PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 :
H04Q 7/00

A2

(11) International Publication Number: WO 00/44183

(43) International Publication Date: 27 July 2000 (27.07.00)

(21) International Application Number: PCT/US00/01450

(22) International Filing Date: 20 January 2000 (20.01.00)

(30) Priority Data:
09/235,118 21 January 1999 (21.01.99) US

(71) Applicant: QUALCOMM INCORPORATED [US/US]; 5775 Morehouse Drive, San Diego, CA 92121-1714 (US).

(72) Inventor: LIOY, Marcello; 7588 Charmant Drive #1924, San Diego, CA 92122 (US).

(74) Agents: MILLER, Russell, B. et al.; Qualcomm Incorporated, 5775 Morehouse Drive, San Diego, CA 92121-1714 (US).

(81) Designated States: 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, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, 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).

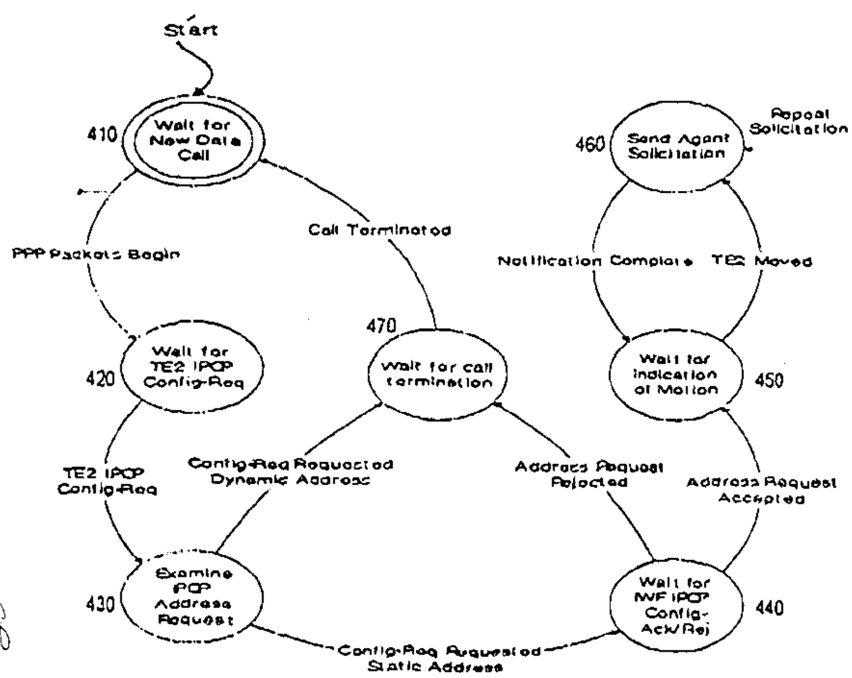
Published
Without international search report and to be republished upon receipt of that report.

(54) Title: AUTOMATIC INVOCATION OF MOBILE IP REGISTRATION IN A WIRELESS COMMUNICATION NETWORK

(57) Abstract

A system and method for invoking the performance of mobile node registration in a wireless communication network. The system comprises a terminal device for transmitting and receiving packetized data and a communication device coupled to the terminal device. The communication device monitors the packetized data for an Internet Protocol (IP) address contained in an IP address request. If the IP address request is for a static IP address the communication device waits for network movement information. Based on the received network movement information, the communication device solicits network address information. Upon receipt of the network address information, the terminal device then initiates Mobile Node registration. As a result, the Mobile Node registration is automatically invoked whenever the terminal device changes its network point-of-attachment.

MT2 DEVICE STATE DIAGRAM



AUTOMATIC INVOCATION OF MOBILE IP REGISTRATION IN A WIRELESS COMMUNICATION NETWORK

BACKGROUND OF THE INVENTION

I. Field of the Invention

This invention generally relates to the field of wireless communications. More particularly, the present invention relates to a novel and improved method and system for automatically invoking a mobile terminal device to initiate IP mobility support in a wireless communications network.

II. Description of Related Art

Recent innovations in wireless communication and computer-related technologies, as well as the unprecedented growth of Internet subscribers, have paved the way for mobile computing. In fact, the popularity of mobile computing has placed greater demands on the current Internet infrastructure to provide mobile users with more support. The life blood of this infrastructure is the packet-oriented Internet Protocol (IP) which provides various services, including the addressing and routing of packets (datagrams) between local area networks (LANs). IP protocol is defined in Request For Comment 791 (RFC 791) entitled, "INTERNET PROTOCOL DARPA INTERNET PROGRAM PROTOCOL SPECIFICATION," dated September 1981, and herein incorporated by reference.

Heuristically, according to the IP protocol, data is encapsulated into IP packets for transmission. Addressing and routing information is affixed to the header of the packet. IP headers contain 32-bit addresses that identify the sending and receiving hosts. These addresses are used by intermediate routers to select a path through the network for the packet towards its ultimate destination at the intended address. A basic concept of IP addressing is that initial prefixes of the IP address can be used for generalized routing decisions. These prefixes contain implied geographical information about the location of a particular host on the Internet. In other words, whenever any router on the

Internet receives a packet having a destination IP address that begins "129.46", the router forwards that packet in a particular direction towards the QUALCOMM, Inc. network in San Diego, California, USA. Thus, the IP protocol allows packets originating at any Internet node in the world to be routed to any other Internet node in the world, given that the originating party knows the IP address of the destination party.

Ideally, mobile computing should provide users with seamless and transparent Internet access regardless of time and its current point-of-attachment. The access should be seamless in the sense that, as the mobile user roams or migrates between networks, there is continuous Internet connectivity with no inconvenience or noticeable difference to the mobile user. The access should be transparent to the user such that applications do not need to be recompiled, reconfigured, or re-executed as the mobile user roams across various networks. Conventional internetworking protocols (e.g., TCP/IP, IPX, Appletalk™, etc.) are, at best, awkward in handling mobile users who migrate between networks. This is because, as stated above, the IP addressing scheme used for Internet routing inherently contains geographic information. If a mobile user desires to use a fixed IP address to identify his mobile terminal, the IP packets intended for the user will not be routed to the mobile terminal when the terminal happens to be away from the network corresponding to the fixed IP address (i.e., its "home" network). If the terminal attempts to rectify this by changing its address, it will lose all connectivity.

By way of example, suppose a user decides to remove his mobile terminal from its "home" network at QUALCOMM, Inc. in San Diego, and connect to Stanford University's network in Palo Alto, California while maintaining his QUALCOMM -assigned fixed IP address. Conventionally, any IP packet intended for the mobile terminal will still be routed to QUALCOMM's network in San Diego because of the geographical location information implicit in the mobile terminal's fixed IP address. Such IP packets will not be delivered to the mobile terminal while away from its "home" network unless some mechanism is in place to forward or route IP packets from

QUALCOMM's network to the mobile terminal's current point-of-attachment at Stanford University's network in Palo Alto.

In order to meet the need for seamless and transparent Internet access, Request For Comment 2002 (RFC 2002), entitled "IP MOBILITY SUPPORT," dated October 1996 and herein incorporated by reference, specifies protocol techniques to achieve the transparent forwarding of IP packets to mobile terminals regardless of their particular point-of-attachment. Using these Mobile IP techniques, each mobile terminal is always identified by its "home" network IP address, regardless of its current point-of-attachment to the Internet. When the mobile terminal is located within its home IP network, it operates without the use of Mobile IP techniques. However, upon the mobile terminal detecting that it is no longer operating within its home IP network but is visiting a "foreign IP network", it obtains a foreign network "care-of" address which provides forwarding information necessary to route IP packets to its current point-of-attachment. This care-of-address may be proffered by an agent on the foreign network, "Foreign Agent" (e.g., a router in the foreign network) through its Agent Advertisement message. Mobile IP techniques require that the mobile terminal send a Registration-Request message to a "Mobility Agent" in order to register a desired care-of-address. This Mobility Agent may either be a "Home Agent" (i.e., a router in the terminal's home network) or the "Foreign Agent" and is responsible for returning a Registration-Reply granting or denying the Registration-Request. If granted, the Home Agent forwards the IP packets intended for the mobile terminal by using a technique called "IP tunneling." IP tunneling involves the Home Agent attaching a new IP header which contains the care-of-address to any arriving IP packet which has a destination address corresponding to the mobile terminal's home IP address. After arriving at the care-of-address, the Foreign Agent at the care-of-address strips off the IP tunneling header, and delivers the IP packet to the mobile terminal at its current point-of-attachment to the Internet.

In this way, Mobile IP supports mobile terminals that roam across different foreign networks and vary their network point-of-attachment, without having to change the mobile terminal's IP address. This capability has several

advantages. First, it allows other nodes elsewhere on the Internet to send periodic "push" services (e.g., stock quotes, e-mail, etc.) to the mobile terminal regardless of the mobile terminal's location. This obviates the need for the mobile user to actively retrieve information from his home network. Second, Mobile IP allows the mobile terminal to relocate to different sub-networks, as often as desired, without any originating parties having to keep track of what sub-network the mobile terminal is currently attached to. Third, by design, Mobile IP is compatible with a variety of networks and media, ensuring seamless and transparent Internet access. For example, Mobile IP is capable of supporting packet traffic generated by a mobile terminal as it travels from its home Ethernet network segment to a foreign wireless LAN, without any significant interruption in service.

As stated above, the current trend is for mobile users to use mobile computers, such as laptop or palmtop computers, in conjunction with wireless communication devices, such as cellular or portable phones, to access the Internet. To wit, just as users conventionally employ "wired" communication devices to connect their computers to land-based networks, mobile users will use wireless communication devices, commonly referred to as "mobile stations" (MSs), to connect their mobile terminals to such networks. As used herein, mobile station or MS will refer to any subscriber station in the public wireless radio network that is intended to be used while in transit or during halts at unspecified points. MS devices include portable units (e.g., hand-held personal phones) and units permanently installed in vehicles (e.g., installed mobile phone units), as well as wireless local loop (WLL) telephones.

FIG. 1 (Prior Art) illustrates a high-level block diagram of a wireless data communication system in which mobile terminal equipment, TE2 device 102 (e.g., the mobile terminal, laptop, or palmtop computer), communicates with an Interworking Function (IWF) 108 via a wireless communication system. The wireless communication system includes a wireless communication device, MT2 device 104, and a Base Station/Mobile Switching Center (BS/MSC) 106. In FIG. 1, the IWF 108 serves as the access point to the Internet. IWF 108 is coupled to, and often co-located with, BS/MSC 106, which may be a

conventional wireless base station as is known in the art. The TE2 device 102 is electronically coupled to the MT2 device 104, which in turn, communicates "wirelessly" with BS/MSC 106 and IWF 108. The TE2 device 102 and the MT2 device 104 may be integrated into a single unit or may be separated out as in an installed mobile phone unit in which a laptop is the TE2 device 102 and the transceiver is the MT2 device 104. The combination of the TE2 device 102 and the MT2 device 104, whether integrated or separate, is also referred to as a mobile node.

There are other protocols that address the data communication between the TE2 device 102 and the IWF 108. For example, Telecommunications Industry Association (TIA)/Electronics Industries Association (EIA) Interim Standard IS-95, entitled "MOBILE STATION-BASE STATION COMPATIBILITY STANDARD FOR DUAL-MODE WIDEBAND SPREAD SPECTRUM CELLULAR SYSTEM" (published in July 1993), herein incorporated by reference, generally provides a standard for wideband spread spectrum wireless communication systems. Also, standard TIA/EIA IS-707.5, entitled "DATA SERVICE OPTIONS FOR WIDEBAND SPREAD SPECTRUM SYSTEMS: PACKET DATA SERVICES" (published February 1998), herein incorporated by reference, defines requirements for support of packet data transmission capability on TIA/EIA IS-95 wideband spread spectrum systems, of which BS/MSC 106 and IWF 108 may be a part. IS-707.5 specifies a packet data bearer service that may be used for communication between TE2 device 102 and IWF 108 via BS/MSC 106. It provides procedures that can apply to multiple packet data services, including the Mobile IP service of RFC 2002.

IS-707.5 also introduces two protocol option models which provide the requirements for communication protocols on the links between TE2 device 102 and the MT2 device 104 (the Rm interface), between the MT2 device 104 and the BS/MSC 106 (the Um interface), and between the BS/MSC 106 and the IWF 108 (the L interface). The first protocol option model, the Relay Model, represents the situation where the PPP link exists between the TE2 device 102 and the IWF 108. In this situation, the MT2 device 104 simply behaves as a pipe transmitting the TE2 device 102 PPP frames over the U_M interface and the IWF 108 frames

over the R_M interface. In contrast, the second protocol option model, the Network model, represents the situation where two independent PPP links exist between the TE2 device 102 and the MT2 device 104 as well as between the MT2 device 104 and the IWF 108. In this case the MT2 device 104 is responsible for un-framing any received PPP packets and re-framing them before forwarding them to their final destination. In this case, it is possible that the MT2 device 104 is responsible for various aspects of mobility management and network address management.

FIG. 2 (Prior Art) is a diagram of the protocol stacks in each entity of the IS-707.5 Relay Model. FIG. 2 corresponds roughly to Figure 1.4.2.1-1 of IS-707.5. At the far left of the figure is a protocol stack, shown in conventional vertical format, showing the protocol layers running on the TE2 device 102. The TE2 protocol stack is illustrated as being logically connected to the MT2 device 104 protocol stack over the Rm interface. The MT2 device 104, is illustrated as being logically connected to the BS/MSC 106 protocol stack over the Um interface. The BS/MSC 106 protocol stack is, in turn, illustrated as being logically connected to the IWF 108 protocol stack over the L interface.

The operation depicted by Fig. 2 is as follows: an upper layer protocol 202 entity, such as an application program running on the TE2 device 102, has a need to send IP packets over the Internet. A representative application may be a web browser program (e.g., Netscape Navigator™, Microsoft Internet Explorer™ etc.). The web browser requests a Universal Resource Locator (URL), such as HYPERLINK "http://www.Qualcomm.com/". A Domain Name System (DNS) protocol, also in the upper layer protocols 202, translates the textual host name www.Qualcomm.com to a 32-bit numeric IP address. The Hypertext Transfer Protocol (HTTP), also an upper layer protocol 202, constructs a GET message for the requested URL, and also specifies that Transmission Control Protocol (TCP) will be used to send the message and that TCP is used for HTTP operations.

The TCP protocol, also an upper layer protocol 202, opens a connection to the IP address specified by DNS and transmits the HTTP GET message. The TCP protocol specifies that the IP protocol will be used for message transport.

The IP protocol, a network layer protocol 204, transmits the TCP packets to the IP address specified. The Point to Point Protocol (PPP), a link layer protocol 206, encodes the IP/TCP/HTTP packets and transmits them across the Rm interface using the relay layer protocol 208 EIA-232 to the EIA-232-compatible port on the MT2 device 104. The PPP protocol is described in detail in Request for Comments 1661 (RFC 1661), entitled "THE POINT-TO-POINT PROTOCOL (PPP)", herein incorporated by reference and briefly discussed below.

The EIA-232 protocol 210 on the MT2 device 104, passes the transmitted PPP packet to the Radio Link Protocol (RLP) 212 and then to the IS-95 protocol 214 for transmission to the BS/MSC 106 over the Um interface. The RLP protocol 212 is defined in IS-707.2, and the IS-95 protocol is defined in IS-95 mentioned above. A complementary relay layer protocol stack on the BS/MSC 106, including the RLP layer 216 and the IS-95 layer 218, receives the PPP packets over the Um interface and passes them to the MT2 relay layer protocol 220 for the L interface to the IWF relay layer protocol 228. The MT2 relay layer protocol 212 and the IWF relay layer protocol 228 are described in TIA/EIA IS-658 entitled, "DATA SERVICES INTERWORKING FUNCTION INTERFACE STANDARD FOR WIDEBAND SPREAD SPECTRUM DIGITAL CELLULAR SYSTEM", herein incorporated by reference.

The PPP protocol 226 in the link layer of the IWF decodes the PPP packets from the TE2 device 102, and serves to terminate the PPP connection between the TE2 device 102 and the IWF 108. The decoded packets are passed from the PPP protocol 226 to the IP protocol in the network layer protocols 224 of the IWF 108 for examination, and further routing to the IP address specified by the TE2 device 102 in the IP packet header (i.e., in this case, the IP address for www.Qualcomm.com). If there are any upper layer protocol tasks to be performed at the IWF 108, such as TCP, they are performed by the upper layer protocols 222.

Assuming that the ultimate destination of the IP packets generated by the TE2 device 102 is not the IWF 108, the packets are forwarded through the network layer protocols 224, the link layer protocols 227 of the IWF 108 to the next router (not shown) on the Internet. In this manner, IP packets from the

TE2 device 102 are communicated through the MT2 device 104, the BS/MSC 106, and the IWF 108 towards their ultimate intended destination on the Internet, thereby providing wireless packet data services for the TE2 device 102 according to the IS-707.5 standard relay model.

Before the TE2 device 102 packets reach their destination, however, it is imperative that the data link connection is established first. As specified in RFC 1661, this requires each end of the point-to-point link (i.e., the TE2 PPP protocol 206 and IWF PPP protocol 226) to first send PPP Link Control Protocol (LCP) packets in order to establish, configure and test the data link connection. After the link has been established by the LCP, the PPP protocol 206 then sends Network Control Protocol (NCP) packets to configure the network layer protocols (i.e., the TE2 IP protocol 204 and IWF IP protocol 224). After each of the network layer protocols has been configured, packets from each network layer protocol can be sent over the link between them.

The NCP for IP in PPP links is the IP Control Protocol (IPCP). IPCP is described in detail in Request for Comment 1332 (RFC 1332), entitled "THE PPP INTERNET PROTOCOL CONTROL PROTOCOL (IPCP)" published May 1992, and herein incorporated by reference. IPCP is responsible for configuring, enabling, and disabling both the TE2 IP protocol 204 and the IWF IP protocol 224 that run at either end of the point-to-point link.

IPCP employs configuration request messages that include IP address configuration options. The configuration option portion provides a mechanism to negotiate the IP address to be used by the sender of the Configure-Request (i.e., here, the TE2 device 102). Specifically, the IP address configuration option allows the Configure-Request sender to state the desired IP address either by proffering an IP address or by requesting that the peer (i.e., in this case, the IWF 108) provide a dynamic IP address for the sender. If the Configure-Request sender sets the IP address field of the IP address configuration option to all zeros, the peer will provide a dynamic IP address by sending a Configure-NAK for the option and returning a valid IP address. If, on the other hand, the Configure-Request sender specifies an address in the IP address field, the peer

can indicate that the specified IP address is acceptable by sending a Configure-ACK for the option.

Alternatively, FIG. 3 (Prior Art) is a diagram of the protocol stacks in each entity of the IS-707.5 Network Model which corresponds roughly to Figure 1.4.2.2-1 of the standard. To the extent that the protocol flow and mechanisms of the TE2 device 102, BS/MSC 106, and IWF 108 are similar to those included in the Relay Model, as depicted in FIG. 2, the reference numerals remain the same. Because the Network model reflects situations where the MT2 device 104 may be responsible for packet mobility management and network address management, the MT2 device 104 contains additional protocol levels. For example, after receiving the PPP packets from the TE2 device 102 via the EIA-232 protocol 210, and the packets are passed on to the PPP_U layer 302, where they are unframed. The packets are subsequently forwarded up to the IP layer 304. For packets that are destined to the IWF 108, the packets are passed back down to the PPP_R layer 306 where they are re-framed. Much like the packets in the Relay Model at this stage, the packets are then sent to the Radio Link Protocol (RLP) 212 and then to the IS-95 protocol 214 for transmission to the BS/MSC 106 over the Um interface.

As presented above, the IS-95 standard provides the general specification for wideband spread spectrum wireless communications. The IS-707.5 standard provides the requirements for communication protocols on the links between a TE2 device 102 and an IWF 108, including the requirements for the Rm, the Um, and the L interfaces. Moreover, shown above, RFC 1661 defines the standard for establishing, configuring and testing the point-to-point data link and RFC 1331 sets forth the PPP-IPCP standard establishing and configuring the IP for both, the TE2 102 side and IWF 108 side of the point-to-point link. As such, the standards and protocols proffered by IS-95, IS-707.5, RFC 1661, and RFC 1331 carefully dovetail and amply support the functionality of Mobile IP services as defined in RFC 2002.

With this said, it is important to note that none of these standards or protocols, not even Mobile IP RFC 2002, provide a mechanism for ensuring that the mobile terminal or TE2 device 102 takes appropriate action when it has

moved its network point-of-attachment. Specifically, when a mobile terminal, such as a laptop, initially attempts to attach to a network other than its home network (i.e., foreign network), RFC 2002 provides a way for the laptop to invoke the Mobile IP node registration procedure to ensure that data destined to the laptop's home network is routed back to the foreign network point-of-attachment. However, if the laptop roams beyond the metes and bounds of its initial foreign network point-of-attachment, there is nothing guarantee that the laptop will be notified that it has moved. In fact, the only device aware that the laptop has roamed to a new point-of-attachment is the MT2 device 104 where the MT2 device 104 becomes aware of this network movement information through signaling traffic from the IS-95 network. Such network information is well-known in the art and is defined in aforementioned TIA/EIA IS-95 standard. Although IS-95 shall not be discussed in detail, some examples of network movement information-bearing signaling includes voice-zone registration, packet-zone identification, system ID changes, network ID changes, PPP packet resynchronization, etc.

What is needed is a method and system that utilizes the mobile station or wireless communication device (i.e., MT2 device 104) for automatically triggering the mobile terminal device (i.e., TE2 device) to re-initiate the Mobile IP registration procedure and update the terminal and Home Agent with the relevant foreign network point-of-attachment information.

SUMMARY OF THE INVENTION

The present invention addresses the need identified above by providing a system and method that allows a wireless communication device to automatically invoke a terminal device to perform Mobile IP node registration when the terminal device has traveled outside the scope of its current network.

Systems and methods, consistent with the principles of the present invention as embodied and broadly described herein, includes a terminal device for transmitting and receiving packetized data and a communication device coupled to the terminal device. The communication device monitors the packetized data for an Internet Protocol (IP) address contained in an IP address

request. If the IP address request is for a static IP address the communication device waits for network movement information. Based on the received network movement information, the communication device solicits network address information. Upon receipt of the network address information, the terminal device then initiates Mobile Node registration. As a result, the Mobile Node registration is automatically invoked whenever the terminal device changes its network point-of-attachment.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of this Specification, illustrate an embodiment of the invention and, together with the description, explain the objects, advantages, and principles of the invention. In the drawings:

FIG. 1 (Prior Art) is a high level block diagram of a wireless communication system in which a terminal device connects to the Internet via a wireless communication device.

FIG. 2 (Prior Art) schematically describes the protocol stacks in each entity of the TIA/EIA IS-707.5 Relay Model.

FIG. 3 is a high-level state diagram depicting the operation of an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following detailed description of the present invention refers to the accompanying drawings that illustrate preferred embodiments consistent with this invention. Other embodiments are possible and modifications may be made to the embodiments without departing from the spirit and scope of the invention. Therefore, the following detailed description is not meant to limit the invention. Rather the scope of the invention is defined by the appended claims.

The Mobile IP protocol allows a mobile node (e.g., a computer host or router) to change its IP point-of-attachment from one network to another. The IP node, being mobile, is capable of changing its location without changing its (permanent) IP home address. The present invention takes advantage of the Mobile IP protocol, as well as other protocols and standards which govern the communications between the TE2 device 102, the MT2 104, and the IWF 108, to automatically determine whether and when the TE2 102 re-initiates Mobile Node registration in order to maintain the link-layer connectivity. In this manner, the mobile IP node can continue communicating with other IP nodes at any location.

The present invention is intended to support seamless and transparent mobility to users of data services-enabled devices. Therefore, a preferred embodiment of the present invention includes TE2 and MT2 devices 102, 104 that contain Mobile IP support capabilities.

It will be apparent to one of ordinary skill in the art that the present invention as described below may be implemented in many different embodiments of software, firmware, and hardware in each of the entities illustrated in the figures (i.e., TE2 device 102, MT2 device 104, BS/MSC 106 and IWF 108). For example, the TE2 device 102 may be a laptop computer with a processing unit executing Mobile IP-compliant software instructions. Similarly, the MT2 device 104 may contain a processing unit that processes TE2 device 102 information and communications network information. The actual software code or control hardware used to implement the present invention is not limiting of the present invention. Thus, the operation and behavior of the present invention will be described without specific reference to the actual software code or hardware components, it being understood that a person of ordinary skill in the art would be able to design software and control hardware to implement the preferred embodiment of the present invention based on the description herein.

FIG. 4 is a high-level state diagram of the operation of the MT2 device 104 of the present invention. The MT2 device 104 begins in the "WAIT FOR NEW DATA CALL" state 310. In state 410, the MT2 device 104 is not currently

in a call, but is waiting for the TE2 device 102 to originate a call. Mobile-terminated calls (i.e., those where the MT2 device 104 is the called party) are not considered in this state, as they assume that the MT2 device 104 has either already been assigned an IP address, or has already registered for Mobile IP.

When the TE2 device 102 sends PPP packets to the MT2 device 104, as per RFC 1661, the MT2 104 device interprets it as an attempt to establish a packet data call and, therefore, initiates a data call. This data call transitions the MT2 104 device into the "WAIT FOR TE2 IPCP CONFIG-REQ" state 420.

In state 420, the MT2 device 104 simply waits for the TE2 device 102 to begin the IP address negotiation process, as prescribed in RFC 1332. Upon the TE2 device 102 sending an IP address Config-Req message, the MT2 device 104 transitions into the "EXAMINE IPCP ADDRESS REQUEST" state 430.

If the address requested by the TE2 device 102 is a dynamic address (i.e., IP address are all zeros), then there is no request for Mobile IP support by the TE2 device 102, and the MT2 device 104 transitions to the "WAIT FOR CALL TERMINATION" state 470. In this state, the MT2 device 104 essentially ignores everything until the call is terminated. Once the call is terminated, the MT2 device 104 transitions back to state 410 and waits for a new data call.

If the IP address field in the Config-Request sent by the TE2 device 102 contains a specific or static (i.e., non-zero) IP address, the MT2 device 104 then transitions to the "WAIT FOR IWF IPCP CONFIG-ACK/REJ" state 440.

In state 440, the MT2 device 104 examines the IPCP packets to determine what the response is to the Config-Request i.e., whether the static IP address request made by the TE2 device 102 has been accepted by the IWF 108 with a configure ACK. If the static IP address request made by the TE2 device 102 is denied by the IWF 108, then the MT2 device 104 transitions back to state 470 because the call cannot be a Mobile IP call since the TE2 device is not given the address requested. As such, the MT2 device 104 simply ignores all transactions and waits for the call to be terminated. If the static IP address request made by the TE2 device 102 is accepted by the IWF 108, then the MT2 device 104 confirms that this is a Mobile IP data call and transitions to the "WAIT FOR INDICATION OF MOTION" state 450.

In state 450, the MT2 device 104 waits for indications by the network that the TE2 device 104 has moved from its prior network point-of-attachment. As stated above, this network movement information is extracted through the signaling traffic from the IS-95 network. Once the MT2 device 104 receives indications by the network that the TE2 device 102 has moved i.e., has changed networks, the MT2 device 104 transitions into the "SEND AGENT SOLICITATION" state 460.

In state 460, the MT2 device 104 sends a Solicitation Message to available Foreign Agents to exploit the default Agent Advertisement mechanism, as outlined in Mobile IP RFC 2002. As indicated by the feedback transition arrow of state 460, the sending of this Solicitation Message may be repeated several times to guard against its inadvertent loss and ensure its receipt by the Foreign Agent.

By having the MT2 device 104 send a Solicitation Message, this invention takes advantage of the Mobile IP infrastructure as the Foreign Agent, upon receiving the message, is triggered into sending an Advertising Message with a foreign network care-of-address to the TE2 device 102 IP address. Pursuant to RFC 2002, the TE2 device 102 notices that the care-of-address has changed and that it must re-register its IP address. For example, if the TE2 device 102 determines that it has returned to its home network, the TE2 device will initiate the Mobile IP node de-registration procedure with its Foreign Agent. If, however, the TE2 device 102 detects a "new" foreign network, it will proceed by re-initiating the Mobile IP mobile node registration procedure and ultimately establishing a care-of-address on the new foreign network.

This invention, therefore, provides a system and method that utilizes the MT2 device 104 to automatically trigger the TE2 device 102 into re-initiating the Mobile IP Registration procedure when the TE2 device 102 has traveled outside its current network point-of-attachment.

The foregoing description of preferred embodiments of the present invention provides illustration and description, but is not intended to be exhaustive or to limit the invention to the precise form disclosed.

Modifications and variations are possible consistent with the above teachings or may be acquired from practice of the invention. The scope of the invention is defined by the claims and their equivalents.

WHAT IS CLAIMED:

CLAIMS

1. A system for automatically invoking mobile node registration in a wireless communication network, said system comprising:

a communication device for interfacing with said wireless communication network, said communication device receiving network IP address information from said wireless communication network; and

a terminal device, coupled to said communication device, for transmitting and receiving packetized data, wherein said terminal device initiates mobile mode registration in response to said network IP address information.

2. The system of Claim 1, wherein said communication device includes means for monitoring said packetized data transmitted by said terminal device for an IP address contained in an IP request.

3. The system of Claim 2, wherein said communication device also receives network movement information from said wireless communication network and includes means for waiting for said network movement information if said requested IP address is a request for a static address and said IP request is accepted by said wireless communications network.

4. The system of Claim 3, wherein said communication device includes means for soliciting said wireless communication network for said network IP address information in response to said network movement information.

5. A method for invoking the performance of mobile node registration in a wireless communication network including a terminal device, coupled to a communication device, for transmitting and receiving packetized data, said method comprising the steps of:

interfacing said communication device with said wireless communication network;

soliciting, by said communications device, network IP address information from said wireless communication network;

receiving, by said communication device, network IP address information from said wireless communication network; and

initiating, by said terminal device, mobile mode registration in response to said network IP address information received by said communication device.

6. The method of Claim 5, further including,

monitoring, by said communication device, said transmitted packetized data for an IP address contained in an IP address request, and

waiting, by said communication device, for network movement information if said IP address request is for a static IP address.

7. The method of Claim 6, wherein said solicitation step is performed in response to said received network movement information.

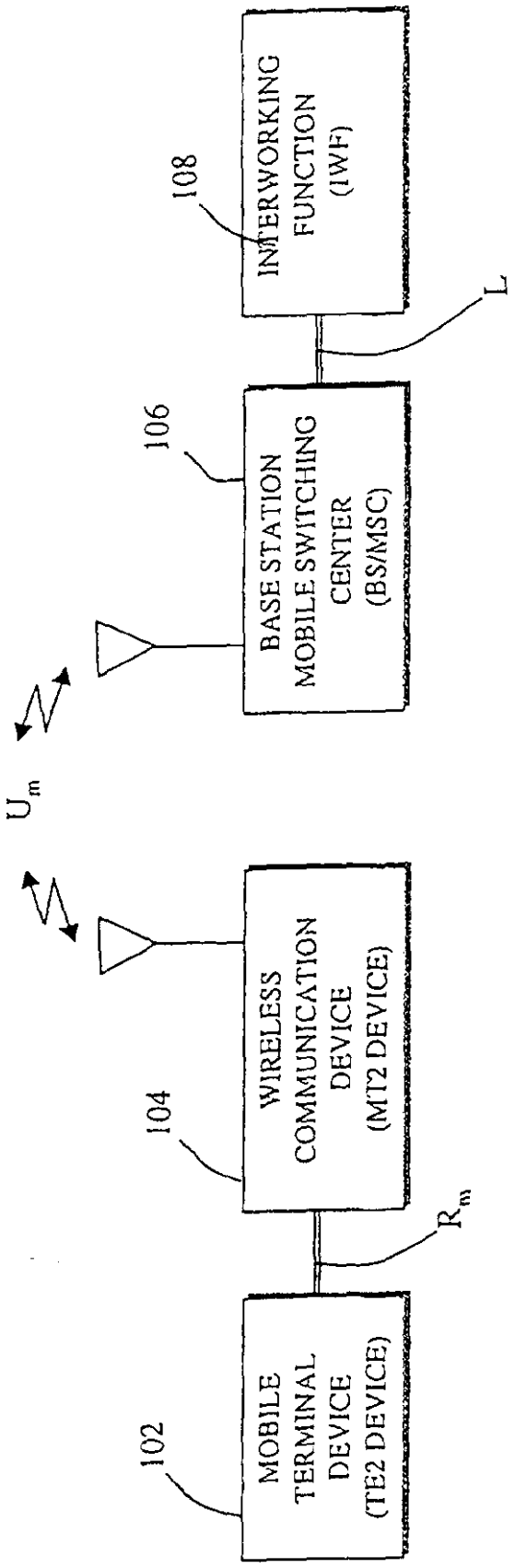


FIG. 1 (Prior Art)

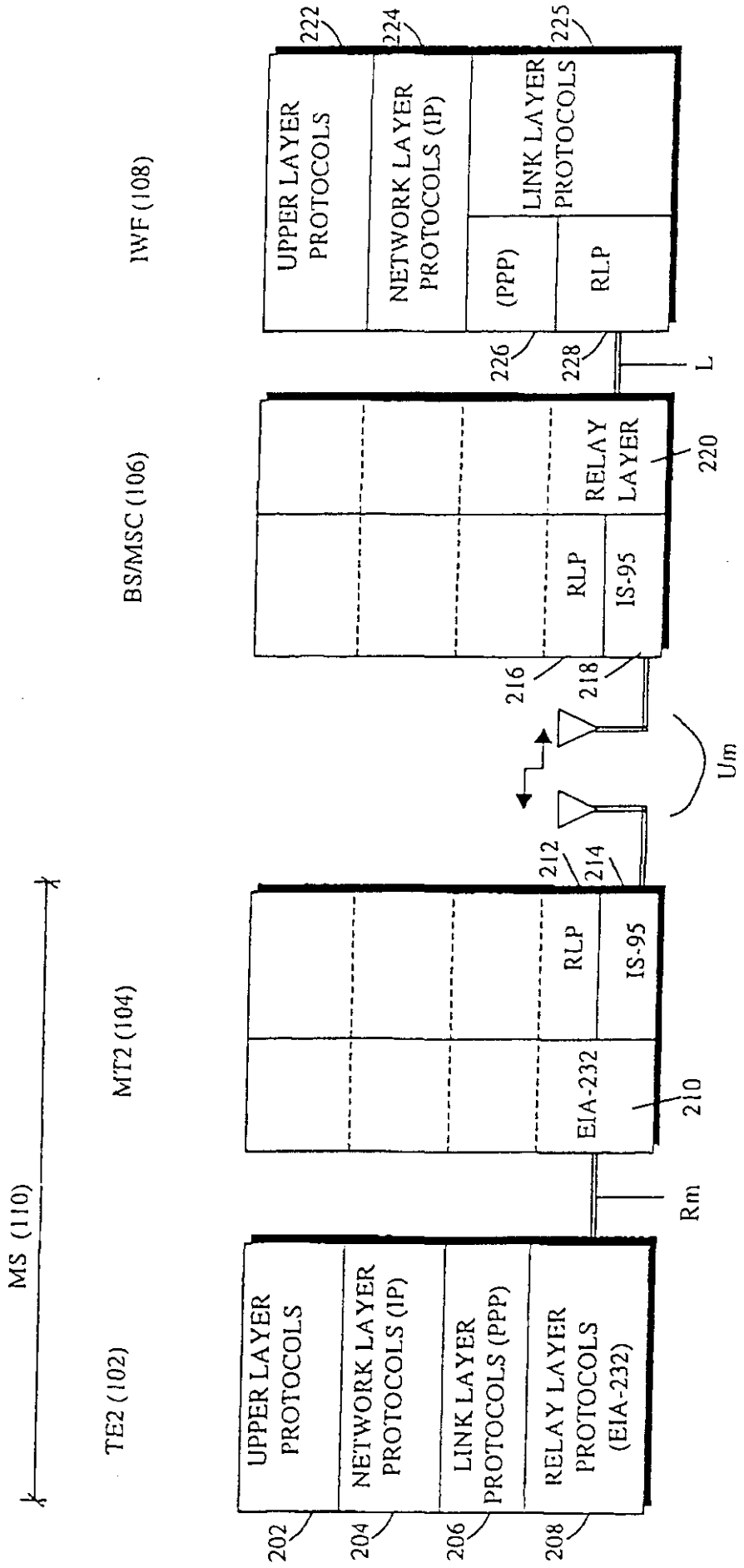


FIG. 2 (Prior Art)

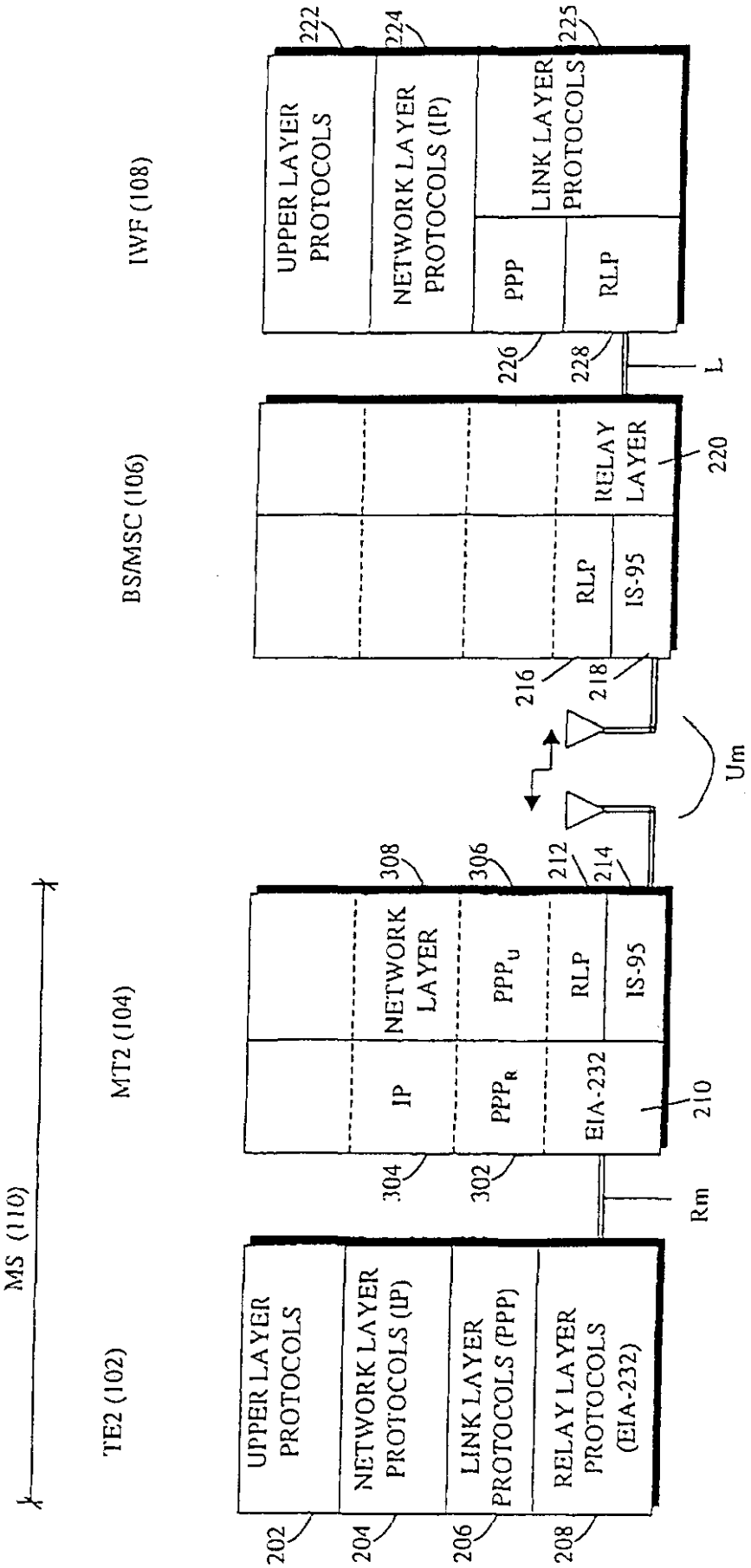


FIG. 3 (Prior Art)

MT2 DEVICE STATE DIAGRAM

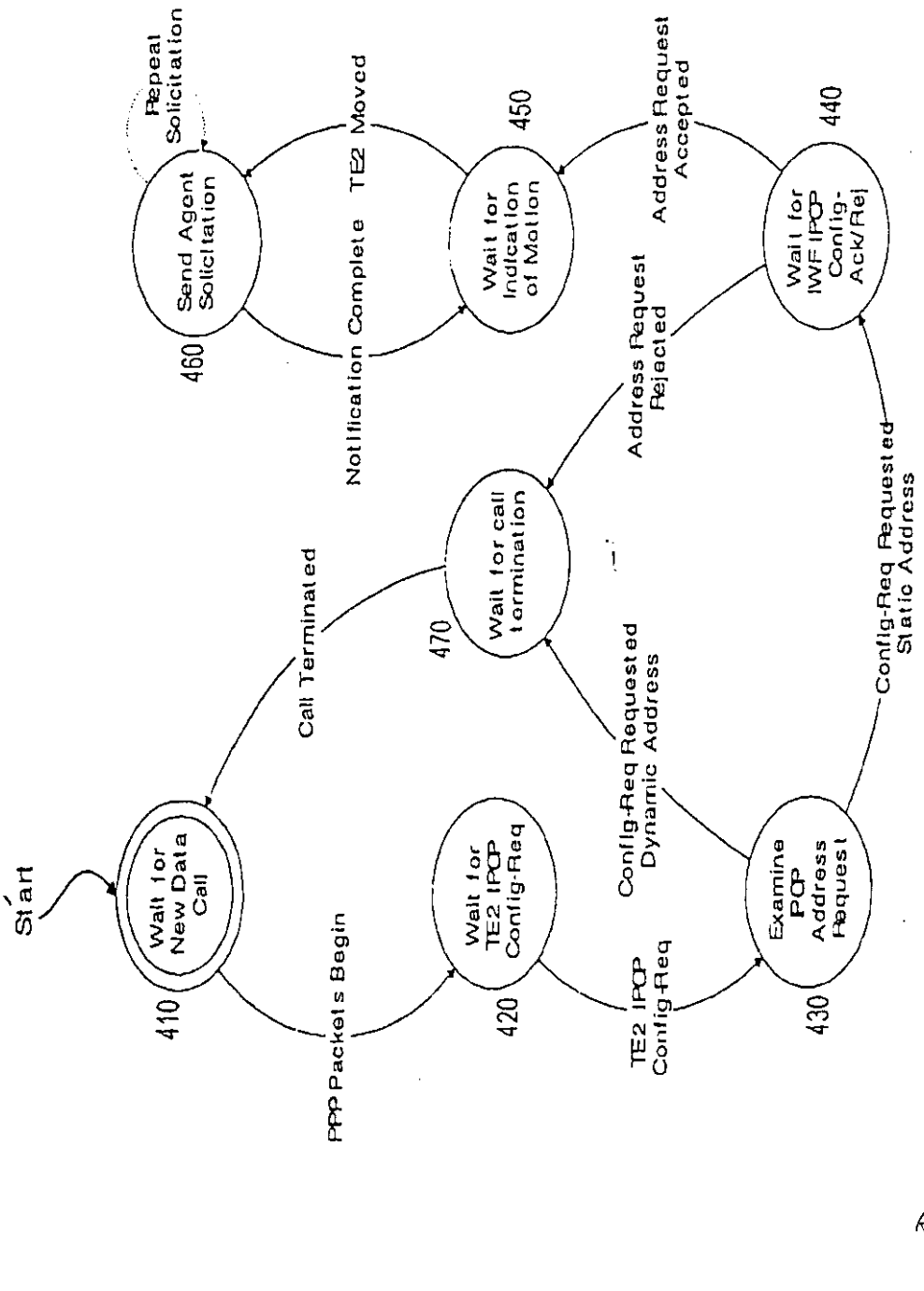


FIG. 4

[19]中华人民共和国国家知识产权局

[51]Int. Cl[7]
H04L 29/06
H04L 29/12

[12]发明专利申请公开说明书

[21]申请号 00805286.7

[43]公开日 2002年4月10日

[11]公开号 CN 1344457A

[22]申请日 2000.1.20 [21]申请号 00805286.7
[30]优先权
[32]1999.1.21 [33]US [31]09/235,118
[86]国际申请 PCT/US00/01450 2000.1.20
[87]国际公布 WO00/44183 英 2000.7.27
[85]进入国家阶段日期 2001.9.24
[71]申请人 高通股份有限公司
地址 美国加利福尼亚州
[72]发明人 M·利奥

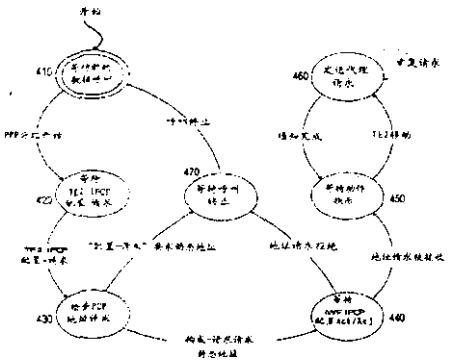
[74]专利代理机构 上海专利商标事务所
代理人 吴蓉军

权利要求书1页 说明书10页 附图页数4页

[54]发明名称 无线通信网络中移动互联网协议登记的自动调用

[57]摘要

一种在一个无线通信网络中调用移动节点登记的特性的系统和方法。该系统包括一个传输和接受分组数据的终端,一个耦合到终端装置的通信装置。通信装置检测分组数据,查找在一个IP地址请求中包括的互联网(IP)地址。如果IP地址请求的是一个静态地址,则通信装置等待网络动作信息。基于所收到的网络动作信息,通信装置请求网络地址信息。收到网络地址信息后,终端装置起动"移动节点登记"。结果,无论何时终端装置改变它的网络连接点,"移动节点登记"均被自动调用。



ISSN1008-4274

权　利　要　求　书

1. 一种在无线通信网络中自动调用移动节点登记的系统，其特征在于，所述系统包括下述装置：

与所述无线通信网络面接的通信装置，从所述无线通信网络中接收网络 IP 地址信息的一个通信装置；以及

耦连到所述通信装置的一个终端装置，用来发送和接收数据包，所述终端装置对所述网络 IP 地址信息作出响应起动移动方式登记。

2. 如权利要求 1 所述的系统，其特征在于，所述通信装置包括监测所述终端装置为 IP 请求中包含的 IP 地址。

3. 如权利要求 2 所述的系统，其特征在于，所述通信装置还从所述无线通信网络接收网络移动信息，并包括如果所述请求的 IP 地址是静止地址的请求并且所述 IP 请求被所述无线通信网络所接受就等待所述的网络移动信息的装置。

4. 如权利要求 3 的系统，其特征在于所述通信装置包括对所述网络移动信息作出响应从而对所述无线通信网络请求网络 IP 地址信息的装置。

5. 一种在无线电通信网络中调用移动节点登记功能的方法，该网络包括耦连到通信装置以便发送和接收数据包的终端装置，所述方法包括以下步骤：

所述通信装置与所述无线通信网络面接；

从所述无线通信网络通过所述通信装置，请求网络 IP 地址信息；

从所述无线通信网络通过所述通信装置，接收网络 IP 地址信息；

通过所述终端装置，对所述通信装置收到的所述网络 IP 地址信息作出反应启动移动方式登记。

6. 如权利要求 5 所述的方法，进一步包括：

通过所述通信装置监测 IP 地址请求中包含的 IP 地址的发送数据包；

如果所述 IP 地址请求的是静止 IP 地址，通过所述通信装置，等待网络移动信息；

7. 如权利要求 6 所述的方法，其特征在于，所述请求步骤响应所述收到的网络移动信息而执行。

说　　明　　书

无线通信网络中移动互联网协议登记的自动调用

发明背景

I.发明范围：

本发明一般涉及无线通信领域，特别涉及在无线通信网络中自动呼叫一个移动终端启动互联网协议移动支持的新颖和改进的方法和系统。

II. 相关技术描述：

无线通信和计算机相关技术的最近的发明和互联网用户前所未有的增长为移动计算扫清了障碍。实际上，移动计算的大众化对目前的互联网基础设施提出了更高的要求，能为移动用户提供更多支持。这种基础设施的关键是面向分组的国际互联网协议(IP)，它能提供各种服务，包括局域网络(LAN)之间的分组的(数据报)的寻址和路由选定。按 791 号(RFC 791)，日期为 1981 年 9 月，题为”国际互联网协议的国防高级研究计划的互联网编程协议规定“的请求评论 791 中定义 IP 协议，在这儿包括了供参考。

按照国际互联网协议直观推断，数据是压缩在 IP 分组中传输的。寻址和路由信息是附加在分组的开头部分。IP 开头部分包含 32 比特的地址来辨认发送和接收主机。由中间路由器使用这些地址选择网络通路，以便分组发送到该地址 IP 寻址的一个基本概念是 IP 地址的开始前置部分可用作作出选择路由的决定。这些前置部分包括有特定主机在互联网上位置的隐含的地理信息。换句话说，无任何时，互联网上任何路由器接收到一个分组含有以“129.46”开头的目的地 IP 地址，路由器将该分组以某一方向传递到美国加利福尼亚圣迭哥的 QUALCOMM 公司网络。这样 IP 协议允许以世界上任何互联网节点的分组送到世界上任何互联网节点，只要起始方知道目的方的 IP 地址。

理想状态，移动计算应为用户提供无缝的和透明的互联网访问，无论何时和它当前的连接点。这种访问在这个意义上是无缝的，当移动用户在网络之间漫游或移动时，有连续的互联网连通性，对移动用户没有不方便或显著的差别。访问对用户应是透明的，这样当移动用户在各种网络中漫游时，各种应用不需要重新编译、重新配置或重新执行。传统的互联网工作协议(如 TCP/IP, IPX， Appletalk™等)在处理在网络间移动的移动用户方面有许多困

难。这时因为，如上所述，用于互联网路由的 IP 寻址方案本身就包含有地理信息。如果一个移动用户想使用一个固定的 IP 地址来标识他的移动终端，当该终端正好离开对应于固定 IP 地址的网络(即它的“主”网络时，该用户的 IP 分组将不会送到该移动终端。如果该终端通过改变它的地址来试图改变，则它将失去所有的连通性。

举例来说，假定一个用户决定将他的移动终端从它的圣地亚哥的 QUALCOMM 公司的“主”网络去除并连接到位于加利福尼亚 Palo 的斯坦福大学网络，而保持他的 QUALCOMM 分配的固定 IP 地址。传统的方法，移动终端的任何 IP 分组将仍然送到圣地亚哥的 QUALCOMM 的网络，这是因为移动终端的固定 IP 地址中隐含了地理位置信息。这样的 IP 分组当移动终端离开它的“主”网络时不会送到移动终端，除非放置一些机械装置将 IP 分组从 QUALCOMM 网络送到移动终端当前的在 Palo Alto 的斯坦福大学网络有连接点。

为了满足无缝和透明的互联网访问的需要，1996 年 10 月名为“IP 移动支持”(这里通过参考加以结合)的请求评论 2002(RFC2002)规定了协议技术来实现将 IP 分组透明地传递到移动终端，无论该终端在某一特定的连接点。使用这些移动 IP 技术，每个移动终端不管它目前与互联网的连接点在哪里，它总能被它的“主”网络 IP 地址所识别。当移动终端位于它的主 IP 网络之内时，不使用移动 IP 技术它就能工作。不过，当移动终端检测到，它不在它的 IP 主网络中工作而在访问一个“外部 IP 网络”时，它获得一个外网络“转交(care-of)”地址，该地址提供将 IP 分组送到它目前的连接点所需要的信息。该“转交地址”可以由外部网络的代理服务器的代理，即“外部代理服务器”通过它的广播消息提供，“外部代理服务器”(即外部网络中的一个路由器)。移动 IP 技术要求移动终端将一个“请求登记”信息发送到“移动代理服务器”以登记一个所需要的“转交地址”。移动代理服务器可以是一个“主代理服务器”(即终端主网络中一个路由器)，也可以是“外部代理服务器”，并负责返回登记许可或拒绝登记请求。

用此种方法，移动 IP 支持移动终端在不同的外网络(foreign network)中漫游并改变它们的网络连接点(point-of-attachment)，而不必改变移动终端的 IP 地址。这种方法有几种优点。首先，不管移动终端在何处，它能允许互联网上的其它节点将周期性的“推(push)”服务(如股票查询，电子邮件等)发送到移动终端。这避免了需要移动用户主动检索来自他的主网络的信息。

第二，如通常所需的那样，移动 IP 允许移动终端重新定位到不同的子网络，任何始发方不用跟踪移动终端目前连接到的什么子网络。第三，通过设计，移动 IP 与各种网络和媒体兼容，保证无缝(seamless)和透明的互联网接入。例如，当一个移动终端从它的主以太网网络段移到一外无线局域网时，移动 IP 能支持移动终端产生的分组话务，而服务时无明显中断。

如上所述，目前的趋势是移动用户使用移动计算机(如膝上型电脑或掌上型计算机)与无线通信装置(如蜂窝式或移动式电话)结合，来接入互联网。就像用户传统上使用“有线”通信装置将他们的计算机连接到陆上网络，移动用户将使用无线通信装置(通常称为“移动站”(MSs))，将它们的移动终端连接到这样的网络。正如这儿使用，移动站或 MS 是指在转接(transit)或在未特定点上停止时使用的公共无线电网络中的任何一个用户站。MS 装置包括便携式单元(例如，手持个人电话)和永久安装在车辆中的装置(如安装的移动电话装置)，及无线本地环(WLL)电话。

图 1(现有技术)示出了无线数据通信系统的高级方框图，在该系统中，移动终端设备，TE2 装置 102(如移动终端，膝上型或掌上型计算机)通过无线通信系统与互通功能(IWF)108 进行通信。无线通信系统包括无线通信装置，MT2 装置 104 和基站/移动交换中心(BS/MSC)106。在图 1 中，IWF108 是作为到互联网的接入点。IWF108 耦合到 BS/MSC 106 并与其并置，而该 BS/MSC106 可以是现有技术中已知的传统无线基站。TE2 装置电子耦合到 MT2 装置 104，它依次与 BS/MSC106 和 IWF 108 进行“无线”通信。TE2 装置 102 和 MT2 装置 104 可以集成为单个单元或在安装的移动电话装置中分开，其中膝上型电脑是 TE2 装置 102，收发机是 MT2 装置 104。TE2 装置 102 和 MT2 装置 104 的组合，不管是集成的还是分开的，都被称作移动节点。

存在对 TE2 装置 102 和 MT2 装置 104 之间的数据通信进行寻址的其它协议。例如，名为“双模式宽带扩展频谱蜂窝系统的移动站-基站兼容性标准(MOBILE STATION-BASE STATION COMPATIBILITY STANDARD FOR DUAL-MODE WIDEBAND SPREAD-SPECTRUM CELLULAR SYSTEM)”(1993 年 7 月出版，此处包括以供参考)的电信工业协会(TIA)/电子工业协会(EIA)暂行标准 IS-95，通常为宽带扩展频谱无线通信系统提供标准。名为“宽带扩展频谱系统的数据服务选项：分组数据服务(DATA SERVICE OPTIONS FOR WIDEBAND SPREAD SPECTRUM SYSTEMS:PACKET DATA SERVICES)”(1998 年 2 月出版，在此包括以供参考)的

TIE/EIA IS-707.5 标准，定义了支持在 TIE/EIA IS-95 宽带扩展频谱系统上分组数据传输能力的要求，其中 BS/MSC 106 和 IWF 108 可以是该系统的一部分。IS-707.5 规定了可用于通过 BS/MSC 106 在 TE2 装置 102 和 IWF 108 之间通信的分组数据载体(bearer)服务。它提供可用于多分组数据服务的程序，包括 RFC 2002 的移动 IP 服务。

IS-707.5 也引进了两个协议选项模型，它们提供在 TE2 装置 102 和 MT2 装置 104(Rm 接口)之间、在 MT2 装置 104 和 BS/MSC 106(Um 接口)之间以及在 BS/MSC 106 和 IWF 108 之间(L 接口)的链路上的通信协议的要求，。第一个协议选项，即中继模式，表示在 TE2 装置 102 和 IWF108 之间存在 PPP 链路的情形。在这种情况下，MT2 装置 104 仅作为通道(pipe)在 U_M 接口上发送 TE2 装置 102 PPP 帧，在 R_M 接口上发送 IWF108 帧。作为对比，第二个协议选项，网络模式，代表这种情况，在 TE2 装置 102 和 MT2 装置 104 之间及在 MT2 装置 104 和 IWF108 之间存在两个独立的 PPP 链路。在这种情况下，MT2 装置 104 负责对任何接收到的 PPP 分组解帧(un-framing)，并且在将它们送到目的地前重新成帧(re-framing)。在这种情况下，MT2 装置 104 有可能负责各种移动管理和网络地址管理。

图 2(现有技术)是在 IS-707.5 中继模式下每个实体(entity)的协议堆栈的图示。图 2 大致对应于 IS-707.5 的图 1.4.2.1-1。在图的最左端是以传统的垂直格式的协议堆栈，显示在 TE2 装置 102 上运行的协议层。图示在 Rm 接口上，TE2 协议堆栈逻辑连接到 MT2 装置 104 协议堆栈。图示在 Um 接口上，MT2 装置 104 逻辑连接到 BS/MSC 106 协议堆栈。图示在 L 接口上，BS/MSC 106 协议堆栈逻辑连接到 IWF108 协议堆栈。

图 2 示意的操作如下：上层协议 202 实体，例如在 TE2 装置 102 上运行的应用程序，需要在互联网上发送 IP 分组。有代表性的应用程序可以是网络浏览器程序(例如，Netscape Navigator™ ，Microsoft Internet Explorer™ 等)。网络浏览器要求通用资源定位器(universal resource locator)(URL)，如 HYPERLINK “http: //www.Qualcomm.com/” 。域名系统(DNS)协议，也在上层协议 202，将文本格式的(textual)主名www.Qualcomm.com转换为 32 比特数字 IP 地址。超文本传输协议(HTTP)，也是上层协议 202，对要求的 URL 构成 GET 消息，还规定了传输控制协议(TCP)将用来发送消息以及将 TCP 用于 HTTP 操作.

TCP 协议，也是上层协议 202，打开到由 DNS 规定的 IP 地址的连接并发送 HTTP GET 消息。TCP 协议规定将 IP 协议用作消息传输。IP 协议，网络层协议 204，将 TCP 分组发送到规定的 IP 地址。点对点协议(PPP)，链路层协议 206，对 IP/TCP/HTTP 分组进行编码，使用中继层协议 208EIA-232 通过 Rm 接口将它们发送到 MT2 装置 104 上的 EIA-232-兼容端口。PPP 协议在名为“点对点协议(THE POINT-TO-POINT PROTOCOL)”的请求注解(requext for comments)1661 (REC1661)中予以详细描述，此处也列出以供参考和以下简要地讨论。

MT2 装置 104 上的 ELA-232 协议 210 将发送的 PPP 分组传递到无线电链路协议(RLP)212，然后传递到 IS-95 协议 214，以通过 Um 接口发送到 BS/MSC 106。在 IS-707.2 中定义 RLP 协议 212，在以上提到的 IS-95 中定义 IS-95 协议。在 BS/MSC 106 上的补充中继层协议堆栈，包括 RLP 层 216 和 IS-95 层 218，在 Um 接口上接收 PPP 分组，并将它们传递到用于 L 接口的 MT2 中继层协议 220 到 IWF 中继层协议 228。在名为“宽带扩展频谱数字蜂窝系统的数据服务互通功能接口标准(DATA SERVICES INTERWORKING FUNCTION INTERFACE STANDARD FOR WIDEBAND SPREAD SPECTRUM DIGITAL CELLULAR SYSTEM)”(在此列出以供参考)的 TIA/EIA IS658 中描述 MT2 中继层协议 212 和 IWF 中继层协议 228。

IWF 的链路层中 PPP 协议 226 将来自 TE2 装置 102 的 PPP 分组解码，并用来终止 TE2 装置 102 和 IWF 108 之间的 PPP 连接。将已解码的分组从 PPP 协议 226 传递到在 IWF 108 的网络层协议 224 中的 IP 协议以检测，然后继续路由到 IP 分组标题的 TE2 装置 102 规定的 IP 地址(即，在这种情况下，WWW.Qualcomm.com 的 IP 地址)。如果在 IWF 108 处有上层协议任务要执行，例如 TCP，则由上层协议 222 执行。

假定 TE2 装置 102 产生的 IP 分组的最终目的地不是 IWF108，则通过 IWF108 的网络层协议 224，链路层协议 227 将分组前送到互联网上的下一个路由器(未显示)。以这种方法，通过 MT2 装置 104，BS/MSC106 和 IWF 108 将 TE2 装置 102 的 IP 分组传播到它们在互联网上的最终目的地，从而按照 IS-707.5 标准中继模式为 TE2 装置 102 提供无线分组数据服务。

不过，在 TE2 装置 102 分组到达它们的目的地之前，必须首先建立数据链路连接。如 RFC1661 规定的，需要点对点链路(即 TE2 PPP 协议 206 和 IWF PPP 协议 226)的每个终端首先发送 PPP 链路控制协议(LCP)分组来建立、配置和测

试数据链路连接。LCP 建立好链路后， PPP 协议 206 发送网络控制协议(NCP)分组以配置网络层协议(即 TE2 IP 协议 204 和 IWF IP 协议 224)。在配置好每个网络层协议之后，可以在它们之间发送每个网络层协议的分组。

PPP 链路中的用于 IP 的 NCP 是 IP 控制协议(IPCP)。在名为“PPP 互联网协议控制协议(THE PPP INTERNET PROTOCOL CONTROL PROTOCOL)(IPCP)”(发表于 1992 年 5 月，在此包括以供参考)的请求注解 1332(RFC 1332)中详细描述了 IPCP。IPCP 负责配置、使能(enable)、禁止(disable)在点对点链路的任何端运行的 TE2 协议 204 和 IWF IP 协议 224。

IPCP 使用配置请求消息，它包括 IP 地址配置选项。配置选项部分提供协商配置请求(Configure-Request)发送方(如在此是 TE2 装置 102)使用的 IP 地址的机理。特别是，IP 地址配置选项允许配置请求发送方通过提供 IP 地址或者通过请求同层(the peer)(如在这儿，IWF108)为发送方提供动态 IP 地址来表明所需的 IP 地址。如果配置请求发送方将 IP 地址配置选项的 IP 地址字段设置为全零，则同层将通过发送用于选项的配置 NAK 并返回有效 IP 地址来提供动态 IP 地址。另一方面，如果配置请求发送方规定 IP 地址字段的地址，同层通过发送用于选项的配置-ACK 来指明规定的 IP 地址是可接受的。

另一方面，图 3(现有技术)是在 IS-707.5 网络模式的每个实体中的协议堆栈图，大致对应于标准的图 1.4.2.2-1。出于 TE2 装置 102、BS/MSC 106 和 IWF 108 的协议流和机理类似于中继模式中所包含的，如图 2 所示，它们的标号是一样的。由于网络模式反映是这种情况，即 MT2 装置 104 负责分组移动性管理和网络地址管理，MT2 装置 104 包含其它的协议层。例如，经过 ELA-232 协议 210 收到来自 TE2 装置 102 的 PPP 分组流后，将分组继续传递到 PPP_U 层 302，在此将它们解帧。随后，分组向上传送到 IP 层 304。对目的地是 IWF108 的分组来说，将分组向下传回到 PPP_R 层，在此将它们解帧。就像在此阶段的中继模式下的分组，然后将分组发送到无线电链路协议(RLP)212，然后到 IS-95 协议 214，以在 U_M 接口上传输到 BS/MSC 106。

如上所述，IS-95 标准为宽带扩展频谱无线通信提供了通用规则。IS-707.5 标准提供对在 TE2 装置 102 和 IWF108 之间的链路上的通信协议的要求，包括对 R_M，U_M 和 L 接口的要求。另外，以上所示，RFC1661 定义了建立、配置和测试点对点数据链路的标准，RFC1331 提出了为点对点链路的 TE2 102 方和 IWF 108 双方建立和配置 IP 的 PPP-IPCP 标准。这样，IS-95，IS-707.5，RFC 1661

和 RFC1331 提供的标准和协议很仔细地吻合并充分支持如 RFC2002 所定义的移动 IP 服务的功能。

注意到这点是很重要的，即，这些标准或协议中，甚至 IP REC 2002 中没有一个能提供一种机理，即保证当移动终端或 TE2 装置 102 移动它的网络连接点时，它们能采取适当的动作。尤其是，当移动终端(如膝上型电脑)最初尝试连接到除其主网络之外的其它网络(如外网络)，RFC2002 为膝上型电脑提供一种方法，调用移动 IP 节点登记程序过程，以保证将目的地为膝上型电脑的主网络的数据路由回到外网络连接点。然而，如果膝上型电脑漫游超出它的初始外网络连接点的边界时，无法保证能通知到膝上型电脑它已经移动了。事实上，唯一意识到膝上型电脑已经漫游到一个新的连接点的装置是 MT2 装置 104，它是通过来自 IS-95 网络的信令话务知道该网络移动信息的。在现有技术中这种网络信息是众所周知的，在以前提到的 TIA/EIA IS-95 标准中定义过。尽管 IS-95 标准不会详细论述，但网络移动信息承载信令的一些例子包括语音区登记，分组区辨别，系统 ID 变化，网络 ID 变化，PPP 分组重新同步，等。

我们需要的一种方法和系统，能利用移动站或无线通信装置(如 MT2 装置 104)自动触发移动终端装置(如 TE2 装置)来重新启动移动 IP 登记程序和用有关外网络连接点信息更新终端和主代理(home agent)。

发明概述

本发明提供一种系统和方法，当移动终端离开它目前网络的范围时，允许无线通信装置自动调用终端装置来执行移动 IP 节点登记。

与这里所体现并广泛描述的本发明的原理一致的系统和方法包括发送和接收分组数据的终端装置和耦合到终端装置的通信装置。该通信装置为 IP 地址请求中包含的网际协议(IP)地址监测分组数据。如果 IP 地址请求是对于静态 IP 地址，则通信装置等待网络移动信息。根据收到的网络移动信息，通信装置请求网络地址信息。一收到网络地址信息，终端装置就启动移动节点登记。结果，无论终端装置何时改变它的网络连接点，都知道调用移动节点登记。

附图说明

组成本说明书一部分的附图示出了本发明的实施例，并且与说明书一起解释本发明的目的、优点和原理。

图 1(现有技术)是无线通信系统的高级方框图，在该系统中，终端装置通过无线通信装置连接到互联网。

图 2(现有技术)示意地描述了 TIA/EIA IS-707.5 中继模式的每个实体中的协议堆栈。

图 3 是示出本发明的实施例的操作过程的操作 高级状态图。

较佳实施例的详细描述

以下对本发明的详细描述参照示出本发明的较佳实施例的附图。也有可能有其它的实施例以及对这些实施例的变化，不偏离本发明的构思和范围。因此，以下的详细说明不是限制发明。而是由所附权利要求书限定本发明的范围。

移动 IP 协议允许移动节点(如计算机主机或路由器)将它的 IP 连接点从一个网络改变到另一个网络。正在移动的 IP 节点能改变它的位置，而不改变它的(永久)IP 主地址。本发明利用移动 IP 协议以及管理 TE2 装置 102，MT2 104 和 IWF 108 之间通信的其它协议和标准，来自动确定 TE2 102 是否以及何时重新启动移动节点登记来保持链路层的连接性，。以这种方式，移动 IP 节点可在任何位置连续地与其它 IP 节点通信。

本发明的目的是支持到数据服务使能装置的用户的无缝和透明移动。所以，本发明的较佳实施例包括 TE2 和 MT2 装置 102，104，它们具有“移动 IP”支持能力。

对于熟悉本技术领域的人员而言，以下描述的本发明可以在如图所示的每个实体中(即，TE2 装置 102，MT2 装置 104，BS/MSC 106 和 IWF 108)的多种不同软件、固件、硬件的实施例中实施。例如，TE2 装置 102 可以是带有执行移动 IP-服从(compliant)软件指令的处理单元的膝上型电脑。类似地，MT2 装置 104 可以包括一个处理 TE2102 装置信息并传播网络信息的处理单元。用来实现本发明的实际软件码或控制硬件并不是对本发明的限制。从而，对本发明的操作和行为进行描述时，不特别参照实际的软件编码或硬件元件，应理解，熟悉本技术领域的人员都能够设计软件和控制硬件以根据这里的描述实施本发明的较佳实施例。

图 4 是本发明的 MT2 装置 104 工作的高级状态图。MT2 装置 104 以“等待新的数据呼叫”状态 310 开始。在状态 410，MT2 装置 104 目前不在呼叫状态，而在

等待 TE2 装置 102 始发呼叫的状态。在这种状态下，不考虑移动-终止的电话(即 MT2 装置 104 是被叫方)，因为它们假设 MT2 装置 104 已经分配有 IP 地址或者已经登记了移动 IP。

按照 RFC 1661，当 TE2 装置 102 发送 PPP 分组到 MT2 装置 104， MT2 104 装置将它解释为建立分组数据呼叫并因此始发数据呼叫的一次尝试。该数据呼叫将 MT2 104 装置转换成“等待 TE2 IPCP 配置-请求”状态 420。

在状态 420，MT2 装置 104 只是等待 TE2 装置 102 开始 IP 地址协商处理，正如 RFC 1332 中描述的。一旦 TE2 装置 102 发送 IP 地址配置-请求信息，MT2 装置 104 转换成“检测 IPCP 地址请求”状态 430。

如果 TE2 装置 102 请求的地址是一个动态地址(即 IP 地址为全零)，则没有使 TE2 装置 102 支持移动 IP 的请求，而且 MT2 装置 104 转换成“等待呼叫终止”状态 470。在这种状态下，MT2 装置 104 实质上忽略任何事，直到呼叫终止。一旦呼叫终止，MT2 装置 104 转换回到状态 410，并等待新的数据呼叫。

如果 TE2 装置 102 发送的配置-请求中的 IP 地址字段包括一个特定的或静态的(即非零)IP 地址，MT2 装置 104 则转换到“等待 IWF IPCP 配置-ACK/REJ”状态 440。

在状态 440，MT2 装置 104 检查 IPCP 分组以确定对配置-请求的响应，即 TE2 装置 102 作出的静态 IP 地址请求是否被 IWF 108 以配置 ACK 所接受。如果 IWF 108 拒绝了 TE2 装置 102 作出的静态 IP 地址请求，那么 MT2 装置 104 转换回到状态 470，这是因为由于没有赋予 TE2 装置所请求的地址，呼叫不可能是移动 IP 呼叫。这样，MT2 装置 104 简单地忽略所有事务，并等待呼叫终止。如果 TE2 装置 102 作出的静态 IP 地址请求被 IWF 108 所接受，则 MT2 装置 104 确认这是一个移动 IP 数据呼叫，并转换到“等待动作指示”状态 450。

在状态 450，MT2 装置 104 等待网络的指示，即 TE2 装置 104 已从它以前的网络连接点移动。如上所述，通过信令话务从 IS-95 网络提取网络移动信息。一旦 MT2 装置 104 收到了网络发出的 TE2 装置 102 已经移动的指示，即已经改变了网络，则 MT2 装置 104 转换成“发送代理请求”状态 460。

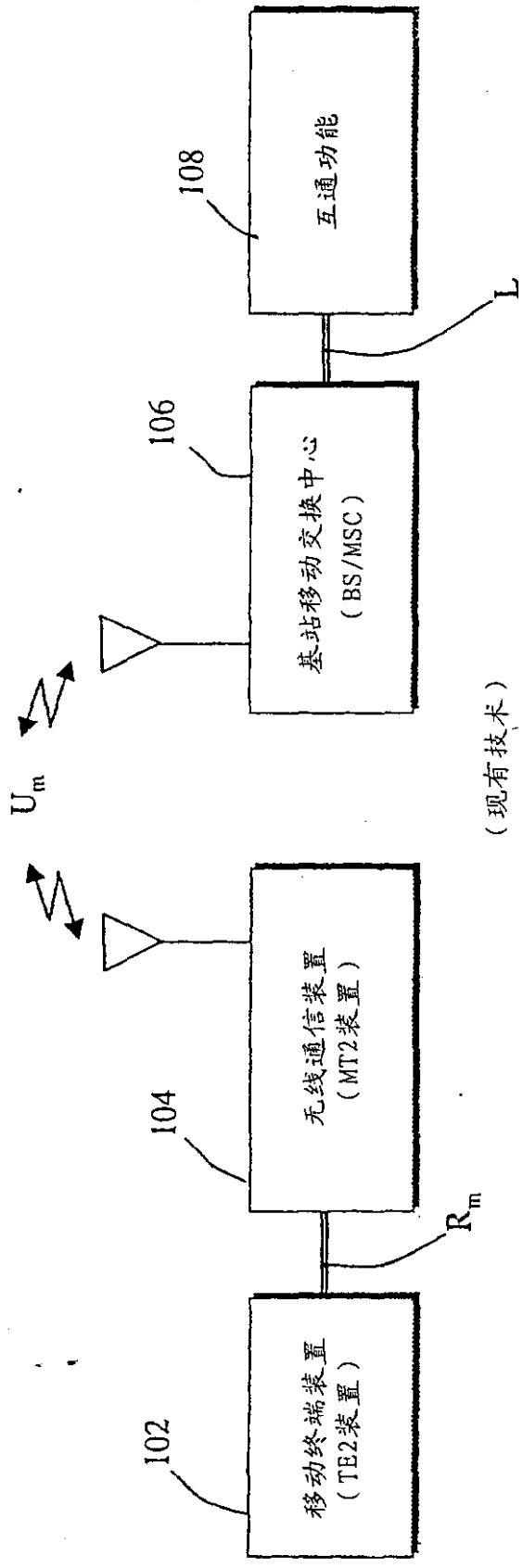
在状态 460，MT2 装置 104 发送请求消息到可用的外代理以利用默认的代理广告(Agent Advertisement)机理，正如在移动 IP RFC 2002 中简述的。如状态 460 的反馈转换箭头指明的那样，请求消息的发送可以重复几次，以防止无意丢失并保证外代理能收到。

通过使 MT2 装置 104 发送请求消息，本发明可以利用移动 IP 基础设施作为外代理，只要收到消息，就能触发它将带有外网络转交地址的(care-of-address)广告消息发送到 TE2 装置 102 IP 地址。按照 RFC 2002，TE2 装置 102 注意到转交地址已经改变，且必须重新登记它的 IP 地址。例如，如果 TE2 装置 102 确定它已经回到它的主网络，TE2 装置将用它的外代理启动移动 IP 节点取消登记程序。不过，如果 TE2 装置 102 检测到 “新的”外网络，它会通过重新启动移动 IP 移动节点登记程序，并最终在新的外网络上建立转交地址来继续进行。

因此，本发明提供一种系统和方法，当 TE2 装置 102 离开它目前的网络连接点时，能利用 MT2 装置 104 自动触发 TE2 装置 102 重新启动移动 IP 登记程序。

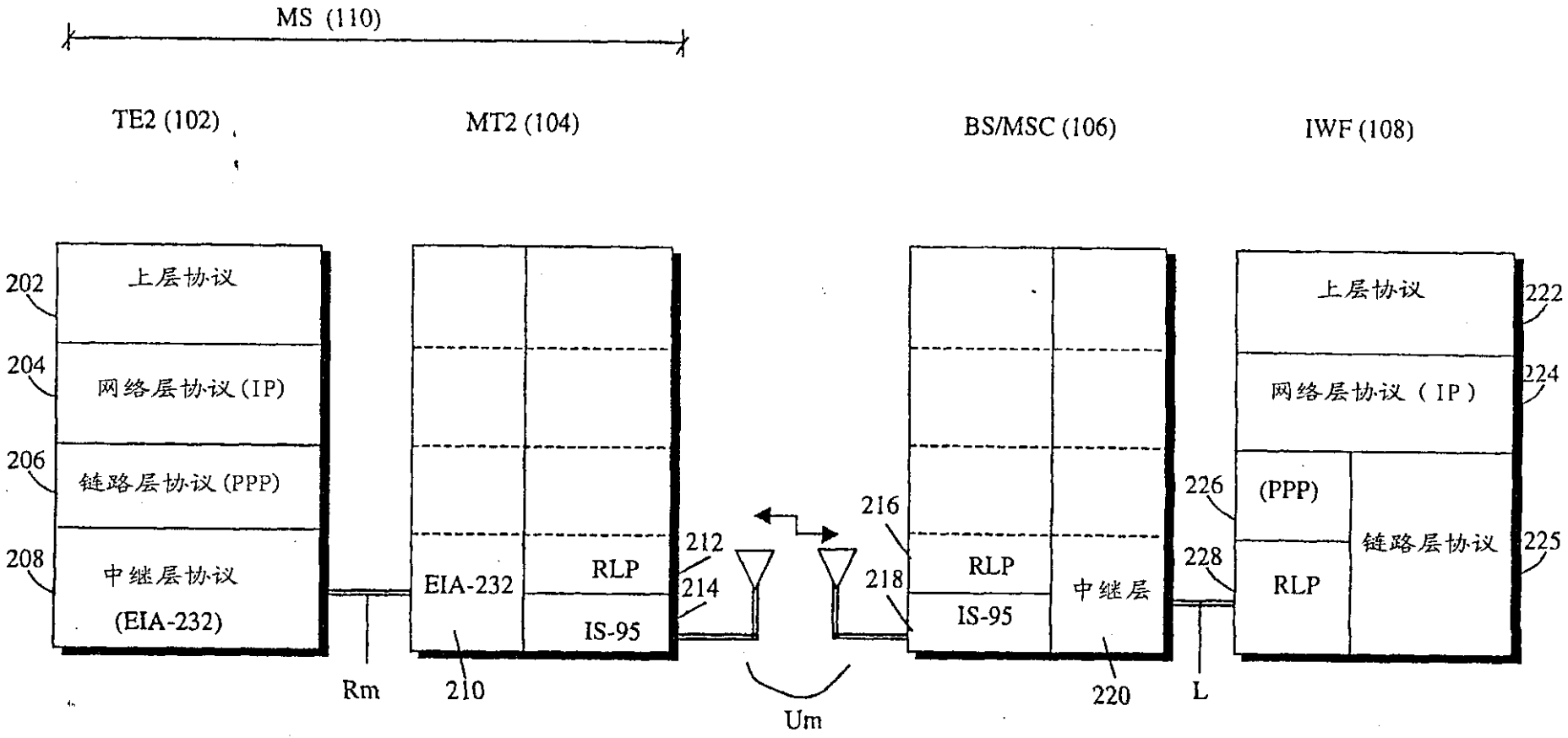
前面对本发明的实现例的描述只是用于示例和描述，但并不是穷举或将本发明限制在所揭示的精确形式。

根据上述教义或者根据本发明的实践可进行各种变更和变化。本发明的范围由权利要求书和其等同限定。


移动终端装置
（TE2装置）
102
无线通信装置
（MT2装置）
104
基站移动交换中心
（BS/MSC）
106
互通功能
108
R_m
U_m
L

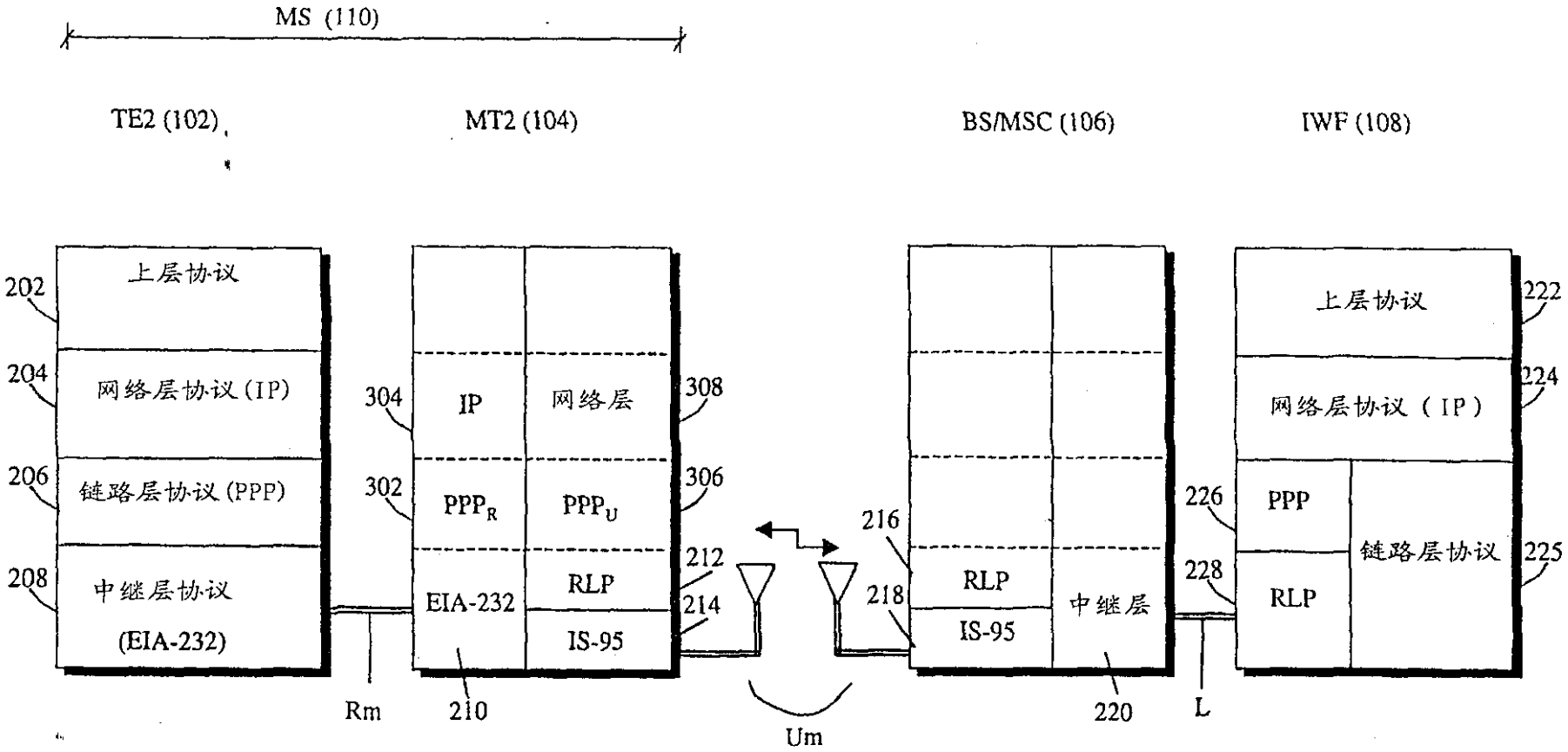
（现有技术）

图　1


MS (110)
TE2 (102)
MT2 (104)
BS/MSC (106)
IWF (108)
202
上层协议
204
网络层协议(IP)
206
链路层协议(PPP)
208
中继层协议
(EIA-232)
EIA-232
RLP
IS-95
212
214
216
218
RLP
IS-95
中继层
220
226
228
上层协议
222
网络层协议（IP）
224
(PPP)
RLP
链路层协议
225
Rm
210
Um
L

（现有技术）

图 2


MS (110)
TE2 (102)
MT2 (104)
BS/MSC (106)
IWF (108)
202
上层协议
204
网络层协议(IP)
206
链路层协议(PPP)
208
中继层协议
(EIA-232)
304
IP
网络层
308
302
PPP$_R$
PPP$_U$
306
212
EIA-232
RLP
214
IS-95
216
RLP
218
IS-95
中继层
220
222
上层协议
224
网络层协议（IP）
226
PPP
228
RLP
链路层协议
225
Rm
210
Um
L

（现有技术）

图 3

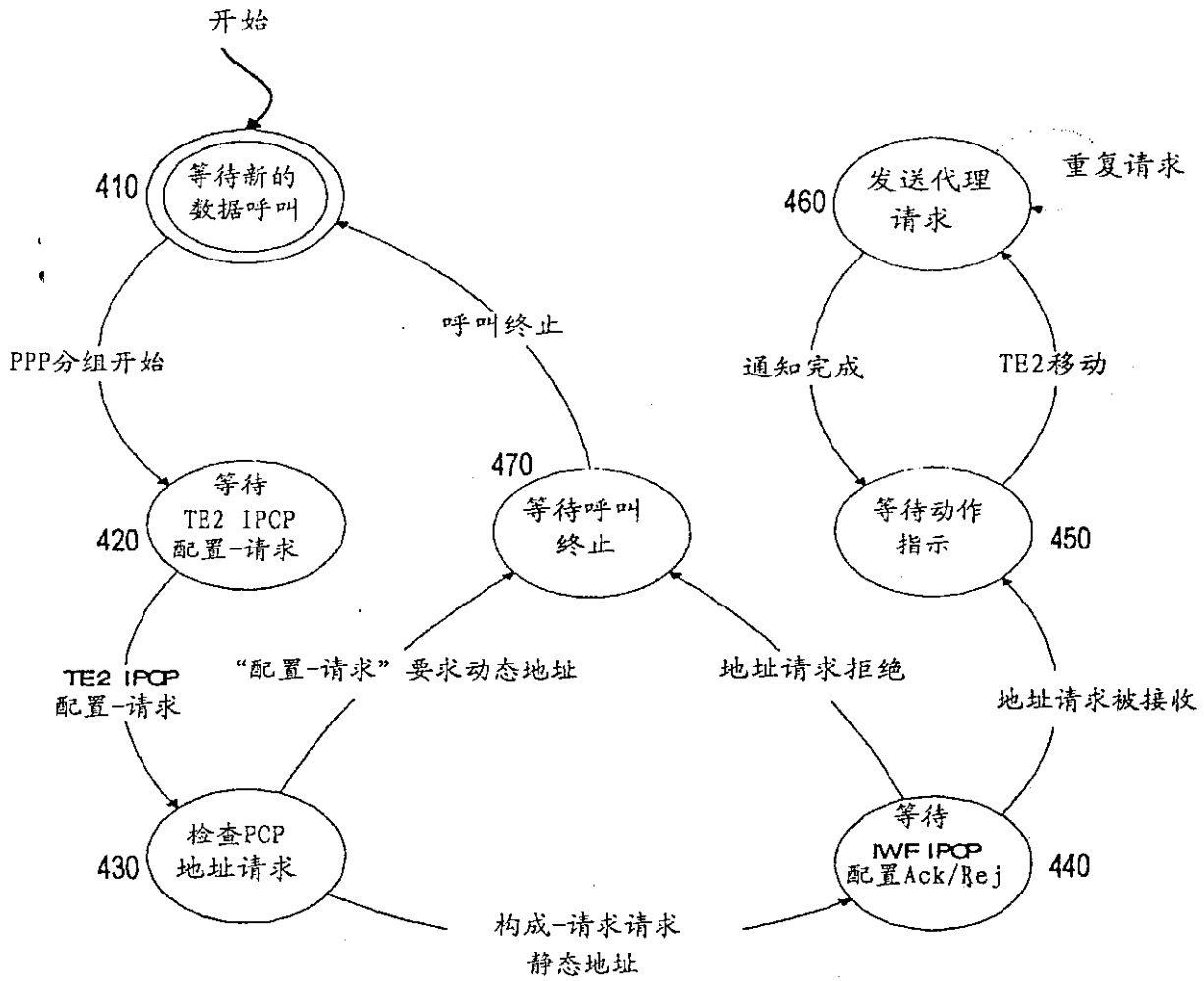

开始
410
等待新的
数据呼叫
PPP分组开始
等待
TE2 IPCP
配置-请求
420
TE2 IPCP
配置-请求
检查PCP
地址请求
430
构成-请求请求
静态地址
等待
IWF IPCP
配置Ack/Rej
440
地址请求被接收
等待动作
指示
450
通知完成
发送代理
请求
460
重复请求
TE2移动
等待呼叫
终止
470
呼叫终止
"配置-请求"要求动态地址
地址请求拒绝

图 4