S4-SGSN Suspend-Resume Feature

This chapter describes the S4-SGSN Suspend/Resume feature.

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Feature Description

The S4-SGSN Suspend/Resume feature provides support for suspend/resume procedures from the BSS and a peer S4-SGSN.

When a UE is in a 2G coverage area wants to make a circuit switched voice call but the Class A mode of operation is not supported by the network, then the packet switched data session (PDP contexts) must be suspended before the voice call can be made. In this case, the BSS sends a Suspend Request to the SGSN. If the UE is already attached at that SGSN then the suspend request is handled via an intra-SGSN suspend/resume procedure. If the UE is not attached at the SGSN then the Suspend Request is forwarded to a peer SGSN/MME through GTPv2 and an inter-SGSN/SGSN-MME suspend procedure occurs. Once the UE completes the voice call, either the BSS sends a resume request to resume the suspended PDPs or the UE directly sends a Routing Area Update Request (RAU) in 2G which will be treated as an implicit resume.

The ability for a GPRS user to access circuit-switched services depends on the subscription held, the network capabilities, and the MS capabilities.

Suspension of GPRS Services

The MS sends a request to the network for the suspension of GPRS services when the MS or the network limitations make it unable to communicate on GPRS channels in one or more of the following scenarios:

1. A GPRS-attached MS enters dedicated mode and the support of the Class A mode of operation is not possible (for example, the MS only supports DTM and the network only supports independent CS and PS).
2. During CS connection, the MS performs a handover from Iu mode to A/Gb mode, and the MS or the network limitations make it unable to support CS/PS mode of operation, (for example, an MS in CS/PS mode of operation in Iu mode during a CS connection reverts to class-B mode of operation in A/Gb mode).
3. When an MS in class A mode of operation is handed over to a cell where the support of Class A mode of operation is not possible (for example, a DTM mobile station entering a cell that does not support DTM).

Relationships to Other Features

One of the following configurations must exist on the SGSN for the Suspend Resume feature to work properly on the S4-SGSN:

- 2G SGSN Service + S4-SGSN Support
- 3G SGSN Service + S4-SGSN Support
- 2G SGSN Service + 3G SGSN Service + S4-SGSN Support

Configuration procedures for the above deployments are available in this guide.

How it Works

S4-SGSN Suspend-Resume Feature

When a UE wants to make or receive a voice call via a GERAN circuit switched domain, and if the UE/BSS doesn't support DTM mode, then the BSS sends a Suspend Request to the SGSN to suspend any packet data transmission. This suspend request can be received on the same SGSN where a subscriber is already attached, or it can be received on an SGSN where the subscriber is not yet attached.

SGSN where subscriber is attached: The SGSN initiates an intra-SGSN suspend procedure and will have to suspend the data transmission all the way up to the PGW by sending a Suspend Request to the SGW/PGW. When the UE completes the CS call, it will resume the packet transmission. The BSS will send a Resume request in this case.

SGSN where subscriber is not yet attached: The SGSN initiates an inter-SGSN suspend procedure by sending a GTPv2 / GTPv1 Suspend Request to the peer SGSN/MME. The peer node will suspend the data transmission. When the UE completes the CS call, it may directly send a Routing Area Update request to the 2G SGSN to handover the packet switched contexts. The 2G SGSN will do a Context Request / Context Response / Context Ack procedure with the peer node and will send a Create Session Request (if SGW relocation occurs) or a Modify Bearer Request (if no SGW relocation occurs) to the SGW. The Modify Bearer Request at the PGW will be treated as an implicit Resume.

Limitations

The following are the known limitations for the S4-SGSN Suspend/Resume feature:

1. If a suspend request aborts an ongoing RAU triggered SGW relocation, the Create Session Request will be aborted and the PDN will be cleaned up. This is to avoid complexities in the state machine. If the system retained PDP, the system would have to recreate the tunnel towards the old SGW to PGW before sending the Suspend Notification. This would delay the Suspend procedure.
2. A Suspend Request from the default SGSN in a pool to the SGSN serving the NRI of the given PTMSI is not possible via the S16 interface due to a standards limitation. R10 specifications don't have a hop counter and UDP source port IEs in the Suspend Notification message and hence this limitation. This is corrected in R11 specifications. TheS4-SGSN will support this call flow only in later releases.
3. HSS initiated modification will be queued, if the Suspend preempts an HSS initiated modification while pending for an Update Bearer Request from the PGW. The queued procedure will be restarted in a subsequent procedure (RAU / Resume). Queued information will not be transferred to another RAT type, if a subsequent procedure changes the RAT type.

4. A Suspend Acknowledge with rejected cause will not be sent to the peer SGSN/MME when an inter-SGSN Suspend procedure is preempted by procedures such as RAU, Context Request, and Detach Request at the old SGSN. Suspend Acknowledge is not sent because it is very complex on the PMM-side to distinguish between two procedures as the PMM has the same state for both the inter-SGSN Suspend procedure and the inter-SGSN RAU procedure.

Call Flows

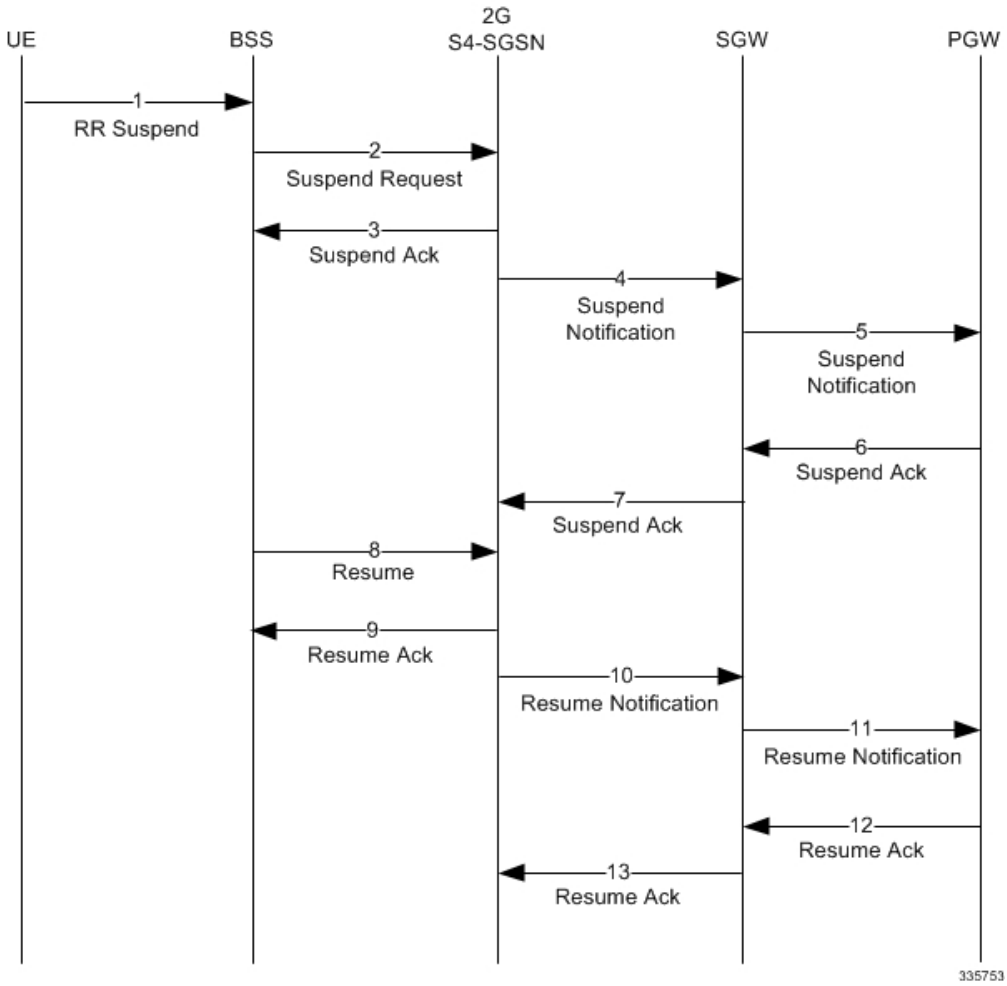
This section includes various diagrams that illustrate the Suspend/Resume call flow procedures, and the interface selection logic.

Intra-SGSN Suspend Procedure with Resume as the Subsequent Procedure

The intra-SGSN Suspend procedure with Resume as the subsequent procedure is illustrated in the following diagram.

- When a 2G SGSN receives a Suspend Request from the BSS and if the subscriber is already attached to the 2G SGSN, the PDPs shall be suspended. The SGSN then sends a Suspend Notification to the SGW, which subsequently is sent to the PGW to stop all data transmissions on non-GBR bearers.
- When a 2G SGSN receives a Resume Request from the BSS, and if the subscriber that is already suspended is attached to the 2G SGSN, the PDPs are resumed. The SGSN then sends a Resume Notification to the SGW, which subsequently is sent to the PGW to resume all data transmissions on non-GBR bearers.

Figure 1: Intra-SGSN Suspend Procedure with Resume as Subsequent Procedure

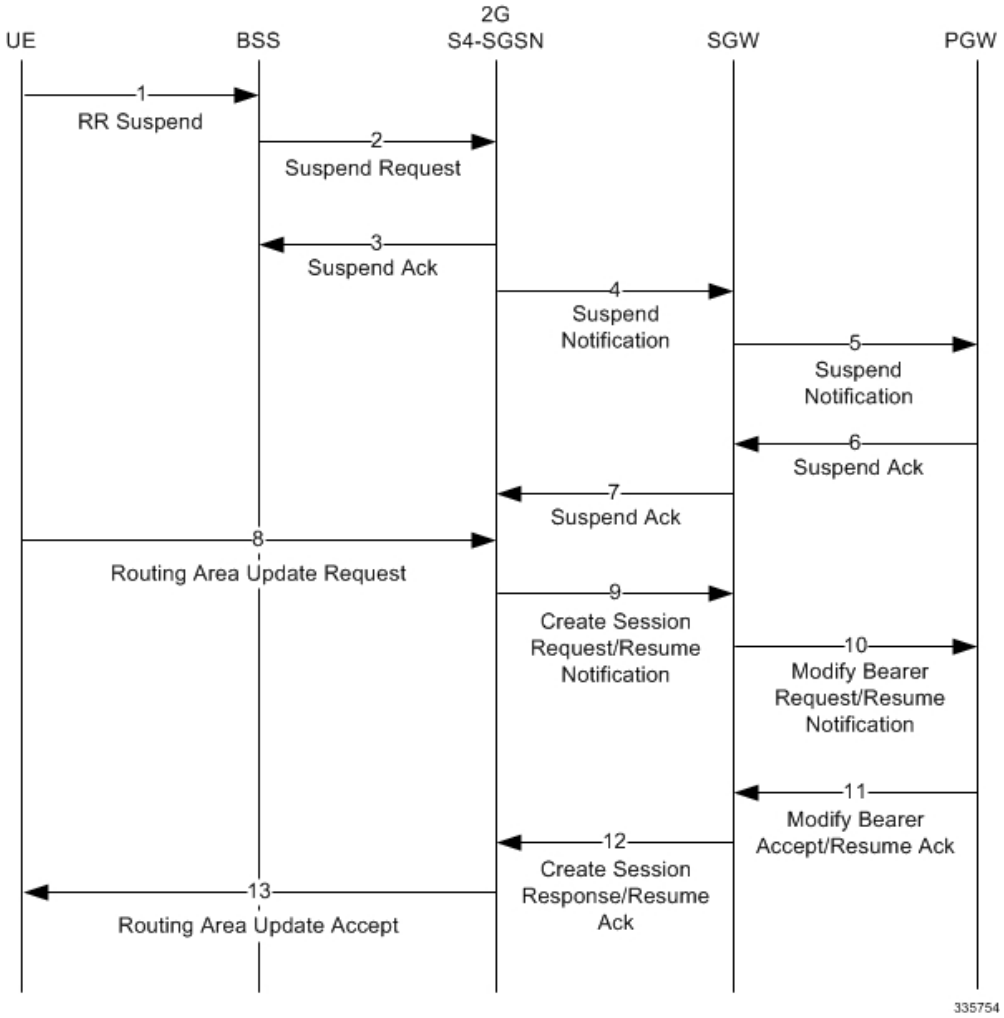


Intra-SGSN Suspend with Resume Procedure with Intra-RAU as Subsequent Procedure

An Intra-SGSN Suspend procedure call flow with an Intra-SGSN RAU procedure as the subsequent procedure is shown in the following illustration.

- If there is no SGW change for the RAU request, then the 2G-SGSN sends a Resume Notification to the SGW and the SGW then sends a Resume Notification to the PGW to resume all data transmissions.
- If there is a SGW change for the RAU request, then the 2G-SGSN sends a Create Session request to the SGW and the SGW sends a Modify Bearer Request to the PGW to resume all data transmissions.

Figure 2: Intra-SGSN Suspend Procedure with Intra-RAU as Subsequent Procedure

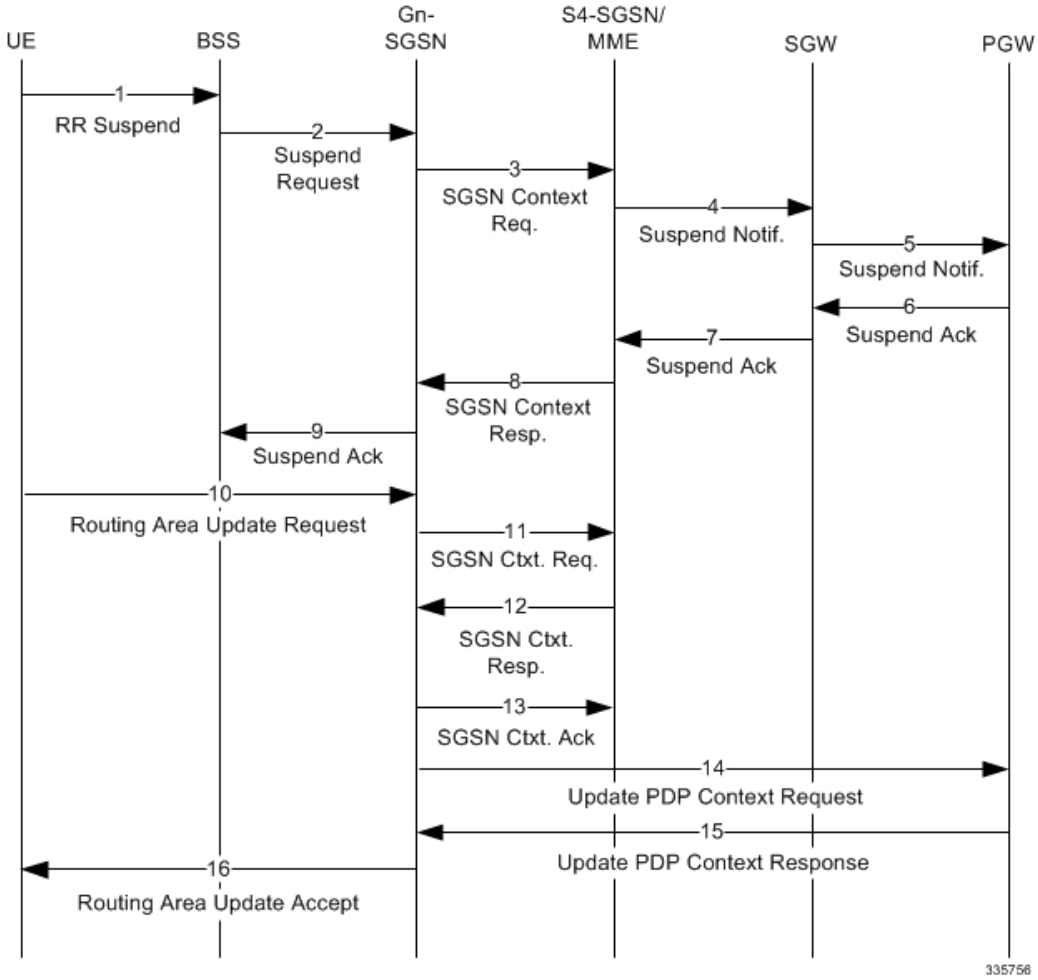


Inter-SGSN Suspend and Resume Procedure with Peer S4-SGSN/MME

The procedure for a new SGSN Suspend Request and Resume procedure with a peer S4-SGSN/MME is shown in the following diagram.

- When an S4-SGSN receives a Suspend Request from the BSS and if the subscriber is not attached to the 2G SGSN, the S4-SGSN will send a Suspend Notification to the peer S4-SGSN/MME.
- The new SGSN RAU is the Resume procedure after a new SGSN Suspend procedure has been completed. The SGSN sends a Create Session Request / Modify Bearer Request to the SGW which subsequently is sent to the PGW to resume all data transmissions on non-GBR bearers.
- When the Gn-SGSN receives a Suspend Request from the BSS and if the subscriber is not attached to the 2G SGSN, it sends a Suspend Notification to the peer Gn-SGSN / S4-SGSN/MME.

Figure 3: Inter-SGSN Suspend and Resume Procedure with Peer S4-SGSN/MME

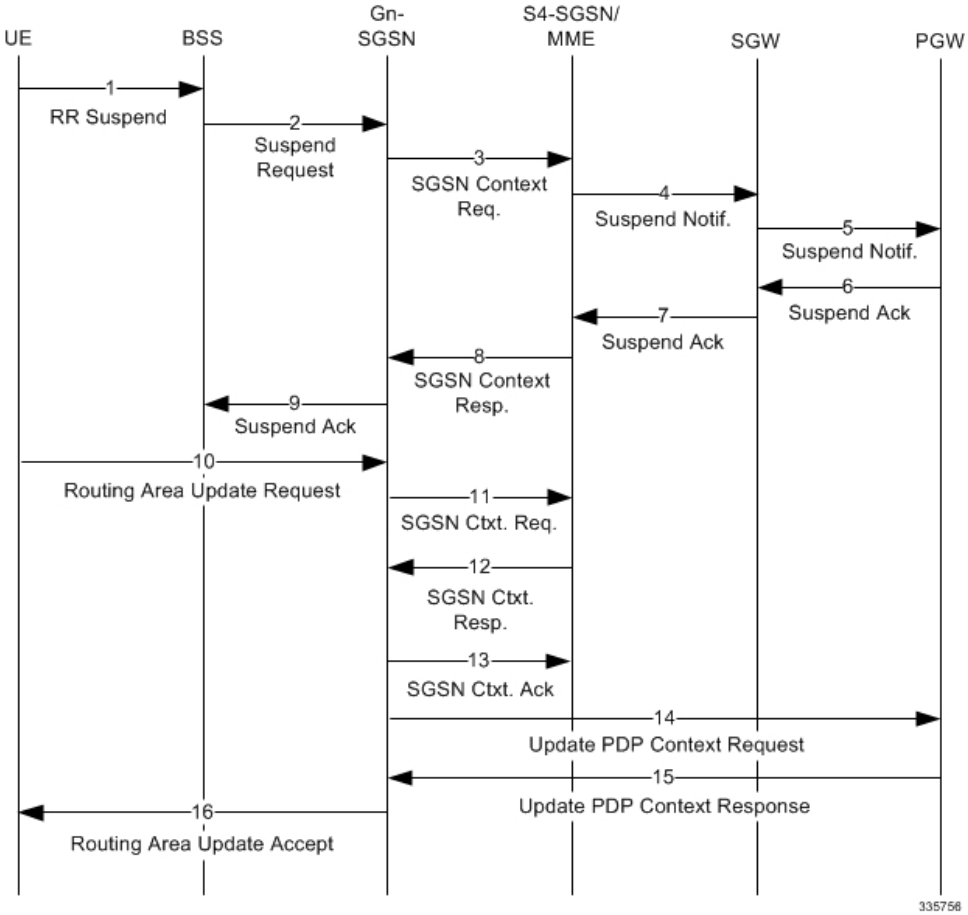


New Inter-SGSN Suspend and Resume Procedure from BSS to 2G Gn-SGSN

A new SGSN Suspend Request from the BSS to a 2G Gn-SGSN is shown in the following illustration.

- The new SGSN RAU is the Resume procedure after the new SGSN Suspend procedure has been completed. The Gn-SGSN sends an Update PDP Context Request to the GGSN which subsequently is sent to PGW to resume all data transmissions on non-GBR bearers.
- When the S4-SGSN receives a Suspend Request from the BSS and if the subscriber is not attached to the 2G SGSN and the peer is a Gn-SGSN, it sends a Context Request with Suspend header (GTPv1 Suspend Request) to the peer Gn-SGSN.

Figure 4: New Inter-SGSN Suspend and Resume Procedure from BSS to 2G Gn-SGSN

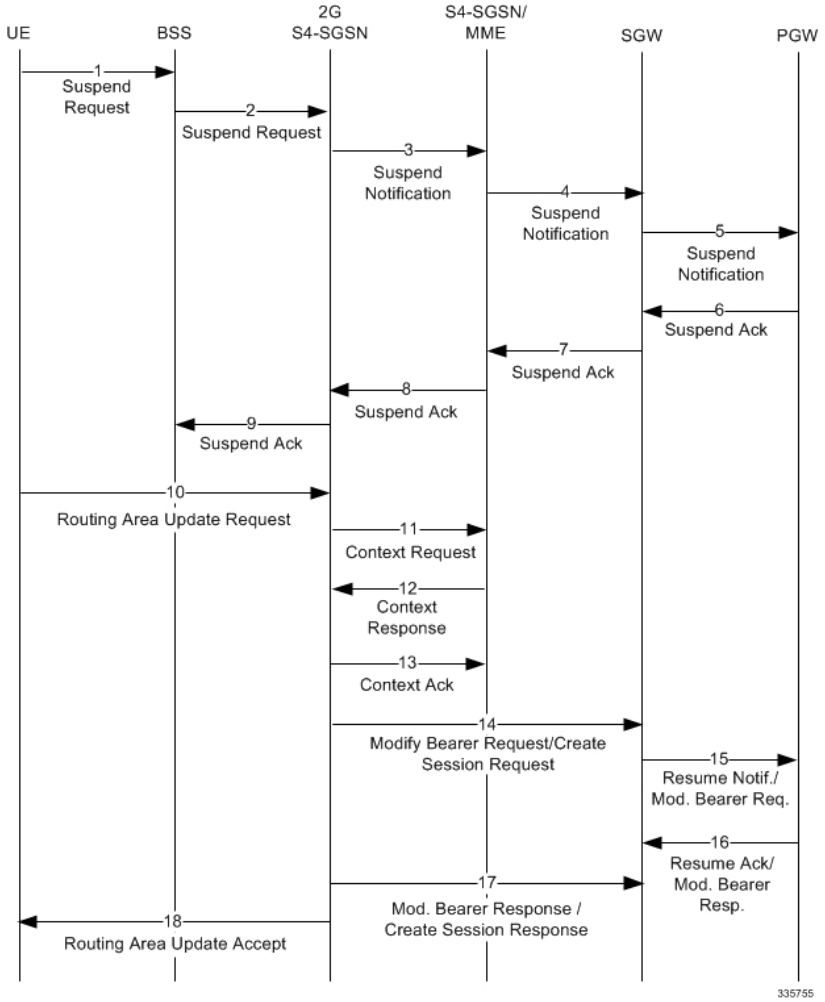


New SGSN Suspend and Resume Procedure with Peer Gn-SGSN as Old SGSN

The new SGSN Suspend procedure with a peer Gn-SGSN as the old SGSN is shown in the following illustration.

- The new SGSN RAU is the Resume procedure after the new SGSN Suspend procedure is completed. The SGSN sends a Create Session Request / Modify Bearer Request to the SGW which subsequently is sent to the PGW to resume all data transmissions on non-GBR bearers.

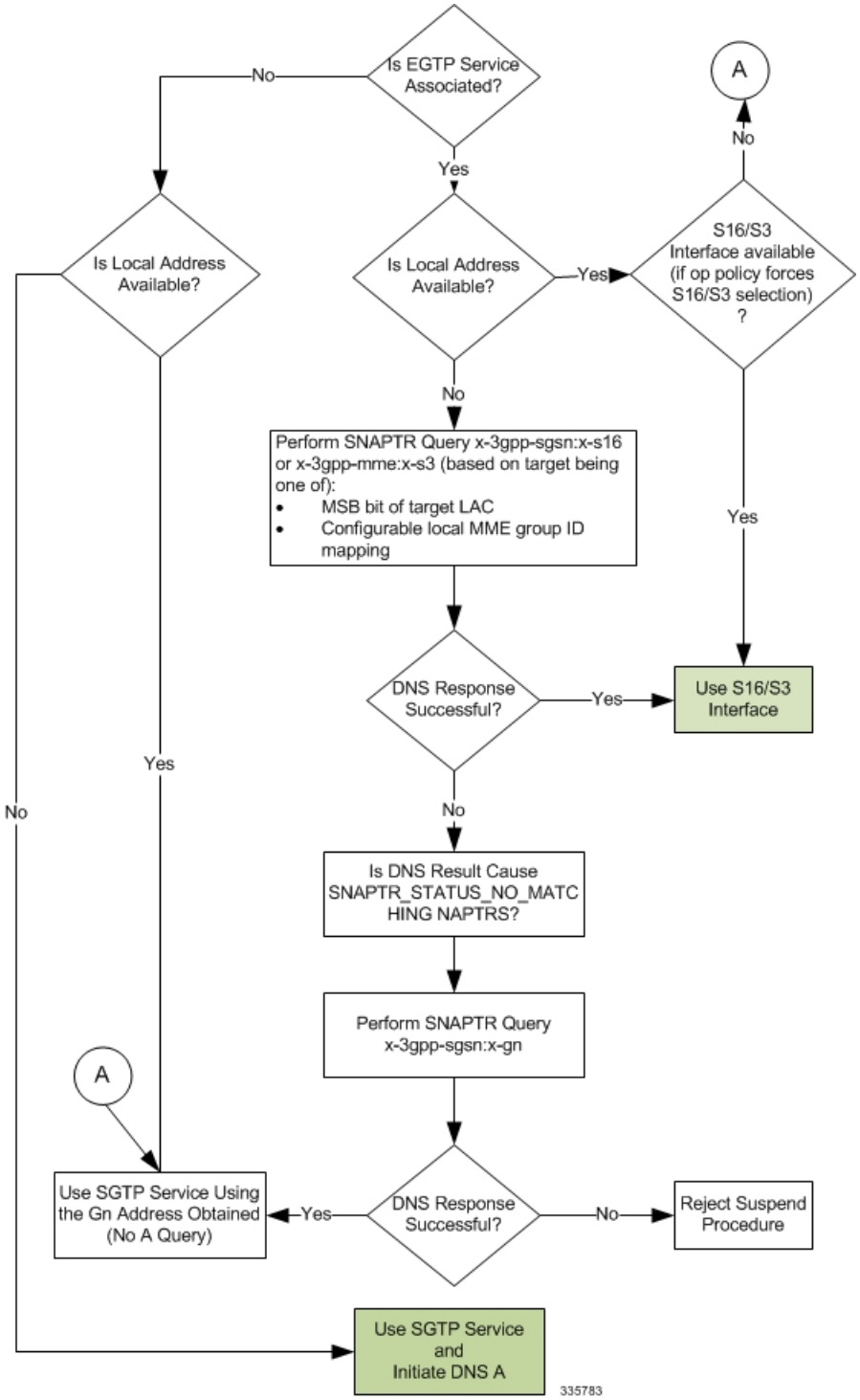
Figure 5: New SGSN Suspend and Resume Procedure with Peer Gn-SGSN as Old SGSN



Interface Selection Logic for Inter-SGSN Suspend (New SGSN) Procedure

Interface selection logic to find the peer address during the Inter SGSN Suspend (New SGSN Suspend) procedure is explained in the flowing flow chart.

Figure 6: Interface Selection Logic for Inter-SGSN Suspend (New Suspend) Procedure

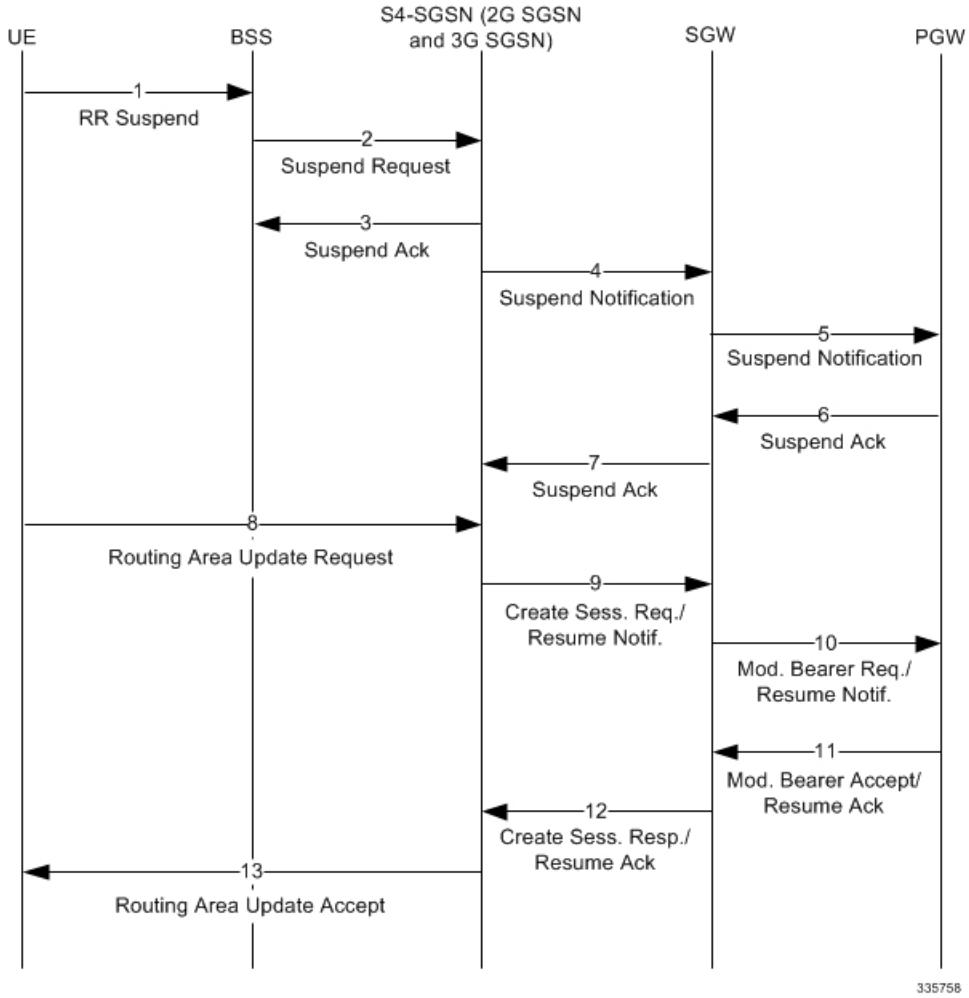


Intra-SGSN Inter-System Suspend and Resume Procedure

The intra-SGSN Inter-System Suspend and Resume procedure is shown in the following illustration. In this case, the BSS sends a Suspend Request to the 2G part of the SGSN. The 2G SGSN will internally send the request to the 3G S4-SGSN where the PDPs are anchored. The PDP contexts are then suspended by 3G S4-SGSN as shown in the diagram.

The RAU is the Resume procedure after the 2G-3G Inter-System Intra-SGSN Suspend procedure is completed. The SGSN sends a Create Session Request / Modify Bearer Request / Resume Notification to the SGW which subsequently is sent to PGW to resume all data transmissions on non-GBR bearers.

Figure 7: Intra-SGSN Inter-System Suspend and Resume Procedure



Inter-SGSN Inter-System Suspend and Resume Procedure

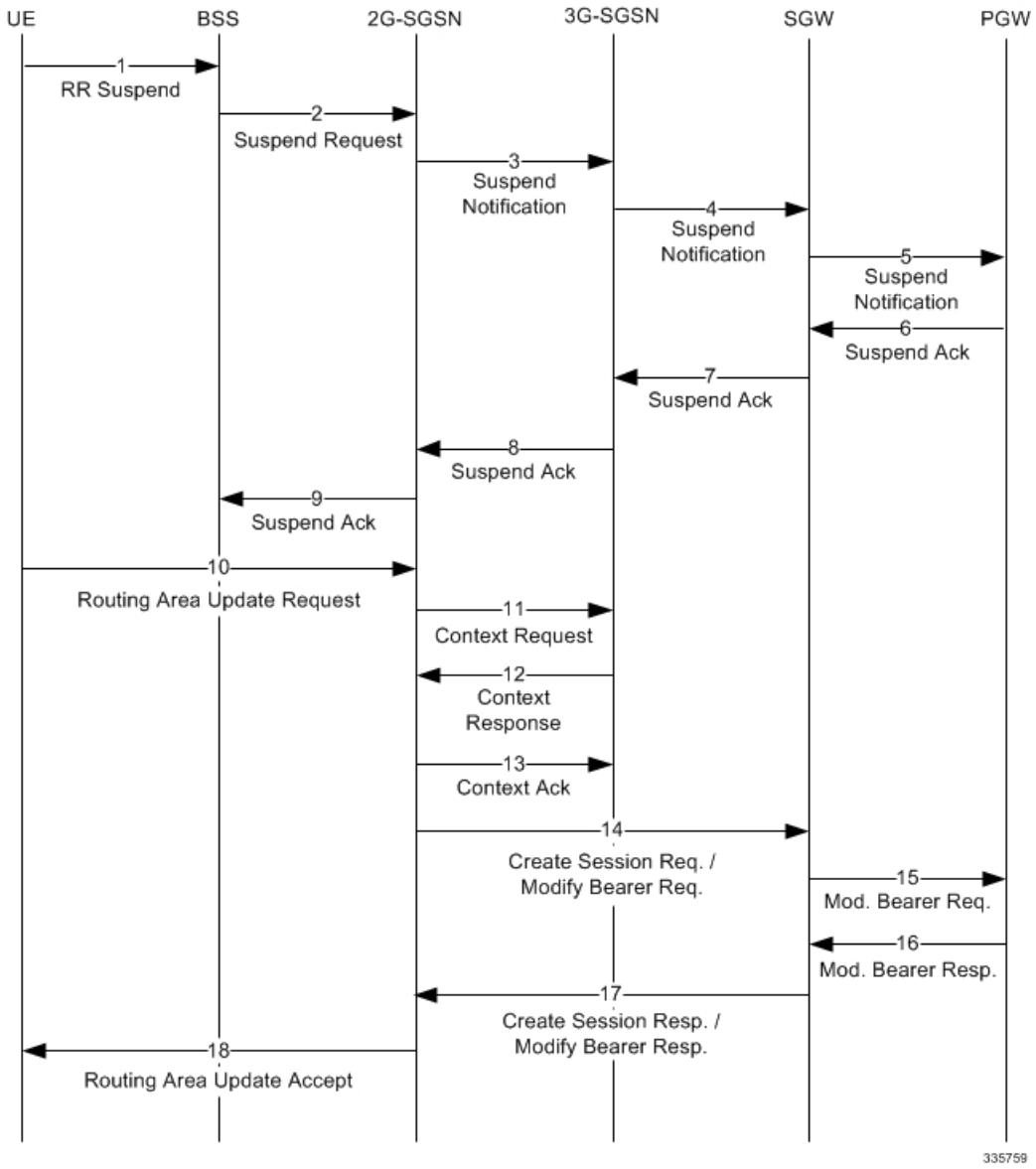
The inter-SGSN inter-system Suspend and Resume procedure is shown in the following illustration. This describes the scenario when the suspend message is received in an SGSN that is different from the SGSN currently handling the packet data transmission and would be valid for at least the following cases:

- MS performs inter-system handover from Iu mode to A/Gb mode during CS connection and the SGSN handling the A/Gb mode cell is different from the SGSN handling the Iu mode cell, (that is. the 2G and 3G SGSNs are separated).

The RAU is the Resume procedure after the 2G-3G Inter-System Inter-SGSN Suspend procedure has completed. The SGSN sends a Create Session Request / Modify Bearer Request to the SGW which subsequently is sent to PGW to resume all data transmissions on non-GBR bearers.

- If there is no SGW change for the RAU request, then the 2G-SGSN sends a Modify bearer request to the SGW. The SGW then sends a MBR all the way up to the PGW if the RAT type / Serving network changes. Otherwise it will send the Resume Request to the PGW to resume all data transmissions.
- If there is a SGW change for the RAU request, then the 2G-SGSN sends a Create Session Request to the SGW and the SGW sends a Modify Bearer Request to the PGW to resume all data transmissions.

Figure 8: Suspend and Resume Procedure for Inter-SGSN Inter-System Suspend and Resume



Standards Compliance

The Suspend/Resume feature on the S4-SGSN complies with the following standards:

- 3GPP TS 23.060 version 10.11.0 Release 10 - section 16.2.1 *3rd Generation Partnership Project Technical Specification Group Services and System Aspects General Packet Radio Service (GPRS) Service description Stage 2 (Release 10)*
- 3GPP TS 29.274 version 10.7.0 Release 10 - section 7.4 *3rd Generation Partnership Project Technical Specification Group Core Network and Terminals 3GPP Evolved Packet System (EPS) Evolved General Packet Radio Service (GPRS) Tunnelling Protocol for Control plane (GTPv2-C) Stage 3 (Release 10)*
- 3GPP TS 23.272 version 10.11.0 Release 10 - section 6.7 (No PS HO Support) *3rd Generation Partnership Project Technical Specification Group Services and System Aspects Circuit Switched (CS) fallback in Evolved Packet System (EPS) Stage 2 (Release 10)*

Configuring the S4-SGSN Suspend/Resume Feature

No configuration is required to enable the S4-SGSN Suspend/Resume Feature.

Monitoring and Troubleshooting the S4-SGSN Suspend/Resume Feature

This section provides information on the show commands and bulk statistics available to support the Suspend/Resume feature.

S4-SGSN Suspend and Resume Feature Show Commands

This section provides information regarding show commands available in support of the S4-SGSN Suspend/Resume feature.

show subscriber gprs-only full all

If the state field in the output of this command reads Suspended, it indicates that a subscriber has been moved from the Ready state to the Suspended state in 2G. Once this state change occurs, operators can use the **show bssgp statistics** and s**how egtpc statistics** commands to view information on whether the Suspend procedure was successful or not.

```
Username: 123456789012345
Access Type: sgsn                                          Network Type: IP
Access Tech: GPRS GERAN
callid: 00004e25                                            msid: 262090426000193
state: Suspended
connect time: Mon Jun 17 02:27:40 2013    call duration: 00h00m14s
idle time: 00h00m14s
User Location (RAI): 26209-4369-19          Cell Global Identity: 3
IMEI(SV): n/a
```

If the state field in the output of this command reads Ready, it indicates that a subscriber has moved from the Suspended state to the Ready state in 2G. For example:

```
Username: 123456789012345
Access Type: sgsn                                          Network Type: IP
Access Tech: GPRS GERAN
callid: 00004e25                                            msid: 262090426000193
state: Ready
connect time: Mon Jun 17 02:27:40 2013    call duration: 00h00m14s
idle time: 00h00m14s
User Location (RAI): 26209-4369-19          Cell Global Identity: 3
IMEI(SV): n/a
```

show subscriber sgsn-only full all

If the state field in the output of this command reads Idle, it indicates that a subscriber has moved from the Connected state to the Idle state in 3G. For example:

```
Username: 123456789012345
Access Type: sgsn                                          Network Type: IP
Access Tech: GPRS GERAN
callid: 00004e25                                            msid: 262090426000193
state: Ready
connect time: Mon Jun 17 02:24:05 2013    call duration: 00h00m23s
idle time: 00h00m12s
User Location (RAI): 26209-4660-18          Service Area Code : 1202
Serving PLMN:          26209
IMEI(SV): n/a                                                Equipment Status
```

If the state field in the output of this command reads Idle, it indicates that a subscriber has moved from the Connected state to the Idle state in 3G. For example:

```
Username: 123456789012345
Access Type: sgsn                                          Network Type: IP
Access Tech: GPRS GERAN
callid: 00004e25                                            msid: 262090426000193
state: Connected
connect time: Mon Jun 17 02:24:05 2013    call duration: 00h00m23s
idle time: 00h00m12s
User Location (RAI): 26209-4660-18          Service Area Code : 1202
Serving PLMN:          26209
IMEI(SV): n/a                                                Equipment Status
```

show bssgp statistics verbose

The output of this command tracks the number of BSSGP messages (BSS Suspend procedure) transmitted and received at the SGSN. It does not track the number messages between the BSS and the peer S4-SGSN or peer MME. The **show egtpc statistics** command is used to track EGTPC messages transmitted and received between the SGSN and a peer S4-SGSN or peer MME. Operators can check number of suspend ack messages received to identify successful suspend procedures. The number of suspend nack messages indicate unsuccessful suspend procedures.

Table 1: show bssgp statistics verbose Command Output

suspend messages received:
Intra-Sgsn suspend message received:
Inter-Sgsn suspend message received:
Inter-System suspend message received:

suspend ack messages transmitted: Intra-Sgsn suspend ack message transmitted: Inter-Sgsn suspend ack message transmitted: Inter-System suspend ack message transmitted:
suspend nack messages transmitted: Intra-Sgsn suspend nack message transmitted: Inter-Sgsn suspend nack message transmitted: Inter-System suspend nack message transmitted:
resume messages received: resume ack messages transmitted: resume nack messages transmitted:

show egtpc statistics

The output of this command tracks the number of Suspend EGTPC messages transmitted and received from or to a peer SGSN/ MME or S-GW. The output also tracks the number of Resume EGTPC messages transmitted to S-GW.

Detailed descriptions of these counters are available in the *Statistics and Counters Reference*.

Table 2: show egtpc statistics Command Output for S4-SGSN Suspend/Resume Feature

CS Fallback Messages:
Suspend Notification:
Initial TX: Initial RX:
Retrans TX Discarded:
No Rsp RX:
Suspend Acknowledge:
Initial TX:
Initial RX:
Discarded:
Resume Notification
Initial TX:
Initial RX:
Retrans TX:
Discarded:
No Rsp RX
Resume Acknowledge:
Initial TX:
Initial RX:
Discarded:

show egtpc statistics verbose

The output of this command tracks the number of denied Suspend notification recived and transmitted procedures.

- Suspend Notification Denied TX means Suspend notification was denied due to any of errors listed in the table that follows.
- Suspend Notification Denied RX means a Suspend notification was received incorrectly from the peer S4-SGSN.

Detailed descriptions of these counters are available in the *Statistics and Counters Reference*.

Table 3: show egtpc statistics verbose Command Output for S4-SGSN Suspend/Resume Feature

Suspend Notification Denied		
Suspend Notification Denied TX		**Suspend Notification Denied RX**
Context not existent:		Context not existent:
Invalid message format:		Invalid message format:

Version not supported:		Version not supported:
Invalid length:		Invalid length:
Service not supported:		Service not supported:
Mandatory IE incorrect:		Mandatory IE incorrect:
Mandatory IE missing:		Mandatory IE missing:
System failure:		System failure:
No resources available:		No resources available:
Semantic error in TFT:		Semantic error in TFT:
Syntactic error in TFT:		Syntactic error in TFT:
Semantic error in Pkt Fltr:		Semantic error in Pkt Fltr:
Syntactic error in Pkt Fltr:		Syntactic error in Pkt Fltr:
Missing or unknown APN		Missing or unknown APN
GRE key not found:		GRE key not found:
Reallocation failure:		Reallocation failure:
Denied in RAT:		Denied in RAT:
Pref. PDN type unsupported:		Pref. PDN type unsupported:
All dynamic addr occupied:		All dynamic addr occupied:
UE ctx w/o TFT activated:		UE ctx w/o TFT activated:
Prot type not supported:		Prot type not supported:
UE not responding:		UE not responding:
UE refuses:		UE refuses:
Service denied:		Service denied:
Unable to page UE:		Unable to page UE:
No Memory:		No Memory:
User Auth Failed:		User Auth Failed:
Apn Access Denied:		Apn Access Denied:
Request Rejected:		Request Rejected:
Semantic error in TAD:		Semantic error in TAD:
Syntactic error in TAD:		Syntactic error in TAD:

Collision with Nw init Req:		Collision with Nw init Req:
UE page unable due to Susp:		UE page unable due to Susp:
Conditional IE missing:		Conditional IE missing:
Apn Restr Type Incompatible:		Apn Restr Type Incompatible:
Invalid len Piggybacked msg:		Invalid len Piggybacked msg:
Invalid remote Peer reply:		Invalid remote Peer reply:
PTMSI signature mismatch:		PTMSI signature mismatch:
IMSI not Known:		IMSI not Known:
Peer not responding:		Peer not responding:
Data Fwding not supported:		Data Fwding not supported:
Fallback to GTPV1:		Fallback to GTPV1:
Invalid Peer:		Invalid Peer:
Temp Rej due to HO in prog:		Temp Rej due to HO in prog:
Unknown:		Unknown:
Resume Notification Denied		
Resume Notification Denied TX		**Resume Notification Denied RX**
Context not existent:		Context not existent:
Invalid message format:		Invalid message format:
Version not supported:		Version not supported:
Invalid length:		Invalid length:
Service not supported:		Service not supported:
Mandatory IE incorrect:		Mandatory IE incorrect:
Mandatory IE missing:		Mandatory IE missing:
System failure:		System failure:
No resources available:		No resources available:
Semantic error in TFT:		Semantic error in TFT:
Syntactic error in TFT:		Syntactic error in TFT:
Semantic error in Pkt Fltr:		Semantic error in Pkt Fltr:
Syntactic error in Pkt Fltr:		Syntactic error in Pkt Fltr:

Missing or unknown APN		Missing or unknown APN
GRE key not found:		GRE key not found:
Reallocation failure:		Reallocation failure:
Denied in RAT:		Denied in RAT:
Pref. PDN type unsupported:		Pref. PDN type unsupported:
All dynamic addr occupied:		All dynamic addr occupied:
UE ctx w/o TFT activated:		UE ctx w/o TFT activated:
Prot type not supported:		Prot type not supported:
UE not responding:		UE not responding:
UE refuses:		UE refuses:
Service denied:		Service denied:
Unable to page UE:		Unable to page UE:
No Memory:		No Memory:
User Auth Failed:		User Auth Failed:
Apn Access Denied:		Apn Access Denied:
Request Rejected:		Request Rejected:
Semantic error in TAD:		Semantic error in TAD:
Syntactic error in TAD:		Syntactic error in TAD:
Collision with Nw init Req:		Collision with Nw init Req:
UE page unable due to Susp:		UE page unable due to Susp:
Conditional IE missing:		Conditional IE missing:
Apn Restr Type Incompatible:		Apn Restr Type Incompatible:
Invalid len Piggybacked msg:		Invalid len Piggybacked msg:
Invalid remote Peer reply:		Invalid remote Peer reply:
PTMSI signature mismatch:		PTMSI signature mismatch:
IMSI not Known:		IMSI not Known:
Peer not responding:		Peer not responding:
Data Fwding not supported:		Data Fwding not supported:
Fallback to GTPV1:		Fallback to GTPV1:

Invalid Peer:		Invalid Peer:
Temp Rej due to HO in prog:		Temp Rej due to HO in prog:
Unknown:		Unknown:

show sgtpc statistics verbose

The output of this comnand tracks the number of SGSN Context Request transmitted and received message transmitted from the peer Gn-SGSN. It also tracks the number of SGSN Context Response messages transmitted and received from a peer Gn-SGSN.

Table 4: show sgtpc statistics Command Output for S4-SGSN Suspend/Resume Feature

SGSN Context Request:	
Total SGSN-Ctx-Req TX:	Total SGSN-Ctx-Req RX:
Initial SGSN-Ctx-Req TX:	Initial SGSN-Ctx-Req RX:
SGSN-Ctx-Req-TX(V1):	SGSN-Ctx-Req-RX(V1):
Suspend-Req-Hdr-TX:	Suspend-Req-Hdr-RX:
SGSN-Ctx-Req-TX(V0):	SGSN-Ctx-Req-RX(V0):
Retrans SGSN-Ctx-Req TX:	Retrans SGSN-Ctx-Req RX:
Ret-SGSN-Ctx-Req-TX(V1):	Ret-SGSN-Ctx-Req-RX(V1):
Ret-Suspend-Req-Header-TX:	
Ret-SGSN-Ctx-Req-TX(V0):	Ret-SGSN-Ctx-Req-RX(V0):
SGSN Context Response:	
Total SGSN-Ctx-Rsp TX:	Total SGSN-Ctx-Rsp RX:
Denied TX:	Denied RX:
Suspend-Rsp-Hdr-TX:	Suspend-Rsp-Hdr-Rx:
Accepted TX:	Accepted RX:
Initial SGSN-Ctx-Rsp TX:	Initial SGSN-Ctx-Rsp RX:
SGSN-Ctx-Rsp-TX(V1):	SGSN-Ctx-Rsp-RX(V1):
Suspend-Rsp-Hdr-TX:	Suspend-Rsp-Hdr-RX:
SGSN-Ctx-Rsp-TX(V0):	SGSN-Ctx-Rsp-RX(V0):
Retrans SGSN-Ctx-Rsp TX:	Retrans SGSN-Ctx-Rsp RX:
Ret-SGSN-Ctx-Rsp-TX(V1):	Ret-SGSN-Ctx-Rsp-RX(V1):

Ret-SGSN-Ctx-Rsp-TX(V0):	Ret-SGSN-Ctx-Rsp-RX(V0):
	Decode Failure RX:

S4-SGSN Suspend and Resume Feature Bulk Statistics

The following statistics are included in various bulk statistics schema in support of the Suspend/Resume feature:

- **SGSN Schema**:
  - 2G-attach-fail-suspend-received
  - 2G-attach-fail-comb-suspend-received

For descriptions of these variables, see the *SGSN Schema Statistics* section in the *Statistics and Counters Reference*.

- **GPRS Schema**
  - bssgp-suspend-msg-rcvd
  - bssgp-suspend-ack-msg-sent
  - bssgp-suspend-nack-msg-sent
  - bssgp-resume-msg-rcvd
  - bssgp-resume-ack-msg-sent
  - bssgp-resume-nack-msg-sent

For descriptions of these variables, see *GPRS Schema Statistics* in the *Statistics and Counters Reference*.

- **EGTPC Schema**:
  - csfb-sent-suspendnotf
  - csfb-sent-retranssuspendnotf
  - csfb-recv-suspendnotf
  - csfb-recv-suspendnotfDiscard
  - csfb-recv-suspendnotfNorsp
  - csfb-recv-retranssuspendnotf
  - csfb-sent-suspendack
  - csfb-sent-suspendackaccept
  - csfb-sent-suspendackdenied
  - csfb-recv-suspendack
  - csfb-recv-suspendackDiscard
  - csfb-recv-suspendackaccept
  - csfb-recv-suspenddenied
  - csfb-sent-resumenotf
  - csfb-sent-retransresumenotf
  - csfb-sent-resumeack
  - csfb-sent-resumeackaccept
  - csfb-sent-resumeackdenied
  - csfb-recv-resumeack
  - csfb-recv-resumeackDiscard

- csfb-recv-resumeackaccept
- csfb-recv-resumedenied

For descriptions of these variables, see *EGTPC Schema Statistics* in the *Statistics and Counters Reference*.

- **SGTP Schema**:
  - sgtpc-sgsn-ctxt-req-v1-tx
  - sgtpc-sgsn-ctxt-req-v1-rx
  - sgtpc-sgsn-ctxt-req-accept-tx
  - sgtpc-sgsn-ctxt-req-accept-rx
  - sgtpc-sgsn-ctxt-req-accept-v1-tx
  - sgtpc-sgsn-ctxt-req-accept-v1-rx
  - sgtpc-sgsn-ctxt-req-denied-tx
  - sgtpc-sgsn-ctxt-req-denied-rx
  - sgtpc-sgsn-ctxt-ack-accept-tx
  - sgtpc-sgsn-ctxt-ack-accept-rx
  - sgtpc-sgsn-ctxt-ack-accept-v1-tx
  - sgtpc-sgsn-ctxt-ack-accept-v1_rx
  - sgtpc-sgsn-ctxt-ack-denied-tx

For descriptions of these variables, see *SGTP Schema Statistics* in the *Statistics and Counters Reference*.