SGSN in a 2.5G GPRS Network

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This chapter outlines the basic configuration and operation of the Serving GPRS Support Node (SGSN) in 2.5G GPRS wireless data networks.

The simplest configuration that can be implemented on the system to support SGSN functionality in a 2.5G network requires one context but we recommend a minimum of two: one for the SGSN service (required) and another for the charging context.

The service context organizes the following:

- GPRS service configuration
- MAP (Mobile Application Part) configuration
- DNS (Domain Naming System) configuration for resolution of APN (Access Point Name) domain names
- SGTP (SGSN GPRS Tunneling Protocol) configuration

The charging context facilitates the following:

- Configuration of connectivity to the CGF (Charging Gateway Function)

The following functionality is configured at the global or system level in the local management context:

- NSEI (Network Service Entity Identity) configuration
- SCCP (Signalling Connection Control Part) network configuration
- SS7 (Signaling System 7) connectivity configuration
- GTT (Global Title Translation) configuration

To simplify configuration management, more contexts can be created to categorize the service configuration. Each context can be named as needed. The contexts listed above can be configured as illustrated in the figure on the next page.

2.5G SGSN Configuration Components

In order to support 2.5G SGSN functionality, the system must be configured with at least one context for the GPRS service (2.5G SGSN service). In the example below, the required context has been named "SGSN_Ctx".

Figure 1: Sample 2.5G SGSN Configuration
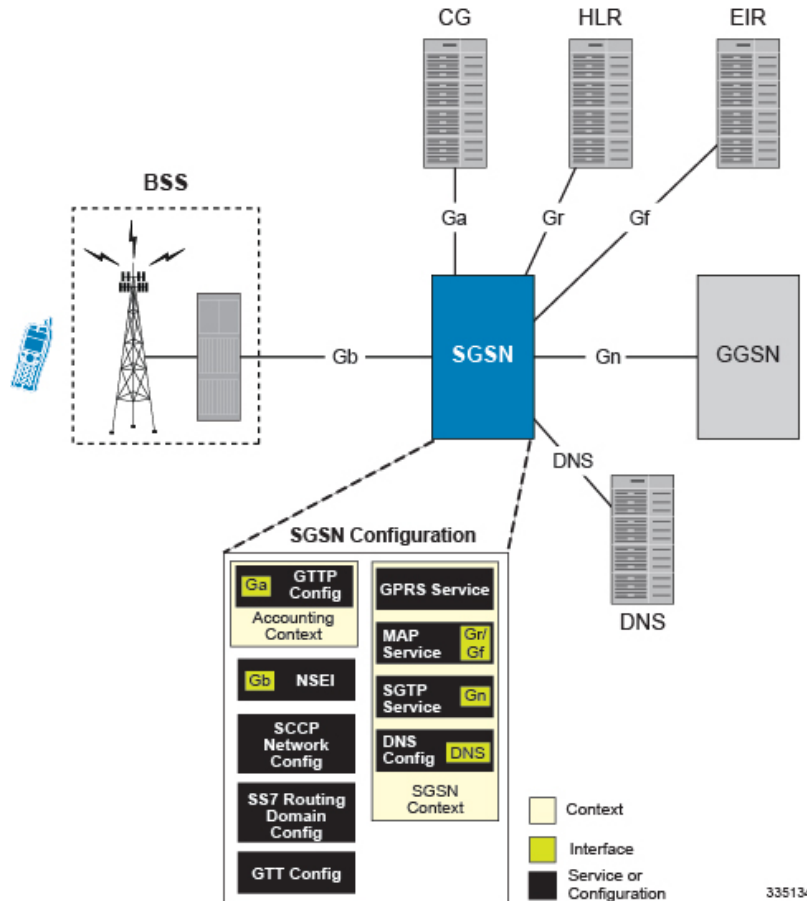
The SGSN_Ctx

As indicated, there must be at least one context to contain the service and routing configurations.

Although multiple context can be created, our example configuration uses only one context, named "SGSN_Ctx", to contain all of the following configurations:

- **SS7 Routing Domain** - SS7 routing is facilitated through the configuration and use of SS7 routing domains. SS7 routing domains group SS7-related configuration parameters. Depending on the SS7 signalling method, an SS7 routing domain may be configured with one of the following:

  - **Linksets** - Used for broadband SS7 signalling, linksets are comprised of link ids that specify point codes for SCCP endpoints. It is important to note that SCCP endpoints are further defined through the configuration of SCCP Networks which are associated with the SS7 routing domain in which the linkset is configured.

- **Application Server Processes (ASPs) / Peer Server Processes (PSPs)** - Used for IP (SIGTRAN), M3UA ASPs and PSPs dictate the IP address and port information used to facilitate communication between network endpoints. ASPs refer to the local endpoints.

- **GTT** - Global Title Translation (GTT) configuration consists of defining GTT associations, defining GTT address maps, and referring to these in an SCCP network configuration.The GTT Associations define GTT rules. The GTT Address Maps define a GTT database. These are configured in the Global Configuration mode and are available to all SCCP networks configured in the system.
- **SCCP Network** - SCCP (Signalling Connection Control Part) networks are a concept specific to this platform. SCCP networks apply only to SS7 applications using SCCP. The purpose of an SCCP network is to isolate the higher protocol layers above SCCP and the application itself from SS7 connectivity issues, as well as, to provide a place for global SCCP configuration specific to SGSN services. Use the following example configuration to specify a global SCCP configuration specific to SGSN services.
- **MAP Service** - The Mobile Application Part (MAP) is an SS7 protocol which provides an application layer for the various nodes in GSM and UMTS mobile core networks and GPRS core networks to communicate with each other in order to provide services to mobile phone users. MAP is the application-layer protocol used to access the Home Location Register (HLR), Visitor Location Register (VLR), Mobile Switching Center (MSC), Equipment Identity Register (EIR), Authentication Center (AUC), Short Message Service Center (SMSC) and Serving GPRS Support Node (SGSN).

The primary facilities provided by MAP are:

- Mobility Services: location management (when subscribers move within or between networks), authentication, managing service subscription information, fault recovery.
- Operation and Maintenance: subscriber tracing, retrieving a subscriber's IMSI.
- Call Handling: routing, managing calls while roaming, checking that a subscriber is available to receive calls.
- Supplementary Services.
- SMS
- Packet Data Protocol (PDP) services for GPRS: providing routing information for GPRS connections.
- Location Service Management Services: obtaining the location of subscribers.

- **SGTP Service**- The SGSN GPRS Tunneling Protocol (GTP) service specifies the GTP settings for the SGSN. At a bare minimum, an address to use for GTP-C (Control signaling) and an address for GTP-U (User data) must be configured.
- **GPRS Service**- All of the parameters needed for the system to perform as a an SGSN in a GPRS network are configured in the GPRS service. The GPRS service uses other configurations such as SGTP and MAP to communicate with other network entities and setup communications between the BSS and the GGSN.
- **NSEI** (Network Service Entity Instance)- This identifies the NSEI to use and associates it with a Network Service Virtual Connection Identifier.
- **DNS**- DNS Client configurations provide DNS configuration in a context to resolve APN domain names.

The Accounting_Ctx

If no context is defined for GTPP configuration, the SGSN automatically generates an accounting context with default GTPP configurations. The context, from our example, contains the following configuration:

- **GTPP Configuration** - This configuration specifies how to connect to the GTPP charging servers.
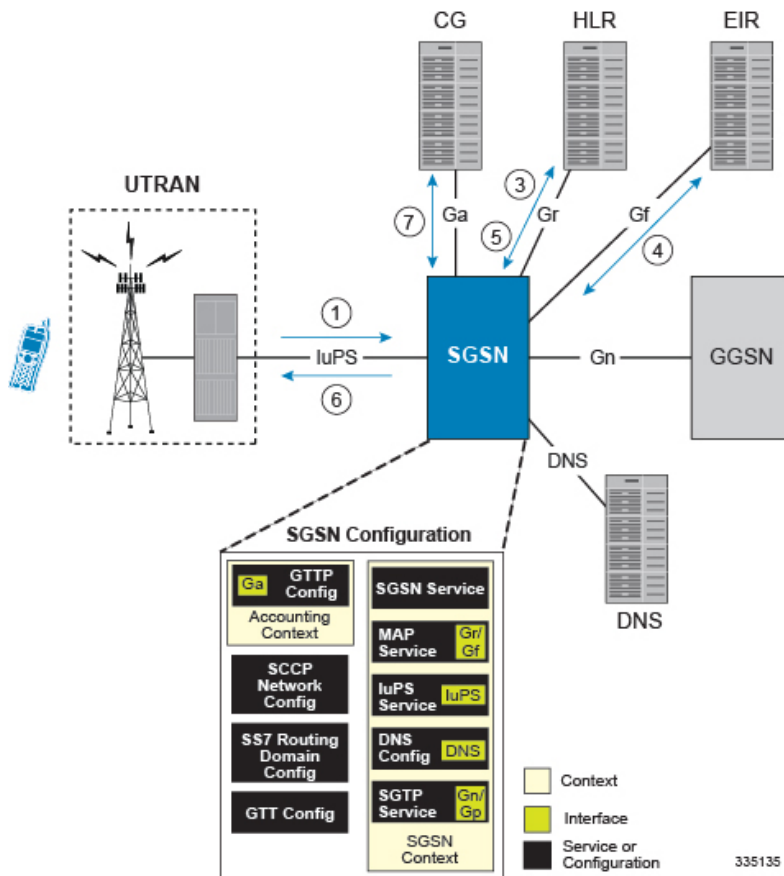- **Ga Interface** - This is an IP interface.

How the 2.5G SGSN Works

In compliance with 3GPP specifications, the 2.5G SGSN supports standard operational procedures such as: attach, detach, PDP activation.

For GPRS and/or IMSI Attach

The following illustrates the step-by-step call flow indicating how the 2.5G SGSN handles a GPRS/IMSI attach procedure.

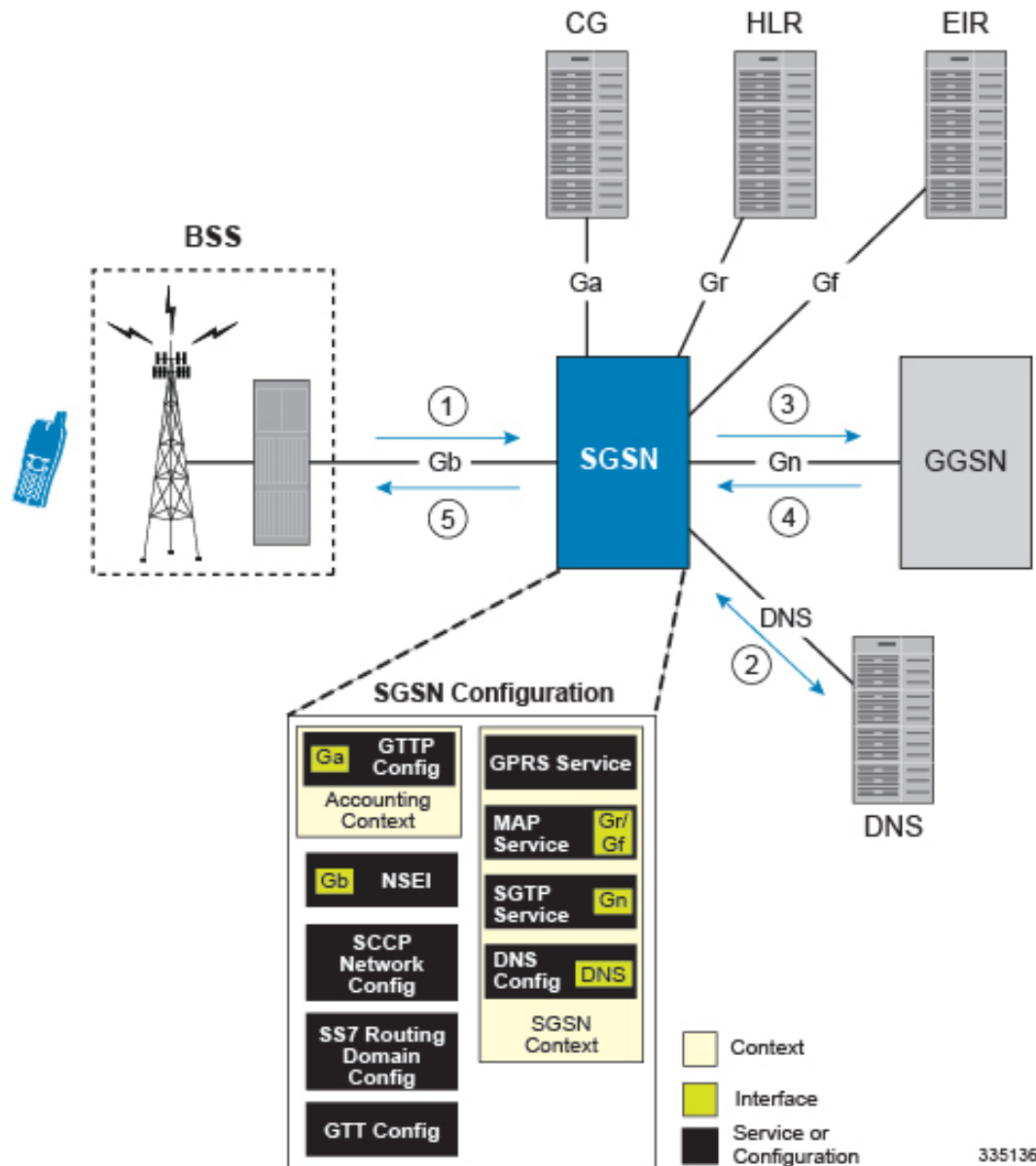**Figure 2: GPRS/IMSI Attach Procedure**

1. An Attach Request message is sent from the UE to the SGSN by the BSS over the Gb interface. This is Typically a Frame Relay connection.
2. The SGSN identifies UE and determines IMSI. Depending on whether or not the UE is already attached, this could be a simple database lookup or it could require the SGSN to communicate with an SGSN that may have been previously handling the call.
3. The SGSN communicates with the HLR to authenticate the UE.
4. Once the UE has been authenticated, the SGSN communicates with the EIR to verify that the equipment is not stolen.

5. Once equipment check is complete, the SGSN communicates with the HLR to update UE location information.
6. The SGSN then sends an Attach Complete message to UE.
7. SGSN begins sending M-CDR data to the CG.

For PDP Activation

The following provides a step-by-step illustration indicating how the 2.5G SGSN handles a PDP activation procedure.

Figure 3: PDP Activation Procedure

1. A PDP Activation Request message is sent from the UE to the SGSN by the BSS over the Gb interface. This request includes the Access Point Name (APN) the UE is attempting to connect to. This is typically a Frame relay connection.
2. The SGSN queries the DNS server to resolve the APN to the IP address of the GGSN to use to establish the PDP context.
3. The SGSN sends a Create PDP Context Request message to the GGSN. This message identifies the APN the UE is attempting to connect to and other information about the subscriber.
4. The GGSN performs its processes for establishing the PDP context. This may include subscriber authentication, service provisioning, etc. The GGSN eventually sends an affirmative create PDP context response to the SGSN containing the IP address assigned to the UE.
5. The SGSN sends an Activate PDP Context Accept message back to the UE. The subscriber can now begin sending/receiving data.
6. The SGSN begins generating S-CDR data that will be sent to the CG.

Information Required for the 2.5G SGSN

This section describes the minimum amount of information required to configure the SGSN to be operational in a 2.5G GPRS network. To make the process more efficient, we recommend that this information be collected and available prior to configuring the system.

There are additional configuration parameters that deal with fine-tuning the operation of the SGSN in the network. Information on these parameters is not provided here but can be found in the appropriate configuration command chapters in the *Command Line Interface Reference*.

Global Configuration

Table 1: Required Information for Global Configuration

Required Information	Description
NSEI (Network Service Entity)	
NSVL Instance ID	A unique ID number to identify the NSVL instance
Peer Network Service Entity	The name or NSEI index number of a peer NSE.
SS7 Routing Domain For Broadband SS7 Signaling	
SS7 Routing Domain ID	A unique ID number from 1 through 12 to identify the SS7 Routing Domain.
SS7 Routing Domain Variant	The network variant for the SS7 Routing Domain.
Sub Service Field	The Sub Service Field selector that this SS7 Routing Domain should use.
Linkset ID	A unique ID number from 1 through 49 to identify the linkset.
Linkset Self Point Code	A point code for the specified network variant that will identify the system when using this linkset.

Required Information	Description
Adjacent Point Code	The pointcode of the entity that the system will use to communicate for SS7 signaling when this linkset is used.
Link ID	A unique ID number from 1 through 16 that identitfies the MTP3 link.
Priority	An MTP3 priority number from 0 through 15 for the link.
Signaling Link Code	A number from 0 through 15 that is unique from all other SLCs in the linkset.
Arbitration	Whether the link will use passive or active arbitration.
SS7 Routing Domain to Support IP SS7 Signaling for SIGTRAN	
SS7 Routing Domain ID	A unique ID number from 1 through 12 to identify the SS7 Routing Domain.
SS7 Routing Domain Variant	The network variant for the SS7 Routing Domain.
Sub Service Field	The Sub Service Field selector that this SS7 Routing Domain should use.
ASP Instance ID	A unique ID number from 1 through 4 to use for the M3UA ASP instance.
ASP Instance Endpoint	The IP address and Port if needed of an interface that will be used as this ASP instance end point. If the interface was created in a context other than the current context, that context name is also needed.
Peer Server ID	A unique ID number from 1 through 49 to use for the M3UA peer server configuration.
Peer Server Name	A name for the Peer Server configuration. Usually this is the name of the SS7 network entity that this instance is configured to communicate with. HLR, VLR, or EIR for example.
Routing Context ID	The ID of the M3UA routing context used to reach this peer server.
Peer Server Process ID	A unique number from 1 through 4 used to identify each PSP process for the current peer server.
Peer server self-point-code	The point code to identify the peer server process being configured.
PSP Mode	Specify whether this peer server process will be used to communicate with the peer server in client or server mode.
Exchange Mode	Specify whether this peer server process will use double or single-ended mode for exchanges with the peer server.

Required Information	Description
SCTP End Point Address	A local SCTP end point address configured in an ASP instance that this peer server process will use.
ASP Association	The ID of a configured ASP instance that this peer server process will be associated with.
GTT	
GTT Association	There are many different ways to configure a GTT Association and the needs of every network are different. Please refer to the Global Title Translation Association Configuration Mode chapter in the Command Line Interface Reference for the commands available.
GTT Address Map	There are many different ways to configure a GTT Address Map and the needs of every network are different. Please refer to the Global Title Translation Address Map Configuration Mode chapter in the Command Line Interface Reference for the commands available.
SCCP Network	
SCCP Network ID	A unique number from 1 through 12 with which to identify the SCCP configuration.
SCCP Variant	The network variant for the SCCP network configuration.
Self Point Code	The point code that the system will use to identify itself when using this SCCP configuration.
SS7 Routing Domain Association	The ID number of the SS7 routing Domain with which to associate this SCCP network configuration.
GTT Association	The ID number of the GTT Association to use with this SCCP network configuration.
GTT Address Map	The ID number of the GTT Address Map to use with this SCCP network configuration.
SCCP Destination	The point code, version, and susbsystem number of the SCCP entity with which to communicate.

SGSN Context Configuration

Table 2: Required Information for SGSN Context Configuration

Required Information	Description
SGSN context name	An identification string from 1 to 79 characters (alpha and/or numeric) by which the SGSN context will be recognized by the system.

Required Information	Description
MAP service Configuration	
MAP Service name	A unique name with which to identify an individual MAP service.
SCCP Network ID	The ID of the SCCP network configuration to use for SS7 connectivity for SCCP applications.
EIR Address	The ISDN or point code of the EIR.
HLR Mapping	The IMSI prefixes and associated HLR point codes and the point code for the default HLR.
SGTP Service	
SGTP Service Name	A unique alpha and /or numeric name for the SGTP service configuration.
GTPC Address	An IP address that is associated with an interface in the current context. This is used for GTP-C.
GTPU Address	An IP address that is associated with an interface in the current context. This is used for GTP-U.
GPRS Service	
GPRS Service Name	a unique name to identify this GPRS service.
PLMN ID	The MCC and MNC for the SGSN service to use to identify itself in the PLMN.
Core Network ID	The core Network ID for this SGSN service to use to identify itself on the core network.
SGSN Number	The E.164 number to use to identify this SGSN.
MAP Service Name	The name of a MAP service that this SGSN service will use for MAP. If the MAP service is not in the same context, the context name of the MAP service must also be specified.
Network Service Entity Identifier	The ID of a configured Network Service Entity Identifier (NSEI) and the RAC and LAC that this SGSN should use.
DNS Client	
Name Server Addresses	The IP addressees of Domain Naming Servers i n the network.
DNS CLient Name	A unique name for the DNS client.
DNS Client Address	The IP address of an Interface in the current context that the DNS is bound to.

Accounting Context Configuration

Table 3: Required Information for Accounting Context Configuration

Required Information	Description
Context name	An identification string from 1 to 79 alphanumeric characters by which the SGSN context will be recognized by the system. Our example uses the name Accounting_Ctx.
GTPP Charging	
GTTP Group Name	If you are going to configure GTTP accounting server groups, you will need to name them.
Charging Agent Address	The IP address of an interface in the current context that to use for the Ga interface to communicate with the CGFs.
GTTP Server	The IP address and priority to use to contact the GTTP server.
GTTP Dictionary Name	The name of the GTTP dictionary to use.