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(54) Title: A METHOD FOR ESTABLISHING PHS PACKET DATA COMMUNICATION INITIATED BY AN EXTERNAL DATA NETWORK

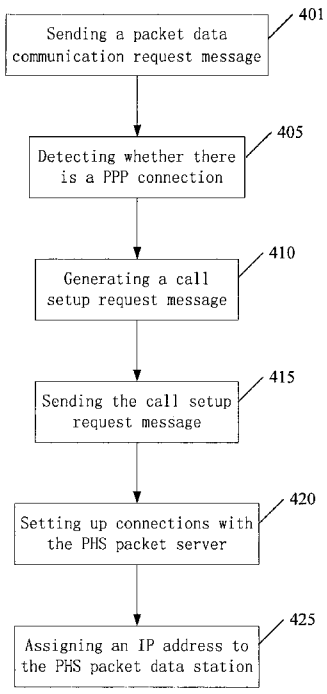


Fig. 4

(57) Abstract: A method for establishing PHS packet data communication with a PHS packet data station initiated by an external data network comprises: a server of the external data network sending a packet data communication request message containing the number of the PHS packet data station to a PHS packet server; the PHS packet server generating a call setup request message containing User to User Information Element and sending it to the PHS packet data station; the PHS packet data station responding to the call setup request message and setting up connections with the PHS packet server; and the PHS packet server assigning an IP address to the PHS packet data station and sending the IP address in a packet data communication response message to the server of the external data network. The present invention can be applied to the establishment of the new packet data communication and the dormant recovery of the PHS packet data station, which are initiated by the external data network, so that the PHS packet data station can receive the packet data communication request and more PHS packet data services can be provided to the PHS packet data station.

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A METHOD FOR ESTABLISHING PHS PACKET DATA COMMUNICATION INITIATED BY AN EXTERNAL DATA NETWORK

Technical Field of the Invention

The present invention relates to packet data service of Personal Handy-phone System (PHS), particularly to a method for establishing packet data communication with a PHS packet data station initiated by external data network and a method for establishing VoIP call between PHS packet data stations.

Background of the Invention

Personal Handy-phone System (PHS) is a kind of radio communications system originally developed in Japan, which uses multi-carrier TDMA/TDD (Time Division Multiple Access/Time Division Duplex) technique and can provide traditional voice service, data communication service and geographical location service, etc. In the past, applications of the PHS system were mainly based on circuit switch and focused on the voice service. However, with development of PHS packet data technique, applications in PHS packet data communication service and multi-media service become hot increasingly.

The PHS packet data communication enables the PHS system to provide the data communication services with higher speed and quality to users. Fig. 1 shows a structural block diagram of the current PHS packet data communication system. As shown in Fig. 1, the PHS packet data communication system includes: PHS station supporting PHS packet data mode (PS) (hereinafter called "PHS packet data station"), PHS cell station (CS), PHS switch and PHS packet server. The interface between the PHS packet data station and the PHS cell station conforms to the PHS air interface standard RCR-STD28. The PHS switch is connected to the PHS cell station via ISDN BRA (Basic Rate Access) interface and is connected to the PHS packet server via ISDN PRA (Primary Rate Access) interface. Both the ISDN BRA interface and the ISDN

PRA interface comply with Q.931 protocol. The PHS packet server is used to convert the ISDN circuit path to the packet path and is connected, through IP interface, to a server of an external data network, for example, www server or mail server of Internet or Intranet.

Fig. 2 is a schematic diagram of protocol stack among all components in the PHS packet data communication system shown in Fig. 1. As shown in Fig. 2, the protocol stack of PHS cell station includes: ISDN (I430) protocol, LAP-B (Link Access Procedure-Balanced) protocol, X.25 (Switched Virtual Circuit, SVC) protocol, PPMP protocol (PHS Packet Management Protocol), PPP protocol (Point to Point Protocol), IP protocol (Internet Protocol), TCP/UDP protocol (Transmission Control Protocol/User Datagram Protocol) and HTTP protocol (Hyper Text Transfer Protocol). The protocol stack of the PHS switch includes: ISDN (I430) protocol and LAP-B protocol. The protocol stack of the PHS packet server includes: ISDN (I430) protocol as Layer 1 protocol, LAP-B protocol, X.25 (SVC) protocol, PPMP protocol and PPP protocol as Layer 2 protocol, and IP protocol.

Normally, the current PHS packet data communication is initiated by the PHS packet data station and the PHS packet data service is limited as the user of the PHS packet data station to access Internet or Intranet initiatively. Fig. 3 shows a schematic diagram of message flow in the current procedure of establishing PHS packet data communication, in which the PHS packet data station and the PHS cell station are combined together for simplicity.

As shown in Fig. 3, when a user of the PHS packet data station wants to access Internet, firstly the PHS packet data station will set up an ISDN connection with the PHS packet server over the PHS switch using Q.931 protocol. Specifically, PHS packet data station/PHS cell station (PS/CS) sends a SETUP message to the PHS switch. The PHS switch returns a Call Proceeding message (CALL_PROC) to the PS/CS and sends the SETUP message to the PHS packet server. Then the PHS packet server sends an ALERTING message to the PHS switch and the ALERTING message is forwarded to

the PS/CS by the PHS switch. Finally, a CONNECT message is sent from the PHS packet server to the PHS switch and then forwarded to the PS/CS. Thus the ISDN circuit path has been set up between the PHS packet data station and the PHS packet server.

Next, a LAP-B and SVC connection, a PPMP connection and a PPP connection will be set up one by one between the PHS packet data station and the PHS packet server with the LAP-B protocol and the X.25 protocol, the PPMP protocol and the PPP protocol. After the PPP connection is set up, the PHS packet server assigns an IP address to the PHS packet data station. Thus, the user of the PHS can access Internet or Intranet.

In addition, if there is no data traffic between the PHS packet data station and the servers of Internet or Intranet during a predetermined period, the PHS packet data station and the PHS packet server will just keep the PPP connection and release all lower layer connection, i.e. the PPMP connection, the SVC connection, the LAP-B connection and the ISDN connection. In this case, the PHS packet data station enters into dormant state.

In the existing PHS packet data communication, the PHS packet data station can only initiate a packet data call, but cannot receive a packet data call. However, some services, such as push to talk service, push mail service and etc. require the external data network to initiate the packet data communication with the PHS packet data station. In addition, when the PHS packet data station is in dormant state, the servers of Internet or Intranet cannot send any packet data to it. Thus some services like Instant Message (IM) and e-mail notification cannot work properly.

Therefore, in the PHS packet data communication, the packet data communication with the PHS packet data station initiated by the external data network is necessary so as to provide more packet data services to the PHS packet data station.

Summary of the Invention

The present invention is proposed in view of above technical problems, and its objective is to provide a method for establishing PHS packet data communication with a PHS packet data station initiated by an external data network, which can enable the external data network to initiate the PHS packet data communication so as to provide more packet data services to the PHS packet data station. Moreover, the present invention also provides a method for establishing VoIP call between PHS packet data stations.

According to one aspect of the present invention, there is provided a method for establishing packet data communication with a PHS packet data station initiated by an external data network, comprising: a server of the external data network sending a packet data communication request message containing the number of the PHS packet data station to a PHS packet server; the PHS packet server generating a call setup request message containing User to User Information Element (UUIE) and sending it to the PHS packet data station corresponding to the number; the PHS packet data station responding to the call setup request message and setting up connections with the PHS packet server; and the PHS packet server assigning an IP address to the PHS packet data station and sending the IP address in a packet data communication response message to the server of the external data network.

According to another aspect of the present invention, there is provided a method for establishing VoIP call between PHS packet data stations, comprising: a first PHS packet data station setting up connections with a first PHS packet server, and sending a VoIP call request message containing the number of a second PHS packet data station; the first PHS packet server sending the VoIP call request message to a second PHS packet server serving the second PHS packet data station; the second PHS packet server generating a call setup request message containing User to User Information Element (UUIE) and sending it to the second PHS packet data station; the second PHS packet data station responding to the call setup request message and setting up connections with the second PHS packet server; the second sending the

VoIP call request message to the second PHS packet data station; and the second PHS packet data station responding to the VoIP call request message and establishing the VoIP call with the first PHS packet data station.

Brief Description of the Drawings

Fig. 1 is a structural block diagram of current PHS packet data communication system.

Fig. 2 is a schematic diagram of protocol stack among all components in the PHS packet data communication system shown in Fig. 1.

Fig. 3 is a message flowchart of the current procedure of establishing PHS packet data communication.

Fig. 4 is a flowchart of a method for establishing packet data communication with a PHS packet data station initiated by an external data network according to an embodiment of the present invention.

Fig. 5 is a message flowchart of a procedure of establishing new packet data communication in the embodiment shown in Fig. 4.

Fig. 6 is a schematic diagram of a format of the UUIE in the call setup request message.

Fig. 7 is a schematic diagram of a format of the UUIE in response messages, Fig. 7(a) shows the format of the UUIE in positive response message, and Fig. 7(b) shows the format of the UUIE in negative response message.

Fig. 8 is a message flowchart of a procedure of dormant recovery in the embodiment shown in Fig. 4.

Fig. 9 is a flowchart of a method for establishing VoIP call between PHS packet data stations according to an embodiment of the present invention.

Fig. 10 is a message flowchart of the embodiment shown in Fig. 9.

Detailed Description of the Preferred Embodiments

It is believed that above and other objectives, characteristics and advantages will be more apparent through the following detailed description of the preferred embodiments in conjunction with the drawings.

Figs. 1-3 have been described in the above and their descriptions will be omitted.

Fig. 4 is a flowchart of a method for establishing packet data communication with a PHS packet data station initiated by an external data network according to an embodiment of the present invention, and Fig. 5 is a message flowchart of a procedure of establishing new packet data communication in the embodiment shown in Fig. 4. The PHS packet data station PS and the PHS cell station CS are combined together for simplicity. Next, this embodiment will be described in detail in conjunction with the figures.

As shown in Fig. 4, at Step 401, when a server of the external data network, such as www server or mail server of Internet or Intranet, tries to communicate with a PHS packet data station, it sends a packet data communication request message to a PHS packet server. The packet data communication request message contains the number of the PHS packet data station and is an IP message. In Fig. 5, the message involved in step 401 is represented as an arrow "IP message".

Next, at step 405, the PHS packet server detects whether there is a PPP connection between the PHS packet server and the PHS packet data station corresponding to the number in the packet data communication request message. If there is no PPP connection, it is indicated that the packet data communication request needs to establish a new packet data communication. If there is the PPP connection, it is indicated that the PHS packet data station is in dormant state and the packet data communication request needs to recover the dormant state of the PHS packet data station.

Then at step 410, the PHS packet server generates a call setup request message SETUP being compliant with Q.931 protocol, according to the received packet data communication request message. The SETUP message contains newly defined User to

User Information Element (UUIE).

Fig. 6 shows a format of the UUIE in the SETUP message. As shown in Fig. 6, the UUIE includes: UUIE Identifier, Length of User-User Contents, Protocol Discriminator, Application ID Length, Application ID, Length of Contents, and Application Type. The Application Type is newly defined. The UUIE identifier is set to 7EH. For the Protocol Discriminator, PHS is represented by 43H. The Application ID Length is set to 01H. The Application ID includes: short message ID (04H), location service ID (08H), and packet data ID (1AH), wherein the packet data ID is newly defined. In this embodiment, the Application ID is set as packet data ID. The Application Type includes: new packet call (1), dormant recover (2), and dormant release (3).

When the detecting result in step 405 is that there is no PPP connection between the PHS packet server and the PHS packet data station, in the SETUP message generated in step 410, the Application Type in the UUIE is set to 1, which indicates "new packet call".

Then at step 415, according to the number of the PHS packet data station in the packet data communication request message, the PHS packet server sends the generated SETUP message to the PHS packet data station.

Specifically, the PHS packet server inquires a PHS switch serving the PHS packet data station based on the number of the PHS packet data station, and then sends the SETUP message to the PHS switch. The PHS switch receives the SETUP message and pages the PHS packet data station with the SETUP message as paging message.

In Fig. 5, the messages involved in step 415 are represented as an arrow "SETUP" from the PHS packet server to the PHS switch and an arrow "SETUP" from the PHS switch to the PHS packet data station.

After the PHS packet data station receives the SETUP message, at step 420, it responds to the SETUP message and establishes connections with the PHS packet server.

Specifically, firstly, the PHS packet data station sets up an ISDN connection with the PHS packet server based on Q.931 protocol. When the PHS packet data station receives the SETUP message, if the SETUP message passes, the PHS packet data station returns a Call Proceeding message CALL_PROC to the PHS switch. The PHS switch skips an authentication for the packet data call. Then the PHS packet data station sends an ALERTING message to the PHS switch and the PHS switch forwards it to the PHS packet server. After the PHS packet data station answers, the PHS packet data station sends a CONNECT message to the PHS switch, and the CONNECT message is forwarded to the PHS packet server by the PHS switch. Thus the ISDN connection has been set up between the PHS packet data station and the PHS packet server. In Fig. 5, the messages involved in the setup procedure of the ISDN connection are represented as arrows "CALL_PROC", "ALERTING" and "CONNECT".

As response messages to the SETUP message, the CALL_PROC message, the ALERTING message and the CONNECT message also contain the UUIE. The difference between the UUIE in the response messages and the UUIE in the SETUP message consists in: for positive response message, the UUIE does not include the Application Type, but includes "Ack" indicating acknowledgement, which is set to "80H"; for negative response message, the UUIE also does not include the Application Type, but includes "NAck" indicating rejection and "Cause", wherein the "NAck" is set to "81H". Fig. 7(a) and Fig. 7(b) show the formats of UUIE in the positive response message and the negative response message respectively.

Secondly, the setup procedures of a LAP-B and SVC connection, a PPMP connection and a PPP connection are performed between the PHS packet data station and the PHS packet server based on the LAP-B protocol and the X.25 protocol, the PPMP protocol and the PPP protocol. In Fig. 5, the setup procedures of these connections are represented as bi-directional arrows "LAP-B and SVC connection setup procedure", "PPMP connection setup procedure" and "PPP connection setup procedure".

After the PPP connection is set up, at step 425, the PHS packet server assigns an IP address to the PHS packet data station and sends the IP address in a packet data communication response message to the www server. The packet data communication response message is an IP response message and includes the IP address of the PHS packet data station. In Fig. 5, the message involved in step 425 is represented as an arrow "IP response message".

The www server receives the packet data communication response message and starts the packet data communication with the PHS packet data station, which is represented as a bi-directional arrow "Packet data communication" in Fig. 5.

When the detecting result in step 405 is that there is the PPP connection between the PHS packet server and the PHS packet data station, it is indicated that the PHS packet data station is in dormant state and the packet data communication request message needs to recover the dormant state. Fig. 8 shows the message flow in the dormant recovery procedure in the embodiment shown in Fig. 4.

In the dormant recovery procedure, the PHS packet server generates the call setup request message SETUP being compliant with Q.931 protocol according to the received packet data communication request message (step 410). The Application Type in the UUIE contained in the SETUP message is set to 2, which indicates "dormant recover". Then at step 415, according to the number of the PHS packet data station in the packet data communication request message, the PHS packet server sends the generated SETUP message to the PHS packet data station.

Specifically, the PHS packet server inquires the PHS switch serving the PHS packet data station according to the number and sends the SETUP message to the PHS switch. The PHS switch receives the SETUP message and pages the PHS packet data station with the SETUP message as paging message.

In Fig. 8, the messages involved in step 415 are represented as an arrow "SETUP" from the PHS packet server to the PHS switch and an arrow "SETUP" from the PHS switch to the PHS packet data station.

After receiving the SETUP message, at step 420, the PHS packet data station responds to the SETUP message and sets up connections with the PHS packet server.

Specifically, firstly, the PHS packet data station sets up an ISDN connection with the PHS packet server based on Q.931 protocol. When the PHS packet data station receives the SETUP message, if the SETUP message passes, the PHS packet data station returns a Call Proceeding message CALL_PROC to the PHS switch. The PHS switch skips an authentication for the packet data call. Then the PHS packet data station sends an ALERTING message to the PHS switch and the PHS switch forwards it to the PHS packet server. After the PHS packet data station answers, the PHS packet data station sends a CONNECT message to the PHS switch, and the CONNECT message is forwarded to the PHS packet server by the PHS switch. Thus the ISDN connection has been set up between the PHS packet data station and the PHS packet server. In Fig. 8, the messages involved in the setup procedure of the ISDN connection are represented as arrows "CALL_PROC", "ALERTING" and "CONNECT".

The formats of the UUIE in the CALL_PROC message, the ALERTING message and the CONNECT message can be defined as the formats shown in Fig. 7(a) and Fig. 7(b).

Secondly, the setup procedures of a LAP-B and SVC connection and a PPMP connection are performed between the PHS packet data station and the PHS packet server based on the LAP-B protocol and the X.25 protocol and the PPMP protocol. Different from the setup procedure of the new packet data communication, in the dormant recovery procedure, the PPP connection would not be set up. In Fig. 8, the setup procedures of these connections are represented as bi-directional arrows "LAP-B and SVC connection setup procedure" and "PPMP connection setup procedure".

After the PPMP connection is set up, the dormant state of the PHS packet data station is recovered and the www server can start the packet data communication with the PHS packet data station, which is represented as a bi-directional arrow

"Packet data communication" in Fig. 8.

It can be seen from above description that the method for establishing packet data communication with a PHS packet data station initiated by an external data network of this embodiment can be applied to the establishment of the new packet data communication and the dormant recovery of the PHS packet data station, which are initiated by the external data network. The method of this embodiment provides a novelty packet data communication with the PHS packet data station by making the server of the external data network initiate the packet data communication request and making new definition to the UUIE in the call setup request message, so that the PHS packet data station can receive the packet data communication request and more PHS packet data services can be provided to the PHS packet data station.

Under the same inventive concept, Fig. 9 is a flowchart of a method for establishing VoIP call between PHS packet data stations according to an embodiment of the present invention, wherein the descriptions for the same portions as those of the previous embodiment are omitted properly. Fig. 10 is a message flowchart of the embodiment shown in Fig. 9. Next, this embodiment will be described in detail in conjunction with the figures.

Assuming that the PHS packet data communication system to which the method of this embodiment can be applied includes a first PHS packet data station, a first PHS switch and a first PHS packet server serving the first PHS packet data station, a second PHS packet data station, a second PHS switch and a second PHS packet server serving the second PHS packet data station. Both the first and the second PHS packet data stations support VoIP services, and the first PHS packet server and the second PHS packet server are connected to each other through IP interface. In this embodiment, assuming that the first PHS packet data station is regarded as calling party and the second PHS packet data station is regarded as called party, and the VoIP call is based on Session Initiation Protocol (SIP).

As shown in Fig. 9, at step 901, the first PHS packet data station sets up

connections with the first PHS packet server. Specifically, the first PHS packet data station and the first PHS packet server set up an ISDN connection with the Q.931 protocol, a LAP-B and SVC connection with the LAP-B protocol and the X.25 protocol, a PPMP connection with the PPMP protocol and a PPP connection with the PPP protocol. The setup procedures of these connections have been described in detail in the previous embodiment and their descriptions are omitted properly. In Fig. 10, the setup procedures of these connections in step 901 are represented as bi-directional arrows "ISDN connection setup", "LAP-B and SVC connection setup", "PPMP connection setup" and "PPP connection setup".

Next, at step 905, the first PHS packet data station starts the establishment of VoIP call based on SIP protocol. It sends a VoIP call request message, such as INVITE message provided in the SIP protocol, which includes the number of the second PHS packet data station to the first PHS packet server over the first PHS switch. In Fig. 10, the message involved in step 905 is represented as an arrow "INVITE".

After the first PHS packet server receives the INVITE message, at step 910, it finds the second PHS packet server serving the second PHS packet data station according to the number of the second PHS packet data station. Then at step 915, the first PHS packet server routes the INVITE message to the second PHS packet server. In Fig. 10, the message involved in step 915 is represented as an arrow "INVITE".

The second PHS packet server receives the INVITE message and starts the establishment of the packet data communication with the second PHS packet data station.

At step 920, the second PHS packet server detects whether there is a PPP connection between the second PHS packet server and the second PHS packet data station. If there is no PPP connection, it is indicated that the second PHS packet server needs to establish a new packet data communication with the second PHS packet data station. If there is the PPP connection, it is indicated that the second PHS packet data station is in dormant state and the second PHS packet server needs to

recover the dormant state of the PHS packet data station.

Then at step 925, the second PHS packet server generates a call setup request message SETUP being compliant with the Q.931 protocol, which contains User to User Information Element (UUIE). The format of the UUIE has been described in detail in the previous embodiment in conjunction with Fig. 6. In this embodiment, the Application ID in the UUIE is set as packet data ID.

If the detecting result in step 920 is that there is no PPP connection, the Application Type in the UUIE in the generated SETUP message is set to 1, which indicates "new packet call". If the detecting result in step 920 is that there is the PPP connection, the Application Type in the UUIE in the generated SETUP message is set to 2, which indicates "dormant recover".

Then at step 930, the second PHS packet server sends the generated SETUP message to the second PHS packet data station over the second PHS switch. In Fig. 10, the messages involved in step 930 are represented as an arrow "SETUP" from the second PHS packet server to the second PHS switch and an arrow "SETUP" from the second PHS switch to the second PHS packet data station.

After the second PHS packet data station receives the SETUP message, at step 935, it responds to the SETUP message and sets up connection with the second PHS packet server over the second PHS switch. Specifically, in the case that the Application Type in the UUIE is set to 1, the second PHS packet data station sets up an ISDN connection, a LAP-B and SVC connection, a PPMP connection and a PPP connection with the second PHS packet server. In the case that the Application Type in the UUIE is set to 2, the second PHS packet data station sets up an ISDN connection, a LAP-B and SVC connection, and a PPMP connection with the second PHS packet server.

In Fig. 10, the messages involved in step 935 and the setup procedures of the connections are represented as arrows "CALL_PROC", "ALERTING", "CONNECT" and bi-directional arrows "LAP-B and SVC connection setup", "PPMP connection setup" and "PPP connection setup".

After the PPP connection is set up or the dormant state of the second PHS packet data station is recovered, at step 940, the second PHS packet server sends the INVITE message to the second PHS packet data station over the second PHS switch. In Fig. 10, the message involved in step 940 is represented as an arrow "INVITE".

Then at step 945, the second PHS packet data station responds to the INVITE message and establishes the VoIP call with the first PHS packet data station to communicate with each other. Specifically, the second PHS packet data station receives the INVITE message, and if the INVITE message is normal, it sends a RING message to the second PHS switch. Then the second PHS switch forwards the RING message to the first PHS packet data station through the second PHS packet server, the first PHS packet server and the first PHS switch. If the second PHS packet data station answers, it sends an OK message to the second PHS switch. Then the second PHS switch forwards the OK message to the first PHS packet data station through the second PHS packet server, the first PHS packet server and the first PHS switch. Thus the VoIP call is established between the first PHS packet data station and the second PHS packet data station, and the user of the first PHS packet data station can have a conversation with the user of the second PHS packet data station.

In Fig. 10, the messages involved in step 945 are represented as arrows "RING", "OK" and a bi-directional arrow "Communication".

It can be seen from above description, the method for establishing VoIP call between PHS packet data stations of this embodiment can establish the VoIP call between the PHS packet data stations through the packet data communication with the called PHS packet data station initiated by the network side and enlarge the range of the PHS packet data services.

Although the method for establishing PHS packet data communication with a PHS packet data station initiated by an external data network and the method for establishing VoIP call between PHS packet data stations are described in detail in conjunction with the preferred embodiment, the present invention is not limited as

above. It should be understood for persons skilled in the art that the above embodiments may be varied, replaced or modified without departing from the spirit and the scope of the present invention.

CLAIMS

1.A method for establishing PHS packet data communication with a PHS packet data station initiated by an external data network, comprising:

a server of the external data network sending a packet data communication request message containing the number of the PHS packet data station to a PHS packet server;

the PHS packet server generating a call setup request message containing User to User Information Element (UUIE) and sending it to the PHS packet data station corresponding to the number;

the PHS packet data station responding to the call setup request message and setting up connections with the PHS packet server; and

the PHS packet server assigning an IP address to the PHS packet data station and sending the IP address in a packet data communication response message to the server of the external data network.

2.A method for establishing PHS packet data communication with a PHS packet data station initiated by an external data network according to claim 1, wherein the UUIE at least includes: UUIE Identifier, Length of User-User Contents, Protocol Discriminator, Application ID Length, Application ID, Length of Contents, and Application Type.

3.A method for establishing PHS packet data communication with a PHS packet data station initiated by an external data network according to claim 2, wherein the Application ID includes: short message ID, location service ID, and packet data ID;

the Application Type at least includes: new packet call and dormant recover.

4.A method for establishing PHS packet data communication with a PHS packet data station initiated by an external data network according to any one of claims 1-3, wherein the step of the PHS packet server sending the call setup request message to the PHS packet data station includes:

the PHS packet server sending the call setup request message to a PHS switch

serving the PHS packet data station; and

the PHS switch paging the PHS packet data station with the call setup request message as paging message.

5.A method for establishing PHS packet data communication with a PHS packet data station initiated by an external data network according to any one of claims 1-4,wherein the step of the PHS packet data station setting up connections with the PHS packet server includes:

setting up an ISDN connection;

setting up a LAP-B and Switched Virtual Circuit (SVC) connection with LAP-B protocol and X.25 protocol;

setting up a PPMP connection with PHS Packet Management Protocol; and

setting up a PPP connection with Point-to-Point Protocol.

6.A method for establishing PHS packet data communication with a PHS packet data station initiated by an external data network according to any one of claims 1-5, further comprising:

before performing the generating step, the PHS packet server detecting whether there is a PPP connection between the PHS packet server and the PHS packet data station;

if there is no PPP connection, in the generating step, the Application Type in the UUIE is set as new packet call; and

if there is the PPP connection, in the generating step, the Application Type in the UUIE is set as dormant recover, and in the step of setting up connections, the PHS packet data station sets no PPP connection with the PHS packet server.

7.A method for establishing PHS packet data communication with a PHS packet data station initiated by an external data network according to any one of claims 1-6, wherein the external data network is Internet or Intranet, and the server is a WWW server or a mail server.

8.A method for establishing VoIP call between PHS packet data stations,

comprising:

a first PHS packet data station setting up connections with a first PHS packet server, and sending a VoIP call request message containing the number of a second PHS packet data station;

the first PHS packet server sending the VoIP call request message to a second PHS packet server serving the second PHS packet data station;

the second PHS packet server generating a call setup request message containing User to User Information Element (UUIE) and sending it to the second PHS packet data station;

the second PHS packet data station responding to the call setup request message and setting up connections with the second PHS packet server;

the second PHS packet server sending the VoIP call request message to the second PHS packet data station; and

the second PHS packet data station responding to the VoIP call request message and establishing the VoIP call with the first PHS packet data station.

9.A method for establishing VoIP call between PHS packet data stations according to claim 8, wherein the UUIE at least includes: UUIE Identifier, Length of User-User Contents, Protocol Discriminator, Application ID Length, Application ID, Length of Contents, and Application Type.

10. A method for establishing VoIP call between PHS packet data stations according to claim 9, wherein the Application ID includes: short message ID, location service ID, and packet data ID;

the Application Type at least includes: new packet call and dormant recover.

11. A method for establishing VoIP call between PHS packet data stations according to any one of claims 8-10, wherein the step of the second PHS packet server sending the call setup request message to the second PHS packet data station includes:

the second PHS packet server sending the call setup request message to a second

PHS switch serving the second PHS packet data station; and

the second PHS switch paging the second PHS packet data station with the call setup request message as paging message.

12. A method for establishing VoIP call between PHS packet data stations according to any one of claims 8-11,wherein the steps of the first and second PHS packet data stations setting up connections with the first and second PHS packet servers respectively includes:

setting up an ISDN connection;

setting up a LAP-B and Switched Virtual Circuit (SVC) connection with LAP-B protocol and X.25 protocol;

setting up a PPMP connection with PHS Packet Management Protocol; and

setting up a PPP connection with Point-to-Point Protocol.

13. A method for establishing VoIP call between PHS packet data stations according to any one of claims 8-12, further comprising:

before performing the generating step, the second PHS packet server detecting whether there is a PPP connection between the second PHS packet server and the second PHS packet data station;

if there is no PPP connection, in the generating step, the Application Type in the UUIE is set as new packet call;

if there is the PPP connection, in the generating step, the Application Type in the UUIE is set as dormant recover, and in the step of the second PHS packet data station setting up connections with the second PHS packet server, the second PHS packet data station sets no PPP connection with the second PHS packet server.

14. A method for establishing VoIP call between PHS packet data stations according to any one of claims 8-13, wherein the VoIP call is based on the Session Initiation Protocol (SIP).

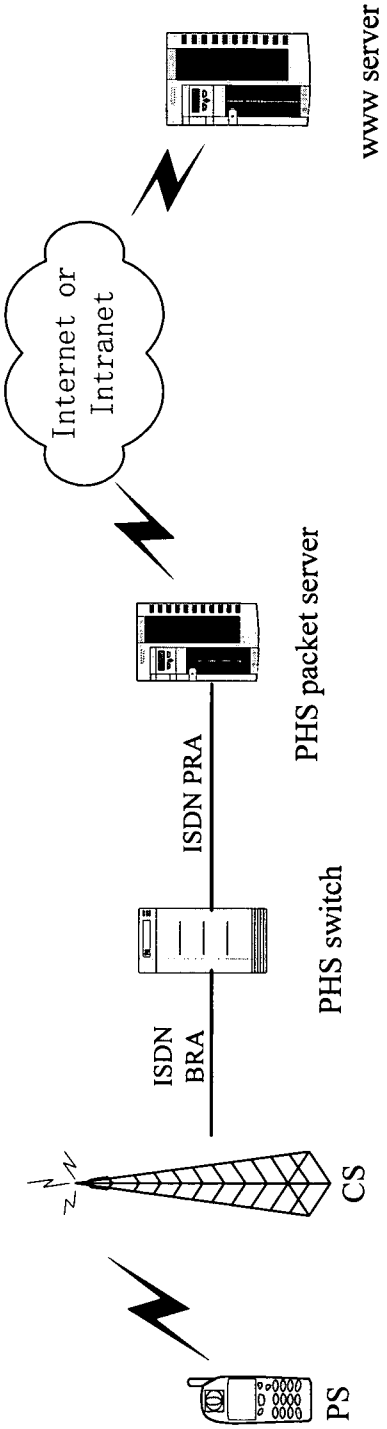

www server
Internet or Intranet
PHS packet server
ISDN PRA
PHS switch
ISDN BRA
CS
PS

Fig. 1

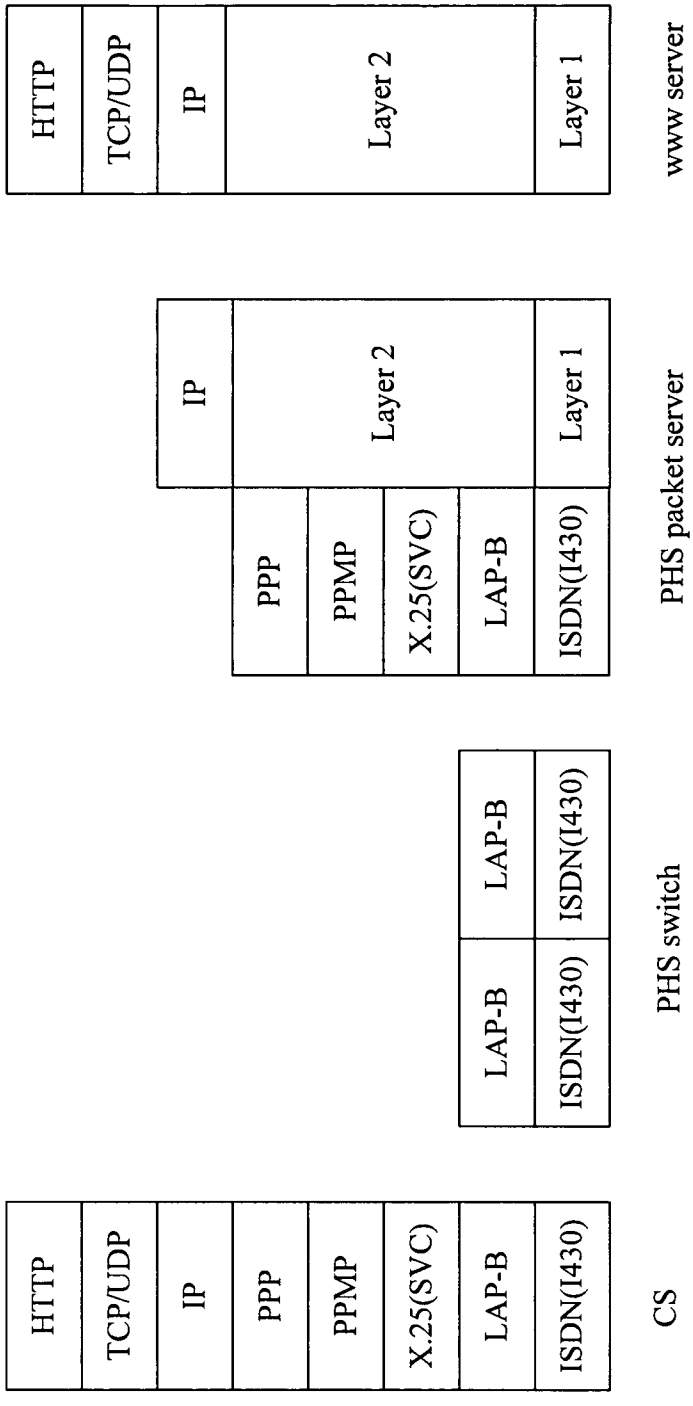

HTTP
TCP/UDP
IP
PPP
PPMP
X.25(SVC)
LAP-B
ISDN(I430)
CS
LAP-B
ISDN(I430)
LAP-B
ISDN(I430)
PHS switch
IP
PPP
PPMP
X.25(SVC)
LAP-B
ISDN(I430)
Layer 2
Layer 1
PHS packet server
HTTP
TCP/UDP
IP
Layer 2
Layer 1
www server

Fig. 2

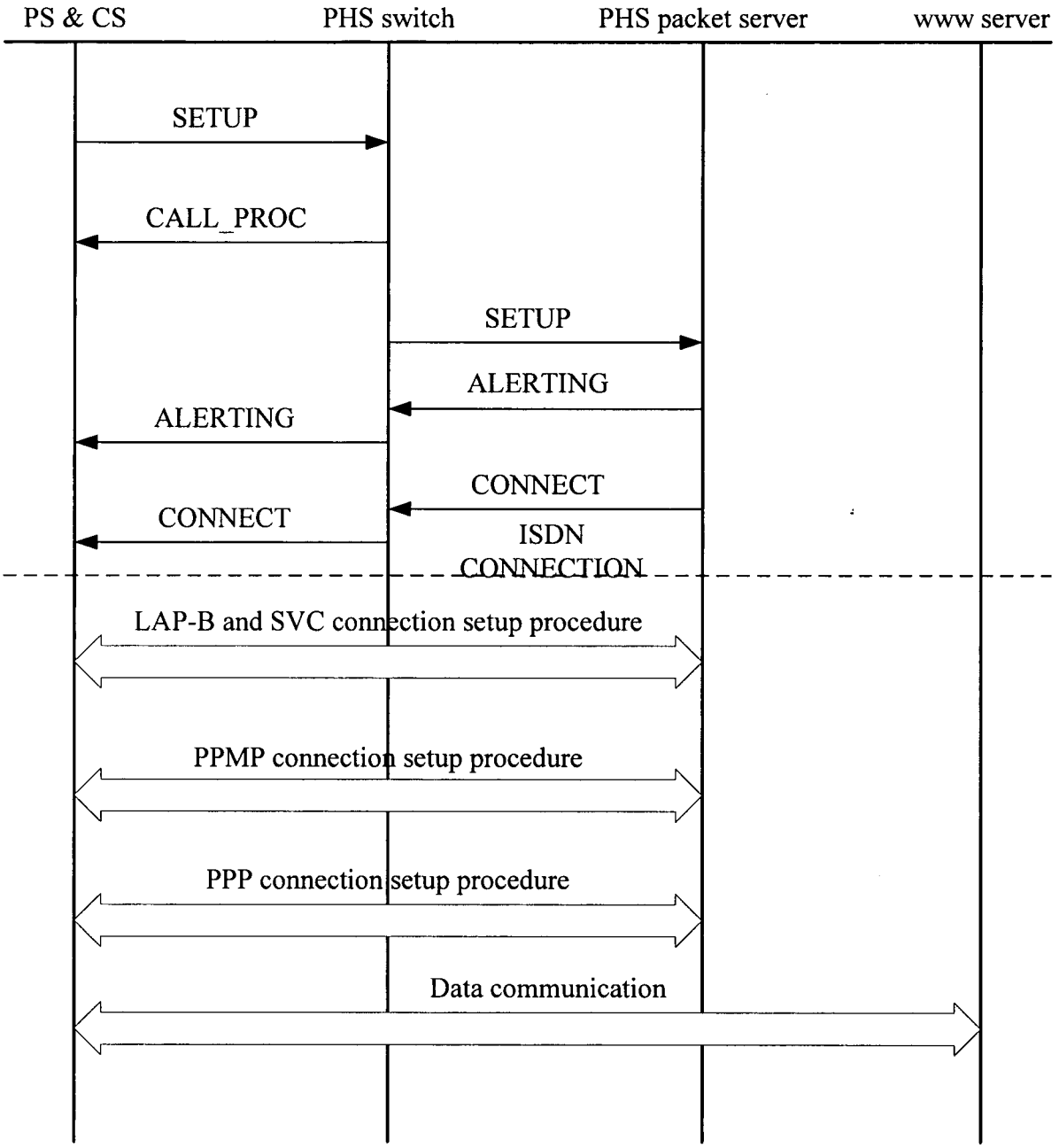

PS & CS
PHS switch
PHS packet server
www server
SETUP
CALL_PROC
SETUP
ALERTING
ALERTING
CONNECT
CONNECT
ISDN
CONNECTION
LAP-B and SVC connection setup procedure
PPMP connection setup procedure
PPP connection setup procedure
Data communication

Fig. 3

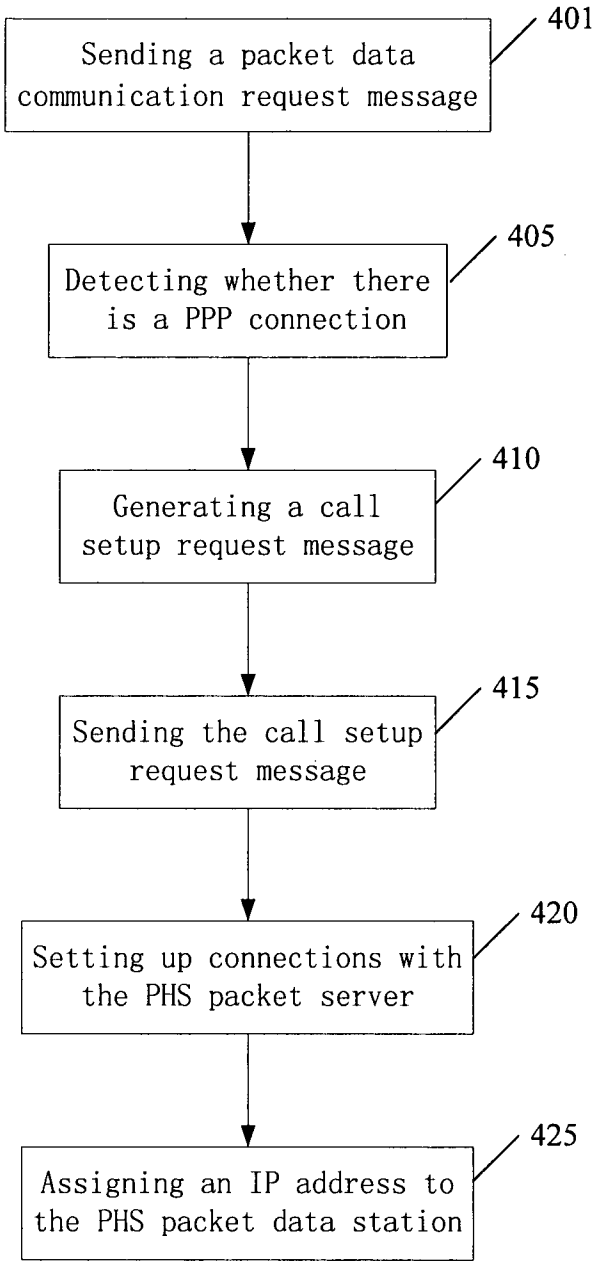

Sending a packet data communication request message
401
Detecting whether there is a PPP connection
405
Generating a call setup request message
410
Sending the call setup request message
415
Setting up connections with the PHS packet server
420
Assigning an IP address to the PHS packet data station
425

Fig. 4

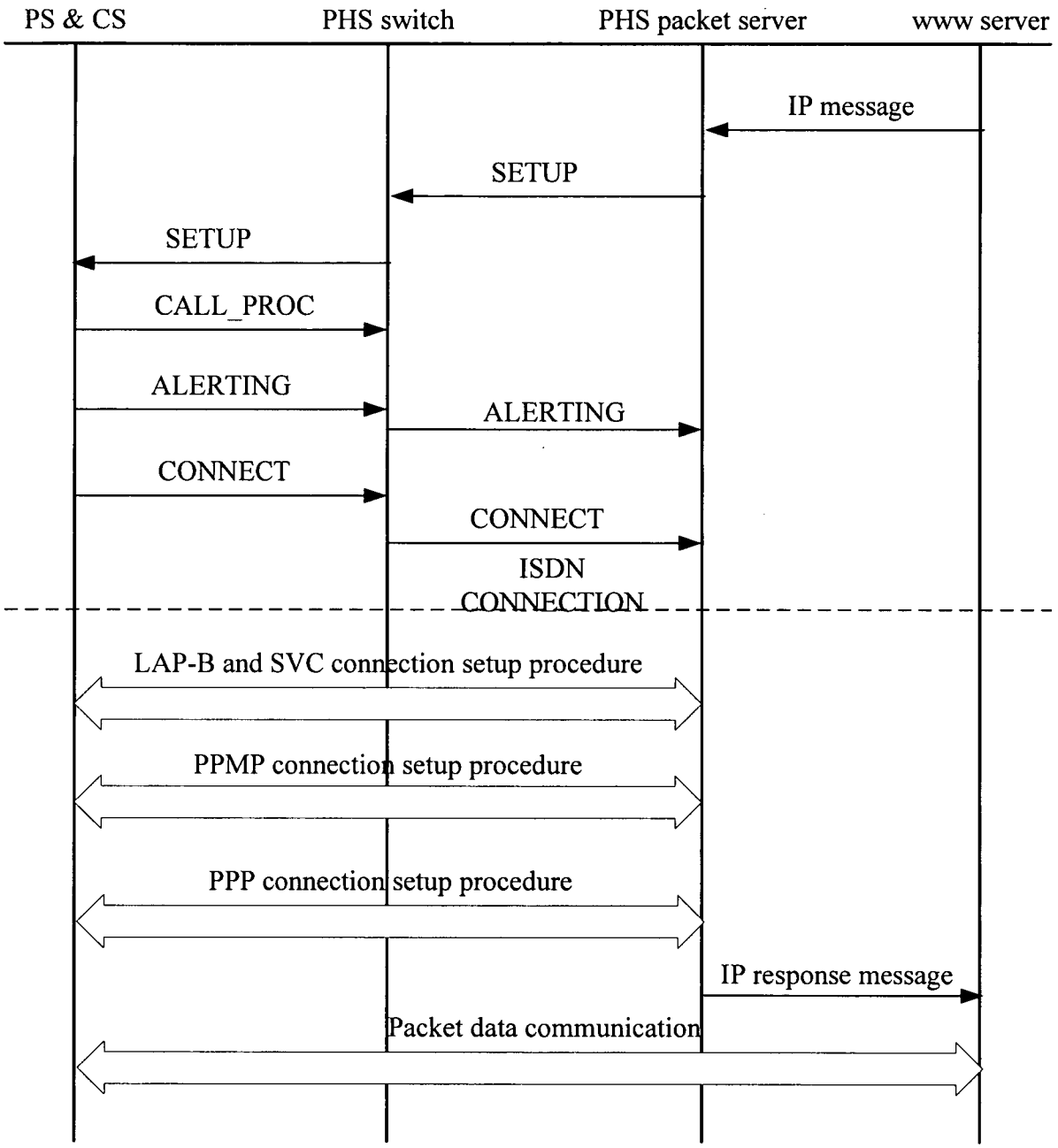

PS & CS
PHS switch
PHS packet server
www server
IP message
SETUP
SETUP
CALL_PROC
ALERTING
ALERTING
CONNECT
CONNECT
ISDN
CONNECTION
LAP-B and SVC connection setup procedure
PPMP connection setup procedure
PPP connection setup procedure
IP response message
Packet data communication

Fig. 5

byte / bit	8	7	6	5	4	3	2	1
1	UUIE Identifier (7EH)							
2	Length of User-User Contents							
3	Protocol Discriminator (43H: PHS)							
4	Application ID Length (01H)							
5	Application ID (04H: short message, 08H: location service, 1AH: packet data)							
6	Length of Contents							
7	Application Type (1: new packet call. 2: dormant recover. 3: dormant release)							

Fig. 6

byte / bit	8	7	6	5	4	3	2	1
1	UUIE Identifier (7EH)							
2	Length of User-User Contents							
3	Protocol Discriminator (43H: PHS)							
4	Application ID Length (01H)							
5	Application ID (04H: short message, 08H: location service, 1AH: packet data)							
6	Length of Contents							
7	Ack (80H)							

(a)

byte / bit	8	7	6	5	4	3	2	1
1	UUIE Identifier (7EH)							
2	Length of User-User Contents							
3	Protocol Discriminator (43H: PHS)							
4	Application ID Length (01H)							
5	Application ID (04H: short message, 08H: location service, 1AH: packet data)							
6	Length of Contents							
7	Nack (81H)							
8	Cause							

(b)

Fig. 7

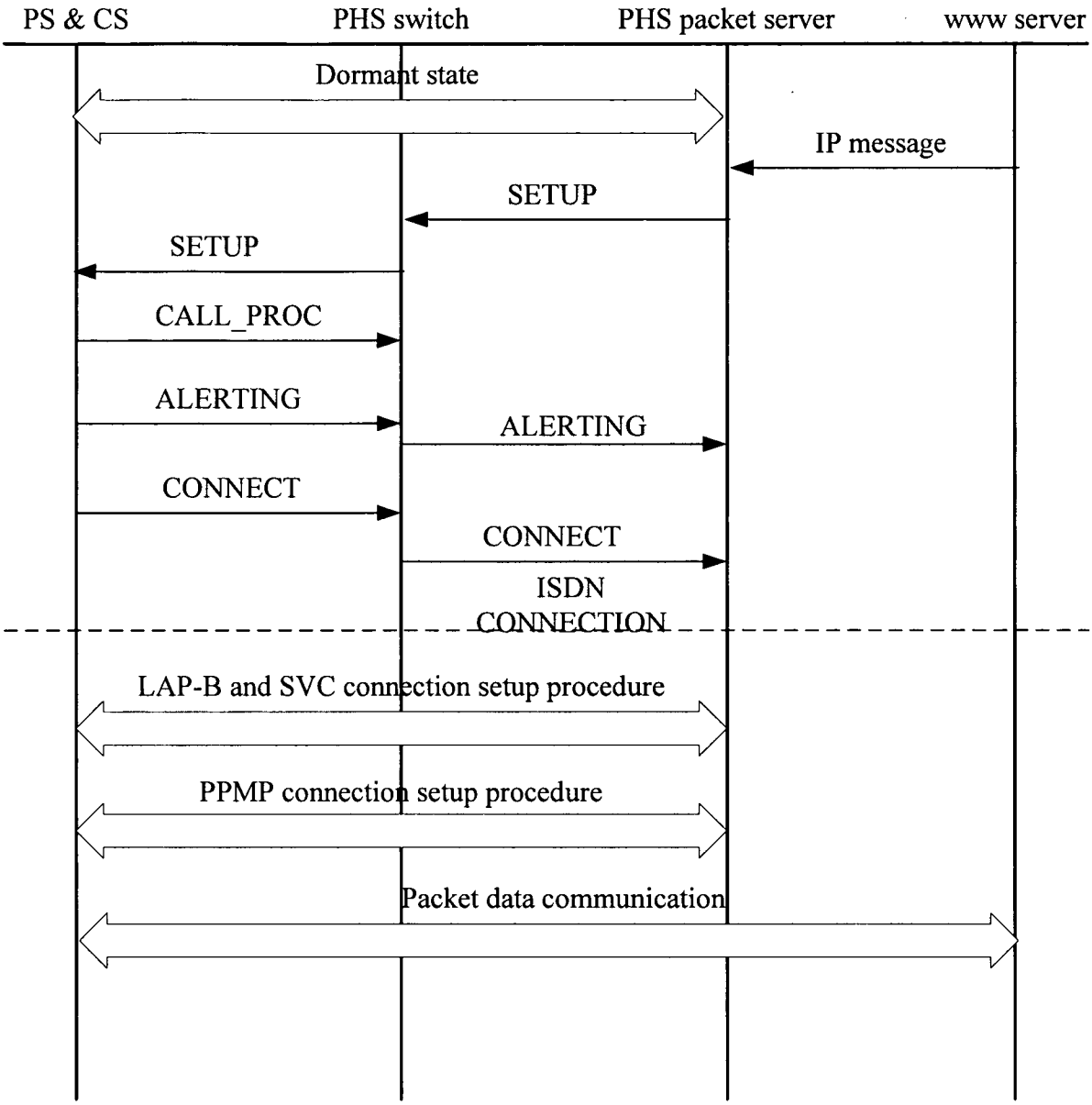

PS & CS
PHS switch
PHS packet server
www server
Dormant state
IP message
SETUP
SETUP
CALL_PROC
ALERTING
ALERTING
CONNECT
CONNECT
ISDN
CONNECTION
LAP-B and SVC connection setup procedure
PPMP connection setup procedure
Packet data communication

Fig. 8

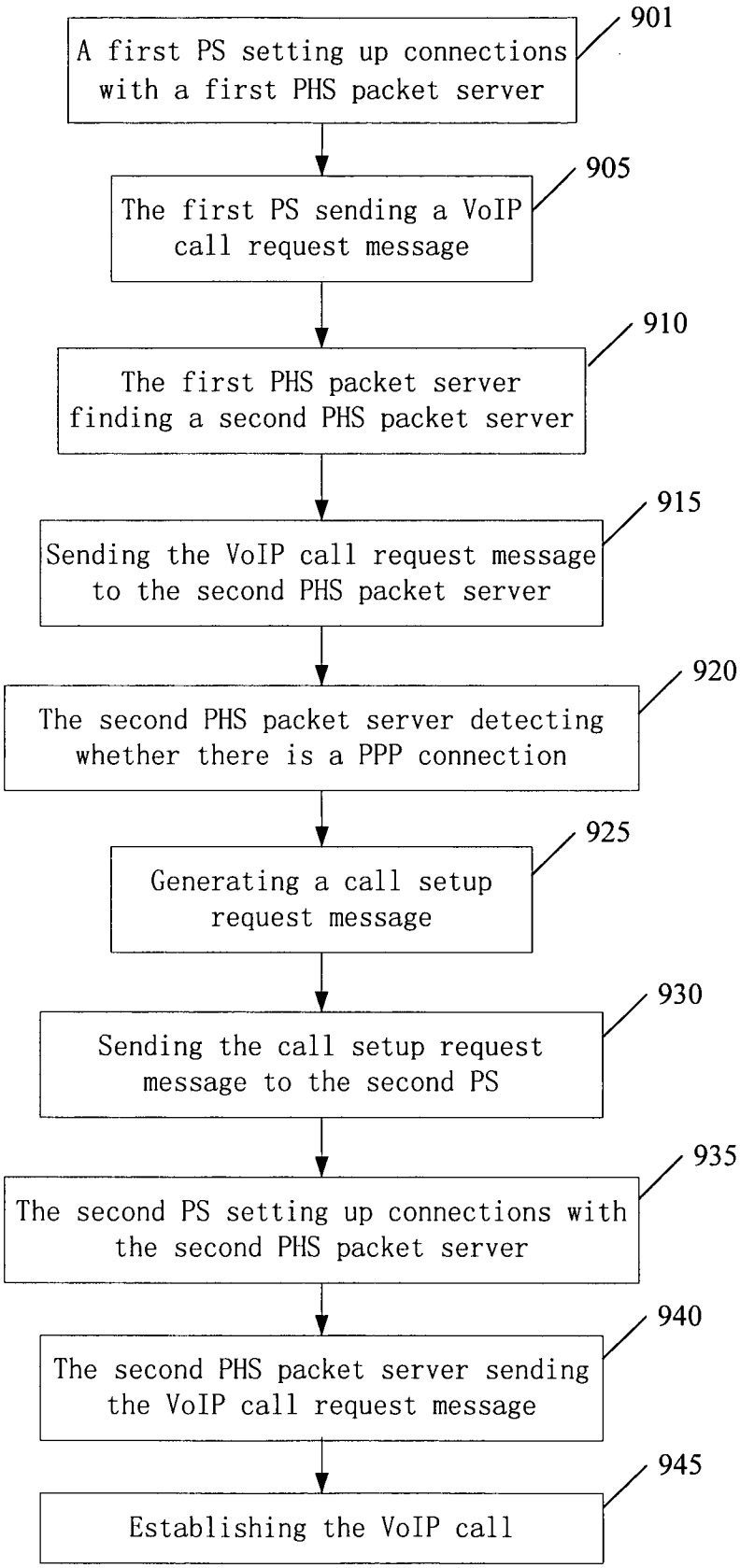

A first PS setting up connections with a first PHS packet server
901
The first PS sending a VoIP call request message
905
The first PHS packet server finding a second PHS packet server
910
Sending the VoIP call request message to the second PHS packet server
915
The second PHS packet server detecting whether there is a PPP connection
920
Generating a call setup request message
925
Sending the call setup request message to the second PS
930
The second PS setting up connections with the second PHS packet server
935
The second PHS packet server sending the VoIP call request message
940
Establishing the VoIP call
945

Fig. 9

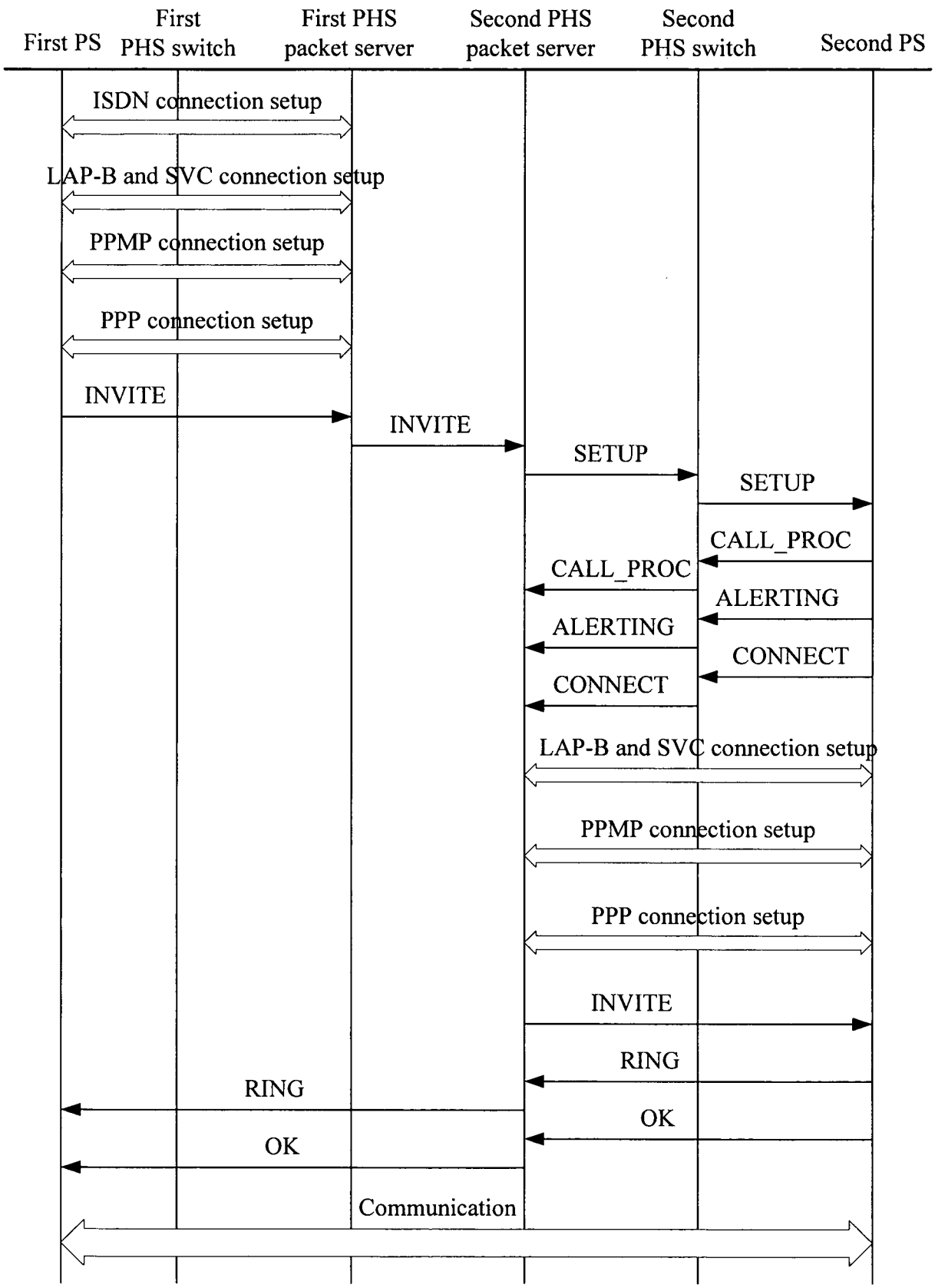

First PS
First PHS switch
First PHS packet server
Second PHS packet server
Second PHS switch
Second PS
ISDN connection setup
LAP-B and SVC connection setup
PPMP connection setup
PPP connection setup
INVITE
INVITE
SETUP
SETUP
CALL_PROC
CALL_PROC
ALERTING
ALERTING
CONNECT
CONNECT
LAP-B and SVC connection setup
PPMP connection setup
PPP connection setup
INVITE
RING
RING
OK
OK
Communication

Fig. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2007/003291

A. CLASSIFICATION OF SUBJECT MATTER

H04L 12/56 (2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H04L, H04L12/-, H04L9/-, H04L29/06

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

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

CNPAT, CNKI, WPI, EPODOC, PAJ: PHS packet data service communicat+ network station setup establish user number

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Vehicular Technology Conference, 1997 IEEE 47th, PHS with packet data communications (PHS-PD) protocol architecture, May 1997 (05.1997), pages 416-420	1-14
A	CN1809071A (LINKAGE COMMUNICATION TECHNOLOGY CO LTD) 26 July 2006 (26. 07. 2006) the whole document	1-14
A	JP10145369A (NEC CORP) 29 May 1998 (29. 05. 1998) the whole document	1-14
A	Universal Personal Communications. 1995. Record., 1995 Fourth IEEE International Conference on, Protocol and network control technology for packet in PHS, Nov. 1995 (11.1995), pages 652-656	1-14
A	WO2007106447A2 (AMERICAN TELECOM SERVICES INC) 20 Sep. 2007 (20. 09. 2007) the whole document	8-14

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

* Special categories of cited documents:

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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 Aug. 2008 (18. 08. 2008)	**04 Sep. 2008 (04.09.2008)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer CHENG Dong Telephone No. (86-10)62411276

Form PCT/ISA/210 (second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2007/003291

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

This Authority consider that there are two inventions covered by the claims indicated as follows:
I: Claim 1 requests for a method for establishing PHS packet data communication with a PHS packet data station initiated by an external data network;
II: Claim 8 requests a method for establishing VoIP call between PHS packet data station;

In the two groups of claims, the technical features included in the two groups of claims are not common or corresponding each other. Therefore the common or corresponding special technical features are not included in the two groups of claims. The inventions are not so linked as to form a single general inventive concept, as required by Rule 13.1 PCT.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2007/003291

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN1809071A	26. 07. 2006	None	
JP10145369A	29. 05. 1998	JP3082686B2	28.08.2000
WO2007106447A2	20. 09. 2007	US2007230447A1	04.10.2007
		WO2007106447A3	10.01.2008