

# GPRS

(General Packet Radio Service)

## GPRS Processes

- **GPRS Attach Process**
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## GPRS Processes

This section describes the following basic processes used in GPRS networks:

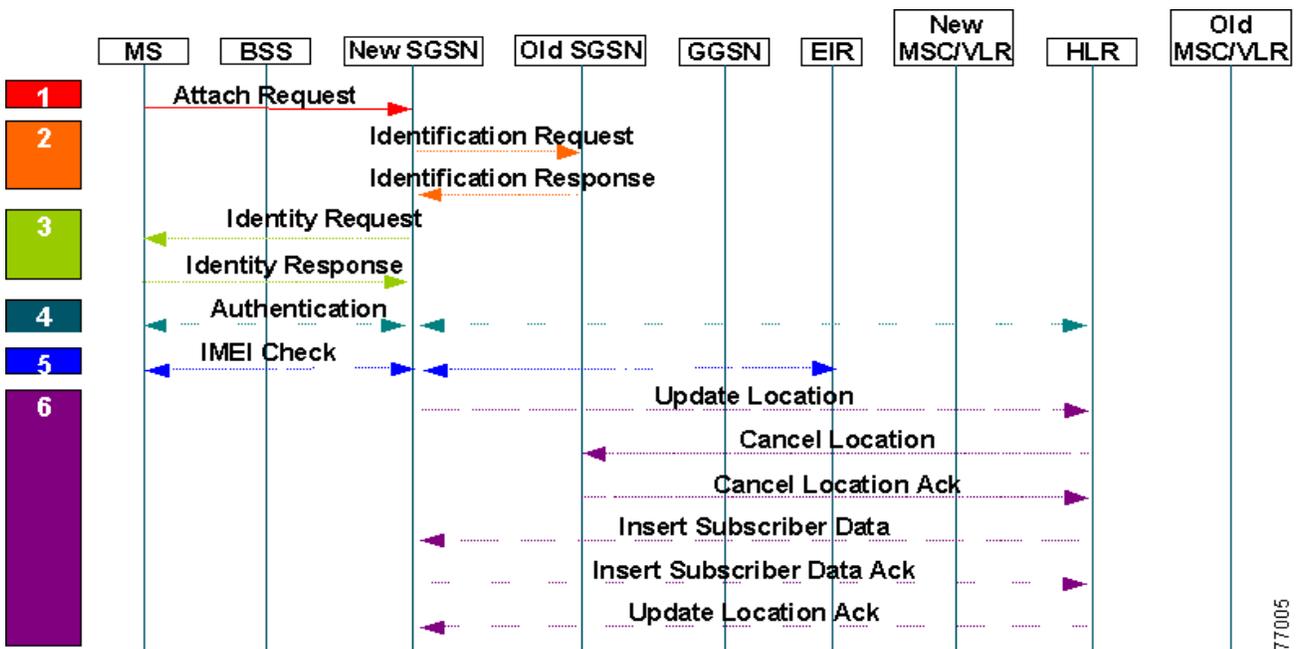
- Attach process—Process by which the MS *attaches* (i.e, connects) to the SGSN in a GPRS network
- Authentication process—Process by which the SGSN authenticates the mobile subscriber
- PDP activation process—Process by which a user session is established between the MS and the destination network
- Detach process—Process by which the MS *detaches* (i.e., disconnects) from the SGSN in the GPRS network
- Network-initiated PDP request for static IP address—Process by which a call from the packet data network reaches the MS using a static IP address
- Network-initiated PDP request for dynamic IP address—Process by which a call from the packet data network reaches the MS using a dynamic IP address

### GPRS Attach Process

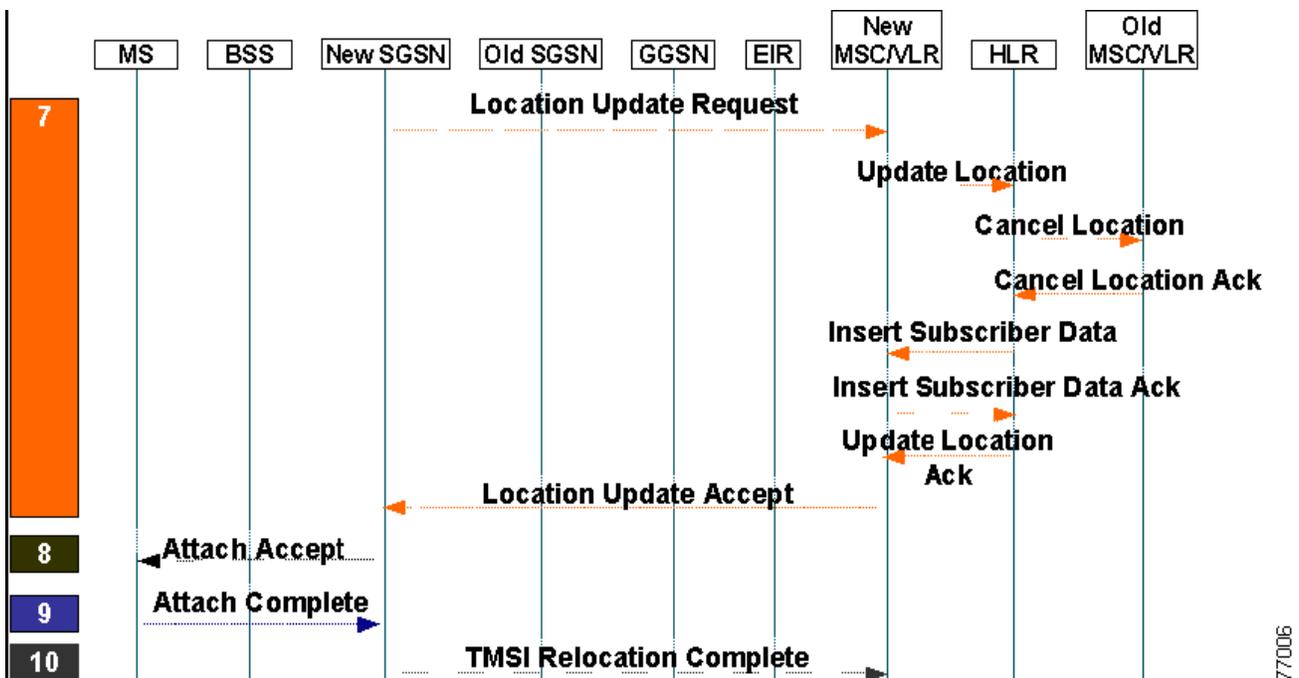
When a mobile subscriber turns on their handset, the following actions occur:

1. A handset attach request is sent to the new SGSN.
2. The new SGSN queries the old SGSN for the identity of this handset. The old SGSN responds with the identity of the handset.
3. The new SGSN requests more information from the MS. This information is used to authenticate the MS to the new SGSN.
4. The authentication process continues to the HLR. The HLR acts like a RADIUS server using a handset-level authentication based on IMSI and similar to the CHAP authentication process in PPP.
5. A check of the equipment ID with the EIR is initiated.
6. If the equipment ID is valid, the new SGSN sends a location update to the HLR indicating the change of location to a new SGSN. The HLR notifies the old SGSN to cancel the location process for this MS. The HLR sends an insert subscriber data request and other information associated with this mobile system and notifies the new SGSN that the update location has been performed.
7. The new SGSN initiates a location update request to the VLR. The VLR acts like a proxy RADIUS that queries the home HLR.
8. The new SGSN sends the Attach Accept message to the MS.
9. The MS sends the Attach Complete message to the new SGSN.
10. The new SGSN notifies the new VLR that the relocation process is complete.

**GPRS Attach Request Procedure**



**GPRS Attach Request Procedure (continued)**

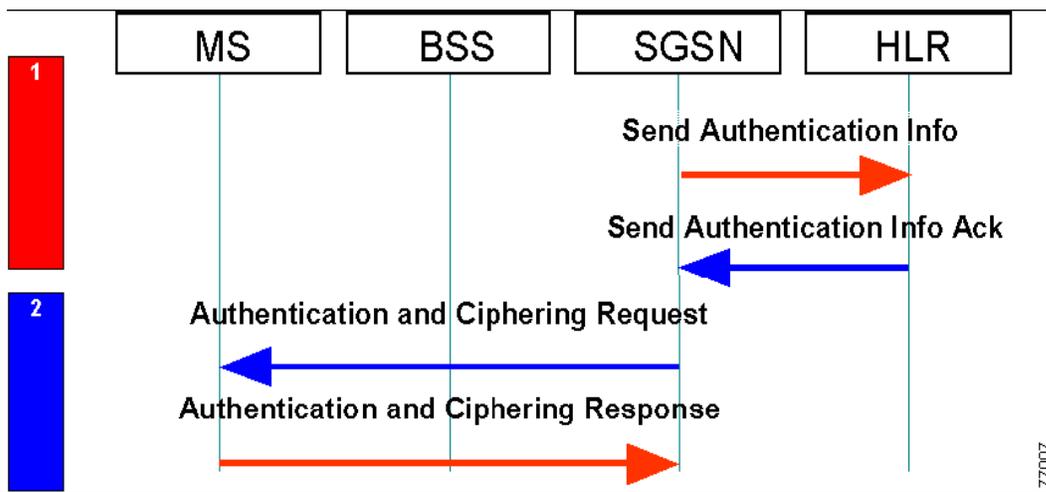


### GPRS Authentication Process

The GPRS authentication process is very similar to the CHAP with a RADIUS server. The authentication process follows these steps:

1. The SGSN sends the authentication information to the HLR. The HLR sends information back to the SGSN based on the user profile that was part of the user's initial setup.
2. The SGSN sends a request for authentication and ciphering (using a random key to encrypt information) to the MS. The MS uses an algorithm to send the user ID and password to the SGSN. Simultaneously, the SGSN uses the same algorithm and compares the result. If a match occurs, the SGSN authenticates the user.

### GPRS Authentication Procedure



### PDP Context Activation Process

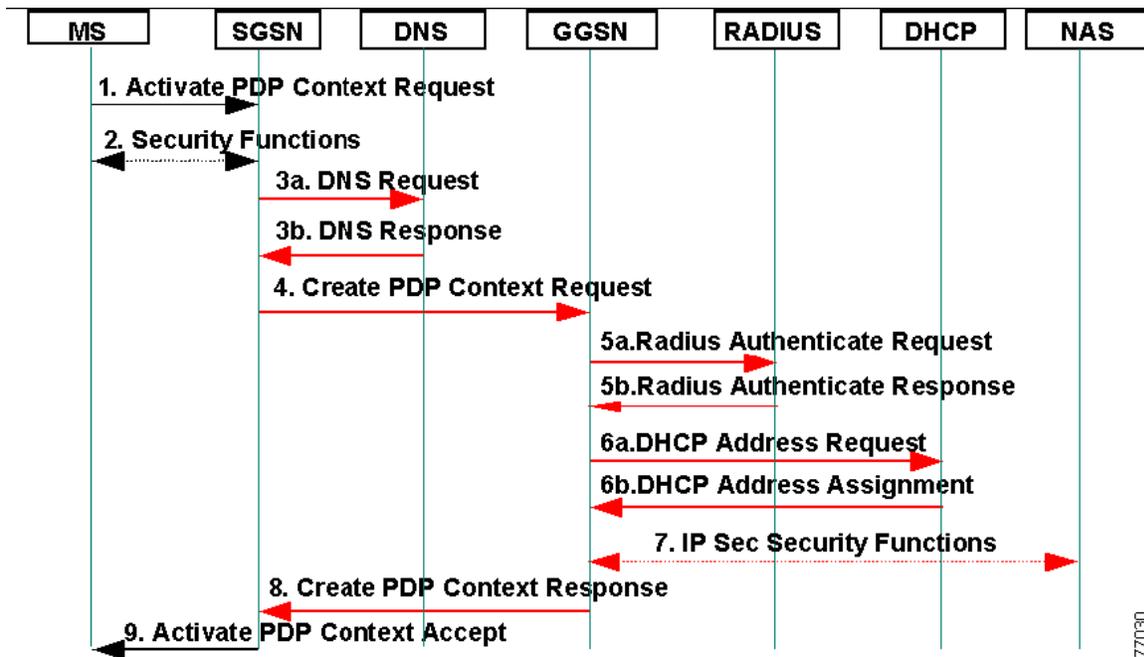
The events in the PDP context activation process are described next.

1. The SGSN receives the activation request from the MS; for example, the MS requests access to the APN *Cisco.com*.
2. Security functions between the MS and SGSN occur.
3. The SGSN initiates a DNS query to learn which GGSN node has access to the *Cisco.com* APN. The DNS query is sent to the DNS server within the mobile operator's network. The DNS is configured to map to one or more GGSN nodes. Based on the APN, the mapped GGSN can access the requested network.
4. The SGSN sends a Create PDP Context Request to the GGSN. This message contains the PAP information, CHAP information, PDP request, APN, and quality of service information.
5. If operating in the non-transparent mode, the PAP and CHAP information in the PDP request packet is sent to the RADIUS server for authentication.

## GPRS Process

6. If the RADIUS server is to provide a dynamic IP address to the client, it sends a DHCP address request to the DHCP server. In transparent mode, the RADIUS server is bypassed.
7. If IPsec functionality is required, security functions occur between the GGSN and network access server (NAS).
8. The GGSN sends a Create a PDP Context Response message to the SGSN.
9. The SGSN sends an Activate PDP Context Accept message to the MS.

### *PDP Context Activation Procedure*



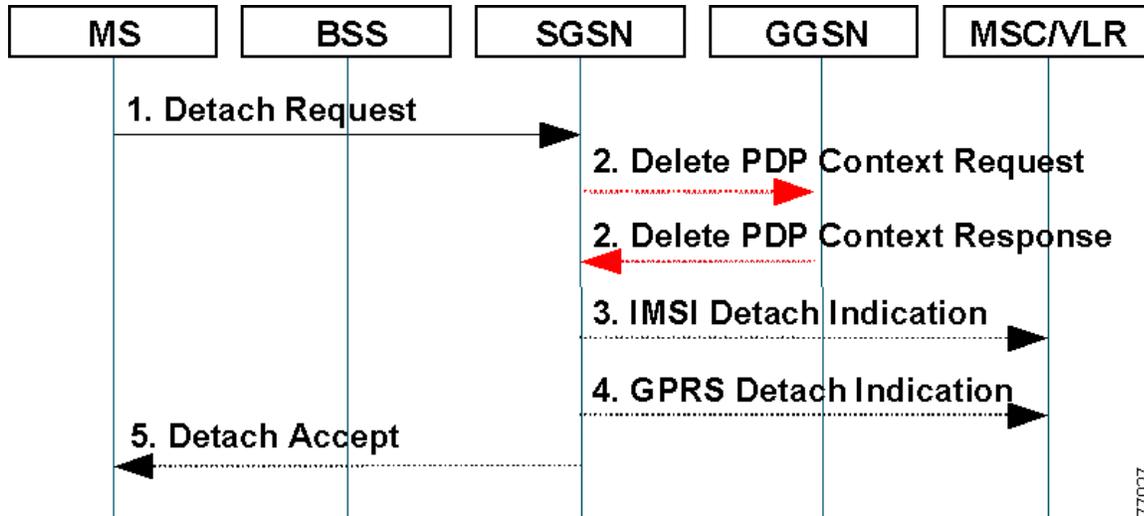
### **Detach Process Initiated by MS**

When a mobile subscriber turns off their handset, the detach process initiates. The detach process is described below.

1. The MS sends a Detach Request to the SGSN.
2. The SGSN sends a Delete PDP Context Request message to the serving GGSN.
3. The SGSN sends an IMSI Detach Indication message to the MSC/VLR indicating the MS request to disconnect.
4. The SGSN sends a GPRS Detach Indication message to the MSC/VLR.
5. The SGSN sends the Detach Accept message to the MS.

**Note** The GSN nodes must always respond to the detach request with a positive delete response to the MS and accept the detach request requested by the client. The positive delete response is required even if the SGSN does not have a connection pending for that client.

**MS Initiate Detach Procedure**



**Network Initiated PDP Request For A Static IP Address**

The PDP protocol data unit (PDU) initiated from the network side is not fully specified by ETSI standards. A connection request generated from the Internet/intranet site specifies only the IP address of the client in the IP packets destined for the MS. The requesting host provides no indication of the mobile device IMSI (i.e., the MAC address of the MS). In mobile communications, all communications are based on the MS MAC address called the IMSI. The IP address must be mapped to an IMSI to identify a valid GTP tunnel. Cisco’s GGSN implementation provides a mapping table via command line interface (CLI) that allows the operator to key in the MS IMSI and the associated static IP address.

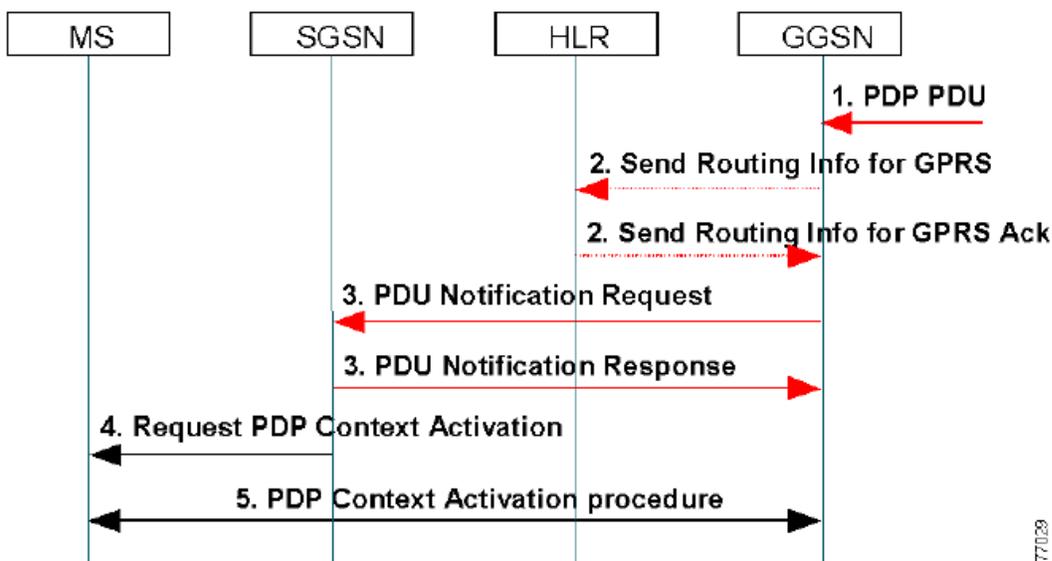
The following steps describe a PDP request initiated from the network side when the client has been assigned a static IP address.

1. When the GGSN receives a packet, it checks its mapping table for an established GTP tunnel for this packet.
2. When the GGSN locates the IMSI associated with this IP address, it sends a Send Routing Information message to HLR through an intermediate SGSN. The intermediate SGSN notifies the GGSN of the actual SGSN currently serving this client.
3. On locating the appropriate SGSN, the GGSN sends a PDU Notification Request message to the serving SGSN.

## GPRS Process

4. The SGSN sends a Request PDP Context Activation message to the MS and notifies it of the pending connection request.
5. If the MS agrees to accept the call, it enters the PDP Context Activation procedure with the requesting GGSN.

### Network Initiate PDP (Static IP Address)



### Network Initiated PDP Request For A Dynamic IP Address

The ETSI standards do not fully specify requirements for a network-generated PDP request when the client is dynamically assigned a temporary IP by a DHCP server. The following message sequence is Cisco's implementation for this scenario. This method uses Cisco's Network Registrar (CNR), which includes a DHCP, DNS, and an LDAP server.

1. The host initiates a DNS query to obtain the IP address of the MS from a DNS server. The DNS server resolves the client's name to an IP address previously assigned to the client by the DHCP server.
2. The host sends a request to the GGSN for a connection using this IP address.
3. The GGSN queries the LDAP server to obtain the MS IMSI. The LDAP server stores a record for the MS with the client IMSI, name, and IP address.
4. The GGSN sends a PDU Notification Request message to the serving SGSN.
5. The SGSN sends a Request PDP Context Activation message to the MS and notifies it of the pending connection request.
6. If the MS agrees to accept the call, it enters the PDP Context Activation procedure with the requesting GGSN.

*Network Initiate PDP (Dynamic IP Address)*

