

METHOD OF SUPPORTING GENERAL PACKET RADIO SERVICE CUSTOMIZED
APPLICATIONS FOR MOBILE NETWORK ENHANCED LOGIC SERVICE

Field of the Invention

5 The present invention relates to mobile communication field,
particularly to a method for supporting General Packet Radio
Service (GPRS) Customized Applications for Mobile network
Enhanced Logic (CAMEL) service and general service when GPRS
is upgraded into a GPRS Intelligent Network (GPRS IN).

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Background of the Invention

As intelligent mobile services are used extensively,
operators have an urgent demand for GPRS CAMEL services. However,
there is a critical problem at present: traditional GPRS
15 networks generally haven't the function of supporting GPRS
CAMEL services.

There are two solutions to support GPRS CAMEL services:

1. SGSN/SSF (Serving GPRS Supporting Node/Service Switch
Function) solution: as the name implies, SGSN/SSF is a switching
20 function of GPRS CAMEL services implemented over SGSN. To
introduce an intelligent network into the GPRS network, the
network elements that need be added on service layer of the
intelligent network include a Service Control Point (SCP), a
Service Management System (SMS) and the like, also include a
25 SGSN that supports GPRS SSF and a Home Location Register (HLR)
that supports management of CAMEL Subscription Information
(GPRS-CSI) etc., to establish the control relation between GPRS
networks and Intelligent services.

Fig.1 is a networking schematic diagram of SGSN/SSF solution.
30 It can be seen from Fig.1, when a subscriber is attached to the
GPRS network or initiates an active PDP (Packet Data Protocol)
context request, HLR inserts the subscriber's GPRS-CSI in the

SGSN in the roaming region. This information will be used to establish an intelligent relation between GPRS SSF and SCP by SGSN. And SCP can perform authentication, authorization and accounting (by duration, traffic, and location etc.) for the subscriber, to realize the control function of packet switching.

2. GGSN/SSF (Gateway GPRS Supporting Node/Service Switch Function) solution: it can be seen from the description above that the SGSN/SSF solution requires SGSN supporting GPRS SSF and HLR supporting management of GPRS-CSI etc., i.e., all SGSNs and HLRs in the whole network have to be upgraded; however, the amount of SGSNs and HLRs in the network is large, thus the project is too complex and investment is too huge, and multi-manufacturer interoperability testing will be required; therefore, this solution is not adapted to provide GPRS CAMEL services quickly at a low cost. Therefore, a GGSN-based GPRS CAMEL network solution is developed, i.e., the function of GPRS SSF is realized in GGSN. The advantage of this solution is that it doesn't need complicated upgrade of HLRs and SGSNs; instead, GPRS CAMEL services can be obtained only by simple data configuration on GGSN. As shown in Fig.2, when a GPRS subscriber initiates an Active PDP context request, GGSN will establish an intelligent relation between GPRS SSF and SCP according to the configured GPRS CAMEL information, and the SCP can accomplish the authentication, authorization and accounting (by duration, traffic, and location etc.) for the subscriber, to realize the control function of packet switching.

The two solutions have no substantial differences in the provided GPRS CAMEL services. However, compared with SGSN/SSF solution, GGSN/SSF solution has advantages of flexible upgrade and low investment, and therefore is approved by many operators.

Though the new core network devices from some manufacturers have been with the function of supporting GPRS CAMEL services, it is impossible for all manufacturers to simultaneously

upgrade GGSNs to support GPRS SSF, since there are currently many GGSN devices from different manufacturers in the traditional networks; furthermore, the solutions for GPRS IN, from different manufacturers, are different; as a result, the coordination work will be a very long process. Once an operator decides to adopt the GGSN/SSF solution to upgrade the GPRS IN, all traditional GGSNs in the network will be required to be replaced by the GGSNs that support GPRS SSF function, and the expense is still large. Thus, operators have a strong demand, i.e., on the premise of protecting traditional investments in GPRS networks, increasing network devices or modifying network structure is avoid as far as possible, and then the object of quickly having intelligent GPRS services will be obtained.

The basic concepts and background of GPRS will be first introduced in the following.

GPRS networks introduce the concepts of packet switching and packet transmission so that GSM (Globe telecommunication Service of Mobile) supporting for data services is enhanced in the network architecture. GPRS is in fact another network over a traditional GSM network, i.e., the network entities such as SGSNs and GGSNs are added in the original GSM network. GPRS shares the BSS (Base Station Subsystem) in traditional GSM network, but requires corresponding update for traditional software/hardware, and mobile stations (MSs) are also required to provide the support for GPRS. Wherein:

SGSN: Serving GPRS Supporting Node.

SGSN provides services for MSs, and cooperates with MSC/VLR/EIR (Mobile Switching Center/Visited Location Register/Equipment Identity Register) to accomplish the mobility management functions including roaming, registration, switching, authentication and authorization, etc., and to accomplish logical link management including establishment, maintenance, and release of logical links, and to accomplish radio resource management. SGSN provides management functions

for calling MSs and called MSs, and accomplishes forwarding, address translation, encryption and compression of packet data. SGSN can accomplish the convergence and transmission of data from Gb interfaces and the conversion between Internet
5 Protocols (IP) at Gn interfaces.

GGSN: Gateway GPRS Supporting Node.

GGSN is actually a gateway or router, which provides interconnection between GPRS and public packet switched data network through X.25 or X.75 protocol (both are protocols used
10 for data network) and provides interconnection between the GPRS and other GPRSs. Similar to SGSN, GGSN also has an IP address, and it functions with SGSN to complete GPRS routing.

In the present document, what is concerned is only the interface between GPRS supporting nodes, without other content.

15 The interface between GSNs (GPRS Service Node including SGSN and GGSN) in a PLMN (Public Land Mobile Network) is called a Gn interface; the interface between GSNs in different PLMNs is called a Gp interface, the signaling platform of which is shown in Fig.3, wherein:

20 UDP (User Datagram Protocol): a non-connection oriented protocol on the transport layer.

IP (Internet Protocol): protocol on the network layer.

L2 (Layer 2): protocol on the data link layer.

L1 (Layer 1): the physical layer.

25 GTP (GPRS Tunnel Protocol): the tunnel encapsulation and dis-encapsulation protocol used to transmit signaling and subscriber data between SGSN and GGSN as well as between SGSNs on the GPRS backbone network; all data packets transmitted between GSNs should be re-encapsulated with GTP.

30 Note: the detailed definition of GTP is described in "GSM09.60: Digital cellular telecommunications system (Phase 2+); General

Packet Radio Service (GPRS);
GPRS Tunnelling Protocol (GTP)"

Fig.4 is a schematic diagram of PDP context activation

Procedure. It can be seen from Fig.4 that when a GPRS subscriber initiates an activation request, SGSN parses the GGSN address through DNS (Domain Name Server) with the APN (Access Point Name) carried in the activation request message, and then informs GGSN to create a PDP context.

Wherein, the BSS (Base Station Subsystem) comprises a BSC (Base Station Controller) and a BTS (Base Transceiver Station).

Fig.5 is the PDP context activation flow; it can be seen from Fig.5 that certain times of information exchange occur between MS, SGSN and GGSN.

The description above is quoted from GSM 03.60 (V7.4.0):

"Digital cellular telecommunications system (phase 2+);
General Packet Radio Service (GPRS);
Service description;
Stage 2.

It can be seen from the above description: SGSN parses the GGSN address through DNS with the APN carried in the Activate PDP Context Request message; however, APN serves as a very important parameter in GPRS network, operators are reluctant to see it is increased or decreased randomly, because either increasing or decreasing implies modifying the network structure. Meanwhile, the GPRS networks in many countries have been commercial ones; therefore, modifying APN will cause inconvenience to all mobile telephone subscribers, which all operators try to avoid.

This is to say, the newly added GGSNs (supporting GPRS SSF function, abbreviated as intelligent GGSNs) for upgrading the GPRS IN should have identical APN as the original GGSNs (not supporting GPRS SSF function, abbreviated as general GGSNs). For a SGSN, only one GGSN address can be parsed through DNS with the same APN, and the address is either an intelligent GGSN address or a general GGSN address. The intelligent GGSN can support packet service access requests for GPRS CAMEL subscribers or general GPRS subscribers; whereas general GGSN

can only support packet service access requests from general GPRS subscribers because it has no GGSN/SSF function.

A contradiction thus exists: if activation requests are sent to intelligent GGSNs, all subscribers can be activated; however, the original general GGSNs will have no effect, and the traditional investment will be wasted; if activation requests are sent to general GGSNs, GPRS CAMEL subscribers can't be activated successfully, equivalent to the case the network is not upgraded.

The traditional protocol used for GPRS only stipulates the protocol interface between SGSNs and GGSNs as well as between SGSNs and SGSNs, and the protocol is the GTP protocol. The topologic structure of a GPRS backbone network is shown in Fig.6. It can be seen from Fig.6 that once an activation request is sent to one of GGSNs, the activation either is accomplished successfully or fails at the GGSN. Therefore, the prior art have not met the operators' demand, which sounds reasonable.

Summary of the Invention

An object of the present invention is to provide a complete solution for the problem encountered in GGSN/SSF solution.

A method for supporting GPRS CAMEL services wherein an external network environment comprises a GGSN, an intelligent GGSN, and a SGSN, comprises: sending a Create PDP Context Request message from a subscriber to the intelligent GGSN first, and determining whether said Create PDP Context Request is an activation from a GPRS CAMEL subscriber according to a GPRS CAMEL Service triggering rule; if so, the intelligent GGSN processing said request; otherwise forwarding said Create PDP Context Request to the general GGSN to process.

Said GPRS CAMEL Service triggering rule is a rule used to determine whether the subscriber sending the Create PDP Context Request message is a GPRS CAMEL subscriber.

Said step of sending a Create PDP Context Request message

from a subscriber to the intelligent GGSN first is achieved by modifying the service data in DNS (Domain Name Server) so that the GGSN addresses parsed from one and the same APN (Access Point Name) are the intelligent GGSN addresses.

5 Said Create PDP Context Request message sent from the intelligent GGSN to the general GGSN is a GTP-compliant Create PDP Context Request message.

10 In said method for supporting GPRS CAMEL service, a Create PDP Context Response message returned from the general GGSN after the successful activation can be accepted by SGSN.

 In said method for supporting GPRS CAMEL service, the intelligent GGSN forwards only Create PDP Context signaling messages from general subscribers.

15 The technical solution in the present invention can well solve the problem that the operators upgrade quickly their GPRS IN and can fully protect traditional investments of the operators, which is impossible to be done with the prior art.

20 **Brief Description of the Drawings**

 Fig.1 is the schematic diagram of the SGSN/SSF solution;

 Fig.2 shows the GGSN/SSF solution;

 Fig.3 is a schematic diagram of signaling plane between different PLMNs;

25 Fig.4 shows the PDP Context activation process;

 Fig.5 shows the PDP Context activation flow;

 Fig.6 is the topological diagram of a GPRS backbone network;

 Fig.7 shows a proxy GGSN activation flowchart;

30 Fig.8 is the flowchart during which the intelligent GGSN forwarding Create PDP Context messages.

Detailed Description of the Embodiment

 An embodiment of the present invention will be described below in detail with reference to the attached drawings.

Fig.7 is a schematic diagram of network connections in the external environment of the present invention. It can be seen from Fig.7 that the network environment comprises a SGSN, a general GGSN and an intelligent GGSN; the connections are shown as solid lines in Fig.7.

In the present invention, the procedure of processing a Create PDP Context Request message from a subscriber is different from those in the prior art: sending the Create PDP Context Request message from the subscriber to the intelligent GGSN first, and determining whether the activation request is an activation request from a GPRS CAMEL subscriber according to the GPRS CAMEL Service triggering rule; if so, the intelligent GGSN processing the Create PDP Context Request message; otherwise forwarding the Create PDP Context Request message to the general GGSN to process.

The GPRS CAMEL Service triggering rule is the rule used to determine whether the subscriber who sends the Create PDP Context Request message is a GPRS CAMEL subscriber. It is a rule used by the intelligent GGSN to determine whether a GPRS CAMEL service is triggered, and is defined by the operator. For instance, China Mobile may take Mobile Station International ISDN Number (MSISDN) as the GPRS CAMEL Service triggering rule (e.g., subscribers with MSISDN prefixed with "136" are GPRS CAMEL subscribers), so that the intelligent GGSN will configure MSISDN in a certain number range (e.g., MSISDNs prefixed with "136") as GPRS CAMEL subscribers. Other GPRS subscribers prefixed with other numbers will be considered as non-GPRS CAMEL subscribers. Other operators may use other information rather than MSISDN (e.g., a certain number range, International Mobile Subscriber Identity (IMSI) or MSISDN (i.e., the mobile telephone number)) as the GPRS CAMEL Service triggering rule. The GPRS CAMEL Service triggering rule is flexible.

Said step of sending a Create PDP Context Request message from a subscriber to the intelligent GGSN first is achieved by

modifying the service data in DNS (Domain Name Server) so that the GGSN addresses parsed from one and the same APN (Access Point Name) are the intelligent GGSN addresses, which is different from the flowchart in the prior art.

5 In the prior art, what the DNS stores is the mapping relation between APN and the GGSN address (actually a database); SGSN finds out the GGSN address using APN as the key word, as a result, the modification to the data in DNS as described in the present invention actually involves modification to the mapping
10 relation stored in the database, for example, suppose the original mapping relation may be apn1<-> Address 1, it may be modified to apn1<->Address 2, so that the address parsing required in the present invention is carried out by modifying the APN configuration data in DNS.

15 In the present invention, the Create PDP Context Request message forwarded from the intelligent GGSN to the general GGSN is a GTP-compliant Create PDP Context Request message.

In the present invention, it is also required the Create PDP Context Request message returned from the general GGSN after
20 successful activation can be accepted by the SGSN.

In the meantime, to reduce the network traffic overhead, what shall be satisfied as far as possible is that the intelligent GGSN forwards only Create PDP Context signaling messages from general subscribers without forwarding the data stream from the
25 subscribers.

Hereunder one embodiment of the present invention is described in conjunction with one detailed processing flow again.

Fig.8 is the activation flowchart during which the
30 intelligent GGSN forwarding the Create PDP Context Request messages. In this solution, the intelligent GGSN provides both the GPRS/SSF function and the proxy forwarding function for Create PDP Context Request/Response messages simultaneously; here it is abbreviated as PPS&PROXY GGSN.

Suppose the address of SGSN's Gn port is A;

Suppose the address of PPS&PROXY GGSN's Gn port is B;

Suppose the address of general GGSN's Gn port is C;

The flow is described in detail as follows:

- 5 1. MS sends an Activate PDP context Request message to SGSN;
2. Through parsing by DNS, SGSN sends the Create PDP Context Request message to PPS&PROXY GGSN;

Wherein, the source address in the IP header is the address of SGSN's Gn port A, the destination address is the address of PPS&PROXY GGSN 's Gn port B; the Create PDP Context Request message contains two information elements: "SGSN Address for signaling" and "SGSN Address for user traffic", which represent the SGSN signaling address and the data address for the PDP context, respectively; the value is the address of SGSN Gn port A; the key information in the message is as follows:

IP header: A->B

SGSN Address for signalling: A

SGSN Address for user traffic: A

3. PPS&PROXY GGSN receives the Create PDP Context Request message:

First, GGSN determines whether the request is a Create PDP Context request from an GPRS CAMEL subscriber; if so, it will process the request; otherwise it forwards the request to the general GGSN, wherein the source address in the IP header is the address of PPS&PROXY GGSN 's Gn port B and the destination address is the address of the general GGSN's Gn port C, and the content in the GTP packet is not changed. The Create PDP Context Request message contains two information elements: "SGSN Address for signaling" and "SGSN Address for user traffic", which represent the SGSN signaling address and the data address for the PDP context, respectively; the value is the address of SGSN Gn IP Address port A; the key information in the message is as follows:

IP header: B->C

SGSN Address for signalling: A

SGSN Address for user traffic: A

4. The general GGSN receives the Create PDP Context Request message:

5 After receiving the Create PDP Context Request message, the general GGSN will create a PDP context, wherein according to the GTP protocol the SGSN signaling address should be the SGSN Address for signaling A carried in the Create PDP Context Request message, and the SGSN data address should be the SGSN Address for user traffic A carried in the message, and the general GGSN designates the signaling and data addresses are the Gn port C of itself; next, the general GGSN returns a Create PDP Context Request Response message, wherein according to the GTP protocol the source address in the IP header should be the address of the general GGSN's Gn port C and the destination address should be the address of the PPS&PROXY GGSN's Gn port B; the Create PDP Context Request Response message contains two information elements: "GGSN Address for signaling" and "GGSN Address for user traffic", which represent the GGSN signaling address and the traffic address for the PDP context, respectively; the value is the address of the general GGSN's Gn port C; the key information in the message is as follows:

IP header: C->B

GGSN Address for signalling: C

25 GGSN Address for user traffic: C

5. PPS&PROXY GGSN receives the Create PDP Context Request Response message:

30 After receiving the Create PDP Context Request Response message, PPS&PROXY GGSN forwards it to the SGSN, with the source address in the IP header as the address of PPS&PROXY GGSN's Gn port B and the destination address as the address of the SGSN's Gn port A; PPS&PROXY GGSN neither cares about the content in the Create PDP Context Request Response message, nor modifies the content. If the Create activation is successful, the Create

PDP Context Request Response message will contain two information elements: "GGSN Address for signaling" and "GGSN Address for user traffic", which represent the GGSN signaling address and the traffic address for the PDP context, respectively; the value is still the address of the general GGSN's Gn port C; the key information in the message is as follows:

IP header: B->A

GGSN Address for signalling: C

GGSN Address for user traffic: C

6. SGSN receives the Create PDP Context Request Response message:

SGSN will create a PDP context; according to GTP protocol, the SGSN address in the PDP context should be the address A designated by itself, the GGSN signaling address should be the information element "GGSN Address for signaling" C carried in the Create PDP Context Request Response message, and the GGSN traffic address is the information element "GGSN Address for user traffic" C carried in the message.

A pair of PDP contexts is thus created between the SGSN and the general GGSN (wherein the SGSN address is A, the GGSN address is C), equivalent to a logical channel for GTP message transmission between A and C; subsequent GTP signaling messages and GTP data packets will be exchanged between the SGSN and the general GGSN, with the PPS&PROXY GGSN excluded.

7. SGSN returns an Activate PDP Context Accept message to MS, so that the mobile phone subscriber can use GPRS service.

The present invention can well solve the problem by the solution above that the operators upgrade quickly their intelligent GPRS network and can fully protect traditional investments of the operators to improve the utility of networks.

The above description is only one better embodiment of the present invention, but the claimed scope of the present invention is not limited to these; those skilled in the art can

readily devise to make modifications or alternatives to the
embodiment within the disclosure in the present invention
without departing from the claimed scope of the present
invention. Therefore, the protection scope of the present
5 invention should be defined in the claims.

CLAIMS

1. A method for supporting General Packet Radio Service (GPRS) Customized Applications for Mobile network Enhanced Logic (CAMEL) service, wherein an external network environment
5 comprises a GGSN (Gateway GPRS Supporting Node), an intelligent GGSN and a SGSN (Serving GPRS Supporting Node), comprises: sending a Create PDP Context Request message from a subscriber to the intelligent GGSN first, and determining whether said Create PDP Context Request is an activation from a GPRS CAMEL
10 subscriber according to a GPRS CAMEL Service triggering rule; if so, the intelligent GGSN processing said request; otherwise forwarding said Create PDP Context Request to the general GGSN to process.

2. The method for supporting GPRS CAMEL services according
15 to claim 1, wherein said GPRS CAMEL Service triggering rule is a rule used to determine whether the subscriber sending the Create PDP Context Request message is a GPRS CAMEL subscriber.

3. The method for supporting GPRS CAMEL services according to claim 1 or 2, wherein said step of sending a Create PDP Context
20 Request message from a subscriber to the intelligent GGSN first is achieved by modifying the service data in DNS (Domain Name Server) so that the GGSN addresses parsed from one and the same APN (Access Point Name) are the intelligent GGSN addresses.

4. The method for supporting GPRS CAMEL services according
25 to claim 3, wherein said Create PDP Context Request message sent from the intelligent GGSN to the general GGSN is a GTP-compliant Create PDP Context Request message.

5. The method for supporting GPRS CAMEL services according to claim 3, wherein a Create PDP Context Response message
30 returned from the general GGSN after the successful activation can be accepted by SGSN.

6. The method for supporting GPRS CAMEL services according

to claim 3, wherein the intelligent GGSN forwards only Create PDP Context signaling messages from general subscribers.