers is accessed and used by the routing intelligence in routing transactions.

2. The transaction router of claim **1** wherein the communication transactions from mobile units are telephone transactions.

3. The transaction router of claim **1** wherein the information regarding position of the mobile units is Global Positioning System (GPS) position indication appended to the transactions.

4. The transaction router of claim **1** wherein the information regarding individual ones of the plurality of service centers includes global position of the service centers, and the information regarding position of the mobile units is global position of the mobile units, and transactions are routed according to proximity of the mobile units to service centers.

5. The transaction router of claim **1** wherein the ports to a network for routing transactions connect to a packet-switched network.

6. The transaction router of claim **1** wherein the ports to a network for routing transactions connect to a line-switched network.

7. The transaction router of claim **1** further comprising a facility for interacting with a caller to determine a purpose for the call, wherein the purpose determined and the position are both used to route the call to an individual one of the plurality of service centers.

8. A communication transaction router, comprising:

a port for receiving communication transactions from mobile units, the transactions including information regarding position of the mobile units;

one or more ports to a network for routing transactions to individual ones of a plurality of service centers; and

an information repository storing information regarding individual ones of the plurality of service centers,

wherein the information regarding the position of the mobile units and the information regarding the individual ones of the plurality of service centers is accessed and used in routing transactions.

9. A routing system, comprising:

a processor; and

a memory, wherein the memory stores instructions that, when executed by the processor, cause the processor to:

receive transactions from a mobile unit, the transactions comprising position information of the mobile unit;

store information regarding a plurality of service centers; and

determine a destination for the transactions from among the plurality of service centers based on the position information and the information regarding the plurality of service centers.

10. The routing system of claim 9, wherein the transactions are telephone transactions.

11. The routing system of claim 9, wherein the position information comprises Global Positioning System (GPS) information of the mobile unit.

12. The routing system of claim 9, wherein the information regarding the plurality of service centers comprises a global position of each of the service centers and the position information comprises a global position of the mobile unit, and wherein the destination for the transactions is determined according to proximity of the mobile unit to a respective one of the service centers.

13. The routing system of claim 9, wherein the instructions, when executed, further cause the processor to access information regarding a purpose of an individual transaction, and wherein the destination for the individual transaction is determined based on the position information and the information regarding the purpose of the transaction.

14. A method for routing transactions, the method comprising:

receiving, by one or more processors, transactions from a mobile unit, the transactions comprising position information of the mobile unit;

storing, by the one or more processors, information regarding a plurality of service centers; and

determining, by the one or more processors, a destination for the transactions from among the plurality of service centers based on the position information and the information regarding the plurality of service centers.

15. The method of claim 14, wherein the transactions are telephone transactions.

16. The method of claim 14, wherein the position information comprises Global Positioning System (GPS) information of the mobile unit.

17. The method of claim 14, wherein the information regarding the plurality of service centers comprises a global position of each of the service centers and the position information comprises a global position of the mobile unit, and wherein the destination for the transactions is determined according to proximity of the mobile unit to a respective one of the service centers.

18. The method of claim 14, further comprising accessing information regarding a purpose of an individual transaction, and determining the destination for the individual transaction based on the position information and the information regarding the purpose of the transaction.

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